AN EXAMINATION OF BANK USE OF CREDIT DERIVATIVES TO MITIGATE RISK: AN EMPIRICAL ANALYSIS OF ITS POTENCY AND IMPACT ON BANK PORTFOLIO MANAGEMENT AND PERFORMANCE

BY

KOLAWOLE ALBRIGHT

A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy

JANUARY, 2017

BOURNEMOUTH UNIVERSITY

COPYRIGHT STATEMENT

ABSTRACT

This study examines what drives the risk appetite of US banks to use credit derivatives to mitigate risk, the potency and impact of the instruments on bank portfolio management and performance. Panel data covering the period of 2002 to 2011 was employed and segmented into three phases (pre-crisis, crisis and post-crisis). The techniques used for analysis were Random Effects Logistic Regression and Arellano-Bond Dynamic Data Generalised Method of Moments.

Findings showed that during the pre-crisis period, banks used the instruments more for trading than for hedging, expanding their level of risk taking. The use of the instruments was subdued during the crisis period, and was used more for hedging purposes due to the heightened state of uncertainties, anxieties and shocks. For post-crisis, banks returned to their trading rather than hedging to improve profitability.

Further findings revealed that pre-crisis, the connection between the employment, application of credit derivatives and bank portfolio performance was generally significant as banks with credit derivatives activities outperformed other banks. At the full length of the crisis period, banks restructured their portfolios to reflect asset write-downs and a subdued demand for the instruments thus affecting portfolio returns significantly. Post-crisis period saw the gradual responses to the reforms in the market place though returns were not at the level of the pre-crisis period as everything was still in a wobbling mode. Furthermore, moral hazard was also identified as one of the reasons for the lapses which led to the crisis and thus bank portfolio performance.

This study concludes that credit derivatives do affect bank portfolio persistence, risk and return for the three periods whether in a capacity of a beneficiary or as a guarantor. Banks would need to re-examine their instruments to get them on a sustainable path as well as attract portfolio flows and growth.

ACKNOWLEDGEMENTS

First, I would like to thank my supervisory team, Dr. George Filis, Dr.Ishmael Tingbani, Dr. Geoff Willcocks and Dr. Madhu Acharyya for their help, guidance, support as well as their constructive and critical comments at our Ph.D. committee deliberations. I am also grateful to Professor Emmanuel Mamatzakis, Dr. Barbara Pettit, and Professor Jenny Piesse for their constructive comments. I also want to thank Dr. Sunday Oke and Dr. Abiodun Odusote both of the University of Lagos for their moral support.

I would like to thank Dr. Gustavo Sanchez and Kristin MacDonald of the technical department of Stata Corporation, Texas, USA, for their patience, help, support and excellent comments on the data analysis chapters 7 and 8 and for helping me to understand how the Stata software works in more depth by giving me a lot of examples.

Dr. Christina Koutra and Dr. Gbola Gbadamosi, I am most grateful for your kindness and for encouraging me to go on and finish my degree as soon as possible. Many thanks to the administration staff of the Business School as well as Barbara Montagna of the International office.

My gratitude also goes to the Chief Risk Officer of Liverpool Victoria, Roger Dix (now at Aviva), for organising some sponsorship of my studies during my trying times which helped a great deal to the completion of my Ph.D. Many thanks to Chris McFarlane, Russell Baldwin, Jean Morgan, Peter Carr and Dr. Laura Hewitt for the opportunity to join the Solvency II programme during my stay at Liverpool Victoria Friendly Society Limited, Bournemouth.

I want to thank the University librarian of the University of Lagos, Dr. Olukemi Fadehan as well as other staff of the library: Dr. Yetunde Zaid, Dr. Christopher Okiki, Dr Alabi, Mrs Bukola Olatise, Mr Sola Ajala, Mr Ikhuoria Godfrey, Mr Ayanlowo Olalekan, Mr Matthew Iroko, Mr Abiodun Shojobi, Mrs Margaret Kingful, Mrs Adetutu Oshiyoye, Mr Vincent Bamishaye and others I cannot mention here for their excellent support and kindness for the use of the library. My good friend, Desmond Ighravwe, a Ph.D student in Mechanical Engineering at the Ladoke Akintola University of Technology in Nigeria, I thank you for the IT support and help in the library.

Let me express my sincere gratitude to my friend, Mr. Oluwatoyin Akinyede, thank you so much for everything. Mr Gbolahan Ogundipe of the foreign operations department of Union Bank Nigeria Plc, I thank you for the financial help. I am most grateful to Mrs

Adejumoke Okege for providing me with a roof over my head and for the financial support as I concluded the research. Mr Amusat Hamzat and Mrs Ganiat Hamzat, I appreciate you both for the financial support.

I also want to thank Mr and Mrs Cyril Iredje of Mountain of Fire and Miracle ministries in Aberdeen, Pastor Chris Gbenle, Pastor Afolabi Otitoju, Tunde Adeoti, Funsho Sanusi and all my friends at Redeemed Christian Church of God, Aberdeen. Also, Pastor Oluwatoyin Fakorede of Breath of Life Church, Bournemouth for being there for me when it mattered most. I would also like to thank Dr. D.K. Olukoya, the General Overseer of Mountain of Fire and Miracles Ministries, Lagos for the provision of accommodation at the church Guest House. Mrs Francesca Okunola, the Guest House manager, I appreciate you for your cooperation and kindness.

TABLE OF CONTENTS

CHAPTER 5: METHODOLOGICAL AND MEASUREMENT ISSUES

LIST OF TABLES

LIST OF FIGURES

Definitions of Credit Derivative Instruments

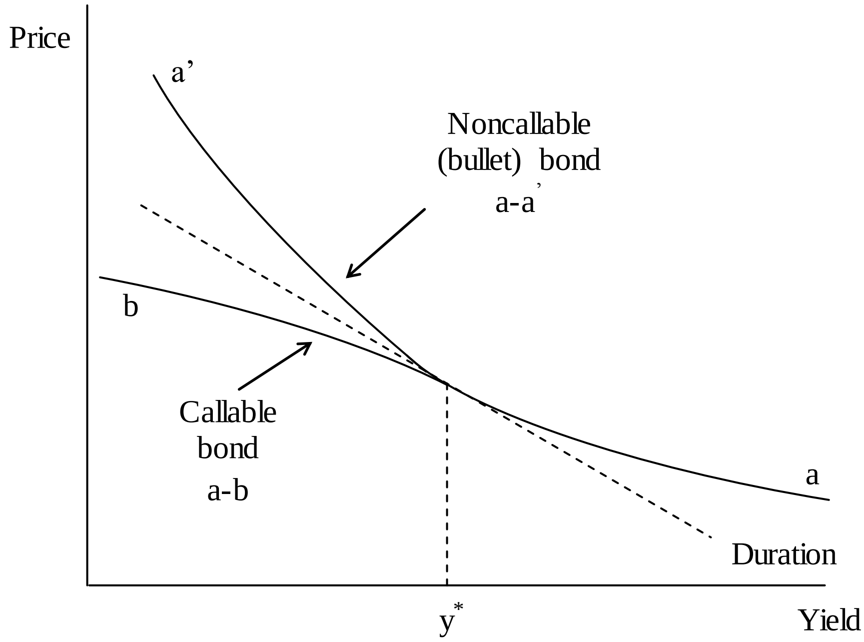
This section provides an overview of some of the financial instruments referred to in this thesis. The products covered include:

1. Bond (callable)
2. Asset Swap (AS)
3. Credit Default Swap (CDS)
4. Basket Default Swap (BDS)
5. Total Return Swap (TRS)
6. Credit Spread Products (CSP)
7. Credit Linked Note (CLN)
8. Collateralised Debt Obligation (CDO)
9. Mortgage Backed Security (MBS)

Bond (callable)

A bond is a debt or loan. It can be callable or non-callable. Generally, a callable bond (in the alternative, redeemable bond) is a straight corporate bond with a contained call option. The contained option gives the issuer of the call (that is, the holder) the right, but not the commitment, to purchase back the bond they have issued at the exercise price, a pre-specified price at issuance of the transaction. Procedurally, there is a period of call protection after issuance when there is incapacity for the bond to be called. Rather than a single price, there will be a schedule of exercise prices, relating to various periods in the future. An additional compensation is paid, in most cases, to the issue of the bond when a call is made especially in the high yield debt market. A downward trend in interest rates is the main reason why calls are made. Investors have a higher coupon with a callable bond than they would have had with a non-callable bond. Sovereign backed entities are the largest market place for callable bonds. These financial institutions own a lot of mortgages and mortgage backed debt.

Figure P1: Price/Yield relationship for a callable and noncallable bond



Sources: Reilly and Brown (2006); Fabozzi (1993); Fabozzi and Fabozzi (1994).

As an illustration, the City of London council (a bond issuer) may issue a 10-year bond today for infrastructural development. Procedurally, the bond might be call protected for the five years at the first instance. Thereafter, the exercise price schedule might be GBP105, GBP104, GBP103, GBP102, and GBP101, the prices being applicable from years five, six, seven, eight, nine and ten respectively. The City of London, as the holder of the option, is the issuer of the bond, therefore, the holder of a callable bond is effectively short the call option, which is American that can be called before the maturity date of the security. Accordingly, a callable bond will be without practical value in other respects identical to non-callable bond.

Asset Swap

Asset swap is possibly the basic element in the world of credit risk. It is a simple framework that allows a counterparty receiving firm and constant settlements on a security to exchange the fixed coupon for a floating rate settlement at a steady spread to London Interbank Offered Rate (LIBOR). Simply, it is a deal which changes the structure of the cash flows of a security through the utilisation of one or more swaps. For instance, the following may suffice in an asset swap transaction:

- Bond interest rate can be exchanged from floating to fixed or with the order reversed;
- Settlement can be switched into various currencies;
- The returns and income from a security can be exchanged for a cash flow based on an index in different asset class.

An asset swap commitment involves the consecutive well defined steps as follows:

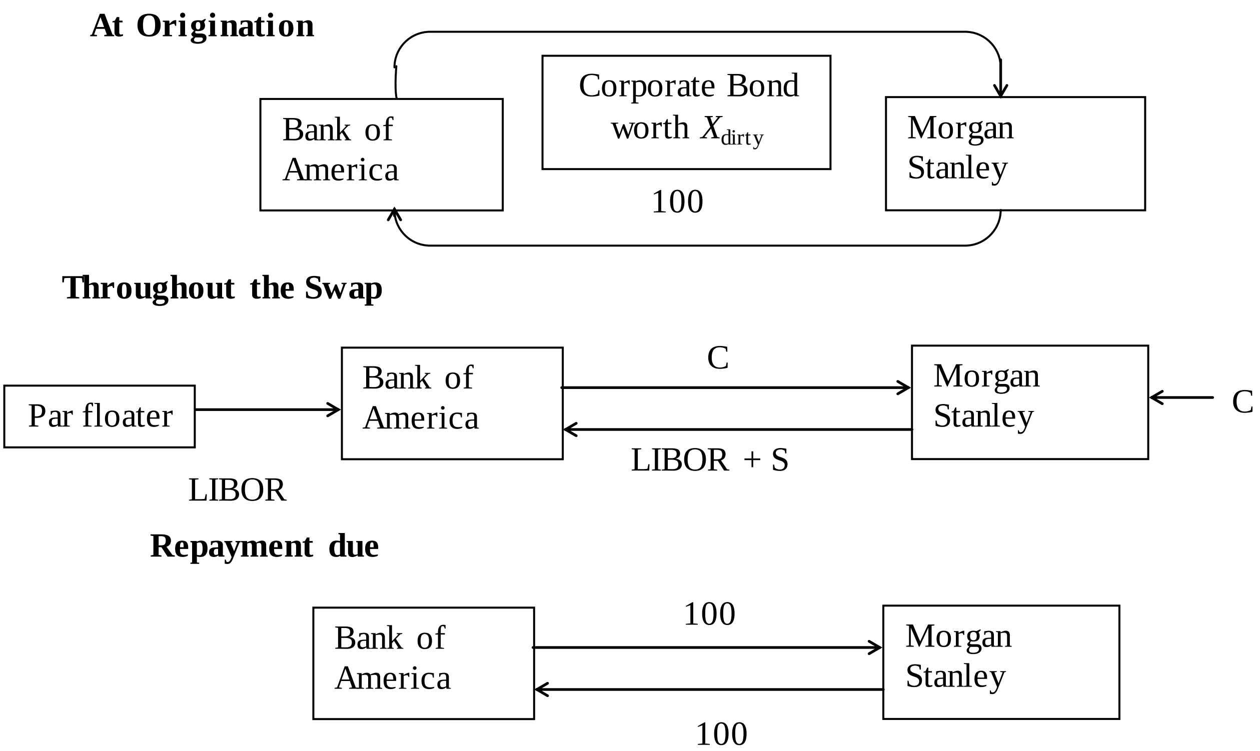
- An asset is bought for cash by an investor;
- The cash flows are switched into the preferred structure;
- The investor holds the bundle comprising the asset and the swap(s); these assets are disclosed on the balance sheet. In other words, they are on-balance sheet items.

In the past, banks have used asset swap to match their assets and liabilities in their balance sheet, for example, the use of short term liabilities to fund long term assets. In other words, when funding mortgage loans and assets with depositor's funds.

The attractive product among the asset swap class among banks is the par asset swap, followed by vanilla asset swap. In the case of the par asset swap, the notional value of the asset swap is proportionate to the face value of the fundamental asset. One party delivers a risky asset to the investor in return for par at maturity. Thereafter, they receive the cash flows of a risky bond in return for regular settlement of the London interbank offered rate in addition to a fixed spread or less a fixed spread if the asset is of better quality than the London interbank offered rate, for example, a US Treasury bill. The fixed spread is commonly referred to as the Asset Swap Spread.

Fundamentally, if there is a non payment situation in the underlying risky asset in assets swaps transaction, the fixed coupons being paid are adequately made certain by the counterparty. Accordingly, the fixed coupon payer has a credit liability to the issuer of the defaulting bond. For that reason, the asset swap spread is the extra return on assets needed by the fixed coupon payer to reward for the credit risk contracted and to settle any variation in price if the bond is trading away from par. The par floater can be acquired by the par amount settled up front. From the diagram below, the general result for "Bank of America" has been to take steady cash flows from a risky asset and trade them for the identical cash flows settled by a London Interbank offered rate quality counterparty. The indicated fixed coupons can then be swapped for floating rate settlements in another regular interest rate swap.As a valuable measure of default risk, the asset swap depicts the extra spread that can be hard-shelled by taking on the risk of an issuer in a fixed-for-floating rate par swap.

Figure P2: Asset Swap



Sources: Das (1998) and Banks et al (2007)

The open market value asset swap is the alternative vanilla asset swap. In this case, the theoretical amount of the swap is equal to the open market value of the fundamental asset at the time the transaction is consummated. Some important modifications give allowance for more custom-made deals. Where the reference asset is a callable bond for example, callable swaps are utilised. The fundamental characteristics of the periodic interest payment of the callable bond correspond to the swap.

In a situation where the fundamental asset is a convertible bond, convertible asset swaps (or stripped convertibles) can also be utilised. Generally, a bank buys a convertible bond and disposes it to an investor for its fixed-income value. The investor thereafter goes into a swap transaction, the asset swap with the bank interchanging the fixed-rate coupon settlement on the conversion for a floating rate. The swap contract is embedded with an option (that is, callable asset swap) which gives the bank the right to recall the bonds back at a time they so wish and so discharge the contract. This makes the investor to hold a callable floating-rate note supported by the credit worthiness of the convertible issuer. Effectively, he has let go the equity option contained in the convertible; the option has been 'stripped' from the convertible in exchange for a greater spread on the swap. The bank is now the owner of the equity element of the convertible as it can make a call on the bonds to take out any increase in worth of the equity option.

Another type of asset swap is the callable/puttable asset swaps. They have been used for positions on changes in credit spreads. They have also been viewed as the earliest instrument on credit derivatives and for which reason are often referred to as credit spread options. This is discussed fully below.

Other forms of asset swap include cross-currency asset swaps where the coupon of the asset is exchanged into a different currency; for forward asset swaps (also referred to as knock-out/knock-off asset swaps), investors can use this to take position of a sharp credit curve for a particular issuer. In a situation where the fundamental asset defaults before the set out date of the swap, the forward swap is terminated. For Maturity-shortened asset swaps, the maturity of the swap is not up to the fundamental asset; asset swaps can be linked with other options, for example, caps, floors and collars, to give more custom-made payment arrangement.

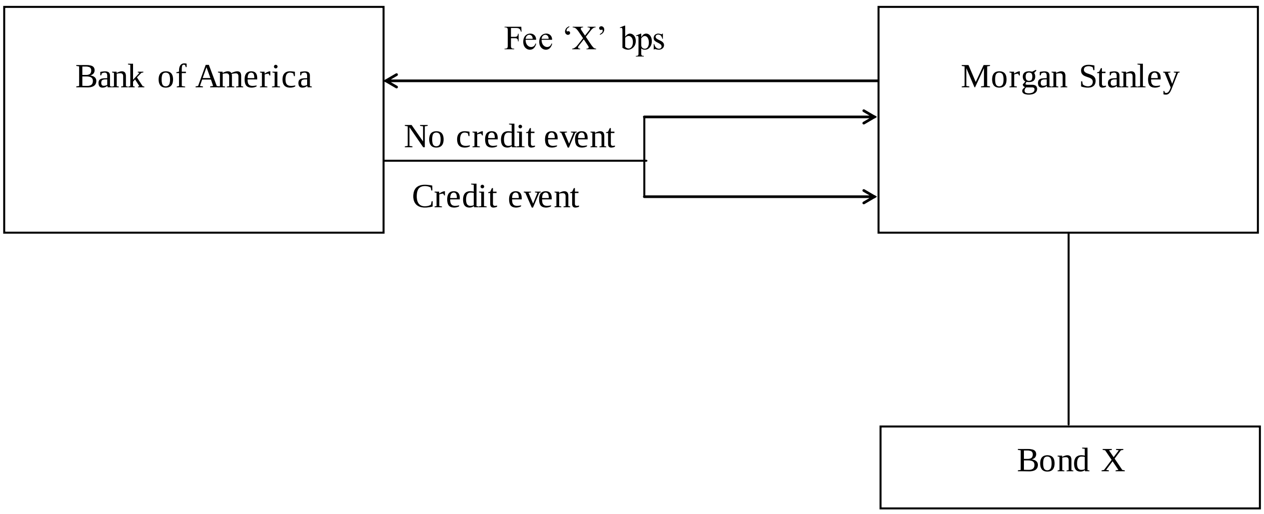
Credit Default Swap

A credit default swap is very similar to a credit default option. Under a credit default swap, the settlement in the event of default, is identical to the settlement in the event of default (Examples of default can be summarised as bankruptcy, restructuring and failure to meet an interest payment) under a credit default option. The only difference is that, under a credit default swap, there is no upfront payment of the premium.

In effect, credit default swaps can be thought of as an insurance policy against the default of some basic and intrinsic financial instrument. It is a reciprocal financial contract where a protection seller pays a fee periodically to the protection buyer, in most cases expressed in basis points per annum, paid on a notional amount payable semi-annually. In the event of the default of the underlying asset the protection seller makes a contractual payment to the protection buyer and the periodic payments made by the protection buyer terminates.

Put simply, it is a swap designed to transfer the credit exposure of fixed income products between two parties. For example, the buyer of a credit swap will be entitled to the par value of the bond by the seller of the swap, should the bond default in its coupon payments. The diagram below gives a more explicit example.

Figure P3: Credit Default Swap



Source: Das (1998)

Assuming Bank of America sells credit protection to Morgan Stanley for five years on $100 million nominal of bond X. Morgan Stanley would pay Bank of America a fee of x basis points. Depending on the terms of the contract, if a defined credit event (bankruptcy, default, rescheduling and downgrades) occurs on bond X, Bank of America will pay Morgan Stanley the credit event payment (CEP). However, if no credit event occurs, the contract will expire after five years without any payment from Bank of America to Morgan Stanley.

Credit Default Swap Option (credit default swaption)

A credit default swap option is identical to the Credit Default Swaps. A credit default swap option might take the shape of the following:

- credit default swap options on a single entity with a regular settlement for the default leg;
- credit default swap options on a single entity with a binary settlement for the default leg;
- credit default swap options on a basket of entities with regular settlement for the default leg; and
- credit default swap options on a basket of entities with a binary settlement for the default leg.

A credit default swap option, gives the right to buy (a call from the protection buyer) or sell (a put from the protection seller) but not the commitment on a defaulted reference asset (for example, bond "X") for the period of the option, in return for par. The option is extinguished if the reference entity defaults during the life of the option. This extinguishing feature marks the fundamental difference between a credit default swap option and a vanilla option.

The right of the option buyer enables it to make an advance payment to the seller which is known as the default option premium. The contract settlement might be through cash or physical delivery. If the contract is settled with cash and if the option is exercised, in that case, the payment will be 100 less the defaulted market value of the underlying asset. The settlement of cash agreement also involves other payments in the event of exercise, for instance:

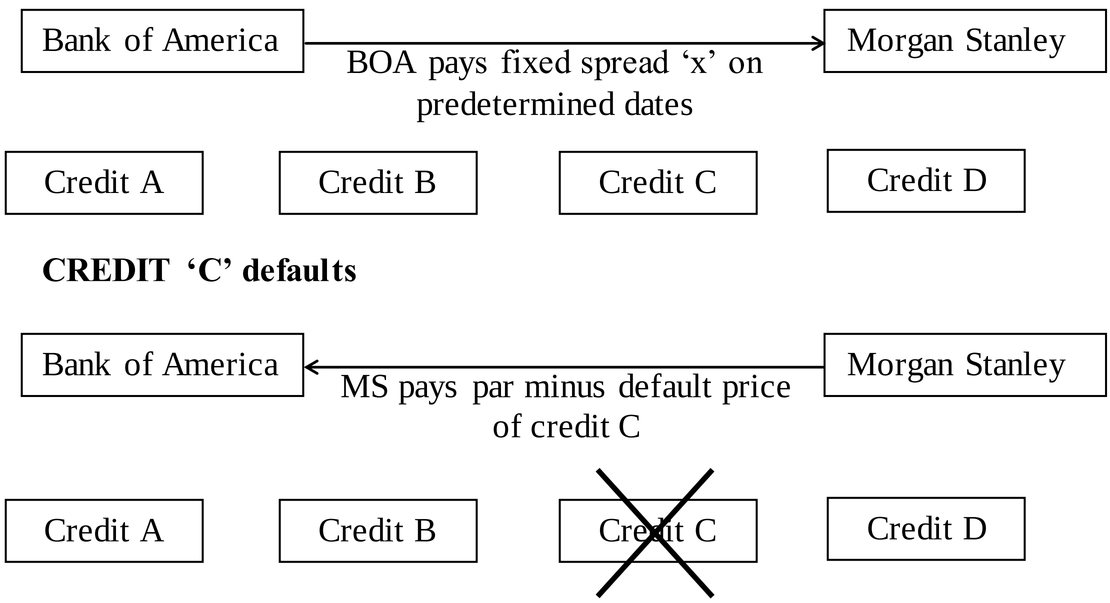
(a) Automated cash payment: Here, a definite settlement is made in the event of default. For example, the theoretical amount of the fundamental asset.

(b) The original value of the fundamental asset less the current market value. The cash settled contract has a superior leverage in that the reference asset might be a pool of underlying assets, with a settlement to the protection buyer if any of the assets becomes delinquent in addition to being able to cover diverse settlement arrangements. Generally, a large chunk of traded credit default swap options are European style options.

Basket Default Swap

A basket default swap is similar to a default swap; the only difference is that it is connected to the default of more than one credit instrument. In the specific instance of a first-to-default basket swap, it is the first instrument in a basket whose credit event activates a settlement to the protection buyer, for example, Bank of America. In the instance of a default swap, this settlement may include one of the other of cash settlement of par less the default consideration of the defaulted asset, or physical transmission of the defaulted asset in exchange for par. In exchange for protection against the first-to default, the protection buyer, Bank of America settles the protection seller, for example, Morgan Stanley with a fee as a set of steady increase by growth cash flows.

Figure P4: Basket Default Swap



Sources: Das (1998) and Banks et al (2007)

For example, in figure P4 we look at a transaction where an investor purchase a first-to-default protection to hedge a $100 million theoretical amount of each of four credits A, B, C, D. Although the total theoretical amount covered is $400 million, if one of the credits instrument is defaulted, only the theoretical size of that credit instrument in the basket gets settled. For instance, if credit C defaults, then we receive the settlement of the theoretical amount of $100 million. In the figure above, the default basket expires remaining credits A, B and D which are then left unhedged.

Deciding and adjusting the value of the fixed spread can be tasking. Reproducing the framework with clear and understandable portfolios statistically is not feasible but we can easily set lower and upper limits on the price. In as much as the framework provides less protection than purchasing default swaps against individual underlying credits, it has got to be lessened than this total cost. For a set lower bound limit, it is noted that the price of the basket has got to be more than the price of a default swap on the minimum credit quality asset in the basket. The dilemma is that these set bounds may be far in between apart so that in reality we would need to develop a model to get a more concise pricing. Buying protection individually on each credit can be seen as expensive. The desire and motive for doing a basket default swap is that it is cheaper to purchase protection on a group of credits. Therefore it is an effective way to scale down credit concentrations at a comfortable cost. This arrangement also provides a way to earn attractive income on low risk, high quality securities, which is the main desire it provides for the protection seller. The regulatory capital benefit to selling protection is also an attraction to investors. For example, an investor may dispose off some protection against ten assets in a basket, with handsome income as the deal is closed, but only expected to settle the supervisory capital charge against two of the assets. The standard management for default baskets is still been debated. As such, the financial gain of this leverage may change depending upon the supervisory framework. It is imperative to appreciate that default basket swaps are correlation trades, to wit: (a) Correlation between changes in the spreads of the assets in the baskets and, (b) Default correlation. Correlation between changes in spreads summarises the fact that as one asset is more likely to default, the possibility that the second asset may likely want to default is high. Default correlation summarises the domino effect that the default of one asset has on the default of another asset.

For example, let us consider a default basket on two issuers within the financial sector. We would expect to find that the credit spread variations of both issuers would be strongly correlated. On the other hand, if one issuer goes ahead to default and is due to erratic and unpredictable reasons, the effect would be beneficial on the other issuer as a result of reducing human capital cost and attracting a sizable share of the market, for example. The conclusion is that we end up with a negative default correlation but positive spread correlation. There are still challenges in collating data in the estimation of these correlations. In view of this, the credits in most baskets are carefully selected in a way that they have insignificant correlations and insignificant probabilities of default with each other.

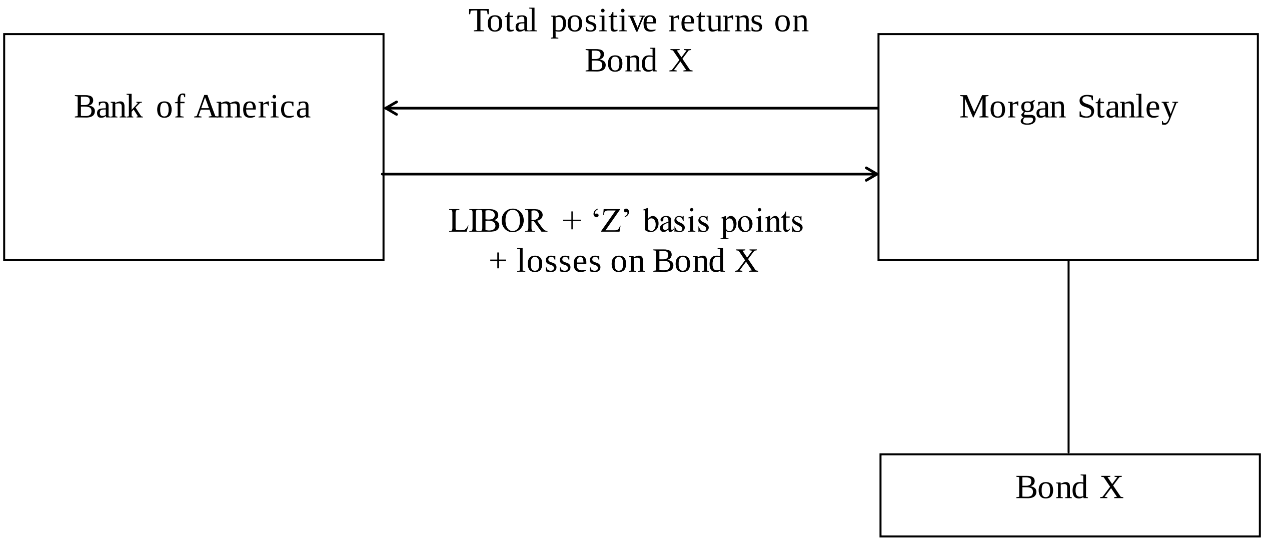
Total Return Swap

A total return swap transaction involves exchanging a commitment to pay interest at a specified fixed or floating rate of payments representing the total return/total rate of return on a loan or a bond. Thus, a total return swap mirrors the return on some underlying instrument. In a total return swap, the party buying credit risk makes periodic floating rate payments at London interbank offered rate (for example, 6 month LIBOR plus 50 basis points), multiplied by some notional principal. The party selling credit risk makes periodic payments tied to the total return to some underlying reference credit, multiplied by the notional principal. The underlying assets can either be a single instrument, such as a corporate bond, or an index. The example below gives a more explicit explanation. Explicitly, a total rate of return comprises the following elements:

(a) The first element consists of all the interest payments at fixed/regular intervals from the underlying asset paid by the buyer to the seller.

(b) The second element reflects any deterioration or appreciation in the value of the asset over the term of the total return swap transaction. If the asset has increased in value, the seller will be paid a sum equal to final value less original value. If the asset has lost value then the seller will make a payment to the buyer. These settlements will take place at the maturity of the total return swap transaction. If the underlying asset defaults the total return swap transaction stops immediately and a last settlement is made. The settlement is made by the total return swap seller to the total return swap transaction buyer, and is equal to the initial value of the underlying asset less its dishonoured value. Preferably, the total return swap seller might take delivery of the defaulted asset for its initial value. The practical explanation below throws more light on this product.

Figure P5: Total Return Swap



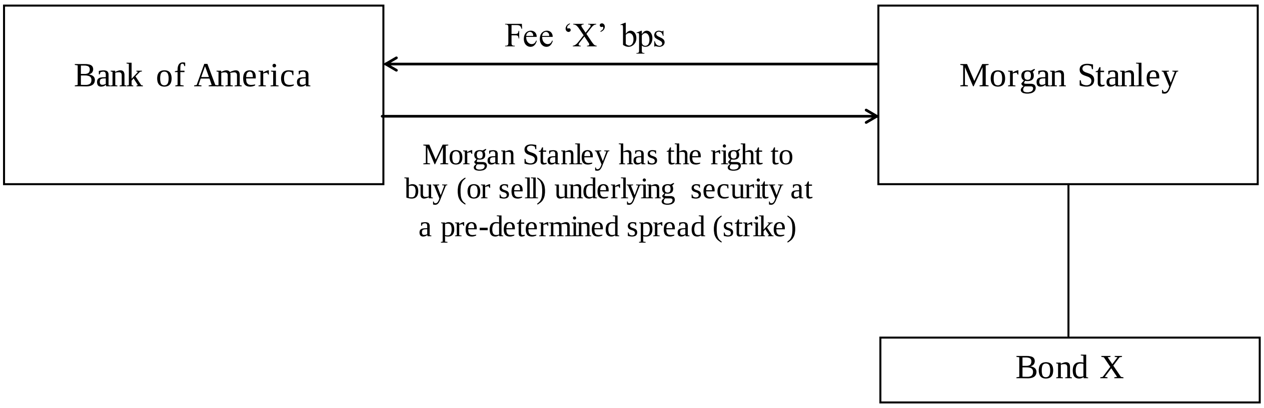
Source: Das (1998)

Assuming Bank of America and Morgan Stanley enter into a total return swap (TRS) for five years referenced to a notional amount of $100 million nominal of bond X. Morgan Stanley makes periodic payment to Bank of America of all cash flows arising from bond X plus any increase in the market value of bond X since the last payment date. On the same dates, Bank of America makes payments to Morgan Stanley of an interest rate related flow (e.g. London interbank offered rate plus z basis points) plus any decrease in the market value of bond X. If there is a defined credit event (e.g. bankruptcy, default, rescheduling and downgrades), the total return swap will usually terminate and the credit event payment will be calculated as though the next normal payment date had been brought forward.

Credit spread options

A credit spread options may be structured to survive a credit event of the issuer or guarantor of the reference asset (e.g. bond), in which case only the credit spread risk changes hands. A simple way to understand a credit spread option is that it works like a car insurance policy. Thus for a fee, the insurance policy hedges the value of a car by eliminating the risk of a large financial loss. The diagram below gives a detailed example.

Figure P6: Credit spread options



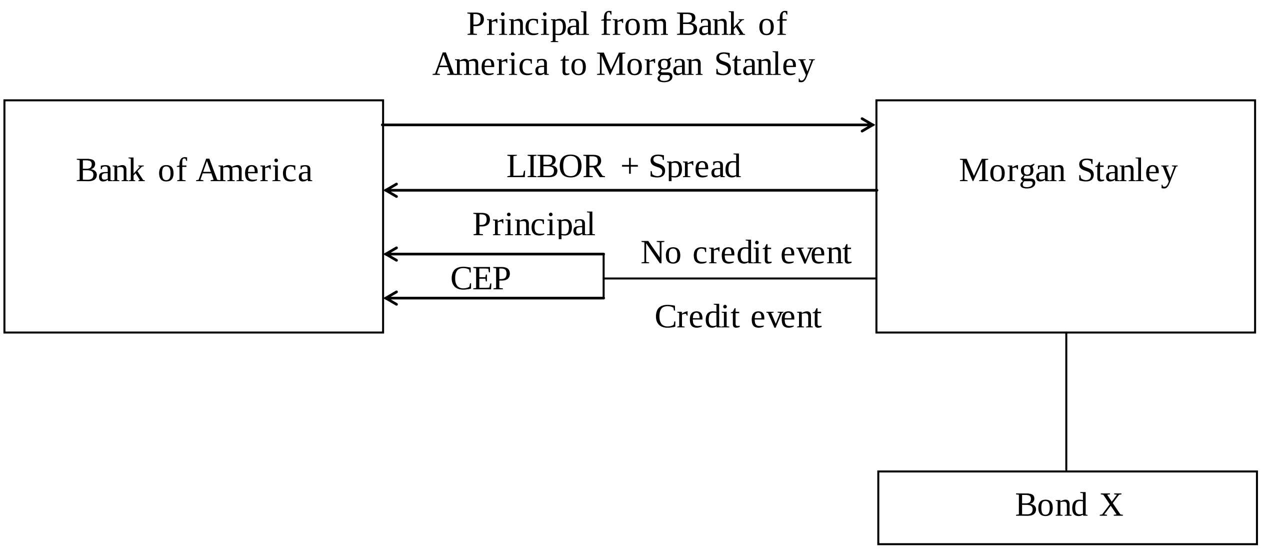
Source: Das (1998)

Assuming Bank of America sells Morgan Stanley a put option on $100 million nominal of an asset swap on bond X, exercisable at any time in the next year, in exchange for a payment of a premium. The option gives Morgan Stanley the right to put the asset swap on bond X to Bank of America at a strike spread over a pre-determined benchmark rate.

Credit Linked Notes

A credit linked note is a straightforward medium term note (MTN) with a contained credit derivatives which may take the form of a credit default swap, total return swap etc. It is a combination of a regular bond and a credit option. It is an obligation of an issuing firm that, like any other note, promises to pay periodic coupons and a final principal, that is, a large lump sum payment when the bond matures. However, the promised payments are affected by credit events of one or more reference credits. The credit option on a bond allows the issuer to reduce the bond's payments if a key financial variable specified by the bond deteriorates. Two of the most popular CLN is the credit default linked note and credit sensitive note. Two interesting examples are the synthetic bonds created by J.P. Morgan. Figure P7 below gives a detailed example.

Figure P7: Credit Linked Notes



Source: Das (1998)

Assuming Morgan Stanley issues $100 million nominal of a five-year note referenced to bond X, and the note pays a fixed or floating rate of interest. Depending on the specifics of the contract, if no credit events (bankruptcy, default, rescheduling and downgrades) occur on bond X, the note will mature at par in five years. If a credit event occurs on bond X, the note will be redeemed for the credit event payment (CEP).

Collaterised Debt Obligation

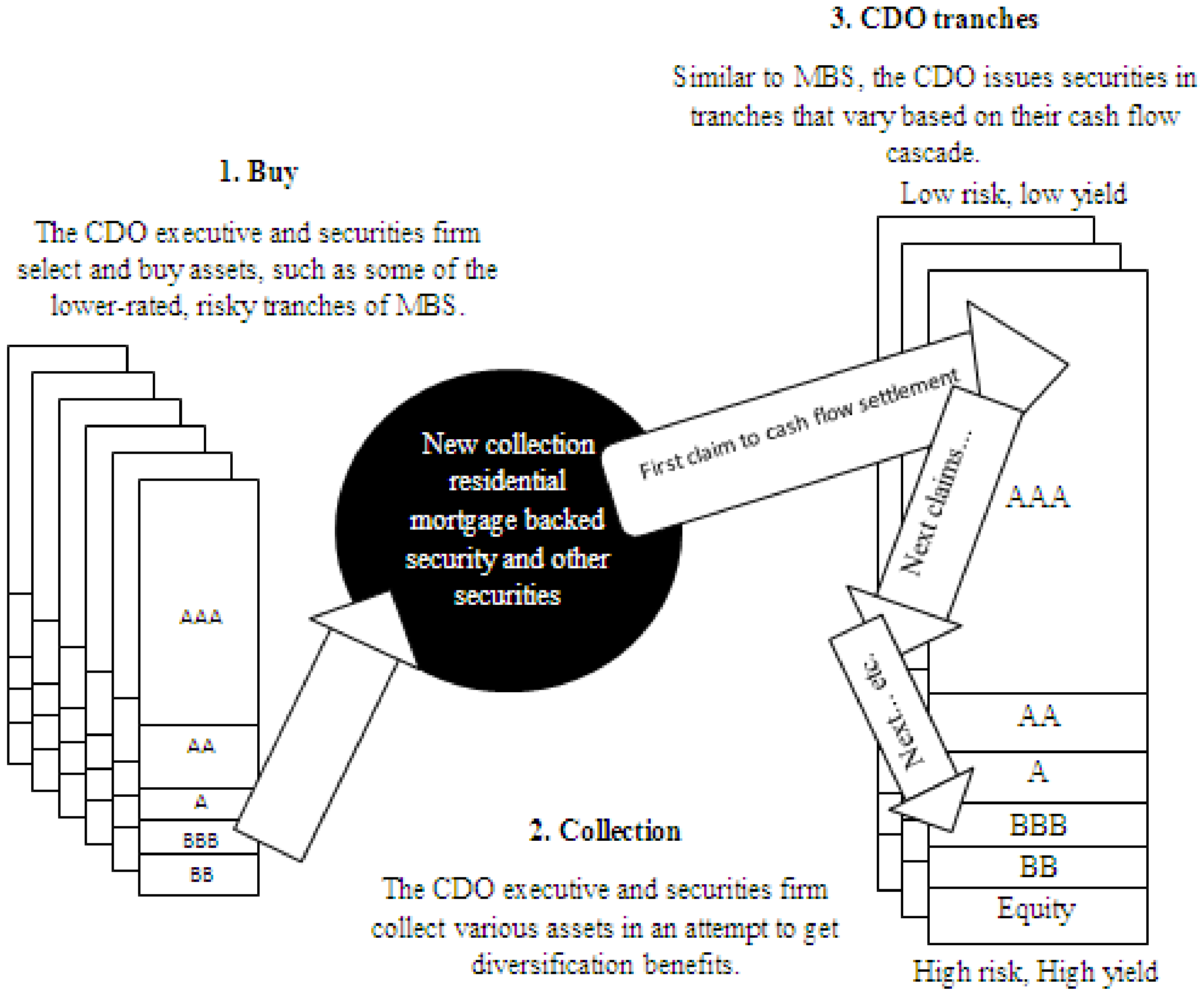
As a way of repackaging credit risk, a collateralised debt obligation can be thought of as a promise to settle investors in a prescribed succession, based on the cash flow the collaterised debt obligation collects from the pool of bonds or other assets it owns. Several classifications are created from a portfolio of bonds (emerging market and corporate bonds and bank loans) and there are rules for determining how defaults are allocated to classes.

Historically, the first collaterised debt obligation was issued by Drexel Burnham Lambert Incorporated in 1987 for the Imperial Savings Association, both institutions are now defunct. The market blossomed in the early 2000’s until the signs of the global meltdown became obvious in 2006. The following can be explained for its growth:

- The speedy pricing of collaterised debt obligation through the introduction of Gaussian copula models in 2001 by David X. Li
- Advantages of securitisation
- Global demand for fixed income investments
- Low interest rates

In most cases, the collaterised debt obligation is divided into parts (tranches), which absorb the cash flow of both the interest and principal settlement in succession based on seniority. Where any of the facilities default and the inflows collected by the collaterised debt obligation is not enough to settle all of its investors, the tranches (junior) in the lower rung of the scale suffer losses first. The tranches (senior) at the upper rung of the ladder are the last to lose settlement in the event of defaults. As a result, the compensation for the default risk affects the interest rates and coupon settlement with the safest tranches (most senior) making the least settlement while the riskiest tranches makes the highest settlement. For example, a collaterised debt obligation transaction might have to issue tranches in order of security, to wit: AAA (senior); AAA, AA, A (Junior) and BBB (residual). Financial institutions that deal in collaterised debt obligation use separate vehicles (special purpose entities) to settle investors their dues.

Figure P8: Collaterised Debt Obligation



Sources: Das (1997, 1998) and Banks et al. (2007).

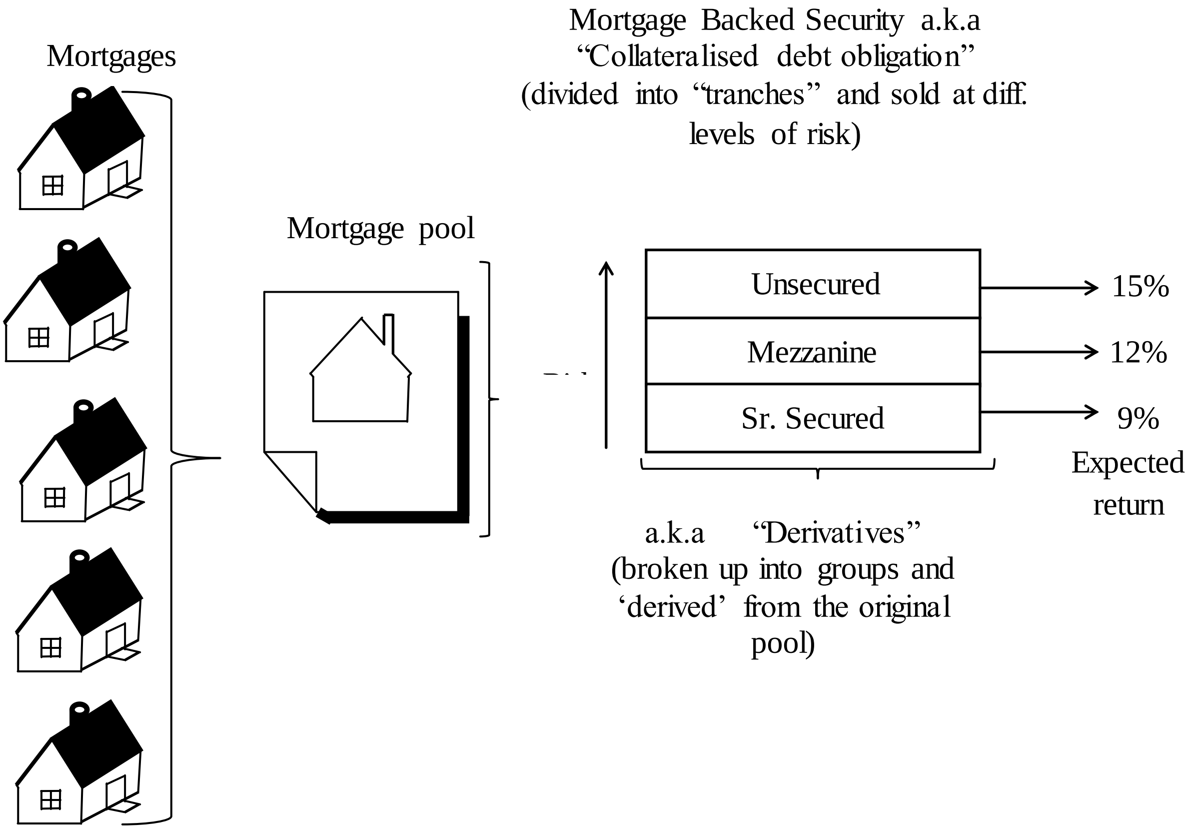
Over the years, the development of collaterised debt obligation further led to replicated tranches such as CDO^2 , the growth of the market in the mid 2000's led to the domination of the collateralised debt obligation market by risky tranches (BBB or A) reprocessed from other asset-backed securities (for example, mortgage backed security), the market subsequently dominated by non-prime mortgages rather than the traditional loan facility. Before then, the market for collateralised debt obligation were well diversified and consisted of transactions ranging from credit card debt, streamlined housing loans, equipment leasing (aircraft lease), student loans, etc. These risky non-prime mortgages and loans encouraged banks into taking risky positions which led to the financial crisis of 2007 to 2009.

Mortgage backed security

As a form of asset backed security, a mortgage backed security is an ownership claim in a collection of mortgages or a commitment that is secured by such a collection that is sometimes hundreds of mortgages. These ownership claims depict the securitisation of mortgage loans. Loans are originated by mortgage lenders. The mortgage facilities (residential or commercial) are then sold to other firms that package the loans as a group into securities that are disposed off in the secondary market.

The structure of the mortgage backed security is also called a *pass-along or pass-through* for the reason that the principal and interest settlements are passed along from the mortgage originator to the purchaser of the mortgage-backed security or it may be more sophisticated, made up of a collection of other mortgage backed security. Other types of mortgage backed security include collateralised mortgage obligations (in most cases structured as real estate mortgage investment channels) and collateralised debt obligations. The securities may be issued by architectures set up by government bureaucracies or firms, or issued by architectures set up by investment banks.

Figure P9: Mortgage backed security



Sources: Das (1998) and Banks et al. (2007)

The shares of subprime mortgage-backed securities issued by various architectures, such as collateralised mortgage obligations, are not similar but rather sliced (issued as tranches), each with a different level of priority in the debt settlement stream, with varying degrees of risk and reward. The high level of risk and the greater interest portion of a mortgage backed security are in most cases additionally altered to be more appealing and exchanged as collateralised debt obligations. These below prime securities issued by some segment of the banking sector were a major issue and cause in the financial crisis of 2007 to 2009.

Unlike most other fixed-income securities and bonds, the principal in mortgage backed securities is not settled as a single payment to the bond holder at maturity but is instead settled along with the interest in each periodic settlement which makes the total face value of a mortgage backed security diminish over time. This lessening in face value is measured by the mortgage-backed security percentage (factor) of the original face that remains to be paid back.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Problem, Inspiration and Aim of the Study

This research has two overarching objectives. The first objective is to examine in detail, the impact of credit derivatives as a credit risk management tool on portfolio performance, persistence, risk and return and whether banks can enhance, increase the value of their assets or achieve a superior risk adjusted return. The period of study is 2002 to 2011 which includes the global financial crises of 2007 to 2009. Bank portfolio performance in this research is examined based on portfolio risk and return. The banks in this research are those with asset sizes from a cut-off of $500 million and above.

The second objective is to enquire into systematically, the role of credit derivatives as determinants of bank use to mitigate risk in its loan portfolio and as a risk management tool to bring into line its credit risk exposure with its credit risk profile that it wished for, for the period under review.

The alternate objective from the second objective is to test the impact of the moral hazard problem on portfolio performance. This problem is prevalent when there is inadequate monitoring of loans supported with credit derivatives contracts as lenders are in most cases unable to do proper follow up on their borrowers resulting in loan loss defaults.

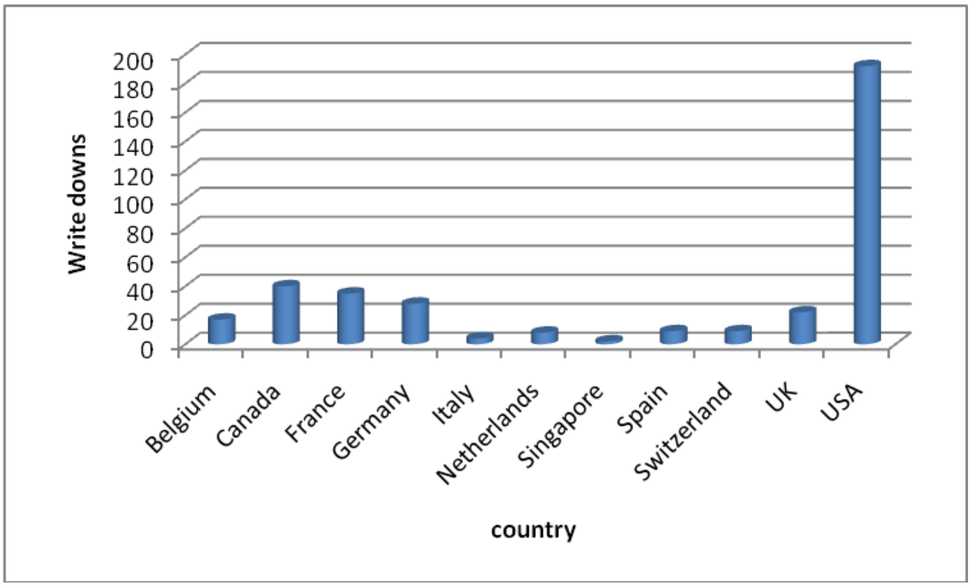
The background and need for the study is influenced with the fact that financial institutions are motivated by the likely benefits of credit risk transfer of (Henke et al. 1998; Minton et al. 2009; Nijskens and Wagner 2011; Bedendo and Bruno 2012; Parlour and Winton 2013): (a) diversification and (b) a reduction in the costs of raising external capital for loan intermediation. Froot et al. (1993) and Froot and Stein (1998) propounded on the expectation of an equilibrium in which a bank transfers credit risk until the costs of doing so exceed the benefits associated with lower capital requirements relative to the scale of the lending business. Conversely, banks incur two major costs when transferring credit risk to another investor: (a) the lemons premium that the investor charges because of the bank's inside information regarding the credit risk. For example, as suggested by Akerlof (1970), Dahiya et al. (2003) and Marsh (2006), banks have privileged facts and figures about borrower's risk of not meeting their obligations, and are expected to be adversely affected by lemons premia from loan disposals; and (b) The moral hazard caused by the suboptimal control by the bank of the borrowers' risk of default since there would be less motivation to control the credit risk of a loan that is disposed off than of a loan that it retains in its balance sheet (Diamond 1984).

During the period from 2007 to 2009, there was record number of defaults, downgrades and bank liquidations worldwide and the regulators were busy changing and responding to the treatment of credit risk, credit risk management, assessment of the current market practice, bank solvency, bank liquidity, prudential regulation, the current structure of banking, the impact on banks of the existence of new financial innovations in credit risk transfer, products of credit trading and mitigation etc (Financial crisis enquiry commission 2011; World Bank Reports-Response to Economic Crisis 2011). The crisis hit the world economy and the entire financial sector much harder when juxtaposed against the dotcom crisis of 2002, such that many businesses including banks failed to modify their business model, invest in robust risk management and professional asset-liability management. This has led to a wealth of new research in credit risk transfer through credit derivatives (Longstaff et al. 2008; Hirtle 2009; Karras 2009; Ben-Ameur 2009; Brigo and Kyriakos 2009; Norden et al. 2014).

The impact of the financial crisis on financial institutions in respect of asset write down in North America and Europe is captured in Table A1 in the appendix, Figures 1.1 and 1.2 below. Adelson (2013) valued the total global losses from the credit/financial crisis at $15 trillion. Atkinson et al. (2013) assess that the credit crisis cost the United States economy an approximated 39 to 90% of one year's production valued between $6.5 to $14 trillion which is equivalent of between $51,000 to $122,000 for every U.S. household.

In the US, since the chartered banking years and the earliest banks from 1780 up to 1840, the sector has grown rapidly. For example, Table A2 in the appendix shows how the US Federal Deposit Insurance Corporation (FDIC) insured institutions have grown over the years. Like other listed firms, a large chunk of the banks are traded on the New York stock exchange while the very big market makers are also quoted on the London Stock Exchange simultaneously.

Figure 1.1: Number of write down by banks to countries



Source: US Federal Deposit Insurance Corporation (FDIC)

Figure 1.2: Value of total write-downs and credit losses of financial institutions during the crisis from 2007 to 2009 (% of GDP (left) USD bn)

Source: Bloomberg, IMF

This thesis focuses on the US banking sector and market for the following reasons: (a) The size of the global derivatives as a percentage of the US derivatives market, for example, according to the Bank for international settlement (BIS), the notional value of the global derivatives market was worth $700 trillion as at the end of 2008 though the figure has nosedived to $544 trillion as at the end of June 2016 while the notional value of the US derivatives market was worth $200 trillion as at the end of 2008 but this has reduced to $177 trillion as at the end of September 2016, according to the US Office of the Comptroller Currency (OCC); (b) the size of the global credit derivatives market as a percentage of the US credit derivatives market, for example, the notional value of the global credit derivatives was worth $62 trillion as at the end of 2008, more than the global notional amount of bonds as well as the global gross domestic product in total. This figure has reduced to $12 trillion as at the end of June 2016 according to the BIS due to recent changes in regulation which includes central clearing and the putting in place of swap execution facilities (Oehmke and Zawadowski 2013, 2014) while the notional value of the US credit derivatives market was worth $14.9 trillion as at the end of 2008 though this has reduced to $6.5 trillion as at the end of September 2016, according to the OCC (c) Availability of banking data from the Federal Deposit Insurance Corporation (FDIC); (d) US Banks have got huge asset capital base, for example, 25 banks actively trading in derivatives account for $10.7 trillion in assets of the total banking assets of $15 trillion as at the end of September 2016, according to the OCC ; (e) Banks derive more fee income from non-lending sources in comparison to income from traditional and core lending sources and (f) Changes in bank regulation-: Volcker Rule (Dodd Frank Law 2012). The thesis also critiques and examines the literature and juxtaposes between the conduct of the banks in the US market. Varied hypothesis and assumptions submit arguments for the use of derivatives to hedge against risks; still, none have proffered solution to all the issues on risk management. Investigations by academicians have found it imperative to zero in on predictive models why they hedge and the benefit to their shareholders. Yet, the enormous budget and endeavour devoted to investigate these predictive models have created further burden for investigators to argue, advance and evaluate these concepts.

Changing Credit Market Landscape

The specificity of credit risks has only been recognised less than two decades ago and its quantitative treatment have lagged that of market risk by several years (Li and

Zinna, 2004). Progress in the understanding of the quantitative treatment and pricing have induced the creation of a plethora of new products designed to hedge or take positions in credit risk. Financial institutions (categorised or classified into commercial banks, investment banks and insurance companies. Others are securities firms, mutual funds and finance companies) have veered into the space of financial engineering and mathematical finance due to the success in complex quantitative methodologies in helping financial professionals, fund and portfolio managers in managing financial risks, they create new and complex financial instruments by connecting derivatives or in most cases, by using derivatives pricing models, framework and techniques in pricing credit derivatives and credit related instruments, for example (Litterman and Iben 1991; Jarrow and Turnbull 1995; Jarrow et al.1997; Duffie and Singleton 1999; Kijima and Komoribayashi 1998).

As suggested by Darren (2009), lenders mitigate risk by using several methods:

- Risk-based pricing;
- Covenants;
- Tightening;
- Credit insurance and credit derivatives;
- Diversification; and
- Deposit insurance.

With the rapidity of the innovations in the financial sector, the next port of call was the management of credit risk after series of financial engineering has been witnessed in areas such as interest rate risk, equity risk, commodity risk and foreign exchange risk. The concentration on credit risk was centred on the following reasons, (Rule 2001; Altman 2002; Gonzalez et al. 2012):

(a) Enhancement of credit portfolio and bank portfolio risk/return analysis;

(b) Enhancement of innovative credit risk management instruments such as securitisations, credit derivatives etc.;

(c) Advancement in credit risk modelling methods and skills;

(d) Enhancement of strongly constructed credit databases;

(e) Growth and expansion of the corporate bonds market; and

(f) The emphasis and importance of the Basel II capital regulation on more sophisticated credit risk management methods.

Historically, lending money was a bilateral transaction involving a lending bank and its customer for the whole term of the operation. A close scrutiny of the customer's quality, a monitoring of its evolution and the negotiation of collateral for the loan represented the central idea of banking. Financial institutions were contented with earning money from profitable loan underwriting and not from excess returns on investments. With financial markets and external investors, the lending business has significantly changed in several directions.

First, the development of the secondary markets for credit risk products has enabled a rationalisation of delegated monitoring done by banks or by external independent providers such as rating agencies (Diamond 1984). Second, the change linked with the introduction of portfolio theory to credit - the Markowitz-style (Markowitz 1959; Sharpe 1970; Lorie and Hamilton 1973; Wind 1974; Gup 1977). Nearly two decades ago not many banks would have had a very clear idea of the composition of their loan portfolio, at that time the focus was on the size of the balance sheet (Hirtle 1997). Third, the driving force behind the development of credit markets is the varying degrees of risk aversion of credit stakeholders (Stulz 1984; Smith and Stulz 1985). It is clear that a bank, an insurance company, a hedge fund and a personal investor do not share the same risk appetite. This diversity is a strong rationale for the transfer of risk through hedging as well as protection buying and selling. Defining what is suitable for an agent, given its risk aversion, implies being able to quantify risk precisely. This explains the strong quantitative approaches to credit risk (See Basel Committee on Banking Supervision 1994, 1995, 1996, 1998, 1999, 2000, 2001, 2004, 2010).

Lastly, there is the acknowledgement that credit risk quantification requires a degree of technical sophistication which until more than a decade ago was not available to banks. New theoretical advances as well as enhanced computing have enabled the development of specific models for credit pricing and hedging (Brigo and Kyriakos 2009). Previous industry sponsored Credit Value-at-Risk methodologies have centred around the JP Morgan Credit Metrics (JP Morgan 1997), the option pricing or structural approach as initiated by Kealhofer, McQuowan and Vasicek - KMV, now part of Moody's Analytics Enterprise Risk Solutions (KMV 1993, 1998) which is based on the asset value model originally proposed by Merton (Merton 1974), the actuarial approach as proposed by Credit Suisse Financial Products (CSFP) with Credit Risk^{+} which focuses on default (Credit Suisse Financial Products 1997) and finally, Mckinsey's Credit Portfolio View (Mckinsey 1997) which is a discrete time multi-period model where default probabilities are conditional on the macro-variables like unemployment, the level of interest rate, the growth rate in the economy which, to some extent, drives the credit cycle in the economy (Saunders 1999; Koopman et al.2009).

Credit risk

For lucidity and clearness, banking is one of the most controlled businesses. To shield the banking public from losses, supervisory outfits are mandated with the authority to act in collating and assessing the facts and figures required in evaluating exactly how healthy the banks are. Consequently, a bank's evaluation of the hazardousness of facilities applications, the subsequent choice to approve loan or otherwise at some interest rate, fine-tuned for risk, and the manner in which one-to-one care of approved facilities occur, are significant working judgement and assessment decisions nearly all financial companies undertake (Jacobson et al. 2006; Goldsmith-Pinkham and Yorulmazer, 2010; Behr et al. 2010, 2011; Calice et al. 2012). In comparison to market risk which results in gain or shortfall chances, the outcome and consequences of credit risks more or less ends in losses. The first and most basic factor in loan advances, possibly the core type of risk encountered by banks as a financial go-between is credit risk. Credit risk is the chance that a debtor will default on a facility. The scale and concentration of the capital of a bank's net worth comparative to the sum total of the monetary worth of their balance sheet items, suggest that a relative limited size of facilities categorised as nonperforming could endanger the well-being of a financial situation and the default risk of a debtor has the potential of depleting a bank's monetary worth to bring it into bankruptcy (Broll et al. 2004; Karras, 2009).

Failure to pay happens where a debtor is unable to meet important monetary agreements, to wit, repayment of loan principal/interest, payments of interest to bond holders etc. Should there be difficulties in meeting financial obligations, adverse losses are suffered by parties such as banks, bond holders etc, in particular, financial institutions incur losses as receipts due to them would not be paid (Neal 1996; Asher, 1998; Lando 2004).

Following the coming off of geographic constraints, credit investments risk accelerated and spreads thinned down, implying that geographic change chiefly protects against superior risk-return selection that develop out of rising process of trying to beat others in the market (Dick 2006; Cacciatore et al. 2014).

Deng and Mao (2007) in their study of the diversification and pricing of debt capital of conglomerate banks found that geographic expansion of these banks is related with a considerable deterioration in equity risk; however has a slight influence on stock yield. Because there are financial institutions that incline to focus their facilities naturally or in specific business, there are restrictions to their capacity to broaden credit risks amongst debtors (Elyasiani and Wang 2012). Financial institutions with focused lending markets may want to spread these risks. Dealing with this type of risk by means of choosing and scrutinising debtors and by setting up a differentiated loan portfolio content and range has always been one of the main tasks in managing a bank. (Broll et al. 2004).

Selling loans is one of the techniques of driving down credit risk. Nonetheless, nearly all bank loans are by far not convertible to cash quickly. In addition, marketing and trading loans can damage the dealings and connections with debtors, a significant ingredient in the financial services market place (Park 1998; McPhail and McPhail 2014). If a bank keeps a group of investments such as loans and facilities that are not disposable or easily marketable, these may be restructured with credit derivatives, which in turn also help the bank to handle different and incompatible goals (Dong 2005; Kiff et al. 2009).

Credit Derivatives

Since then, due to financial innovations in credit risk transfer, credit derivatives have continued to play an interesting, vital, but controversial role in the financial markets and will continue to transform the credit markets in the years to come. Recent research seems to categorise credit derivatives based on their ability to transfer risk, mitigate risk, their hidden dangers and ability to cause systemic risk. As the credit derivatives markets have developed, their impact on the financial institutions has become more profound.

Credit derivatives are a key tool in the dynamic portfolio management that is growing in importance in the global banking industry. Increased use of the instrument and other risk-transfer techniques will redistribute credit risk, at least theoretically, within the banking system as well as redirect it outside, chiefly to the insurance sector, investment funds, and hedge funds. In their increasingly complex forms, they have posed challenges to accounting standards, regulators and the financial markets (Xing and Yuqin 2012).

It has not, as commonly believed, helped banks avoid meaningful amounts of losses in their credit cycle and it is not yet panacea for the credit problems of the banking system around the world. Evidence from the credit crisis suggest that a tiny fraction of the notional amount outstanding actually represent a transfer of credit risk from banks' lending and trading activities to other market participants. The remainder are representing the dealing books of the banks that dominate the market. These dealing banks enter into credit derivatives largely as a client service and then seek to lay off the risk. The open question is whether they are infact completely hedged and whether there is no portion of the business that represents proprietary trading in a now attractive, tradable asset class.

Another aspect of the credit derivatives business that has limited the amount of risk transferred away from the banking system is that the risks that can be protected with credit default swap (CDS) are largely investment grade. This appears to have the effect of shifting the remaining risks in the banking system further towards the riskier, non investment-grade range of the spectrum.

Credit derivative can be used to express a view on credit risks (Das 1995). For example, for institutions that take on credit risks, the liquidity and convenience as well as the pricing of the credit risk is an attraction. Even though the category or kind of risk is not previously unfamiliar or not widely known, it is principally unfunded and hidden, which could allow some players to become leveraged in a way that outsiders or even senior management might not be aware of.

Though credit derivatives have been a clear success in view of its market growth, they are not without their challenges. First, it has been a disruptive influence in financial services because they have altered the way banks are structured and activity is carried out. Second, it has the potential for throwing up conflicts of interest between public and private markets especially where credit default swap participants have access to private information sourced from loan syndication (Acharya and Johnson 2007), regulatory licences associated with credit ratings and the special treatment of derivatives in bankruptcy. Third, it has thrown up other issues such as moral hazard and other incentives problems, limited disclosure, potential systemic risks, high transaction costs, and the mispricing of credit etc. Fourth, they also expose investors and intermediaries to credit risk, market risk, liquidity risk, legal risk and operational risk. Because effective risk management is essential to the long term success of any organisation, institutions dealing in credit derivatives must consider, and ultimately control, all relevant risk parameters in a manner consistent with corporate imperatives and applicable regulations (Danielason et al. 2002). The largest risk in using credit derivatives is the operational risk (market attached to speculative activity). A classical example is the collapse of Barings Plc, a British investment bank in 1995 and subsequently sold to ING group for GBP 1.00.

For clarity, the international stock and financial markets was excited about the potentials of credit derivatives products which enabled financial institutions and other counterparties, to isolate their credit risks from other types of financial risks, for example, interest rate risks, foreign exchange risks etc. The belief was that the new asset class of credit derivatives had the capacity to change radically the way credit risk is valued, handled and administered.

Financial institutions especially commercial banks saw in credit derivatives a new mechanism of redistributing credit risk generated in their loan books or trading portfolios to other investors, for example, banks, insurance companies, hedge funds etc. They also allow banks to have access to credits and architecture not available in the established cash marketplace as well as free more capital to regenerate more credit to their customers.

Before the credit crisis, empirical research on credit derivative products was skewed towards pricing for the following reasons (Rudiger and Jochen 2008; Longstaff and Rajan 2008) : (a) Differences in the ratings of these products by rating agencies may lead to wrong investment decisions; (b) Quantifying and understanding the credit worthiness of a borrower or debtor may be difficult; (c) Tracking and controlling the market price of the fundamental credit obligation is intricate; and (d) Credit default is not a common event and getting practical, real life data in respect of a liquid company may be a difficult task for an investor. However, research into the impact of these financial products on bank portfolio persistence and risk-adjusted return are few. A pragmatic analysis of the impact and performance of these products on the portfolio of banks and there control assists the counterparties have a superior discernment of credit derivatives. The key points of the growth of credit derivatives before and after the financial crisis pointed to the fact that some financial institutions saw it either as genuine products to mitigate risk while some also saw it as just an avenue to make easy money but without understanding the financial products they traded in, the risk they pose to the banks and the entire financial system.

The counterparties to a credit derivatives transaction, the protection seller and protection seller buyer, will in most cases, enter into a trade for mutual benefit. A protection seller is always happy with the constant stream of income and the potential to increase their bottom line except where a deal is triggered by a credit default. As seen during the heat of the financial crisis, most protection sellers rated too low the hidden risk of the financial contracts and products they entered into.

For example, at the beginning of the first quarter of 2012, when the major financial markets were in comparative tranquil, a derivatives trader with JP Morgan, triggered some concerns among hedge fund insiders who became aware that the market in CDS was possibly being traded aggressively by his activities with reference to the huge positions he was taking in the CDS market. Substantial counter gamble to his spots were done by other traders, the London branch of the bank was among the counterparties who acquired the derivatives presented by the bank in such substantial quantity. A massive loss of two billion dollars was declared by the bank in the middle of the second quarter of 2012 in respect to these trades. The traded article was in respect of an index which handles trades on the delinquent risk of big US firms. Interestingly, the staff in the office of the Chief Investment Officer with a wide freedom for unsupervised trading were claimed to have asserted that they were merely executing the investment strategies required by the risk management model of the bank for hedging purposes (New York Times, May 10, 2012; Skyrm 2014).

Hedging of credit risk is the paramount reason protection buyers enter into credit derivatives contract but they are not immune from the inherent risks in these deals as credit derivatives also have enormous credit risks that an active position-taker will have to contend with in every counterparty.

For example, a protection buyer hedges the credit risk in a facility with CDS but by extension, they would also have to contend with the credit risk problem from the protection seller as well which are highly concentrated from the evidence of the financial crisis and from which settlement can be very enormous.

Another potential risk that protection buyers face is the clarification and comprehension of credit derivative contracts which sometimes create legal tussles between counterparties. For example, in 2010, the Swiss banking giant, UBS was engaged in a legal tussle with a German city (Leipzig) arising from unforeseen risks embedded in credit derivatives contracts running into millions of Euros of penalties to be paid. Like many other cities, Leipzig entered into derivatives contracts to scale down interest rates payments amidst reducing revenues and to restructure their balance sheet. In detail, the transaction involved CDS contracts in which Leipzig sought to restructure an earlier arrangement of a sale and leaseback arrangement to dispose off assets which included the water works to US investors. The transaction involved public properties, transport infrastructure and utilities. The deal was part of the cross-border leasing deals that German cities entered into to take advantage of the favourable tax regime of leased assets in the US and Germany with the expectation of mutual financial gains for both parties.

Since the financial crisis, some of the cities that took part in these transactions have had to seek additional collateral by reason of additional counterparty risk due to new financial difficulties. As part of a transaction with Depfa Bank and Landesbank Baden-Württemberg, both subsidiaries of UBS, the water company of the city of Leipzig, KWL, entered into a credit default swaps and collateralised debt obligations contracts with the banks in which it insured the banks against losses on a portfolio of loans amounting to €290 million with the knowledge and approval of management committee of the city. The city of Leipzig approached the courts in London when it defaulted in interest payments under the CDS contracts claiming that the staff, who had been dismissed, entered into the contracts without the authority of the management committee of the council. However, UBS on its part also commenced legal proceedings against the city to honour its contracts. UBS lost the case eventually (Daily Mail, November 4, 2014).

In as much as the money making opportunity lured some banks into credit derivatives trading, some preferred the traditional banking model due in part to the valuation problems associated with financial instruments such as credit default swaps and collaterised debt obligations. The data from the US Federal Deposit Insurance Corporation (FDIC), US Office of the Comptroller of Currency (OCC), International Security and Derivatives Association (ISDA), Bank for international settlement (BIS) and the British Bankers Association (BBA) shows that credit derivatives trades are concentrated in London and New York. In the US, five large banks are the principal market makers in the credit derivatives market.

1.2 Growth, maturation of the credit derivatives market and the banking industry

Historically, the birth of credit derivatives can be traced to 1975 when the New York stock exchange stopped fixed commissions which led to the dropping of commission rates and broker consolidation (Lockwood and Lin 1990). There was increased licensing of investment banks by the regulatory authorities. It witnessed a harsh recession and oil price volatility. It also saw the collapse of the New York City real estate market which consequently made the New York City council defaulting on its borrowings and bonds. The resulting collapse of the real estate market saw major banks on the edge of declaration of bankruptcy and heavy burden of bad loans.

By 1980, the prime lending rate had hovered between 20 to 22%. The Iran/Iraq conflict was in full swing which eventually lasted for another eight years. The interest rate yield curve had pointed to another potential recession. The operating model of banks then was to buy/retain loans and bonds in their portfolios and balance sheet. The leveraged leasing sector witnessed increased boom but there was limited trading in the secondary credit window. The market had no artificial credit structures or financial engineering products to transfer credit risk. Major Banks like Citibank, Morgan Stanley, and Chase Manhattan etc were principal players' in big ticket loan syndication transactions and private placement activities. In view of the boom in their lending activities and to provide satisfactory relationship banking for their clients, banks also provided adequate training for their staff on fixed income trading for up to three years to make them well grounded in the financial markets activities. Bond syndication by banks was disposed off without any trace of counterparty risks.

The US market controlled a large chunk of the secondary bond trading with limited activity in the UK though there was limited sale of the debt trading of the German government. Banking products were not complicated; they were limited to interbank loans, commercial papers, banker's acceptances etc. It also saw the restriction of US investors like insurance companies, pension funds etc who were barred from investing abroad. There was increasing expertise in project finance among western banks, US banks increased loans granted to third world countries including Latin American countries which was backed by sovereign debt guarantees. The resultant volatilities in interest rate, foreign exchange market and high inflation rate gave rise to the trading of interest rate swaps. At this stage, banks had started to devise structure on how to off load risks from their portfolios and balance sheet. The consolidation of the banking sector was initiated to reduce the number of banks.

By 1995, the American bank, JP Morgan created the first credit derivatives instruments (CDS and CDO's). Due to shrinking returns, the bank steadily veered away from relationship banking to credit trading and made good business from accounting and regulatory arbitrage. It steadily gained expertise in moving credit risk from their balance sheet by accumulating loans, remarketing portfolios and buying protection from other institutions after loan syndication to its borrowers. The growth of the credit derivatives market grew rapidly in 1996 with the global notional outstanding value standing at one hundred and eighty billion dollars at the end of 1997, according to the BBA report of 1998. Between 1998 and 1999, trading in Basket portfolio had began and the transaction in the entire debt capital was on a firm footing. The development of new CDS transactions had allowed the offsetting of possible losses on sub-investment grade, high yield bonds and loans. With the expansion and sophistication of the market, the ISDA updated its CDS documents and supplements which led to the standardisation of the CDS market which reflected in volume business by the market players. The global notional value of the market stood at five hundred and eighty six billion dollars at the end of 1999, according to the BBA report of 2000.

Between 2000 and 2001, there was a risk of price squeeze on the defaulted bonds used for physical delivery with the volume of CDS transactions worth one hundred billion dollars exceeding the volume of cash bonds which stands at thirty billion dollars. To avoid the dangers of physical settlement, the first cash settlement of CDS terms were used. The collapse of the dot.com boom sent shock waves of credit defaults in the financial markets with investors becoming aware of the need for credit protection. Traders in the CDS market saw an opening in the ratings arbitrage strategies by exploiting the delays in the upgrades and downgrades of counterparties and products to make abnormal gains through speculation. The market for the credit linked notes products accelerated in the Euro zone thus paving the way for the development of the CDS market. The global notional value of the market stood at one trillion, nine hundred and fifty two billion dollars at the end of 2002, according to the BBA report of 2002.

By 2005, the sophistication of the market prompted the ISDA to create terms and translations on CDS of ABS. The Delphi default threw up enormous counterparty risk and complications on defaulted bonds used for physical delivery thereby causing price squeeze. Enormous losses were recorded by a number of hedge funds and market makers as purchase of defaulted bonds for physical delivery created a price squeeze. Processing and documentation procedures by the back office desk of counterparties created delays in settlement thus throwing up a systemic risk of the likelihood of a potential financial and credit crisis. In response to the threat to the market, chairman of the US Reserve bank threatened the market players with sanctions and a halt in trading if they failed to clean up the documentation and settlement mess. The counterparties responded to his prodding and started the cleanup of the procedures. At this stage, the contracts and transactions on CDS were still over-the-counter though Australia had a limited retail market structure. The market became increasingly profitable for fund managers and major market makers which stemmed from the use of special purpose vehicles, slicing, tranching and re-marking risks with the use of Nth-to-Default, CDO, CDO-squared (CDO^2), etc.

The following year 2006 saw the development of industry-specific indexes such as the CMBS, ABS (ABX) etc. Due to the expansion in the market, more counterparties such as hedge funds, multinational corporations, insurance companies etc became more active thus exposing themselves to counterparty risks as well. With the increasing availability of credit derivative products to redistribute risks, big market players especially banks with massive balance sheet had no need to situate new loans on their books. According to the ISDA, the activity in the market saw the notional volume of credit derivatives increased to twenty six million trillion dollars. With potential risks from operational, market and credit risks, the BASEL II became a mechanism to drive compliance among counterparties.

The accounting standards IAS 39 (Walton 2004) and FASB 133 (Hwang et al. 2001) placed more premiums on the compliance on credit default models. The risk premiums in new bond subscription were raved up due to the consolidation of guarantors. Again, to avoid credit squeeze, the market moved towards cash settlement and auction pricing of defaulted credits on the trigger of default occurrence. Standard pricing structures for the pricing of credit derivatives products, to wit: Markit, CDX, and iTraxx are now helping the trading of the financial product. And to set up the first standard and large retail market, the Chicago Mercantile Exchange (CME) considered the listing of the standardised single name credit default swap contracts. The speed of trade clearing and settlement was enhanced with the development of the DTCC clearing system which reduced costs and operational risks. The CDS market witnessed an exponential growth with outstanding notional value hovering around twenty five trillion dollars with an underlying bond value of forty trillion dollars, according to the BIS. To enhance improve documentation and clear standardised industry procedures, the Dura default auction was successful in November 2006. Increasingly, the counterparty risks among hedge funds refused to go away as most market makers still lend to these funds through their brokerage subsidiaries. The use of Permanent Capital Vehicles (PCVs) were now gaining ground as a vehicle to invest in the credit markets in which investment managers were now able to do cycle plays, longer term arbitrage and capital structure, locking in investment money up to five years or more.

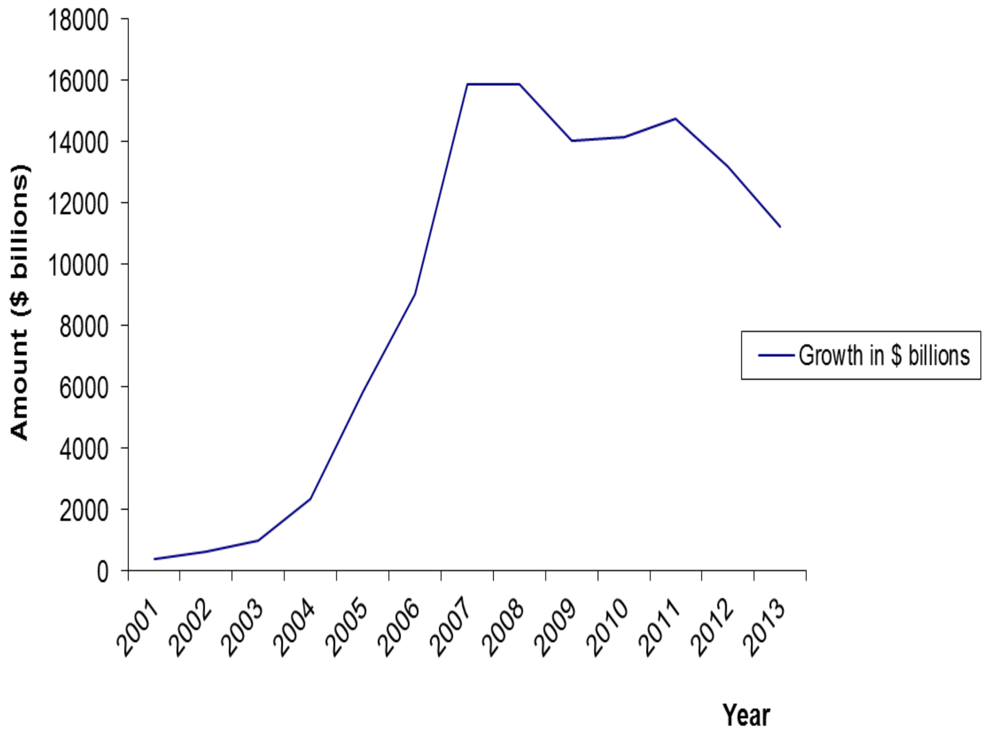
In the US, major banks dominate the credit derivatives market. According to the ISDA, worldwide notional gross value stood at thirty five trillion, one billion dollars. The value grew rapid to sixty two trillion dollars in 2008, according to the Times report of September 15, 2008.

1.3 Research Objectives and Questions

Research Problem

The significant addition of these financial products to portfolio management of banks is the provision of a conceivably valuable mechanism in the management and isolating their credit risk distinctly from other risks. The creation of an "efficient" portfolio, to wit, a portfolio that has a minimum total risk for a given level of expected return should be the aim of a portfolio manager, irrespective of the composition of the portfolio of the asset class. A bank portfolio manager can also without difficulty adjusts the portfolio's exposure to a certain degree of benchmark and consequently adjust the portfolio's risk framework, attribute and quality to achieve an efficient portfolio (Angelidis et al. 2009).

Figure 1.3: Changes in the US credit derivatives market in different periods: outstanding notional value of credit derivatives contract in (US $'millions) from 2001 to 2012.



Source: US Federal Deposit Insurance Corporation (FDIC)

Table 1.1: Notional amounts outstanding by instruments (2011-2013)

Risk Category	Notional amounts outstanding (US $ 'millions)					Gross market values (US $'millions)				
	Jun-11	**Dec-11**	**Jun-12**	**Dec-12**	**Jun-13**	**Jun-11**	**Dec-11**	**Jun-12**	**Dec-12**	**Jun-13**
Single-name instruments	18,105	16,865	15,566	14,309	13,135	854	958	715	527	430
Multi-name instruments	14,305	11,761	11,364	10,760	11,214	490	628	472	321	295
Total Credit default swaps	**32,409**	**28,626**	**26,931**	**25,069**	**24,349**	**1,345**	**1,586**	**1,187**	**848**	**725**
Multi-name instruments of which index products	12,473	10,514	9,731	9,663	10,170					

Source: Bank for international settlement (BIS)

Table1.2: Notional amount outstanding by instruments and counterparties up to June 2013 (US $ 'millions)

Instruments and counterparties	Notional amounts outstanding			Gross market values			Net market values		
	Bought	**Sold**	**Total**	**Positive**	**Negative**	**Total**	**Positive**	**Negative**	**Total**
Total CDS contracts	19,257	18,820	24,349	605	576	725	121	93	152
Reporting dealers	13,711	13,745	13,728	455	455	455	64	62	64
Other financial institutions	5,425	5,004	10,429	143	117	260	52	28	80
Central counterparties	2,776	2,772	5,548	43	44	87	4	4	9
Banks and Security firms	1,220	996	2,216	35	31	66	9	7	16
Insurance and financial guaranty firms	165	66	230	7	2	9	6	1	7
SPVs, SPCs and SPEs	292	80	372	14	7	21	9	3	12
Hedge funds	443	633	1,076	21	21	42`	7	8	15
Other financial customers	529	457	986	23	12	35	16	6	22
Non-financial institutions	122	71	193	6	3	10	5	2	8

Source: Bank for international settlement (BIS)

The primary objective of this study is to investigate the impact of credit derivatives on bank portfolios performance. The research will test the hypothesis that financial institutions can achieve a superior risk-adjusted return on their portfolios with the help of credit derivatives compared to when the instruments are not used in bank portfolios as the use of these financial products could have both positive and negative effects on bank portfolio performance.

The second primary objective investigates the determinants why banks use credit derivatives to mitigate risk and also as a risk management tool.

Related to the primary objective is the alternate objective. Banks are mostly the market makers in the credit derivatives market. When banks are considered as a whole, loan default losses resulting from moral hazard problem cannot be taken as internal cash transfers but the same cannot be said of the premiums paid by protection buyers to protection sellers, these are just internal cash transactions and transfers among banks. In the same vein, protection sellers have to cover the loan default losses but protection buyers do not lose anything because they are protected. In view of the volatility of bank income stream sometimes, the relationship between credit derivatives instruments and bank portfolio performance could be worsened where moral hazard problem is critical.

In view of the above, the alternate objective of this study is to investigate the moral hazard issues bordering on the entry of credit derivatives. As an attribute of these instruments, banks transfer the default risks of their loan asset to the protection seller which causes banks to have minimal incentive to monitor their loans which invariably increases the rate of loan defaults.

Research Questions

This study addresses the primary research question whether bank use of credit derivatives boost the efficiency and performance of bank portfolios. The introduction of credit derivatives has thrown up varied interest with several researches. None have empirically investigated the comparability of portfolio performance with credit derivatives before and after the credit crisis of 2007 to 2009.

To establish the plausible reason to the question is an important progression for the regulation of the banking industry and focuses on the question of whether large market players require careful watching over for the stability and safety of depositors and their assets. To answer the primary question better, specific research questions are presented below. Please see chapter five for detailed explanation.

Hypothesis 1

To test if the usage of credit derivatives affects bank investment and portfolio performance.

Hypothesis 2

To test if the purchasing of credit derivatives affects bank investment and portfolio performance.

Hypothesis 3

To test if buying credit derivatives reduces the effect on the average absolute deviation (risk) of bank investment and portfolio performance.

Hypothesis 4

To test if dealing in credit derivatives does not affect (negative) the return of bank investment and portfolio performance.

Hypothesis 5

To tests the constructive effects of purchasing credit derivatives (bank is beneficiary) on bank portfolio returns on asset.

Hypothesis 6

To test if buying credit derivatives causes more bank defaults.

1.4 Scope and Limitations of the Study

This research will focus on US commercial banks with total assets sizes from a cutoff of $500 million and above. The market makers in the credit derivatives market are very large banks. The detailed description of data used in this study will be presented in Chapter 6. Due to the availability of data, only US banks are included in this study.

This study uses quarterly data from the first quarter of 2002 to the last quarter of 2011. There are 40 time periods in total. Banks have only been required to report their credit derivatives data to FDIC from 1997. Full data of both positions from banks was only made available from 2002.

The major limitations of this research derive from the availability of data. Credit derivatives bought and sold are the major data which the FDIC provides two positions of notional amount for each bank on. Thus this research is unable to study these financial products, for example, by pricing, maturity, underlying assets, and to investigate the relationship between these financial products and bank portfolio performance with more penetrating, and perceptive analysis.

Another drawback is our inability to include large European banks since London accounts for 40% of the credit derivatives market, according to the Bank for International Settlement. The non inclusion of European banks in this research will make it challenging to make a sweeping assumption of the research outcome to the financial markets outside the US. More so, the international comparison between US and European banks is not feasible with the non availability of these data. The limitations concerning research methodology of this research is discussed in Chapter 5.

1.5 Contributions of the Thesis

This study is primarily concerned with one of the main problems in Financial Economics, the use of financial engineering and associated instruments to enhance portfolio risk and return in view of the demand being made on financial institutions to perform efficiently. For example, there has being an increased use of financial instruments where credit risk is used as pricing factor. With the increasing use of credit derivatives, financial institutions must employ models which can price credit risk as well as market risk and hence improve their bottom line. The data set was chiefly collected from the US Federal Deposit Insurance Corporation (FDIC) and the Office of the Comptroller of the Currency (OCC) to explore the factors that motivate the use of credit derivatives and their impact on bank performance.

Our dataset sidesteps the trap of cross-sectional or time-series data by permitting us to examine and determine series of critical questions and finding solution to the plethora of econometric challenges that frequently arises in empirical studies which otherwise would have been onerous to research into. For instance, the frequently perceived contention of the real reason researchers discover (or none discovery) certain effects is the existence of missing (unarranged or unnoticed) variables that are strongly correlated with independent variables. Panel data allows for the controlling of omitted (unnoticed or unarranged) variables (Hsiao 2003). In making use of panel data, our data set bypassed selectivity, heterogeneity,and dynamic panel data models bias. For instance, neglecting heterogeneity bias (in slope and/or constant) could result in having meaningless estimates of compelling parameters.

This study gives beneficial information to policy makers, researchers, and practitioners. In particular, the world of banking, financial engineering and investment opportunities has changed fundamentally. Banks, like other investors are faced with a wide variety of investment outlets to create value for their shareholders. Sometimes their decisions are affected by the value and growth of the investment, income stream, geographical dispersion etc which needs a lot of brain storming and technical expertise to get it right. The benchmark and target performance makes the right call difficult sometimes.

Conversely, the minimisation of errors in the valuation and pricing models of credit derivatives and its subsequent impact on the portfolios of financial intermediaries has posed continuous challenge to practitioners, academics and professionals in banking and finance. Empirical evidence has shown that statistical analysis has its draw backs; therefore, portfolio risk analysis should be approached with robust methodologies to enhance overall risk management of the organisation. The descriptive statistics of the independent variables has given us a very good idea of the shape of the distribution, therefore additional tests and statistics have been used to further capture the behaviour and interaction of additional risk variables and factors. This is one of the first studies that will carry out extensive tests in addition to random effects logistic regression, Arellano-Bond dynamic panel data Generalised Method of Moments (GMM) and sensitivity analysis from a statistical and econometric stand point on the US banking sector with a huge sample of banks.

The more distinguishing additions and input of the study can be encapsulated as follows:

- It provides a contemporary review of diverse ways and mechanisms to the selected topic: It examines the role of credit derivatives as determinants of bank use to mitigate use and also their impact on bank performance, pre and post the credit crisis among US banks, 2002 to 2011. In as much as it adds to the body of knowledge of banking, finance and credit derivatives, it also gives valuable information to practitioners, researchers and policy makers. Empirically, this thesis evaluates the effectiveness of credit derivatives in the banking industry given the critical roles of large financial institutions to the industry. We note, however, many data modelling exercises in economics, finance and related spheres are typified by two situations requiring great effort: (a) the lack of a complete derivable and reasoned model of the data production mechanism and (b) inadequate body of data. When there is a lack of a complete derivable and reasoned model of the data production mechanism or where it is not in existence, it is only sensible for the researcher to adopt a non-parametric modelling path. In this research, luckily, the bulk of our data are provided by the FDIC (US) and the Office of the Comptroller of the Currency (OCC).

- It provides an enhancement of our comprehension of the economic, ethical and management reasons that drives the use of credit derivatives: This study is an addition to the growing literature on some of the missing variables and factors that better explains the determinants of why banks use credit derivatives and the impact of their use on bank portfolio and performance by extending the work of Minton et al. (2009) .The literature review gives an appreciation of the potential weaknesses in the theoretical underpinnings of the models used and allows us to draw some concrete conclusions. In addition, it enabled us to develop and confirm some hypotheses of the explanatory variables that directly or indirectly affect the determinants and impact on bank performance.
- It provides answers to the problem of the impact and influence of credit derivatives on the performance of bank portfolios and their sensitivity:

This has been the subject of debate for less than ten years with heightened intensity in the last five years. Common measures of portfolio returns use returns on capital employed, returns on investment, returns on asset etc.In the same vein, portfolio returns is also affected based on the state of the market, that is,when the market is in a high or low risk environment (Angelidis et al. 2015). Nevertheless, where expected returns and risks change over time, this may bring about time-variation in portfolio risk and return. Thus, common approaches can reveal a performance that is different from the standard or norm to an investment strategy which is not true. We are able to gauge the bank portfolio manager's character after adjusting for various deviations from normal recorded in the economics and finance literature. We extend the work of Minton et al. (2009) by incorporating for example, lagged dependent variables, leverage, macro-economic context, profitability, market risk, credit risk, liquidity, size/reputation and risk management explanatory variables in our extended models. As we find some evidence of bank use and impact of credit derivatives on bank risk adjusted returns and performance in these models. The sensitivity analysis shows that the market makers among the banks are publicly owned companies with shares traded on the stock exchange markets in New York and London in comparison to privately owned banks.

1.6 Overview of the Thesis

In this section, a brief overview of the thesis is presented.

Chapter 1: The background of the problem, inspiration and aims of the study was discussed in this chapter. Emphasis was on growth, maturity of credit derivatives market and the banking industry. Also, the major contributions of the thesis were highlighted.

Chapter 2: In this chapter, the characteristics and the background of the US banking system were discussed, considerations was on the early history, the deregulation trend up to the present moment.

Chapter 3: This chapter provides an introduction and discussion of credit derivatives and the credit crisis of 2007 to 2009. The different phases of the crisis were identified and the suggestions to avert a future reoccurrence were proffered.

Chapter 4: In this chapter, we discuss a comprehensive analysis and explanation of the literature review, to wit, survey of credit research, risk management, financial derivatives, portfolio management especially the multifactor risk modelling, portfolio theory and its application to bank portfolio management, credit derivatives and their usage in managing bank risk. Specifically, distinct models and theories are broken down to components, for example, modern portfolio theory, capital asset pricing model (CAPM), arbitrage pricing theory (APT), three-factor model and the four-factor model. This chapter, furthermore, refers to the important contributions made by diverse researchers and writers in the area credit research, credit derivatives and multifactor risk models. Empirical tests and studies conducted by diverse researchers are presented and their outcomes form the basis for the source of better models to explain the impact of credit derivatives on bank portfolio risk and return.

Chapter 5: This chapter presents the methodology of the thesis. We explain the research design for the study, which includes the groundwork about information gathering, methodological philosophy and measurement issues, models to be estimated, benefits of panel data, Random Effects Logistic Regression, Arellano-Bond dynamic panel data

Generalised Method of Moments. The chapter also describes some measurement issues relevant to the definition and measurement of bank portfolio efficiency and effectiveness. We also define measures of bank portfolio risks, returns and limitations of the methodology.

Chapter 6: In this chapter, a review of the main data sources- the FDIC and OCC (US) is done. It also reviews the data analysis procedures and its limitations.

Chapter 7: This chapter gives an in-depth analysis of the role of credit derivatives as determinants of bank use to mitigate risk (pre-crisis, crisis period and post-crisis period (2002-2011)). We discuss the work, models and weaknesses of the models of Minton et al. (2009). We explain the econometric test, specification, approaches and diagnostic analysis. We also define the empirical models and analysis. This chapter has several objectives. The first one is to investigate whether a bank is less likely to buy protection if it has more capital and quality asset. Second, it is to test if a bank is more likely to buy protection if it is larger (size) and has more diversified loan portfolio. The third is to test whether banks with consumer loans are less likely to buy protection since they can be sold or packaged and securitised. It will also test whether banks reporting other types of derivatives are more likely to use credit derivatives. The fifth objective is to test whether banks that sell loans or securitise loans are more likely to buy protection, and finally, it is to test whether banks that are less liquid and profitable are more likely to buy protection.

Chapter 8: In this chapter, we attempt to extend the models of Minton et al. (2009) in order to explain the impact of credit derivatives on portfolio persistence, risk and return. Based on the Minton et al. (2009), we use the Arellano-Bond dynamic panel data Generalised Method of Moments to estimate our models taking into account the portfolio risk management, portfolio average absolute deviation, market risk, credit risk, firm leverage, macro-economic context and loan portfolio. In particular, we look at portfolio liquidity and profitability. Lastly, we explain the sensitivity analysis by introducing such variables such as ownership, firm size and reputation etc.

Chapter 9: This chapter discusses the opportunities for future research. The conclusion of this study is also discussed and presented.

CHAPTER TWO

CHARACTERISTICS AND BACKGROUND OF THE US BANKING SYSTEM

2.1 Introduction

This chapter discusses the background of the US banking system, the deregulation trend, financial innovation and securitised lending, legal and supervisory matters and the Basel III reforms for a proper understanding of the issues that led to the research question of the thesis.

For well over two hundred years, the US banking system has undergone tremendous changes, developing rapidly from an humble beginning to an intricate financial organisation, to wit: progression in technological development especially the use of information systems, liberal statutory (government) regulations, competition from non-traditional financial institutions, globalisation, a large array of financial products, increased efficiency in service delivery to customers and many others (Frankel and Montgomery 1991; Meyer 1998; Sylla 1998; McCartan-Quinn et al. 2004; Akhigbe and Madura 2005; Mamun et al. 2005; Tirtiroglu et al. 2005; DeYoung 2007; Sherman 2009). At the moment, some financial institutions are going through different changes, particularly uncertainty, thus this chapter shall briefly examine the historical background of finance and banking in the US in an attempt to answer some of the research questions and problems in this research especially the impact of credit derivatives.

Historically, banks have played critical roles in global finance. This has led to the increase in the standard of living across the globe through commerce (Mulder and Westerhuis, 2015). Crane and Bodie (1996), in their work on the financial transformation of banking, summarised the core needs served by the financial system: (1) Methods of making payments and settlement in order to smoothen the exchange of goods and services; (2) The structure to transfer economic assets over time and across distances, as in lending and investing; (3) Methods of managing risk, such as undertaking against loss of assets or harm, diversifying, and hedging; (4) price intelligence, for example, interest rates and asset prices, to help disperse decision making in various sectors of the economy and, (5) ways to handle incentive problems that interfere with efficient business transactions. For example, by restraining borrowers' liberty of action by loan covenants is one way to handle incentives problems. However, financial intermediation and leverage have integrated risks which have implications for the stability of a country's economy when not properly supervised by the financial/economic authorities and the market. This is examined in depth in chapter three.

To serve their customers better, banks embraced automation of their systems and operations. Banking technology has altered in multifarious ways the delivery of banking services to the US banking public within the last thirty years. These changes have worn away the deposit-based capital leverage of U.S. banks, revolutionised their traditional branch and street-wise networks, and reduced their usual dependence on interest revenue and earnings.

In effect, taking for granted now are the uses of debit and credit cards, internet and telephone banking, automated teller machines which were introduced in the early 1970's, these have had enormous impact on commercial banks, they are not only within and outside bank branches but also in strategic places for easy reach of customers, electronic funds transfer with use of mobile phones etc. Banking halls are now constructed and structured to look appealing for the comfort of customers with bank staff stationed at strategic places and always happy to help.

Also the procedures, methods and technical skills of banking supervision by regulators, the OCC and the FDIC have changed along with the advances, complexity and rapidity of the changes in the banking sector. Like the banks, they now make use of computers and sophisticated technology to conduct their examination to be sure they are sound and in good health. However, the recent credit and economic crisis has laid bare the incompetence of the regulators.

In 1971, the Money Market Mutual Fund (MMMF) was introduced; it was the first of these changes. The money market mutual fund changed completely, sizeable denomination money market instruments, for example, treasury securities, negotiable certificate of deposits (NCD's), commercial paper, etc into lower denomination securities and investments which an average household can afford, they were not subject to Regulation Q and allow investors some cheque writing rights.

The MMMF became larger effectively in the nineteen seventy's when the Federal Reserve bank close monetary policy accelerated the interest rates of the money market by as much as 10% above the ceiling on deposit interest rates for the Regulation Q. A process known as disintermediation revealed how family funds moved from accounts in financial institutions to these mutual funds. The automated teller machines provided better availability and comfort for bank retail customers by improving the quality of service, improved income generation from charges from other bank's customers and cutting cost from the hitherto bank tellers with their attendant staff costs thereby improving efficiency of bank branches.

In a study conducted by DeYoung et al (2004), in comparison to most advanced economies, exactly two-thirds of U.S. payments transactions were still being done using cheques and cash at the end of the 20th century. However, in the same study, the data suggest that the average banking branch in the U.S. has become more fruitful in terms of assets, profit, and the number transactions per branch have all increased since the 1980 which explains the enormous increase in the number of branches since the 1970s.

In a research conducted by Gerdes and Walton (2002), Humphrey (2002) and Gerdes et al. (2005) they find that electronic payments technologies are very quickly substituting paper-based payments in the U.S. as they are cheaper for banks to produce, and usually more comfortable for their customers. They also find that during the late 1990s the number of cheques paid in the U.S was reducing by up to 3% annually, while transactions paid with credit cards and debit cards were accelerating by 7 and 36% per annum. Berger (2003) finds that the Federal Reserve handled volume of automated clearinghouse payments and transactions, for example, payment of recurring monthly bills, automatic deposit of wage and salary payments accelerated by 14% annually for the ten years from 1990 to 2000. Due to the predictability of the dispersal and receipt dates of electronic payments than for cheque-based payments, U.S. consumers now hold smaller precautionary balances. According to the Federal Reserve Survey of Consumer Finance (2004), the fraction of family financial assets held in transactions accounts fell from 7 to 5% for the 18 years from 1983 to 2001.

In a study conducted by DeYoung (2005) and DeYoung et al. (2007), they find some evidence that Internet banking platforms can also improve the worth of small financial institutions. Internet banking has further reduced geographical boundaries and diminished the cost of basic banking services. Going by the advantage of the economies of scale with the delivery channels, the variable cost of an average Internet banking transaction has crashed considerably. However, due in part that U.S. banks have not been relaying detailed data transfer rate of their numerous delivery vehicles, a well rounded picture is still emerging. The Internet banking long term plans dominant among banks is the traditional model which combines an Internet site for customer's transactions and other information with the networks of conventional offices and automated teller machines; the US banks offering their services exclusively through the internet platform has risen considerably, possibly more than twenty five at the moment. For example, some loan applications and approvals are now facilitated via online platforms without necessarily going to the banking halls.

2.2 The Deregulation Trend

Dore and Singh (2009) identified the following legislative acts as the major planks for the expansion of credit through new debt instruments and other financial innovations: (a) The depository Institution Deregulation and Monetary Control Act of 1980 (b) The Tax reform Act of 1986 and (c) The Gramm-Leach-Bliley Act of 1999.

On the run up to the 1980's, the rapidity of the development, growth and changes in the financial markets had rendered the old regulatory leadership of organisation unfit for purpose. Part of the old regulatory regime was swiftly taken apart. The removal of family savings from bank deposits into higher returns money market mutual fund and other non-bank investments forced the US central bank to do away with the interest rate limits set by Regulation Q. With the enactment of the 1982 Garn-St. Germain Depository Institutions Act, financial institutions were authorised to offer money market deposit accounts to the public with no interest rate limits; this allowed them to contend directly with money market mutual funds. With the act, thrift institutions were also allowed to make commercial loans and thus contend directly with smaller banks like community banks.

Gradually, between 1980 to 1994, 32 States in the Federation loosened the limits put in place on banking and the setting up of branches within their state. The Federal McFadden Act was also bypassed and thwarted by many states by going into agreements through multi-bank holding companies and cross-border bank ownership. Many years down the line, 44 states had given the green light to some sort of interstate banking.

By 1987, the Federal Reserve permitted bank holding companies subsidiaries to operate "Section 20" clause to insure corporate securities with restrictions. In 1989, the Federal Reserve had whittled down restrictions in the Glass-Steagall Act that forbidded commercial banks from themselves insuring corporate securities.

By 1994, the U.S. Congress enacted the Riegle-Neal Interstate Banking and Branching Efficiency Act thus repealing the McFadden Act at the national level and harmonised the mishmash of the state and branching rules (Stritzel 1995). The law prohibited the cross border expansion of commercial banks from taking over other commercial banks where their national deposit base is more than 10%.

In 1999, the Congress effectively repealed the Glass-Steagall Act which was designed in the first instance to maintain checks and balances in the financial markets in place of the enacted Graham-Leach-Bliley Financial Services Modernisation Act. This granted enormous powers to securities, insurance, banking companies and relaxed controls on the financial markets. The laws encouraged innovation in debt instruments which were high risk in nature which eventually proved risky for the US economy, helped increased the speed in the adoption of new information technologies by U.S. banks and financial back office processes thus affirmed the struggle of the deregulation movement that started forty years back. The abrogation of the Glass-Steagall Act triggered a wave of mergers and acquisitions within the industry. According to the U.S Federal Deposit Insurance Corporation, there were exactly three thousand five hundred bank mergers, acquisitions and combinations during the 1980s, nearly five thousand more during the 1990s, and over two thousand more between 2000 and 2006. This flurry of activities changed the balance sheet size and branch network of most U.S banks thus creating for the first time in the history of the United States, big, multi-state banking firms. However, this did not create a truly nation-wide retail banking franchises envisioned during the process as the results were slow and difficult in coming.

Berger et al. (1995) in a research of the banking industry consolidation during the process, predicted a future course for consolidation that overrun the line of the actual returns thus predicting the speed and extent of the industry consolidation has been difficult. Jones and Critchfield (2005) had a contrary view due in part to additional data for additional ten years suggesting that consolidation was still in process but may finally be showing some indications of decelerating. Smaller community banks compared to multi-state banks have been smarter to embrace and adopt new financial and information technologies, including diverse forms of electronic payments, credit scoring, loan securitisation, financial derivatives, other off-balance-sheet activities and operations. Frame and White (2014) noted that the more expandable of these technologies have also distributed faster at smaller banks, although with a few years delay, due to the cost reduction of delivering these technologies and a highly competitive sector of third-party technology vendors desirous of a sizeable slice in the market. A very good example of these technologies is the imaging technology. The cheque clearing for the 21st Century Act of 2003 aided the efficient clearing of cheques by recognizing an electronic representation as a legal substitute for a paper cheque (Felsenfeld and Bilali 2006).This allowed banks to send cheques as electronic representation thus saving them time and enormous costs connected with paper cheques like transportation and handling costs.

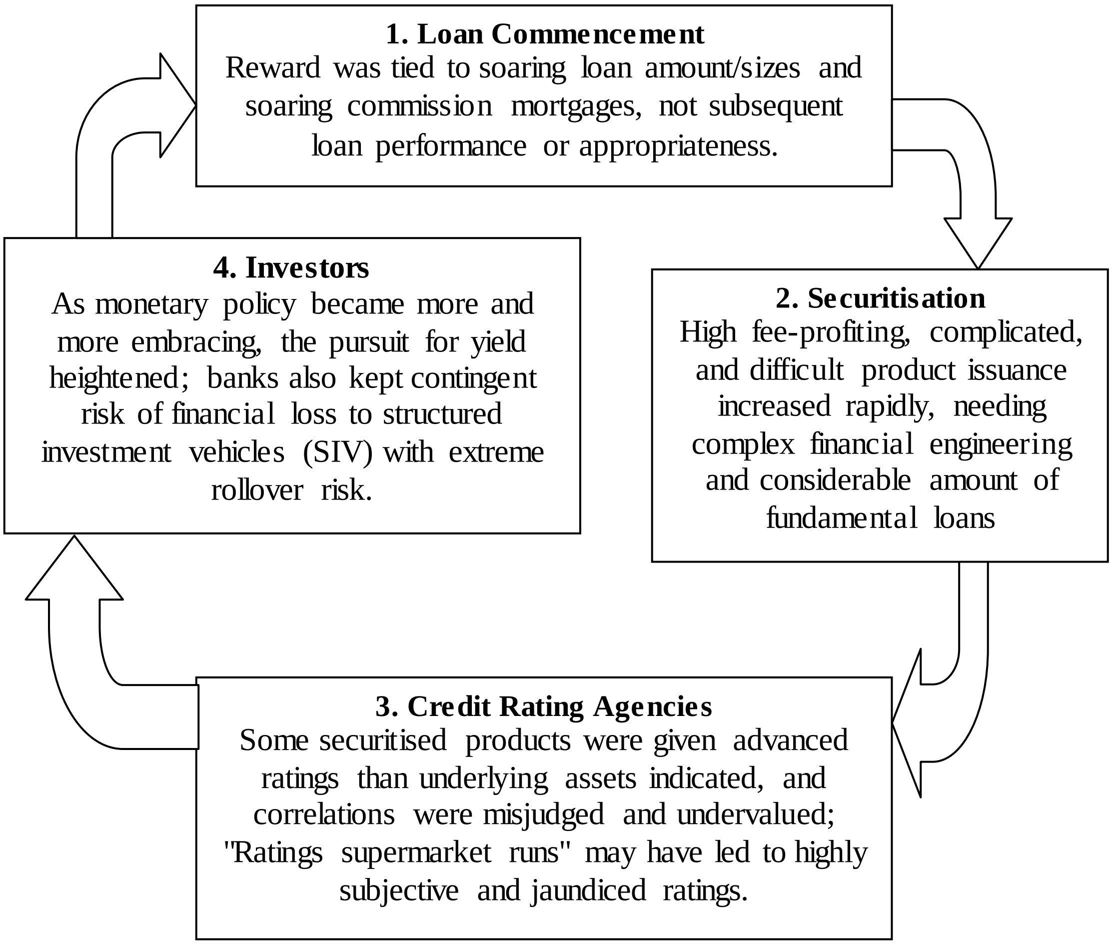
2.3 Financial Innovation and Securitised Lending

With the rapidity in these changes, securitised lending is possibly the biggest distinguishing mark of all the financial innovations that have developed in the last forty years since the early seventy's in the US. The economies of scales connected with securitisation of loans have considerably altered the banking industry's strategic characterisation. Banks dispose off majority of their loans not long after creating them; get income from the fees billed for originating, securitising, and servicing these loans. Securitisation is a lending technology that has yielded enormous production and financing efficiencies for banks that utilise it, and has accelerated access to credit for millions of families and small businesses. A similar growth in the US banking secondary market for syndicated loans has also provided identical liquidity advantage where big ticket loans are made to big firms by a syndicate of banks where they are not able to fund them alone in order not to exceed their single obligor limit. Simply, securitisation is a situation where banks originate loans but do not finance them (Mullineux 2013; Erel et al. 2014).

2.3.1 The rudimentary process and procedure of securitisation

The securitisation activity starts with the commencement and succeeding pooling of assets with transmission to a balance sheet that is legally distinct from that of the prime mover's balance sheet. This is by and large an insolvency-detached Special purpose Vehicle. The balance sheet, which keeps the pooled assets as guarantee is financed by the delivery of asset backed security. Figure 2.1 show the rudimentary workings of the securitisation procedure and catalog the key players. The essential features related with the initiation and grouping together of assets and the arrangement and origination of liabilities are deliberated further down.

Figure 2.1: Simple securitisation procedure and set of key players



Source: International Monetary Fund, Finance and development report (2008)

i. Origination of assets

Although the assets that are grouped together and securitised can in theory be any assets that have liquidness that can be replicated or simulated with some dependability, characteristically the surety assets are loans, securities or other types of claims such as expected fee or royalty income, lease payments or credit card receivables. The securitisation of assets makes available balance sheet and capital respite to initiators, given them to initiate new facilities and enhance the provision and contribution of credit to the real sector of the larger economy. Securitised assets may be scheduled, prearranged loans that were initiated prior to the securitisation procedure and methods began and thus have a history of prompt settlement features and credit risk data, better still, they may be fresh facilities initiated for the objective (Egly et al. 2015).

Some initiators make available credit to those who need loans with the objective of moving the facilities to a securitisation medium. The business brand and genre of the initiator is a main thought when examining the arrangement of motivation of initiators and managers with those of shareholders and stakeholders. In the result and reverberations of the financial crisis, rules have been put forward that entails the holding by the initiator and the manager of a slice of the risk of the original assets (IMF 2009).

ii. Asset pools

The group of assets in a securitised arrangement is not always fixed and inactive. Securitisations of auto dealer floor plans and credit card money owed characteriscally have a rotating phase in which fees gotten by a trust is used to buy new business assets owed. In other arrangements, there are specific and clear requirements that consent to the replacement of the group of assets in the collection under particular circumstances. In conclusion, some arrangements, such as in collaterised debt obligation's or collaterised loan obligation's, hire an asset manager who aggressively handles and run at least a part of the group of assets of fundamental assets and who consequently perform an important part in the eventual working of the securitisations (IMF 2009).

iii. Structuring and issuing securities

The legal responsibility of the securitisation medium and channel are usually securities with risk features that hold specific and direct investor desires. Credit-and time-slicing are the main operational and essential method. Credit-slicing leads to top grade, usually first rate senior or superior slices with a first and primary demand on incomings-income, revenue, businesses etc. On the other hand, the junior-rated mezzanine and equity slices take in short fall on the fundamental asset collection and make available shield and safeguards for the more senior slices. Time-slicing methods are associated to credit-slicing, since the more superior slices, from a credit standpoint, will also be chief in queue in getting re-imbursements of what is due. The early time-sliced securitisations were collateralised mortgage obligations pioneered by the government enabled mortgage suppliers. Re-imbursements were scheduled based on their likely maturity dates while investment securities with the extended-likely age also held the better part of the advance payment hazard. Additional way of facility improvement is financial security or excess collateralisation. Furthermore, securitisations arrangements can also make do of derivatives instruments such as interest rate swap, currency swap etc to mitigate specific risks (IMF 2009; Podolski 2012).

Historically, in 1970, the securitisation business came into being with the first pass-through security backed by "Ginnie Mae", (also called the Government National Mortgage Association (GNMA)). Ginnie Mae guaranteed mortgages made to first time homeowners in the best interest of the Federal Government and as part of the U.S. Federal Housing Administration (FHA), its securities are the only mortgage backed security supported by the government commitment to repay the loans and credit of the U.S. government.

Besides Ginnie Mae, in 1970, Freddie Mac, (also known as the Federal Home Loan Mortgage Corporation (FHLMC)) was established to bring more rivalry to the housing market and in 1971, it started the securitisation of U.S. residential home mortgages. (Kothari 2006). This was followed in 1981 by "Fannie Mae", (also known as the Federal National Mortgage Association (FNMA)). As part of the New Deal in 1938, Fannie Mae came into being with the purpose of backing the housing market subsequent to the Great Depression. In 1968, it was sold to the public as a business but prior to this, it bought and kept mortgages from originating banks. As government assisted businesses and chartered by the U.S. Congress, both Fannie Mae and Freddie Mac were set up to augment the flow of loans to the residential property market. Fannie Mae and Freddie Mac bought qualified mortgages from banks while also making available a surety against borrower non-payment. Mortgage loans acquired were securitised by moving the legal right of the mortgages to a distinct purpose unit or entity which securities were issued against. Those securities were settled from the principal and interest of the original mortgages. While they benefit from special tax advantages and specific credit lines with the Department of Treasury of the US government, they have both been owned by shareholders for more than forty years.

Generally, the securitisation business was at the epicentre of the U.S. mortgage market, motivated mainly by the investment requirements of the government assisted businesses and the Federal Housing Administration. The foremost private-label property pass-through transaction was originated by Bank of America in 1977. However it was not until 1985 that the first private-label asset backed security transaction was originated by Sperry Univac Corporation. Taxation connected origination reduced the tranching of residential mortgage backed transactions inefficient in the United States uptil the 1986 U.S. tax act, (Auerbach and Slemrod 1997; US, Securities and Exchange Commission, 2003). Auto connected securitisations controlled the U.S. asset backed security market in its earliest few years, though the securitisation of credit card receivables increased fast after the initial transaction in 1987, and other asset classes surfaced soon after that. The securitisation businesses in the US lead that of Europe by fifteen years in the United Kingdom and twenty years in continental Europe.

In 1985, the United Kingdom launched its first mortgage securitisation. However, the securitisation business was slower in Europe to grow due to a more complex legal circumstances and situation. In 1988, the legal basis for securitisation in Europe was laid by France with consumer loan asset backed security originated successively, followed by the initial residential mortgage backed security transaction in 1991. After that, securitisation connected vehicles became prevalent in other countries on the continent, to wit, Belgium, Netherlands, Spain etc. For example, in the Netherlands, the asset backed security transactions amounted to nearly two hundred and seventy billion Euros at the end of the 2007 fiscal year, or 50% of the country's Gross Domestic Product. Nearly two-thirds of the securities were made up of residential mortgage backed security (Chaudron, 2008).

Likewise, between 2000 to 2008, the German development bank, Kreditanstalt für Wiederaufbau (KfW), owned by the German Federal Government and the German federating states in the eighty and twenty percent ratio, also issued one hundred and twenty five billion Euros of residential mortgage backed security and small and medium sized enterprise (SME) securitisations with the collateral for the small scale enterprises sourced from across the European Union (Rahe 2004; Kaiser and Axford 2006; Basurto et al. 2013).

As explained in Chapter 1, the financial derivatives work dominant to the global financial crisis, in terms of the financial markets and derivatives instruments, was basically ready by the end of 2000 fiscal year. For example, the origination and delivery of U.S. private-branded securitisation remained at $1 trillion, up to five times that of the issuance in continental Europe (IMF 2009). The Subprime securitisations business had become established in the United States. Asset backed security had become a normal feature in the market from the 1990's. Also, the origination of collateralised debt obligations started in the late 1990s while credit default swaps were established and put into operation to corporate debt in the 1990s and first applied to asset backed security in the late 1990s. Sudden and marked vicissitudes in the makeup of the business then open out in the years right away prior to 2007, some of which had an important effect on the overall financial system. The distribution and delivery quantity and capacity swelled in very complicated, hazardous, and impervious market sector that had before taken part only a fringe role.

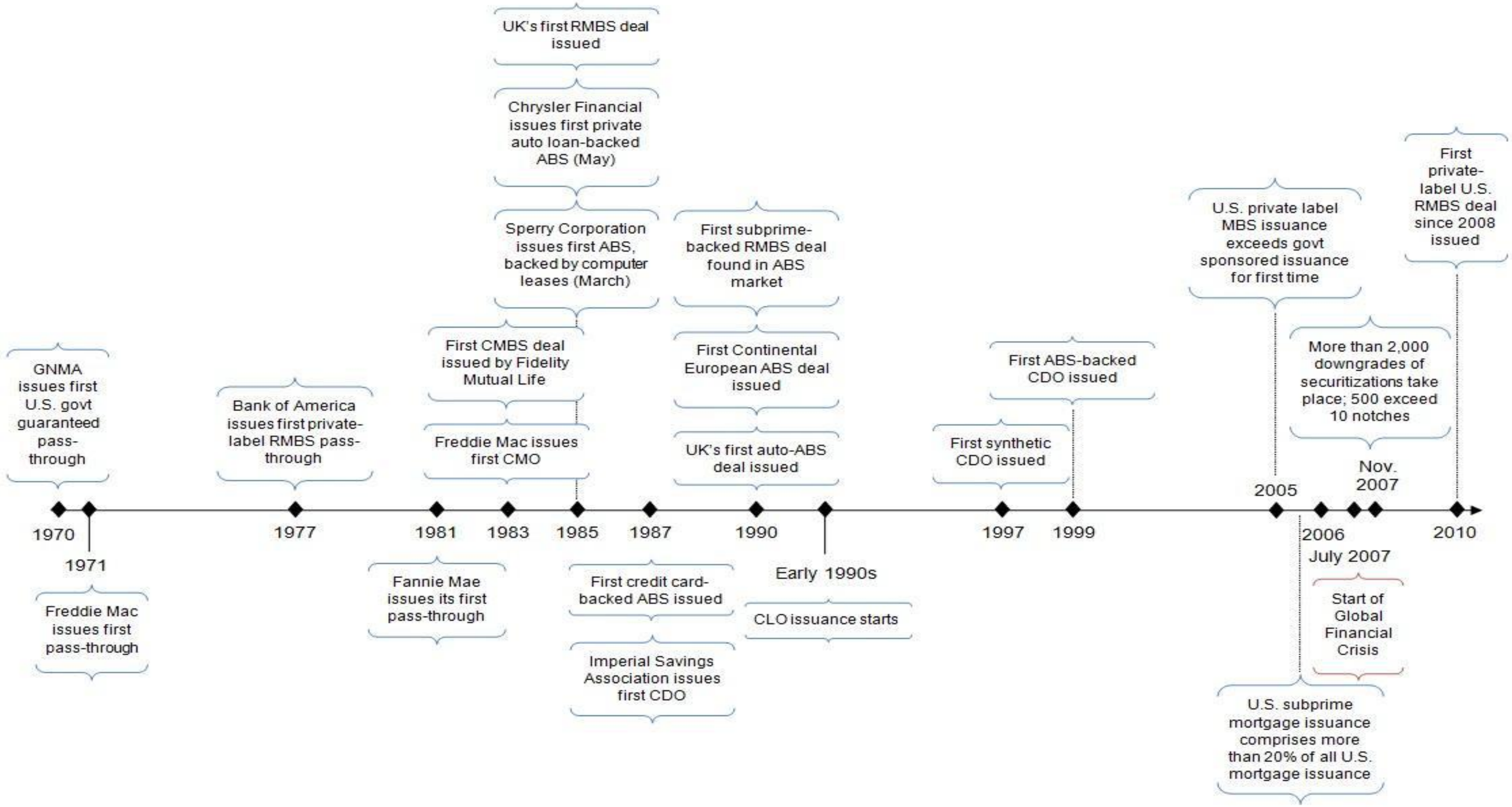
At the large scale point, 2000 to 2007, delivery of collateralised debt obligation accelerated to more than six times to one trillion dollars, while the delivery of collateralised debt obligation-squared product accelerated eleven times to about three hundred billion dollars. In the US, yearly delivery level in the subprime section of the mortgage market accelerated from one hundred billion dollars to just over six hundred billion dollars over the 2000 to 2006 phase. This buoyed up the subprime part of the entire U.S. mortgage initiation from a 7% low to a 20% high in just five years. Nearly all of these were variable-rate mortgages, normally beginning with a two or three-year fixed-rate phase and deferment of main settlement up to five years, which meant that mortgagor were deeply unprotected to rising interest rate in addition to main settlement jolts at the reset times.

The arrival of private firms besides the government promoted businesses such as Fannie Mae, Freddie Mac**,** and Ginnie Mae etc, fresh competitors in the mortgage backed security delivery were connected with a sudden and pointed fall in loan principles and ethics over this phase. Private-branded residential mortgage backed security delivery in the US accelerated from one hundred and forty eight billion dollars in 1999 to one point two trillion dollars by 2006, accelerating its portion of entire delivery from 18 to 56%. Still, some portions of the securitisation market definitely partake in the overall financial crisis; nonetheless it is instructive to say that this was not widespread to the entire securitisation marketplace. As the extensively changing function of securitised instruments pre and post the universal Financial Crisis shows, it would be deceptive to debate the marketplace for securitisation as a sole, uniform asset class. For illustration, the official features of the U.S. subprime mortgage marketplace make up quite a distinct situation of securitisation from which it is problematic to deduce broad spectrum findings about other section of the securitisation marketplace (BIS 2011).Various securitisation instruments have proven an extensive past performance, as well as across the low point of the crisis. As a case in point, the aggregate deficiency rates from 1993 to 2011 were for U.S. auto loan (0.3%), credit card (0.7%), student loan (1.7%), and equipment lease asset backed security (5.9%) (Moody's 2012a, 2012b). These specific asset groups have characterised 81% of asset backed security delivery in the US since 2008. Some empirical research have predicted that going by the US collateralised loan obligations fundamental corporate loans usually function by no means not as good, and in certain situations superior, than unsecuritised lending of similar credit quality (Benmelech, Dlugosz and Ivashina 2012). Others have discovered no backing for the opinion that US borrowing of money to purchase other company transaction held in structured credit mediums were of inferior class or function not as good as buyout transactions that were not successively concerned with securitisation (Shivdasani and Wang 2011). Securitisation mortgage transactions in a place like Italy have been confirmed to have a lesser chance of delinquency than mortgage transactions that were not securitised (BIS 2011).

Standard and Poor's statistics reveal merely 0.07% of the balances of the fundamental European residential mortgage backed eecurity, making up over and above half of the entire European securitisation delivery initiated before the end of the second quarter 2007, had failed to pay by last quarter of 2011 (AFME Securitisation report 2012).

This was in complete comparison to the functioning of collaterise debt obligations of asset backed security, where the inability to pay level was about 30% over the same cycle and phase. In the course of the intervening phase of market instability and turmoil in 2011, the marked-to-market workings of European residential mortgage backed security was better to most European Union senior bank debt, sovereign debt, and many covered bonds, apart from 'Pfandbriefe' German class of bonds like mortgage backed securities (AFME Securitisation report 2012). So, far-reaching sweeping statements about the functioning of securitisation should be explained with restraint.

Figure 2.2: Phases in the development of securitisation



Source: World Bank Report (2008, 2009); IMF Report, (2012); FDIC Report (2012)

Table 2.1: Review of securitisation

<table>
<tr><td colspan="14">Securitisation – A summary</td></tr>
<tr><td colspan="7">Funding Business deals and contracts
The fundamental assets are loans, legal rights to specific assets (for example, leased equipment), and rights to specific cash flows (for example, cash flows from equipment leases).</td><td colspan="7">Non-Funding Business deals and contracts
The fundamental assets are securities, subordinated debt, loans(SME), or commitments to pay fees on derivatives depending on certain events occurring, for example, CDS,CDO's</td></tr>
<tr><td colspan="2" rowspan="2">Asset Backed Security (ABS)</td><td colspan="3" rowspan="2">Residential Mortgage Backed Security (RMBS)</td><td rowspan="2">Commercial Mortgage Backed Security (CMBS)</td><td colspan="2">ABCP channels</td><td colspan="6" rowspan="2">Collaterised Debt Obligations (CDO)</td></tr>
<tr><td>Single- and Multi-seller channels</td><td>Arbitrage channels
SIVs
SIV-Lites</td></tr>
<tr><td></td><td colspan="3">Private-label RMBS</td><td>Government-backed Lending</td><td rowspan="2">Commercial Mortgages</td><td>Collateral: Claims on receivables, leases, etc.</td><td>Collateral: Securities</td><td></td><td></td><td></td><td colspan="2">ABS-CDOs</td><td></td></tr>
<tr><td>Non-RMBS
Credit Cards, Auto Loans, Student Loans, and "Niche facilities"</td><td>Subprime
(Low quality Home Equity Loans)</td><td>Alt-A
(Inter-mediate Quality)</td><td>Prime Jumbo, Non-US Residential Mort-gage Loans</td><td>U.S.: GSEs (FHLMC and FNMA) and GNMA
Collateral: Conforming Mortgages

Germany: KFW (as explained above)</td><td colspan="2">Largely financed through the sale of highly rated ABCP</td><td>CBOs</td><td>Hedge CDOs
(usually synthetic)</td><td>CLOs</td><td>Cash CDOs</td><td>Synthetic CDOs</td><td>TruPS CDOs</td></tr>
</table>

Source: IMF report (2008, 2009); FDIC report (2010)

However, the shortcomings of Securitised lending technology were one of the major issues for the failings in global financial markets during the credit crisis of 2007 to 2009 (Mullineux 2014). By using funds raised by selling mortgage-backed securities (MBSs) to third-party investors, a loan securitisation, as a trust, purchases existing home mortgage loans, car loans, credit card etc from banks. The mortgage-backed securities return on investment is based on the efficiency of the mortgage loans retained in the trust. This procedure enables banks to dispose off illiquid borrowings to the securitisation, and utilise the money obtained from the transaction of these sales to fund more loans or better still, invest them in other investment outlets. Likewise, smaller banks like community banks have tried to vary their loan concentration portfolios in which they obtain mortgage-backed securities from securitisations from other geographical areas. Juxtaposed against small banks, large banks now make more money from fee based income and non-interest income streams from loan servicing fees, loan origination fees, loan securitisation fees, etc and less on traditional interest-based income. Consequently, many large, high street, retail banks have metamorphosed themselves from conventional originate-and-hold lenders to originate-and-securitise lenders (Mullineux 2011, 2014).

In summary, the development and progress in securitised lending was assisted largely in part by two firms promoted by the government, to wit, in 1938, the government established The Federal National Mortgage Association, which was, also known as Fannie Mae, while in 1970, the government also established the Federal Home Loan Mortgage Corporation, also referred to as Freddie Mac. They are the major players in U.S. mortgage markets for homeowners and about 50% of the total existing homeowner mortgage debt in the U.S. has either been securitised, or is domiciled in the portfolios of these two mortgage institutions. The lines of credit extended to these government sponsored entities at the U.S. Department of the Treasury was largely responsible for the dominant market positions they enjoyed, the credit lines also gave them a funding advantage over private-sector mortgage entities engaged in securitisation. This created the understanding in financial markets that they were "too-big-to-go-down". Frame and Wall (2002) as well as Wall et al. (2005) evaluated the policy issues and the apprehension on the insolvency of any one of these institutions in view of their sizes. To underscore the importance of this, the US Treasury injected equity funding and nationalised the banks thus making good on the "implicit government guarantee" of the US Treasury Department when Fannie Mae and Freddie Mac suffered huge losses in their portfolios of subprime Mortgage backed securities in 2008 and were on the brink of collapse.

Credit scoring is another financial innovation that loan securitisation rests upon. Individual borrower's information such as income,borrowings, payment history, employment, addresses etc is quantitatively gathered and analysed using predictive models and transformed into a one credit score which ranks the credit worthiness of customers. It is used by investment banks to systematically put together pools of loans to be securitised; bond-rating companies (Fitch ratings, Moody's etc.) use it to assign risk ratings to mortgage backed securities and lenders use it when analysing loan applications. As observed by Mester (1997), credit scoring made its debut in the 1950's; lenders now use it for consumer, mortgage, and small scale lending businesses.

However, bigger banks have developed their own in-house credit scoring methodologies. The bulk of lenders now rely on the credit scores generated by third party credit bureaus such as Experian, Equifax etc to select suitable loan applicants. Frame et al. (2001) finds that lenders now have expanded ability to make more credit available to borrowers due to the innovation of credit scoring mechanism which translate to significant reduction in the unit cost of insuring individual loans and hence increase the minimum efficient graduated system of consumer loan underwriting activities (Berger et al. 2005). On the run up to and up to 2007, substandard mortgage credit to families with adverse and low credit scores made up a large chunk of this credit expansion; a lot of these families defaulted on their credit which resulted in huge losses for US banks that held these loans in their accounts as well as those who held the securitised investments as mortgage backed securities in their portfolios.

2.4 Legal and Supervisory Matters

Ground breaking financial creations in most cases raises new legal and supervisory subjects. Credit derivatives are not an exclusion. Before the credit crisis and since credit derivatives are comparatively novel products, the supervisory framework was not appropriate with the rapidity of the innovation. The comprehensive scale of settlement, documentation, legal, supervisory, and accounting concerns that possible influence the use of credit derivatives by banks are thrashed out in this section.

2.4.1 Risk-based capital structure rules, credit derivatives and the Basle Committee on Banking Supervision

Established by the foundation central bank Governors of the Group of Ten countries at the last quarter of 1974, The Basle Committee on Banking Supervision is not conferred with official power or legal implementation. More properly, it forms a great breath of banking supervisory course of action and standards and look forward to individual territories to put them into effect in their appropriate methods.

At the last quarter of 1987, the committee released a document encompassing a suggested plan for apportioning capital based on credit risk (BIS 1987). At the third quarter of the same year, the document was recognised and validated as the Basle Accord by the central banks of the Group of Ten countries. As with the other foundation members, the document was embraced by the supervisory authorities in the US for their banking sector. The main purpose of the document was to make available the determination and evaluation of capital adequacy for banks. The risk-based capital structure was employed to make certain consistent capital standards. Derivatives are integrated into the risk-based capital structure with a two-stage process. Primarily, credit change components are used to switch every single item into a credit corresponding sum. Additionally, the credit corresponding sum is classified in a similar way as balance sheet elements.

Nevertheless, the initial risk-based capital estimation did not take into account credit derivatives. It was indistinguishable the group credit derivatives should fall into to apply credit change issues. Nine years later, precisely 1996, the FDIC released a regulatory document that deal with credit derivatives in the banking book as off-balance sheet straightforward credit alternative (Gordy 2003).

As a result, credit derivatives on the part of banks who sell protection are changed into credit corresponding sum at 100% (FDIC 1996). They are apportioned to the risk group suitable for the fundamental assets instead of the credit derivatives participant in the transaction, for the reason that the fundamental assets influence the level of credit risks. A likely collapse of the buyer of protection brings about the seller of protection no deficiencies and shortfall. Given that credit derivatives are on the side of the buyer of protection, the risky asset sheltered may be regarded at the risk weight of the seller of protection. Buyers of protection could ask for capital relief with the credit derivatives acquired. On the other hand, these capital relief needs are evaluated on specific circumstances.

Eight years down the line, precisely at the second quarter of 2004, the Basel II document was made public by the Basel Committee (BIS 2014). It Acknowledges credit derivatives instruments like credit default swaps, total return swaps etc. that makes available credit shield comparable to guarantees.

With the Regulated Method, 60% of the sum of the credit derivatives can be accepted as protected if the sum of credit derivatives is lower or equal to the sum of the fundamental commitment for credit derivatives reserved in the banking book, better still 60% of the sum of the fundamental commitment can be established as protected if the sum of the credit derivatives is more than the sum of the fundamental commitment. The 60% identification issue is made available as provisional handling which will be honed preceding execution afterwards allowing for extra information. The protected segment of the fundamental commitment is ascribed the risk weight of the seller of protection. The unprotected segment of the fundamental commitment is ascribed the risk weight of the fundamental participant in the business transaction. Provided that the credit derivatives are domiciled in trading book to protect a credit risk in banking book, the identical banking book handling will be employed to estimate the capital obligation for the protected banking book requirement. Once more than one credit derivatives are domiciled in the trading book, the particular risk capital costs counterbalance are permitted by the ensuing guidelines:

(a) Maximum permitted amount will be accepted if the worth of two situations at all times travel in the contrasting course and to the same degree;

(b) 80% limited capital relief will be accepted if the worth of the two situations at all times travel in the differing way but not to the same degree and limited capital relief will be accepted if the worth of the two situations usually travel in the differing ways (BIS 2014).

2.4.1.1 Banking book contrasted with the trading book

The banking book is made up of three major bits: deposits, group of investments and loans of the banks. The group of investments includes bonds, securities, shares, and other instruments for investment goals. The trading book is made up of assets that are purchased and kept for the desired effect of disposing them when situation calls for it. Usually, the trading book holds derivatives instruments. Given that some conditions are met, credit derivatives are in most cases expected to be domiciled in the banking book as the same time as some territories also accept credit derivatives to be domiciled in the trading book. The trading book rules specifies that banks must keep capital against counterparty risk, specific risk for derivative transactions and general market risk. Every so often, trading book guidelines entail a smaller amount of capital charges compared to banking book guidelines. Given that long and short credit derivatives arrangement are seamlessly fit in terms of type, reference asset, and maturity, they may be counterbalanced by each other for capital requirement intent and objective. The US Federal Reserve expects bank examiners to base capital obligation for credit derivatives in banking book on the credit risk of financial loss of the reference assets. The US Federal Reserve made available its second rule to provide advice for examinations of credit derivatives in trading account at the end of the second quarter of 1977 (Moser 1998). It categorised credit derivatives in the trading book into three classes, to wit, open positions, matched positions, and counterbalancing positions. Regular capital obligations are used for each class. However, the Office of the Comptroller of the Currency (OCC) was of the opinion that the credit derivatives market was in its infancy to take broad supervisory assessments and appraise bank's credit derivatives positions on individual and specific basis (Moser 1998). The Office of the Comptroller of the Currency was worried that intervening prematurely would blight the growth of the new ideas and methods. The rules in Basel II concede credit derivatives to be domiciled in both the banking book and the trading book of the financial institutions. Nevertheless, to be given trading book capital handling and care, credit derivatives must adhere to some fundamental conditions, to wit, (a) Well detailed and written down trading strategy for the arrangement permitted by the bank's executive committee; (b) Well stated course of action and established method for the effective organisation and supervision of the arrangement and; (c) Well stated course of action and established method to keep an eye on the arrangement in comparison with the bank's trading plans and policies.

Basel II makes available motivation and encouragement to banks aggressively participating in credit derivatives market with the handling of credit derivatives in the trading book of banks in addition to the identification of credit default swaps and total return swap as comparable to credit agreements and pledges. For this reason, it promotes the growth of the credit derivatives marketplace.

2.4.1.2 Insurance contrasted with investment

Big insurance businesses and reinsurance firms are active players in the derivatives market and have built up comparatively large credit derivatives arrangements. Credit derivatives are usually conditional on the same rules as other derivative instruments in the insurance industry. Compared to banks, insurance companies have a higher relative efficiency in that Insurance companies operate outside the Basel established system and are expected to keep smaller capital against credits than banks that are under supervisory capital rules. Also, it is not essential for insurance businesses to mark their portfolios to markets (Dunbar 2000 ; Allen and Carletti 2006). The development of the credit derivative market has enabled them to make the most of this. However, the abrogation of the Glass Steagall Act in the US watered down this benefit eventually (Crawford 2011). The development of credit derivatives market has distorted the customary differentiation between investment and insurance products. As explained earlier, credit derivative could be an insurance contract. Theoretically, the difference between credit insurance and credit derivatives is insignificant. Insurance businesses are restricted largely to investment business. Consequently, banks and insurance companies must be cautious in discerning their credit derivatives products as insurance products or non-insurance products.

2.4.2. Basel III reforms

As a worldwide, discretionary regulatory rule as a basis for judgment on bank risk management, capital adequacy, liquidity risk, market risk , stress testing etc., Basel III was expected to bolster and enhance capital requirements for banks by reducing leverage and developing bank liquidity. It was initiated in response to the inadequacies in financial regulation shown by the financial meltdown of 2007 to 2009. Originally, in 2010 through 2011, the constituent members agreed to the implementation by banks from 2013 through 2015 but alterations from the first quarter of 2013 extended application of the rules until the end of March 2023. In summary, Basel III addresses the following:

- Larger Capital Requirement for banks
- Revision of eligible Regulatory Capital for banks
- Larger Capital Charges for Banking Book risk of financial loss
- Larger Capital Charges for Trading Book risk of financial loss
- Replacement of old Leverage Ratio for banks
- Two fresh Liquidity Ratios for banks

Table 2.2: The measurement and recording of the best time to act on the Basel III reforms

Financial Regulation	Date	New Requirements
Capital Requirements	End of 2010	Increased charges and fees for Trading Book exposures
	End of 2010	Increased capital charges and fees for Banking Book exposures
	2013-2014	Rise in minimum Common Equity Capital Ratio
	2013-2023	Narrower definition of Qualifying Capital: Stand down of Non-Qualifying Instruments
	2014-2017	Introduction of deductions from Core Tier 1
	2016-2018	Introduction of new Countercyclical Capital Buffer
	2016-2018	Introduction of new Capital Conservation Buffer
Leverage Ratios	Up to 2012	Supervisory monitoring
	2013-2018	Parallel run
	2018	Migration to Pillar 1 capital requirement
Liquidity ratios	2011-2014	Liquidity coverage ratio observation period
	2015	Liquidity coverage ratio commencement of new standard
	2012-2017	Stable funding ratio observation period
	2018	Stable funding ratio commencement of new standard

Source: (BIS 2011)

2.4.2.1 Important aspect of the Basel III rules

i. Capital obligations

Base II required banks to hold 2% of common equity and 4% of Tier I capital. The Basel III 2010 revised rules required banks to hold 4.5% of common equity and 6% of Tier I capital of risk-weighted assets. In addition, Basel III introduced two capital shields, to wit, a 2.5% obligatory capital safeguarding shield and an optional counter-cyclical shield to allow central banks to require up to an additional 2.5% of capital during times of increasing credit growth (BIS 2011).

ii. Leverage ratio

A minimum leverage ratio was introduced by Basel III. This was arrived at by deflating Tier 1 capital by the bank's average total consolidated assets, (this is different from the risk weighted). The expectation of the regulators was for the banks to maintain a leverage ratio of more than 3% under Basel III. However, the U.S. Federal Reserve announced at the beginning of the third quarter of 2013 that the irreducible minimum Basel III leverage ratio would not be less than 6% for 8 Systemically important financial institution (that is, banks whose failure could trigger a financial crisis due to their reach and complexities) banks and not less than 5% for their insured conglomerate outfits or bank holding companies (BIS 2013).

iii. Liquidity requirements

Under the liquidity requirements, Basel III advanced two new obligatory liquidity ratios, to wit, Liquidity Coverage Ratio and Net Stable Funding Ratio. The Liquidity Coverage Ratio was expected to make a bank to keep adequate top-grade and excellent liquid assets to protect its entire net cash outlays over thirty days; the Net Stable Funding Ratio was to make the on hand volume of steady funding to go beyond the obligatory quantity of secure funding over an extended stress period of 1-year (BIS 2014).

iv. U.S. version of the Basel liquidity coverage ratio requirements

The U.S. version of the Basel Committee on Banking Supervision (BCBS)'s Liquidity Coverage Ratio (LCR) was approved during the third quarter of 2013 by the Federal Reserve Board of Governors . This is to start from beginning of the first quarter of 2014.This ratio will apply to specific US financial institutions and other systemically important financial institution. The US version is a lot more stringent compared to the Basel Committee on Banking Supervision with respect to bigger banking conglomerates. This requires bigger financial institutions to have sufficient reserve of top-grade liquid assets (TGLA) that can easily be converted to cash to bridge liquidity needs when needed urgently. The Liquidity Coverage Ratio is applicable to U.S. banking operations with assets of more than ten billion dollars.

The Liquidity Coverage Ratio consists of two sections (Federal Reserve Board 2013):

- The numerator is the worth of TGLA, and
- The denominator is made up of the total net cash outflows over a certain stress phase, to wit: the total expected cash outflows less the total expected cash inflows.

Table 2.3: Type of Banks, requirements of Liquidity Coverage Ratio and holdings of Top-Grade Liquid Assets (TGLAs)

Type of banks	Consolidated Asset Base	Requirements
Large Bank Holding Companies	Over $250 billion or more in on-balance sheet foreign exposure, and to systemically important, non-bank financial institutions	To hold enough TGLA to cover thirty days of net cash outflow. That amount would be determined based on the peak cumulative amount within the thirty day period.
Regional firms	Those with between $50 and $250 billion in assets	Would be subject to a modified LCR at the Bank Holding Company level only. The modified Liquidity Coverage Ratio requires the regional firms to hold enough TGLA to cover 21 days of net cash outflow. The net cash outflow parameters are 70% of those applicable to the larger institutions and do not include the requirement to calculate the peak cumulative outflows.
Smaller Bank Holding Companies	Less than $50 billion in assets	Would remain subject to the prevailing qualitative supervisory framework.

Table 2.4: Specific classes of qualifying Top-Grade Liquid Assets (TGLAs)

	Types of assets
1	These represents assets that are highly liquid (usually those risk-weighted at 0% under the Basel III standardised approach for capital) and receive no trimming or reduction. Especially, the Federal Reserve chose not to include Government Sponsored Business-issued securities in Level 1, despite industry application of pressure and push, on the basis that they are not guaranteed by the "full faith and credit" of the U.S. government.
2A	Usually include assets that would be subject to a 20% risk-weighting under Basel III and includes assets such as Government Sponsored Business-issued and -guaranteed securities. These assets would be subject to a 15% trimming which is similar to the treatment of such securities under the BCBS version.
2B	These assets include corporate debt and equity securities and are subject to a 50% trimming. The BCBS and U.S. version treats equities in a similar manner, but corporate debt under the BCBS version is split between 2A and 2B based on public credit ratings, unlike the U.S. proposal. This treatment of corporate debt securities is the direct impact of the Dodd–Frank Act's Section 939, which removed references to credit ratings, and further evidences the conservative bias of U.S. regulators' approach to the LCR.

Source: (BIS 2014)

The U.S. proposal segregates qualifying TGLAs into three specific classes, to wit, Level 1, Level 2A, and Level 2B. Across the categories, the combination of Level 2A and 2B assets cannot exceed 40% TGLA with 2B assets limited to a maximum of 15% of TGLA.

The suggested plan requires that the Liquidity Coverage Ratio be at least the same level to or more than 1.0 and incorporates a multiple year changeover period that would entail: 80% compliance with effect from 1 January 2015, 90% compliance with effect from 1 January 2016, and 100% compliance with effect from 1 January 2017.

Finally, the suggested plan requires both sets of business, to wit, large bank holding companies and regional companies, subordinate to the Liquidity Coverage Ratio conditions to present correction schemes and strategy to U.S. supervisory body to deal with what steps would be engaged if the Liquidity Coverage Ratio drops lower than 100% for three or more successive days (FRB 2013).

2.4.2.2 Implementation of Basel III

Table 2.5: Summary of originally (2010) proposed changes in Basel Committee language

No	Issues	Proposed Changes
1	Raising the quality, consistency, and transparency of the capital base	(a)Tier 1 capital: the predominant form of Tier 1 capital must be common shares and retained earnings. (b)Tier 2 capital: supplementary capital, however, the instruments will be harmonised. (c) Tier 3 capital will be eliminated.
2	Strengthening the risk coverage of the capital framework	(a) Promote more integrated management of market and counterparty credit risk. (b)Add the credit valuation adjustment–risk due to deterioration in counterparty's credit rating. (c) Strengthen the capital requirements for counterparty credit exposures arising from banks' derivatives, repo and securities financing transactions. (d) Raise the capital buffers backing these exposures (e) Reduce procyclicality. (f) Provide additional incentives to move OTC derivative contracts to qualifying central counterparties (probably clearing houses). Currently, the BCBS has stated derivatives cleared with a QCCP will be risk-weighted at 2% (The rule is still yet to be finalised in the U.S.). (g) Provide incentives to strengthen the risk management of counterparty credit exposures. (h) Raise counterparty credit risk management standards by including wrong-way risk.
3	Introduction of leverage ratio as a supplementary measure to the Basel II risk-based framework. The ration was finalised in September 2014 and is known as the Supplementary Leverage Ratio (SLR)	(a) Intended to achieve the following objectives: (i) Put a floor under the build-up of leverage in the banking sector (ii) Introduce additional safeguards against model risk and measurement error by supplementing the risk based measure with a simpler measure that is based on gross exposures.

Table 2.5 Cont'd

No	Issues	Proposed Changes
4	Measures introduced to promote the buildup of capital buffers in good times that can be drawn upon in periods of stress ("Reducing procyclicality and promoting countercyclical buffers")	(a) Address procyclicality. (i) Dampen excess cyclicality of the minimum capital requirement; (ii)Promote more forward looking provisions; (iii) Conserve capital to build buffers at individual banks and the banking sector that can be used in stress; and (b)Achieve the broader macro prudential goal of protecting the banking sector from periods of excess credit growth. (i)Requirement to use long-term data horizons to estimate probabilities of default, (ii) downturn loss-given-default estimates, recommended in Basel II, to become mandatory (iii) Improved calibration of the risk functions, which convert loss estimates into regulatory capital requirements. (iv) Banks must conduct stress tests that include widening credit spreads in recessionary scenarios. (c) Promoting stronger provisioning practices (forward-looking provisioning): (i) Advocating a change in the accounting standards towards an expected loss (EL) approach (usually, EL amount: = LGD*PD*EAD).
5	A global minimum liquidity standard for internationally active banks	This is introduced that includes a 30-day liquidity coverage ratio requirement underpinned by a longer-term structural liquidity ratio called the Net Stable Funding Ratio. (In January 2012, the oversight panel of the Basel Committee on Banking Supervision issued a statement saying that regulators will allow banks to dip below their required liquidity levels, the liquidity coverage ratio, during periods of stress.
6	Need for additional capital, liquidity or other supervisory measures	(a) To reduce the externalities created by systemically important institutions. (b) As of September 2010, proposed Basel III norms asked for ratios as: 7–9.5% (4.5% + 2.5% (conservation buffer) + 0–2.5% (seasonal buffer)) for common equity and 8.5–11% for Tier 1 capital and 10.5–13% for total capital.

Source: (BIS 2014)

After some discussions, the Basel Committee on Banking Supervision announced the final adaptation of its framework (Supervisory Framework for Measuring and Controlling Large Exposures) that develops established Basel Committee on Banking Supervision regulation on credit risk financial loss concentrations. Towards the end of the last quarter of 2014, the U.S. banking regulators, to wit, the Federal Reserve, Federal Deposit Insurance Corporation and the Office of the Comptroller of the Currency, released their final regulation executing the Liquidity Coverage Ratio. For clarity, the Liquidity Coverage Ratio is a brief period of time liquidity gauge planned to make sure that banking institutions keep enough assemblage of liquid assets to shield net cash outflows over a thirty day stress phase (BIS, 2011, 2013, 2014)

U.S. implementation of the Basel III

The Federal Reserve of the US declared at the end of the last quarter of 2011 (Getter 2012), the machinery to the Basel III rules significantly has been set in motion which was going to be applicable to banks as well to all financial institutions with more than fifty billion dollars in assets as stated in Table 2.6:

Table 2.6: U.S. implementation of the Basel III rules

No.	US Implementation
1	**"Risk-based capital and leverage requirements" including first annual capital plans:** Conduct stress tests, and capital adequacy "including a tier one common risk-based capital ratio greater than 5 percent, under both expected and stressed conditions". A risk-based capital surcharge.
2	**Market liquidity:** First based on the United States' own "inter-agency liquidity risk-management guidance issued in March 2010" that require liquidity stress tests and set internal quantitative limits, later moving to a full Basel III regime.
3	**The Federal Reserve Board itself would conduct tests annually "using three economic and financial market scenarios":** Institutions would be encouraged to use at least five scenarios reflecting improbable events, and especially those considered impossible by management, but no standards apply yet to extreme scenarios. Only a summary of the three official Federal Reserve scenarios "including company-specific information would be made public" but one or more internal company-run stress tests must be run each year with summaries published.
4	**Single-counterparty credit limits to cut "credit exposure of a covered financial firm to a single counterparty as a percentage of the firm's regulatory capital":** Credit exposure between the largest financial companies would be subject to a tighter limit.
5	**"Early remediation requirements" to ensure that "financial weaknesses are addressed at an early stage":** One or more "triggers for remediation—such as capital levels, stress test results, and risk-management weaknesses—in some cases calibrated to be forward-looking" was proposed by the Board in 2012. "Required actions would vary based on the severity of the situation, but could include restrictions on growth, capital distributions, and executive compensation, as well as capital raising or asset sales".

As of the first quarter of 2014, the implementation of many of the Basel III rules has been on course regardless of dissimilarity in ratio obligations and calculations.

2.4.2.3 Impact of Basel III

(i) Macroeconomic impact

The organisation for Economic Cooperation and Development in a study in 2011 on the impact of the Basel III (Slovik and Cournède 2011), suggested that the impact of the of Basel III implementation on GDP growth in the medium term would be in the scale and scope of −0.05 to −0.15% per annum. Financial and commercial yield would be largely affected by an upsurge in lending spreads of banks as they transfer an increase in bank funding costs to their customers, due to higher capital obligations. Banks were projected to raise their lending spreads by about fifteen basis points on average to meet the capital obligations at first effective in 2015. Bank capital obligations effective as of 2019, to wit, the common equity ratio of 7%, the Tier 1 capital ratio of 8.5%, could escalate bank lending spreads by about fifty points. The projected result on Gross Domestic Product development take for granted no dynamic reaction from monetary course of action. As far as monetary course of action would no longer be inhibited by the nil lower bound, the impact of Basel III on economic yield could be counterbalance by a fall in monetary guiding principles by about thirty to eighty basis points (Cociug and Dogotari, 2014; Angelini et al. 2015).

ii. Criticism of the Basel III rules

Studies such as Noh (2013), Brownbridge (2015), Kinateder (2016) have contended that Basel III simply develop and additionally explains the current Basel II supervisory foundation devoid of basically probing its underlying principles, chiefly the increased reliance on regulated evaluation of credit risk promoted and sold by notable rating agencies, to wit, Moody's and Standard and Poor’s, therefore using public policy to reinforce anti-competitive concentration of power in two powerful groups and systems. The disputed and undependable credit ratings of these rating agencies are in the main perceived as a key reason to the US credit crisis. Impervious handling of the entirety of derivatives transactions is also faulted. Even though organisations have series of lawful and reasonable risk lessening reasons to deal in derivatives, to wit: hedging, insurance etc., the Basel III accords:

- Do not oblige establishments to examine relationships of all in-house risks they possess.
- Do not assess establishments for the methodical or assertive disputed promotion and sale of risk - other than necessitating a systematic clearing up of derivatives in a crunch and disciplined accounting.
- Handling protection buyers and sellers in the same way even although protection sellers undertake additional focused risk, to wit, plainly buying them, after which they are then likely to counterbalance correctly short of supervision.

In view of the fact that derivatives posed significant new parameters in a crunch, these are seen as significant weaknesses by some researchers making some to claim that the class and category of being "too large to go out of business" rest with detail to main derivatives trader who assertively took on chances and probabilities of an occurrence they did not consider ought to materialise, but again then did not happen. While Basel III does not completely need tremendous scenarios that organisations entirely decline to be contained within pressure and stress testing, this continues susceptibility. Nevertheless, regulated outside examination and modelling is one of the main subjects suggested to be looked into by Basel IV. Some researchers also contend that capitalisation rule is integrally ineffective as a result of these and identical teething troubles and - notwithstanding a contrary philosophical perspective of rules - concur that "too large to collapse financially" refuse to go away.

Likewise, Basel III has been faulted for its paper load and hazard constrains by financial institutions and by some researchers who also contend that it would damage their business, in addition to general financial and profitable development as well. The Organisation for Economic Cooperation and Development projected that the application of Basel III would lead to a fall of yearly Gross Domestic Product development by 0.05 to 0.15%, attributing the sluggish revitalisation from the credit meltdown of 2007 to 2009 on the slack regulation. The Basel III regulation was also disapproved as badly influencing the ability to maintain balance of the financial system by upsurge in motivation of banks to sport the supervisory structure. Likewise some policy makers expressed the opinion and disapproval to Basel III in their remarks and judgment to the regulators advising that the Basel III suggestions, if carried out, would damage fringe banks by building up and expanding their capital assets considerably on loans in the mortgage and small business sectors of the market. Furthermore, other policy makers have contended that Basel III did not significantly and sufficiently supervised banks as insufficient and ineffective supervision was a reason of the credit crisis.

At the beginning of the first quarter of 2013, the inclusive banking sector which had advocated for the facilitation of the of Basel III rules won a stay of execution on the implementation schedule to 2019 from the Basel Committee on Banking Supervision which however widened the classification and description of liquid resources and assets (King 2013; Dietrich et al. 2014; Gavalas 2015).

2.4.3 Summary

In this chapter, we discussed the brief history of the US banking system, financial innovation and the development of securitised lending, the deregulation trend, regulatory issues, in particular Basel II and development of the Basel III frame work, important aspect of the Basel III rules and its implementation going forward. Chapter 3 discusses credit derivatives and the credit crisis of 2007 to 2009.

CHAPTER THREE

CREDIT DERIVATIVES AND THE CREDIT CRISIS OF 2007 TO 2009

3.1 Review of the Crisis

Studies including those by Zimmerman (2007), Ferguson and Johnson (2009), Kyeong-Won and Hwa-Nyeon (2009), Reinhart and Rogoff (2008, 2009, 2014), Anjan (2015), Thakor (2015), Fligstein and Roehrkasse (2016), Lavoie (2016), Nisha (2016) have tried to figure out the causes and policy lessons of the Great Recession of 2007 to 2009, in a number of respects, and it has been compared to the Great Depression of the 1930's. In this chapter, we start with a brief technical introduction as well as a review of the financial crisis, the following recession, the part played by credit derivatives and the alternative course of action the Federal Reserve should have taken.

On February 7, 2007, HSBC announced that it had incurred losses associated with the US risky sub-prime loans. Twenty days later on February 27, 2007, Freddie Mac, the US mortgage giant announced that it was not interested in the continued purchase of speculative sub-prime loans. Three days later on April 2, 2007 New Century Financial, Sub-prime mortgage lender files for bankruptcy-court protection. In June 2007, two hedge funds owned by Bear Stearns with substantial holdings of subprime mortgages ran into substantial losses and are forced to get rid of some risky assets. On August 9, 2007 BNP Paribas froze three of their Funds, that investors will not be able to take funds out of it, that they have no way of valuing the complex assets such as the collateralised debt obligations (CDOs), or packages of sub-prime loans inside their portfolios owing to escape of liquidity. It was the first major financial institution to profess the risk of exposure to sub-prime mortgage assets (Cecchetti, 2008).With the unfolding scenario, the European Central Bank pumped ninety five billion Euros into the banking market to ease liquidity. This followed a further injection of one hundred and nine billion Euros over the next few days. Other central banks-The U.S Federal Reserve, the Bank of Japan, the Bank of Canada etc. also injected massive funds to improve the tight liquidity that was unfolding (Covitz et al. 2013).

Hanak (2009) discussed the intervention of the US Federal Reserve bank. The US Senate approved two stimulus packages totalling over a trillion dollars during 2008 ($250 billions) and 2009 ($787 billions). During the last quarter of 2009, government debt and troubled private assets were purchased from the troubled major banks by the Federal Reserve and other central banks in the Euro Area totalling $2.5 trillions. These central banks also raised the capital of their banks by $1.5 trillions through the purchase of newly issued preferred stock in the troubled major banks, IMF (2009).

On June 17, 2009, the US president announced a new set of proposed regulatory reforms to restore responsibility, accountability, and build the foundation for a stronger and safer financial system. The proposals addressed the following: one, expanded regulatory powers to be granted to the US Federal Reserve to regulate bank holding companies and other large firms that pose risk to the financial system in the event of a failure, two, consumer protection mechanism to protect the public from financial firms who do not tell their customers the truth on contracts entered into by them, three, promote free and fair markets by closing gaps and loop holes in the regulation of the financial system, four, expanded regulation of the shadow banking system and the derivatives market, executive pay, bank capital, and many more. On Friday December 11, 2009, the US Treasury Secretary announced the House passage of the H.R.4173, the Wall Street Reform and Consumer Protection Act of 2010 (Michael 2013).

From the foregoing, the course of the financial crisis can be divided into distinct phases (Cecchetti 2008; Covitz et al. 2009; Mian and Sufi 2009; Mian and Amir 2009; Keys et al. 2009; Bernanke 2009; William and Julapa 2010; Financial Crisis Inquiry Commission 2011; Mullineux 2013) :

(1) On set of the crisis, (2) Fundamental crisis and countermeasures by the regulatory agencies, (3) The gradual effect of the measures and (4) Recovery of the crisis and long-term unsustainability of government finances:

(a) Onset of the crisis: The financial crisis started from June 2007 and lasted until last quarter of 2009. However, the US National Bureau of Economic Research (NBER) suggests that the US recession started fron June 2007 until the second quarter of 2009.The financial crisis was majorly related to the housing market in the USA. As a result of weakened regulatory framework and unreliable assessments on the part of the lenders, a great deal of the borrowers with poor and adverse credit ratings were allowed to borrow mortgage facilities. The mortgage borrowers were the first to be hit when houses began to fall, this eventually spread to the mortgage landscape. The liquidity of the banks became tight, there was a spike in the interbank rates and in the first quarter of 2008, Bear Sterns, an investment bank in the US kissed the dust. The over bloated credit ratings of most banks were downgraded by the ratings agencies. To avert the collapse of the mortgage market, the US government took over the largest mortgage lenders (Fannie Mae and Freddie Mac).To improve liquidity, the Federal Reserve and other central banks reduced interest rates and supply funds to banks at longer maturities.

(b) Fundamental crisis and countermeasures by the regulatory agencies: With the calamity that befell Lehman Brothers towards the end of the third quarter of 2008, the confidence of the market was shaken which led into panic, since the credit derivatives counterparties transacted like a web, this further spiked the interbank rates among banks. A globally coordinated slump ensued, which continued until the end of the first quarter of 2009. This saw the world trade almost collapsed, emerging economies and countries that were hitherto insulated became infected. This saw the intervention of central banks, drastically reducing interest rates to sometimes 1%. Far reaching intervention and monetary policies and economic packages were put into action in several countries.

(c) The gradual effect of the measures: The counter measures by the regulatory authorities signaled some recovery albeit slowly from the second and fourth quarters of 2009. Expansive automatic stabilisers and stimulus measures became increasingly the Fiscal policy of the day. The fastest recovery was recorded in Asia due to the strong domestic demand by the Chinese consumers due to the stimulus measures put in place by the government. The downward slide in the US and Europe was tamed and some slow recovery was noticeable while the financial markets also recovered slowly from the deep slide at the beginning of the crisis, confidence returned to the financial markets as the counter measures were sustained.

(d) Recovery of the crisis and long-term unsustainability of government finances: The effect of the measures put in place gradually firmed the economy of the world; this became visible from the first quarter of 2010, the financial markets also stabilised though prices of assets were still depressed. Gradually, as economic recovery became steady, there was a corresponding easing of the fiscal interventions and stimulus measures. However, the recovery of the emerging economies was faster than the advanced economies. For example, the national debt of countries attracted a lot of attention in which some (Greece, Ireland) had to turn to the International Monetary Fund and the European Union for help. To further consolidate the recovery program, the European Central Bank introduced the Securities Markets Program, set up the European Financial Stability Facility; this was followed by the permanent European Stability Mechanism which took effect after 2013. The US Federal Reserve announced additional monetary policy measures to assist the sluggish recovery of the US economy. Likewise, other advanced economies approached the stabilisation of their economies with more urgency with the enactment of legislations and sustainable fiscal policies.

Evidence gleaned from the major players in the crisis suggests that they were caused at two levels (Berger et al. 2009; Bhansali et al. 2008; Wade 2008; Wray 2008; Gorton 2009; Jacobs 2009; Markham 2009; Wilmarth 2009; Lastra 2010; Lewis et al. 2010): (1) global macro policies bothering on liquidity and (2) Ineffective regulatory framework. The global policies on liquidity created an overflow of liquidity: Petro - dollar reserves from the oil producing countries, China's fixed exchange rate, accumulation of massive reserves in Sovereign Wealth Funds, zero percent interest rates in Japan and one percent interest rate in the US. The liquidity overflow got the asset bubble and excess leverage underway.

Some studies have also postulated other reasons attributable to the cause of crisis (Zimmerman 2007; Ferguson and Johnson 2009; Kyeong-Won and Hwa-Nyeon 2009; Purnanandam 2011): one, unethical mortgage brokers, two, obsessive greed among bankers, three, ill informed homeowners, four, badly informed and unsophisticated investors who failed to accurately price the risks involved in the mortgaged backed securities (MBS). Other reasons adduced were agency problems between brokers and the banks, originate-and–distribute models of securitisation, excessive and extensive use of leverage and short term funding, unwholesome incentive culture, conflicts of interest from the rating agencies, lax and permissive monetary policies and regulatory structure not fit for the 21st century. Tables 3.1 and 3.2 below capture the history of world financial crisis from 1976 to 2015. Figure 3.1 depicts the cost of previous banking crisis in the developed world while Figure 3.2 shows the fiscal outlays in the global financial crisis from 2007 to 2009 in the developed economies.

Table 3.1: History of World Financial Crisis from 1976 to 2015

Year	Advanced/Emerging/Developing Economies	Related To:	Preceding speculation in:	Monetary expansion from:	Speculative Peak:	Crisis (Crash/Panic)	Lender of Last Resort
1976-97-(21Years)	Global	Currency Crisis, financial liberalisation, Convertibility without macro-economic coordination.	Foreign exchange	Not applicable	Speculation in currencies of:	**Advanced Economies**: Austria (1982),Britain (1976,1979,1981-1982,1986,1992),Canada (1976,1992),Finland (1977-1978,1982,1991-1993),France (1982),Greece (1980,1982-1983,1985),Hungary (1989,1994-1995),Iceland (1983-1984,1988,1992-1993), Italy (1976,1992,1995),Japan (1979,1989-1990), New Zealand (1975,1983-1988,1991),Norway (1978,1986,1995),Portugal (1976-1978,1982-1983,1993,1995),Romania (1990-1991),Singapore (1975),South Africa (1975,1978,1984-1986,1996),Spain (1976-1977,1982,1992-1993),Sweden (1977,1981-1982,1992-1993), Switzerland (1978). **Emerging Economies:** Argentina (1975-1976,1982-1983,1989-1991),Bangladesh (1975-1976),Bolivia (1981-1985,1988,1990-1991),Brazil (1982-1983,1987,1990-1991,1995),Chile (1985),Columbia (1985),Costa Rica (1981),Ecuador (1982-1983,1985-1986,1988),Egypt (1979,1989-1991),India (1976,1991,1993,1995),Indonesia (1978,1983,1986,1997),Jordan (1983,1987-1989,1992),Korea (1980,1997),Lao PDR (1995),Malaysia (1986,1997),Mexico (1976,1982,1985,1994-1995),Nicaragua (1993),Nigeria (1986-1987,1989,1992),Peru (1976,1979,1978-1988),Philippines (1983-1984,1986,1997),Sri Lanka (1977),Syria (1977,1982,1988),Thailand (1981,1984,1997),Turkey (1978-1980,1994),Uruguay (1982-1983),Venezuela (1984,1986,1994-1996). **Developing Economies:** Botswana (1984-1986,1996), Burundi (1976,1983,1986,1988-1989,1991,1997),Cameroon (1982,1984,1994),Dominican Republic (1985,1987,1990),Equatorial Guinea (1991,1994),El Salvador (1986,1990),,Ethiopia (1992),Fiji (1986-1987),Ghana (1978,1983,1986-1987),Grenada (1978),Guatemala (1986,1989-1990),Guinea-Bissau (1991,1996),Guyana (1978,1989-1991),Haiti (1977,1991),Honduras (1990),Jamaica (1978,1983-1984,1990-1992),Kenya (1975,1981-1982,1985,1993-1995,1997),Madagascar (1984,1986-1987,1991,1994,1996),Malawi (1982,1985-1987,1992,1994),Mali (1993),Malta (1992,1997),Mauritius (1979,1981),Morocco (1983-1985,1990),Mozambique (1993,1995),Myanmar (1975-1977),Nepal (1975,1981-1982,1984-1986,1991,1993,1995),Paraguay (1984-1986,1988-1989,1992),Sierra Leone (1988-1990,1997)Swaziland (1975,1979,1982,1984-1986),Trinidad and Tobago (1985,1988,1993),Tunisia (1993),Uganda (1981,1987-1989),Zambia (1985,1987,1994),Zimbabwe (1982,1991,1993-1994,1997).	Network of central banks, International Monetary Fund, World Bank.

Table 3.1: Cont'd

Year	Advanced/Emerging/Developing Economies	Related To:	Preceding speculation in:	Monetary expansion from:	Speculative Peak:	Crisis (Crash/Panic)	Lender of Last Resort
1976-97-(21Years)	Global	Banking Crisis				**Argentina** (1980-1982,1989-1990,1995-1997),**Bangladesh** (1987-1996),**Bolivia** (1986-1987,1994-1997),**Botswana** (1994-1995),**Brazil** (1990,1994-1997),**Britain** (1975-1976,1984),**Burundi** (1994-1997),**Cameroon** (1987-1993,1995-1997),**Canada** (1983-1985),**Chile** (1976,1981-1983),**China** (1982-1986),**Columbia** (1982,1987),**Costa Rica** (1987,1994-1997),**Denmark** (1987-1992),**Ecuador** (1980-1982,1996-1997),**Egypt** (1980-1985,1991-1995),**El Salvador** (1989),**Equatorial Guinea** (1983-1985),**Ethiopia** (1995-1995),**Finland** (1991-1994),**France** (1994-1995),**Germany** (1978-1979),**Ghana** (1982-1989,1997),**Greece** (1991-1995),**Guatemala** (1991-1992),**Guinea-Bissau** (1995-1997),**Guyana** (1993-1995),**Hungary** (1991-1995),**Iceland** (1985-1986,1993),**India** (1993-1997),**Indonesia** (1994,1997),**Italy** (1990-1995),**Jamaica** (1994-1997),**Japan** (1992-1997),**Jordan** (1989-1990),**Kenya** (1985-1989,1992-1997),**Korea** (1997),**Lao PDR** (1991-1994,1997),**Madagascar** (1988),**Malaysia** (1985-1988,1997),**Mali** (1987-1989),**Mauritius** (1996),**Mexico** (1981-1991,1995-1997),**Mozambique** (1987-1997),**Myanmar** (1996-1997),**Nepal** (1988-1994),**New Zealand** (1987-1990),**Nicaragua** (1988-1996),**Nigeria** (1993-1997),**Norway** (1987-1993),**Panama** (1988-1989),**Paraguay** (1995-1997),**Peru** (1983-1990),**Philippines** (1981-1987,1997),**Portugal** (1986-1989),**Romania** (1990-1997),**Sierra Leone** (1990-1997),**Singapore** (1982),**South Africa** (1977,1985,1989),**Spain** (1977-1985),**Sri Lanka** (1989-1993),**Swaziland** (1995),**Sweden** (1990-1993),**Thailand** (1983-1987,1997),**Trinidad and Tobago** (1982-1993),**Tunisia** (1991-1995),**Turkey** (1982-1985,1991,1994-1995),**Uganda** (1994-1997),**Uruguay** (1981-1984),**Venezuela** (1978-86,1994-1997),**Zambia** (1995),**Zimbabwe** (1995-1997).	Network of central banks, International Monetary Fund, World Bank

Table 3.1: Cont'd

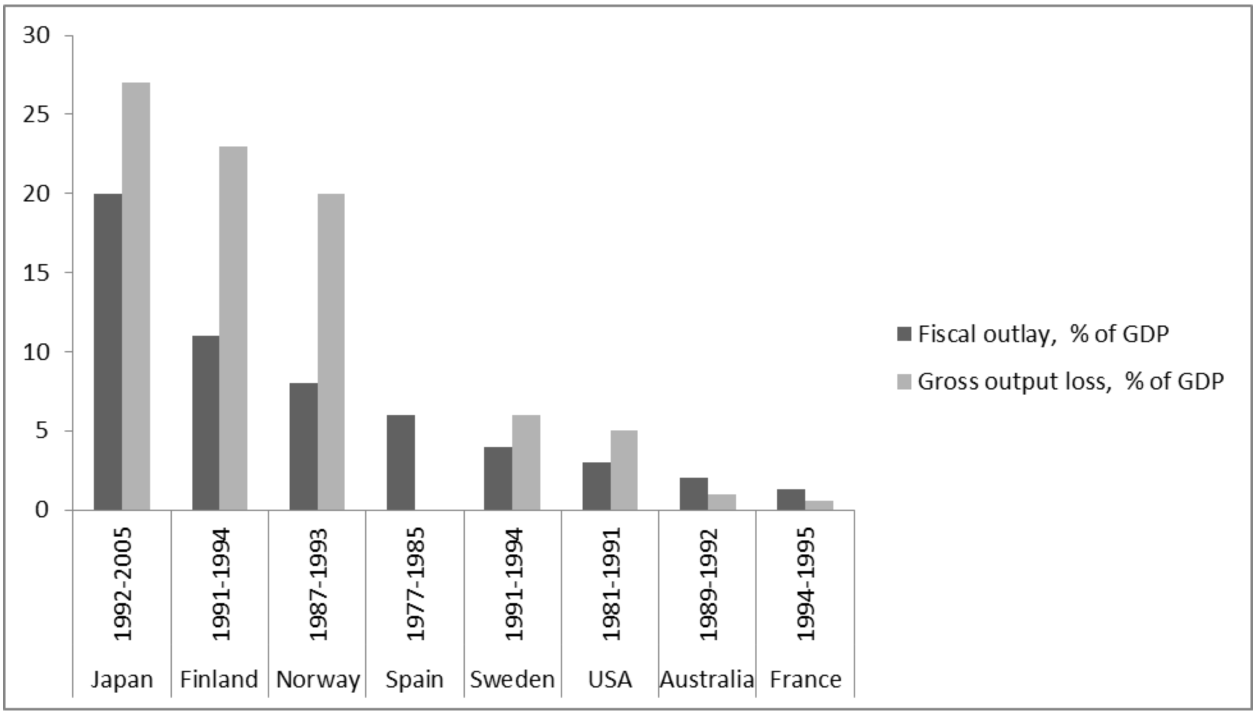
Year	Advanced/Emerging Economies	Related To:	Preceding speculation in:	Monetary expansion from:	Speculative Peak:	Crisis (Crash/Panic)	Lender of Last Resort
1997-1998	Asia (Emerging)	Credit bubbles and fixed currency exchange rates	Unsustainable asset price levels	Investors poured money into several emerging Asian Economies	1997	1997 (Indonesia, South Korea,Thailand,Malaysia,Philippines,HongKong)	IMF bailout/structural adjustment packages
1998-1999	Russia	Debt Crisis	Triggered by declining productivity, a high fixed exchange rate between the ruble and foreign currencies to avoid public turmoil, and a chronic fiscal deficit.	Cost of the Chechnya war, rebuilding of the Chechnya economy after the war, Asian financial crisis of 1997,reduced demand for extractive commodities impacted the foreign exchange reserves	First quarter,1998	August 17,1998	World Bank/International Monetary Fund
1998-2002	Argentina	Economic depression	Triggered by the Russian and Brazilian financial crisis	Fixed exchange rate, large borrowings by the government, tax evasion, money laundering	1999, 2001	Third quarter 1998	IMF,Central bank of Argentina
2001	US	Credit Crisis/Dotcom crash	Speculation in telecoms and internet securities	Venture capital/IPO's	2000	2001-2002	None
2007-2009	Global	Subprime crisis	speculation in mortgage related securities	US bank lending, low interest rate etc	2005-2006	2007	Network of central banks, International Monetary Fund, World Bank etc

Table 3.1: Cont''d

Year	Advanced/Emerging Economies	Related To:	Preceding speculation in:	Monetary expansion from:	Speculative Peak:	Crisis (Crash/Panic)	Lender of Last Resort
2009	Greece	Sovereign debt crisis	Triggered by the turmoil of the Great Recession/credit crisis of 2007-2009, structural weaknesses in the Greek economy, and a sudden crisis in confidence among lenders.	Large capital inflows, government borrowings	2009	Third quarter 2009	European Central bank,IMF
2014	Russia	Financial Crisis	Fall in the price of oil, international economic sanctions over the annexation of the Crimea and the alleged Russian intervention in Ukraine	collapse of the Russian rubble, drop in the Russian stock market index by 30%	Second half of 2014	June 2014 to December 2014	Russian Central Bank intervention
2015	China	Stock Market crash	In the year leading up to the crash, enthusiastic individual investors continued inflating the stock market bubble through mass amounts of investments in stocks, exceeding the rate of economic growth and profits of the companies they were investing in	Investors faced margin calls on their stocks and many were forced to sell off shares in droves, precipitating the crash	8-9 July 2015	27 July 2015	Stopping short selling of stocks, IPOs China Securities Regulatory Commission (CSRC) imposed a six-month ban on stockholders owning more than 5% of a company's stock from selling those stocks, resulting in a 6% rise in stock markets

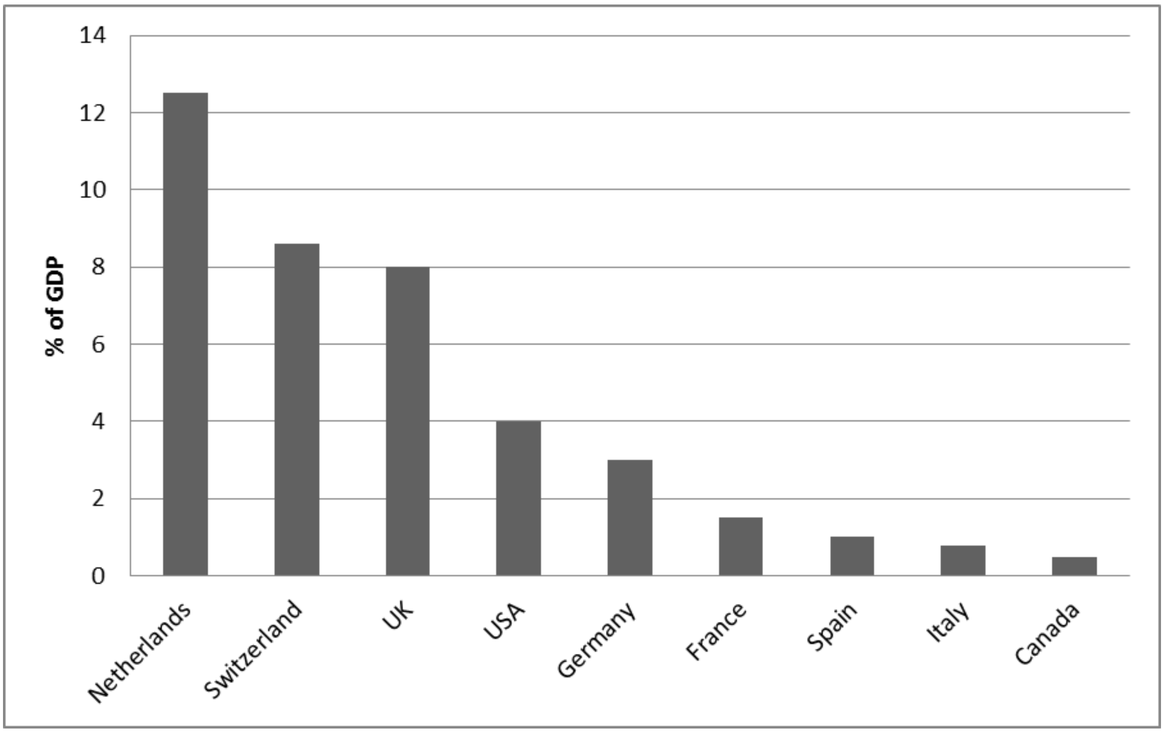
Source:World Bank Report (2009); IMF Report (2008, 2009).

Figure 3.1: Cost of previous banking crisis in the developed world



Source: World Bank Report (2008,2009,2010)

Figure 3.2: Fiscal outlays in the global financial crisis from 2007 to 2009 in the developed countries.

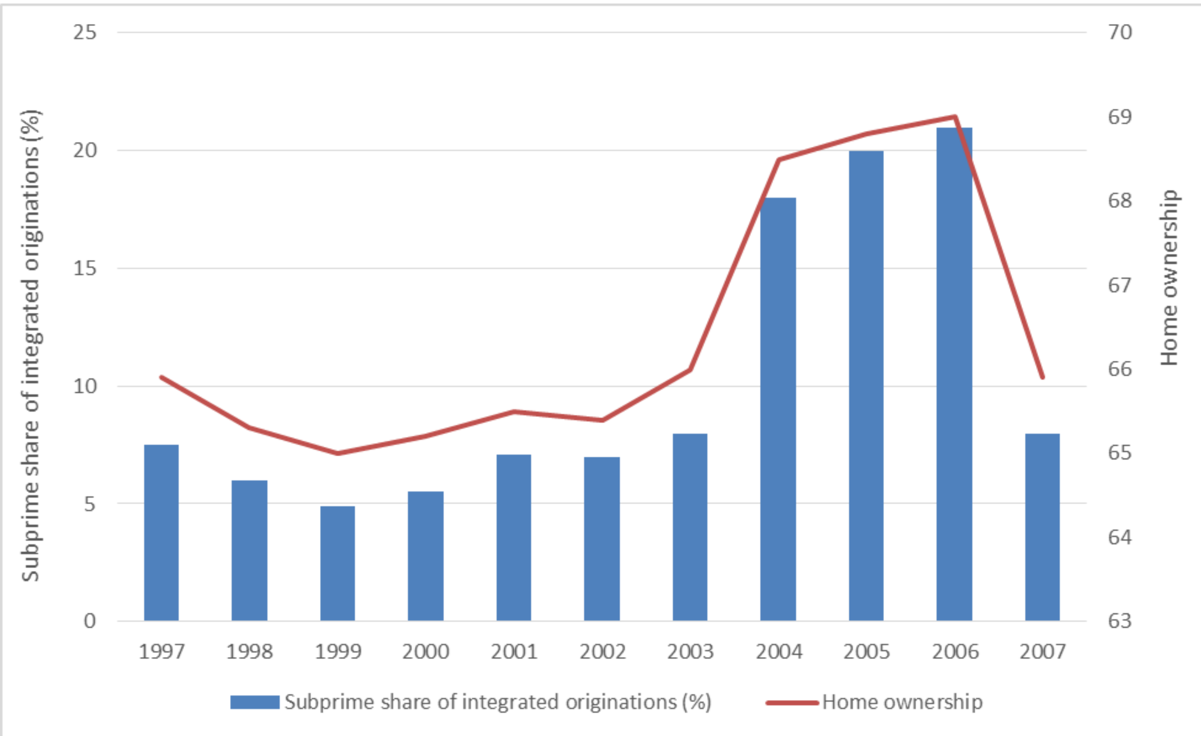


Source: BIS, IMF

3.2 Key part played by credit derivatives to the financial crisis and the resultant banking institution failures.

The possible grounds of the 2007 to 2009 financial crisis are complicated, multifaceted and interconnected to each other. However, some studies such as Kranacher (2008), Peicuti (2013), Pajarskas and Jočienė (2014, 2015) have submitted that the root cause of the financial crisis was the subprime mortgage crisis in United States. For emphasis, Subprime mortgage loan are residential mortgage facilities issued to risky borrowers characterised with a history of delayed payments or insolvency (Arentsen et al. 2015). Sometimes, some of these borrowers have been found to be without a job, income or assets (Hwang et al. 2015).

Figure 3.3: Growth of US Subprime Loans from 1997 to 2007



Source: US Department of Housing and Urban Development (2010), US Federal Reserve (2010)

One of the numerous and diverse cracks instrumental to the financial crisis and bank failures was the use of credit derivatives by financial institutions well past their innovatively envisioned desired effect. Credit derivatives deadened the banking industry to the possibility of investment loss it was taking, particularly when credit default swaps were connected and knit with securitisation procedures and methods created from the expansion of mortgage loans including subprime loans without proper risk management.

The intricate and labyrinthine derivatives system was first intended to develop and make available a comparatively large financial resource base to the mortgages market. Nonetheless, the increases in size of mortgage facilities were not moved closely by protecting the execution of mortgage itself. The financial institution and counterparties involved in mortgage facilities, from the initiator of the loan to the bonds writer, were not concerning of the execution and efficiency of the mortgage. This condition was for the most part caused by the system of mortgage loan motivating influence that was reciprocally related to the amount of mortgage transaction, not the quality of the mortgage. The studies conducted by Arentsen et al. (2015) suggest that credit derivatives had stimulated the exponential growth of credit supply to subprime mortgage acquirers. Credit derivatives had also given rise to financial assets composed of elaborately interconnected parts with high yields and high credit ratings. With the expectation of high profit and high credit ratings consequently, diverse financial institutions worldwide had invested a great deal in the credit derivatives instruments. Therefore, the rather large risk of subprime mortgage facilities had been transmitted to the financial institutions worldwide through credit derivatives. The connection of financial institutions worldwide in credit derivatives with underlying mortgage facilities had also brought in another likely explanation of the financial crisis: gamble or game of chance. Furthermore, Sharma (2013) contends that credit default swaps instruments have become a 'financial instrument of mass destruction'. Additionally, the study contends that credit derivatives instruments has undercut and diminished the international market for debt as well as equity. Flavin and Sheenan (2015) made clear further that credit derivatives instruments, particularly credit default swap, had emboldened banks to transact on much riskier facilities; assisted growth in leverage in the worldwide financial system thereby exposing a broader exposure to default risk. In reality, the release and aid to America International Group by the US government in the heat of the credit crisis was to a great extent due to their considerable exposure to the credit default swap.

Nevertheless, the use of derivatives instruments will have negligible or no effect on existent economy on the proviso that the fundamental assets of credit derivatives, which are the mortgage facilities, were liquid into the future (Bongaerts et al. 2011).

In comparison, the influence of credit derivatives on existent economy could be strengthened during the rising instability and conjoined with a rapid and unanticipated shift in the market. As a result, during the fall of property values which came after the increasing failure to meet financial obligations from the subprime mortgage facilities, the credit derivatives instruments were also remarkably influenced as their value gathered from their fundamental assets. Because of the form that was intrinsically built in the credit derivatives instrument, each failure to meet the financial obligation of the mortgage facility were now magnified repeatedly, and no longer confined to the mortgage facilities itself. Additional failure to pay the mortgage will have an influence on the highly rated credit derivatives connected with the mortgage. Credit derivatives invented to create financial returns in an exciting market can turn around into a headspring of huge losses.

Furthermore, the usual procedure of credit derivatives to influence the financial position could increase the size of the net gain, or net loss. To illuminate this further, when a bank has leveraged their credit derivatives instruments by 20:1, this signifies that a 5% earned loss in the fundamental assets will change completely into a 100% loss of their statutory capital. Subsequently, a remarkably leveraged bank could deplete a large chunk of its reserved capital even though failure rates of the subprime mortgage facilities were depressed.

Veritably, financially bankrupted entities, for example, AIG, Lehman Brothers, Bear Stern etc were deeply leveraged to maintain and supply enough statutory capital to support their transaction position (Vyas 2011). Still, credit derivatives are created for mitigating risk, as protections are not expected to take losses. Agreeably, if certain risks are switched from one counterparty and switched to another counterparty, the receiving counterparty should be ready to back up their position when market fluctuates. As a matter of fact, financial institutions involved did not sufficiently cover their risks vulnerability (Karras 2009).

Moreover, Murphy (2010) contends that although credit derivatives instruments are not singly accountable reason for the credit crisis, it has undoubtedly made the worldwide financial web more intricate and complicated. Furthermore, he contended that the making and development of credit derivatives instruments was more blameworthy than anything else for aggravating the harshness of the credit crisis. Further, Adelson (2013) also posits that the middlemost of the credit crisis was the credit derivatives instruments because the size and the complexity of instrument traded increased the difficulty in evaluating the level of risk to subprime mortgage facilities and deciding the risks in each bank.

Likewise, the concern of the actual mortgage losses, since the real losses itself has not been accurately calculated, had contributed to further severity of the credit crisis (Stulz (2010). Additionally, over-leveraged of credit derivatives instruments of various banks and other financial outfits, the totality of the mortgage bubbles, confiscation of rights due to inability to pay subprime mortgage, not well controlled credit derivatives instruments, had made the credit crisis expand worldwide. As well, intricate financial architecture of credit derivatives instruments had also made the credit crisis get difficult to be identified since it involved a systemic risk connected worldwide. In the course of time, the financial system worldwide was too weighed down to bear the losses (Saretto and Tookes 2013).

On the other hand, studies by some researchers such as Buchholz (2015), Wu et al. (2016), Provost (2016) and Nisha (2016) have contended that supervisory let-down was a key issue in the crisis. It is submitted that the most germane argument is that supervisors were fascinated and seized by the banking industry, not just by their system of social beliefs but also functionally and practically. The prominent banks with particular interests tried to influence the regulators to set their own capital obligations and credit derivatives were an important element of these series of actions, taking into account extensive capital cutback by way of risk transfer to other financial institutions and unsuccessful insurers such as AIG, the monolines etc .The hazards transmitted contained within mortgage risk, thus it cannot entirely be maintained that poor mortgage advances spearheaded, on the whole, the losses at banks while credit default swaps linked losses were something entirely different (Roy and Kemme 2012). Genuine mortgages were made to provide credit default swaps traders' and securitisation bankers' strong desire to bring in profit. Furthermore, deteriorating credit default swaps spreads led to the opinion and confidence among the players that general credit risk was insignificant. A fraudulent investment operation was being built on a basis of deceptive credit potency and this generated the setting for poor mortgage loans and advances (Ayadi and Behr 2009).

In retrospection, one of the many significant supervisory mistakes throughout the credit expansion phase was the imperfection to control by rules and laws credit derivatives as insurance agreement from their commencement in the 1990s (Rötheli 2010). If this had transpired, one component or piece of credit risk could not have been moved throughout the financial system a lot of stages over and all around. Naturally, credit derivatives would seem to be a rational and functional way of isolating credit risk from the interest rate risk characteristic in bonds, nevertheless regrettably, they have transformed, chiefly into a very profitable toy for a limited gang living on income from investments and hot heads who specialise in the application of mathematical and statistical methods at prominent banks and hedge funds, a case in point is JPMorgan's "London whale" trader (Bruno Iksil) debacle discussed in chapter 1 which led to billions of dollars in losses (Skyrm 2014). The reality is that a deal of credit default swap activity takes place between dealers who, it is assumed, have been manipulating and taking advantage of their market position. This is not similar as kindly moving credit risk from place to place in the financial system for some better pleasantness.

3.3 Alternative course of action to the Financial Crisis the Federal Reserve ought to have taken

Initially, many observers were not bothered about the announcement of August 9, 2007 but as more information became available in the press, it was obvious that the immediate issue was that most mortgages lending by the financial institutions was securitised mainly on the general characteristics of the borrowers and the loans in which lenders did not know the actual values of the mortgage backed securities in their portfolios (Peicuti 2013). Therefore, lenders in the interbank market would be weary of making fresh loans to their colleagues with substantial mortgage backed securities in their portfolios with significant increase in risk premiums. Equally, it was clear that the 5% increase in home ownership by families that escalated from 1994 to the start of the crisis was not likely to be maintained, that the price of properties would continue to nosedive causing additional degeneration in markets and economy.

Significantly to a greater extent, the collapse of the housing market was going to be a lot more serious than the dot-com debacle in 2001 and the recession that followed since a few physical assets were brought to existence during the dot-com debacle (Marshall 2013). Conversely, this would not take the shape of the mortgage crash as the collapse of the market was followed by a massive hang over of residential and commercial properties (Poole 2010). On balance, process associated with the dot-com disaster was relatively trouble-free and nimble since there was no excess of physical capital; all that was needed was only flows to adjust. For this reason, the downturn was not severe and fizzled out in a short while (Wang 2007; Dagher and Arnold 2015; Hirakubo and Friedman 2002). Theoretically, stock-flow realignments are full of problems and lasts a lot more. For this reason, the recession was much larger and longer. On balance, this would need a very large decline in the actual value and prices of the stock of properties since the number of the properties can only change gradually. Furthermore, the wealth effect on homeowner expenditure would be enormous (Bucher-Koenen and Ziegelmeyer 2014).

The fitting monetary policy in this regard was to have substantially increased the monetary base, that is, the supply of credit, to make it easier for the adjustments necessary to achieve a new balance (Viorica 2012). Because of this, it would have been better that the Federal Reserve bought enough amounts of Treasury securities to increase the supply of credit to the system. There is no established method to know precisely how much the monetary base should have been increased to in such a situation. A suggestion of $900 billion would have been fine for the markets to stabilise enough though more could have been added if it was not enough initially (Nersisyan 2015). The question of whether the Federal Reserve should limit its purchases to Treasuries would have been less important than the amount purchased. The only requirements would have been that high grade Treasury securities were bought in order to reduce the Federal Reserve credit risk, and informed the public that the increase in the monetary base is just for a while and that the different part of the Federal Reserve's balance sheet and the bigness of the monetary base would go back to normal as the markets and economic fundamentals began to normalise (Blau et al. 2016).

It is noted that the Federal Reserve supplied funds to the banks through the Term Auction Facility in December 2007 which was a good concept to address the widening spread of the interest rate gap between overnight and term interbank lending as banks retreated from risk taking but it was also worrying to note that the loans were made at subsidised rates to the banks (Berger and Roman 2015). It was an error, however, on the decision to sterilise the lending to the banks (Calomiris and Khan 2015). It would have been better to announce to the markets that the Federal Open Markets Committee would suspend aiming the Federal Funds Rate and to a large degree increase the supply of credit to the financial market by the making of loans and buying of assets. It would have been better to announce that additional funds would be removed and the Federal Open Markets Committee would return to Federal Funds Rate aiming as soon as the financial markets became stable (Li 2013). It would further have been better to announce the steps taken were temporary and was necessary to allay the fears of the markets that the Federal Open Markets Committee might go back on its promise to a long-run stability pricing. These suggested actions should have been tested and allowed some space to work. However, if providing additional credit to the market was not healing then extreme measures would have been considered necessary.

It was risky to translate experiences from previous U.S. financial crises to the 2007 to 2009 credit crisis as information gathered from the crisis of the late 1800's to the early 1900's may not be handy in grasping the problems and thus resolving future crisis as financial markets of today are different from the ones of the past 150 years (Wheelock 2010).

The Federal Reserve's independence, strength and effectiveness may have been significantly lessened by participating in activities such as the bailout of Bear Sterns (Kohn

2013), providing credit to selected segments of the financial market etc to the detriment of others as it is not within the ambit of the Federal Reserve to decide if a financial institution is too big to run down or collapse but that of the US Congress to decide (Taylor 2013), that is to say, the Federal Reserve should provide the liquidity or short term credit while the government provides the capital if it is imperative to do so (Moenninghoff et al. 2015; Boyd and Heitz 2016). If in the wisdom of the US government to save an institution from collapsing which can result in systemic reverberations, the government must provide plausible reasons for doing so to the public and the market and how the funds would be provided in doing so (Gormley et al. 2015).

The decision of the Federal Reserve to bail out Bear Sterns by buying twenty nine billion dollars in dodgy assets was not a well thought decision and other policy actions that may have eroded the independence of the Federal Reserve (Meltzer 2013). It may not be possible to establish that these suggestions are fool proof or would have ended in a better result than the actions the Federal Reserve has implemented as economics does not have a controlled laboratory with experiments thus these suggestions and approach should be examined based on empirical evidence and existing theory more so there is no econometric model that is capable in constructing better simulations of different policy directions and course of actions.

It is a considered opinion that the addition of large amounts of credit is effective only at the beginning of a credit crisis, when the uncertainty in the financial market and uncertainty are unpredictable (Feldkircher 2014). However, when the markets have maintained stability, the injection of more credit would not produce the desired results. For example, the policy action of the Bank of Japan will suffice here. The Bank of Japan did not make available further liquidity at the beginning of its recession but rather chose to reduce its interest rate to 0% and greatly enlarged the monetary base in the early months of 2001. The policy actions appeared not to have served the purposes but rather appeared not fit and highly unsettled (Bowman et al. 2011). The foothold of the government in the economy greatly reduced the degree of probability that the monetary policy direction would impact on the economic recovery as the financial markets was more or less controlled by the Japanese government as with other financial markets.

There seems to be some evidence that the policy direction suggested above would have produced much better results. After the collapse of Lehman Brothers, the Federal Reserve took a policy direction similar to what is outlined above as the size of the monetary base increased in 2008 from August to December (Carpenter et al. 2014). As expected, announcement of Lehman Brothers collapse was disastrous for the financial markets and the economy, the markets improved significantly in the early months of 2009 and the recession showed signs of abating towards the middle of 2009 (Abbassi and Linzert 2012).

The Economic Stimulus Act of 2008, which was assented to on February 13, 2008 and the Troubled Asset Relief Program which was also assented to on October 3, 2008 no doubt could have been responsible for these improvements (Calomiris and Khan 2015). Because of this, it is not possible to know to which extent the Federal Open Markets Committee's response to Lehman Brother's alone was responsible for the visible signs of improvement in the markets and the economic activity. Therefore, it seems the action of the Federal Reserve before the Lehman Brother's collapse did not add much to the well being of the markets and economy as the US industrial production index fell from 100.7 in 2007 to 96.2 in August 2008 and the unemployment rate accelerated to 6% by August 2008 (Chodorow-Reich et al. 2012; Çevik et al. 2012). Furthermore, the uninterrupted downward spiral in value and quality in financial and economic conditions resulted first to the collapse of Bear Stearns and subsequently Lehman Brothers. Practically, the actions of the Federal Open Markets Committee's since Lehman had been driven by a term structure of interest rate that has a connection of macro-finance and economics that appears to be imperfect with little empirical basis (Bhar et al. 2015).

The 0% interest rate policy of the Federal Open Markets Committee has been motivated by the expectation hypothesis or modified expectation hypothesis (Galbraith 1988), which has been repeatedly rejected on empirical basis under which excess bond returns are zero or constant (Sargent 1979; Hansen and Sargent 1991). There is also little evidence that the policy thrusts of quantitative easing and operation twist have reduced substantially the longer-term yields on bonds (Krishnamurthy and Vissing-Jorgensen 2011). Theoretically, the basis for the use of quantitative easing or operation twist where the Federal Reserve buys and sells short term or long term bonds depending on their monetary policy direction is open to disagreement (Kapetanios et al. 2012; Herbst et al. 2014).

The proof of the use of lower frequency data rather than high velocity data is not fit as it lacks strength and character even as the statistical significance, importance and existence in the same form of the high-frequency effects on longer-term bond yields is far from convincing. There is also no convincing evidence that the Federal Reserve forward guidance policy rate path have had a substantial impact and effectiveness on longer-term bond yields (Moessner 2015). Evidence that the policies of the Federal Reserve have impacted on employment and economic activity is not convincing yet as the ineffectiveness of the Federal

Open Markets Committee's perception in the court of public opinion is on the rise, only of recent is the figure on unemployment showed a marginal increase (Kranacher 2012; Groshenny et al. 2013).

Thornton (2010, 2012) in his study posited that the Federal Open Markets Committee's low interest rate policy path of the last ten years had little impact on longer-term bond yields or economic growth. For example, with long-term rates to a large extent below any sensible approximate calculation of the natural rate, firms cash holding cost escalation due to substantial cash holding and banks holding nearly two trillion dollars in excess reserves, it is hard to see how more of the Federal Reserve asset purchases could have a substantial impact on employment or economic growth (Moessner 2014).

It is also noted that the goal of these policy paths is to effect economic decisions by altering asset prices (Farka and Fleissig 2013). Such misleading alteration can have impact that frustrates economic growth and potentially create problems in years to come. For instance, the Federal Open Markets Committee's 0% interest rate policy has substantially reduced the incomes of pensioners and others who are reliant on their previous savings for their current disposable income. Furthermore, the lack of capacity to attract reasonable profit on dependable short-term assets provides a leeway for pension funds, hedge funds, and individuals etc to take on additional risk in their portfolios (Moessner 2014). Thorton (2011) in his study noted that there is empirical evidence that the Federal Open Markets Committee's low interest rate policy may be increasing the prices of commodities which also was a factor that contributed to the property debacle.

The facts outlined above is enough grounds for the Federal Open Markets Committee's to revisit its monetary policy path by informing the markets that the 0% interest rate and unusual policy path will advance risk taking beyond what is acceptable and usual thus consequently are likely to hinder economic growth. Furthermore, a continuing 0 to 0.25% interest rate policy path is not in line with a positive long-run real interest rate and the Federal Open Markets Committee's 2% inflation target (Friedman and Shachmurove 2015).

The Federal Reserve can bring its balance sheet size nearer to the level it was before the credit crisis for interest rates to be more in tune with the real rate of interest. This can be achieved, taking cognisance of the absorptive capacity of the market by selling the securities outright. With this done, the Federal Funds Rate target will be accelerated to a level that is more in line with the long-run real interest rate. The anticipation of the Federal Open Markets Committee that the overall feel and effect of bringing the wheels of the monetary policy back to standard will be of good effect, to wit, the distortion and its effects on an extended 0% interest rate on the prices of asset and risk taking will be gotten rid of, the income on interest will become larger while investor view and attitude will become better. With careful implementation and good communication, the suggested policy thrust will impact significantly on the financial markets and economic growth.

The recommendation on policy change is derived from some established facts: (a) it is not practicable with a long-term real interest rate that is 0% or negative to have a significant and positive economic growth; (b) that a continuing 0% interest rate is not consistent with a positive real interest rate and a 2% inflation goal, it is clear that such a policy will not achieve both objectives but only one; (c) Quantitative easing, the 0% interest rate, and operation twist policy path are based on the fundamental principle of expectation hypothesis, a theory of the term structure in which excess bond returns are zero or constant but which has no empirical basis; (d) As Thornton (2010) noted, there is evidence that increased control over very short-term rates by the Federal Reserve and other central banks resulted in a substantial failure of the connection between the long-term sovereign debt yields and the rate targeted by central banks; (e) the expectation theory has no theoretical basis in comparison to the classical theory of interest rates assumptions that long-term yields are caused by economic essentials or foundation and short term rates connected to long term yields by simultaneous buying and selling, appears to be a better explanation of the conduct of interest rates along the term structure (Laidler 2015); (f) evidence that the Federal Reserve forward guidance path shows no greater ability of such policies to influence longer term returns in a way constant with the expectation hypothesis; and (g) there is no evidence of a liquidity effect and change that is analytically or financially significant.

3.4 Main Points of Policy Suggestion

It can be argued that the Federal Reserve did not heavily increase the monetary base in early months of 2008 when it should have but it had no choice than to do so after the bankruptcy announcement of Lehman Brothers, it took action to continue with the monetary base after the Lehman debacle rather than allow the monetary base reduce naturally as it should as the financial market became stable and the recession terminated (Bicksler 2009). The Federal Open Markets Committee tried to stimulate aggregate demand by trying to reduce longer-term rates using quantitative easing, forward guidance, and Operation Twist when faced with the challenges of a very high unemployment rate and weak economic activity and development. The Federal Open Markets Committee responses was instigated by technocrats utmost belief in the expectation hypothesis, what some see as the clear records of events on the result oriented monetary policy was the fact that the Federal Reserve only lend money and make investments or manages the federal funds rate through the open market operations which sometimes is on a large scale or the additional importance on anything that interferes with trade or better still, misallocation and the financial market frictions (Pratap and Urrutia 2012).

The observations above helps to explain the Federal Open Markets Committee lack of success to greatly enlarge the monetary base in the early months of 2008 and the policy thrust of the use of operation twist, 0% interest rate and quantitative easing. The Federal Reserve reactions to the credit crisis would have been faster and more robust had technocrats in government embraced the empirical failures of the expectation hypothesis (Sarno et al. 2007), truly taken into account the situation that long-term Treasury returns were not responding to the 425 basis point increase in the Federal Funds Rate goal from the middle of 2004 through the middle of 2006 (Goyenko et al. 2011) and accepted that real long-term rates are largely caused by basic economic essentials, such as the rate of economic activity and development and are therefore practically free of undesirable effects of business cycles and contractionary monetary policy (Canlin and Min 2014).

Furthermore, technocrats in government ought to take the Fisher equation with seriousness in respect of estimating the relationship between the nominal and real interest rates under inflation (Everaert 2014). If they think deeply about this, they would come to the conclusion that a 0% nominal interest rate policy path is not consistent with 2% inflation and positive economic development, that is to say, a positive real long-run interest rate. Even though a 0% nominal interest rate policy can be tolerated for a comparatively little period of time, it is completely invalid as a long-run policy path.

Friedman's (1970) thought of a Federal Reserve explanation of man's general inclination to just do something when confronted by unfriendly event causing change mirrors the Federal Open Markets Committee severe policy thrusts during the crisis, that some policy steps were taken had its own impact even if the results of the process of change were not palatable. Regrettably, severe way of doing things or towards a course of action can have bad results for economic activity, growth and long term wellbeing of the financial markets. The long term economic results of such a severe policy path are not easy to say what might happen in the future. To what ever degree, such policies can have long term results for the monetary policy of the Federal Reserve, to wit, the evaporation of the ability to inspire belief and trust credibility as the increasingly severe policy thrusts results in little and possibly smaller and possibly bad results.

3.5 Summary

In this chapter, we discussed briefly the financial crisis, the recession, the key part played by credit derivatives and the alternative course of action the Federal Reserve should have taken. Chapter 4 discusses the literature review of this work.

CHAPTER FOUR

CREDIT DERIVATIVES AND BANK PORTFOLIO MANAGEMENT

4.1 Introduction

The literature review presented in this thesis identify, examine and analyse the key issues, views and opinions on risk management and on the rationale of firms to mitigate against risk. Furthermore, the literature review considered banking literature to identify reasons why banks are likely to use credit derivatives to manage their portfolios. This will provide a means of assessing the results of the present study. The studies are reviewed within general subject areas to provide a logical flow to the chapter, to enable effective comparison between the studies and to facilitate the drawing of general conclusions from existing evidence. To aid this review, materials consulted include journals, books, specialist reports and web based sources. The areas to be reviewed have been broken down into four subheadings as follows:

1. Overview of credit research;
2. Banking risks and Risk management;
3. Portfolio theory and its application to bank portfolio management; and
4. Credit derivatives and bank portfolio management.

4.2 Survey of Credit Research

4.2.1 Credit Spreads research

Fisher (1959), in his seminal paper, established the initial groundwork for the interpretation of bond risk premium. He tested the hypotheses about the causal factors connecting the variation of the expected rate of return on a corporate bond to maturity and the equivalent risk-free rate of risk-fewer bonds in the oil prices to maturity. First, he hypothesised that the average risk premium depends on the risk that the firm will default on its bonds. Second, the default risk can be measured by a function of the interplay of: (a) net income variability of the firm for the period under review; (b) ability to meet obligations to third parties; and (c) the firm's capital structure. This in general will influence the quality and marketability of the bonds.

More precisely, Fisher defined the risk of default as the chance of adverse earnings variability which may hinder the firm from been able to meet its interest obligations on its bonds. He suggested that investors would be able to estimate the probability of default based on the factors listed above while the risk premium would depend on lender's estimates of the risk of default and the liquidity of the bonds in the market. Using a cross section of US industrial corporations over five periods of different business cycles, the study finds that the logarithmic regression coefficients of the risk premium with respect to each of the four explanatory variables in the model is relatively stable over time. The stability made it feasible to bring together the experiential variances and covariance's and get hold of a single set of "finest" assessment of the elasticities. Further showing that economic and statistical methods are relevant and appropriate to security analysis. However, the basic model could not show whether investor behaviour is rational or predictive over time though the study show that in the bond market, elasticities are relatively stable over time.

In the study conducted by Silvers (1973), an attempt was made to use a basic certainty-equivalent model as an alternative way in measuring the price volatility of a risky corporate bond taking cognisance of risk premium adjustment from the financial market. The study differed with the findings of Fisher that the liquidity and determination of bond price in the market is not an important index when default risk is held constant. Bierman and Hass (1975) extended the studies of Fisher (1959) in an attempt to use more complex method to analyse a bond. Using factors such as risk aversion and portfolio effects in their simple certainty-equivalent model to predict investor appetite, they find that the par bond credit spread is exclusive of their maturity period,as length of time to maturity expands, the risk differential extend downwards. The assumption that the conditional probability distribution of the survival process is limitless across time calls for further investigation, thereby making the conclusion ineffective.

The Bierman and Hass (1975) model was extended by Yawitz (1977) to include the terms of settlement in the event of default probability. While also assuming constant conditional probability of survival like Bierman and Hass (1975), their results confirms that risk premium is unconnected with the maturity of not only par bonds but also with investment grade, discount and premium bonds. The work of Bierman and Hass (1975) as well as Yawitz (1977) was extended by Yawitz et al. (1985) and Rodriguez (1988) to address the omission on the effect of taxability on yield spread and differentials in probability of default. The findings of Rodriguez (1988) suggested that the characteristic of default risk premium does not hold for non-par taxable bonds.

The study conducted by Stock (1994) challenged the findings of previous research on default risk premium on bonds which was suggested to be independent of maturity. He posited that results from previous research do not hold under an all-embracing modelling, noting that the term structure between non-taxable and taxable yields are manifestly dependent upon the bond maturity. The study of Fons (1994) brought in more life into previous research which hitherto had relied on hypothetical models with conditional explanatory variables to analyse the yield spread on bonds. Relying on the certainty equivalent bond pricing strategy of previous research, the study developed a simple risk-neutral model that uses multi period corporate bond default rates to illustrate the relationship between credit spread, probability of default, and recovery rate. However, the paper suffered from the non-inclusion of tax and liquidity premium which feature in real life (Nashikar et al. 2011).

Using 4,000 bond rating real life data from Moody's studies from 1970 to 1993 on the default experience (marginal default rates and weighted-average marginal default rates) from all US corporate bonds, the study shows that, when juxtaposed against a similar maturity risk-free bond, as a corporate bond matures and accelerates, its credit spread may fluctuate based on the credit risk of the corporate bond. In constructing a risk-neutral bond pricing equation (certainty-equivalent pricing equation) to determine a risky bond rate, he assumed that: (a) bonds are priced at par; (b) investors hold bonds to maturity or to default; (c) investors are risk-neutral; and (d) capital markets are arbitrage free. The constructed pricing equation (Fons 1994) is specified as:

$$\text{Price } = \sum_{t=1}^{N} \frac{s_t c + s_{t-1} d_c \mu (c+1)}{(1+i)^t} + \frac{s_N}{(1+i)^N} \qquad (4.1)$$

where,

s_t is the probability of the delivery of a coupon payment due in t years

d_t is the survival of the bond to year t without the probability of default

μ is the recovery rate in the event of the probability of default

i is the yield on a corresponding maturity treasury bond

Using Moody's financial data for each bond rating quality (Aaa, Aa, A, Baa, Ba, B), the equation is used to price and rate the risky investment-grade bond at par (100%). The hypothetical spread curve and credit spread derived (C – i), which is similar to that derived by Merton (1974) and improved by Black and Cox (1976), is what is needed for the risky bond to reward a buy-and-hold investor who is risk averse, for defined marginal default rates (d_t), and expected recovery rate (μ). Investment in this bond and a corresponding maturity, Treasury bond yielding (i) may not interest such an investor since a rational investor would expect to be compensated for the adjusted rate of return fluctuation brought about by the chance of default.

4.2.2 Floating rate instruments research

A floater, which is a shortened name for floating rate securities or notes (FRNs), is structured differently from a fixed rate note of the same duration and maturity; in most cases, the initial coupon of a floating rate security is lower than that of a fixed rate note. Duffie and Liu (2001) investigated the term structure of the yield spread between fixed rate notes and floating rate notes of the same credit quality, maturity, yield volatility, yield spread volatility, correlation between changes in yield spreads, default-free yields etc. and show that where and if the floater's issuer's default risk is risk-neutrally independent of interest rates, the sign of the floating-fixed spreads is determined by the term structure of the risk-free forward rate.

The performance of a floating rate security is influenced by the reference rate or benchmark such as the U.S. Treasury Bills, London Interbank offered rate, the Consumer Price Index etc .This can have a coupon structure with a reset period of monthly reset, 3 month London Interbank Offer Rate etc. Where a floater can trade at discount on a reset date for example, the note duration will no longer be equal to the reset period. Kaufold and Smirlock (1991) investigated the effect of credit risk on the pricing and duration of floating rate note. They find that where the borrower's credit risk of a floating rate security has changed since the security was issued; the duration will become greater than the time to the subsequent reset date. In addition, if the credit risk falls, this may become negative. Furthermore, a strong correlation between the default risk and interest rate will increase the duration of the floating rate note.

The credit crises of 2007 to 2009 resulted in the widening of credit spread which resulted into the huge losses of the values of various financial assets in the portfolios of many financial institutions. The evidence from stress testing carried out in some banks indicated that the risk management infrastructure and systems was not robust enough to capture the enormous credit spread widening and the pricing distortions of the financial instruments in their portfolios (Schuermann 2014; Kandrac 2014; Covas et al.2014).

Letizia (2010) investigated the widely used discounted cash flow mapping pricing analysis of financial instruments, the matching treatment of the probability of losses with a simplified value-at–risk model and the credit risk evaluation of plain vanilla floating rate note. They find that during the repeated period of very difficult credit spread widening, wrong measurement of risk on interest rate could result from modified duration, but does not take cognisance of the spread risk in the floating rate note element of a bank portfolio. Furthermore, interest rate and credit spread changes, specific "what if" measures, which are functional to the improvement of risk management systems were identified by an adjustment of the evaluation models, which made them highly sensitive to the effect of the spread risk.

4.2.3 High yield bond and debt repackaging research

Following the financial crisis of 2007 to 2009, there has been intense research into high yield bond (junk bond, speculative grade bond and non-investment grade bond), prediction models of probability of default, credit scoring models and packaged securities (credit derivatives) into collaterised debt obligations (CDO). By their nature, high yield bonds exhibit higher returns compared to high quality bonds due to their attractiveness to investors which is compensated for by their higher default risk (Asquith et al. 1989). In the opinion of moody rating agency, a junk bond is rated below Baa3 while Standard and Poor's rates them below BBB-.The market for junk bonds is mainly centred in the United States, activity has surged from the post crisis period from $288 billion in 2010 to $347 billion deals in 2012.

One of the earliest predictions for the probability of default and credit scoring models was developed by Altman (1968), Altman et al. (1977) and Altman (1987), widely known as the Zeta credit scoring model or Z-score model for credit risk analysis of financial instruments, bankruptcy, financial efficiency etc. The model was developed via a statistical technique called discriminant analysis. The model utilised accounting and market explanatory variables, linear analysis was then used to classify those that are able to honour their obligations and those that are not able to. Ohson (1980) used logistic regression to develop a model that could predict the precise probability of default in a corporate failure and bankruptcy which is an improvement on the methodology used by Altman.

4.2.4 Fixed Income Plan of action

Fixed income planning research papers can freely be described as those concerned with improving yields, protection against credit risk or for a certain level of risk. In a study of hedging of corporate bond portfolios during different business cycle, Marcus and Ors (1996) examine the capacity to hedge a corporate bond portfolio with stock and treasury debt instruments. As explained earlier, a corporate bond portfolio has two aspect; interest rate and credit risk. Interest rate risk is the risk due to potential short in duration or movement in the theoretical rate of return on an investment (Das 1997). Conversely, credit risk is encountered from changeable credit spreads.

In calculating the ratios of possible losses, Marcus and Ors (1996) regress the bond rate of returns on the percentage fluctuation in the price of Treasury bond contracts and S&P 500 futures. The Treasury bond contracts are used to protect the theoretical rate of return on assets or risk-free interest rate fluctuation, the S&P 500 futures contracts are used to protect against fluctuations in the credit spread. The specification of their regression is presented below:

$$R_{bond} = a_0 + b_0 \text{ x T-bond} + c_0 \text{ x S\&P} + (a_1 + b_1 \text{ x T-bond} + c_1 \text{ x S\&P}) \text{ x (Optimism dummy)} \quad (4.2)$$

where,

R_{bond} is the bond return for a given rating class and specific month.

T-bond and S&P are the yield or returns on the two futures contracts in the specific month.

Optimism dummy is variable that equals 1 in best times (optimistic) and 0 at other times (pessimistic).

The numerical part of the algebraic term as a consequence from the regression is considered to be the mixture of the two futures contracts that best simulates or resembles the corporate bond portfolio. The data and regressions covered the twelve years period from July 1982 to June 1994 with 144 observations. They find that Aaa-rated corporate bond portfolios can be protected more efficiently by only employing the T-Bond futures. Other lower graded bonds like Baa bonds have a higher protection or hedge ratio fastened to the S&P 500 futures contract.

They further divided the data into business periods of optimism and pessimism to provide additional perception. They re-estimate the regression with an optimism dummy equal to 1 in an optimistic (high confidence) period and 0 in a pessimistic period (low confidence). They find that the equity component of corporate bonds is not noticed even for the lower rating categories of bonds during optimistic periods. In contrast, the hedge ratio of the S&P futures contract becomes greater throughout pessimistic periods. Interestingly, they find that the hedge ratio of the T-Bond futures contract diminishes throughout the low confidence periods which, Bierwag and Kaufman (1988) as well as Babbel et al. (1997) see as the making shorter of the effective duration which, in turn, is brought about by an increase in the market's impression of the amount of default risk.

Skinner (1998) as well as Ioannides and Skinner (1999) suggested the possible need for various new hedging contracts which includes over the counter swaps, two hypothetical corporate bond hedging instruments etc in an attempt to increase the correctness of Marcus and Ors (1996) hedging strategy. Marcus and Ors (1996) hedge the credit component through the use of S&P futures contracts. In as much as the contract reflects credit risk, it is comprised of a mix of high and low rated companies.

Skinner (1998) proposes new hedging tools where the credit component is hedged instruments more closely matched to the bond portfolio under examination. Lehman Brothers' benchmark Aa and high-yield bond indices were used to hedge the credit part of Aa and Ba rated bond portfolio respectively. He proposes the bringing in of recently created derivative hedging instruments prone to credit risk to hedge such portfolios as he finds that these hedging instruments can make better the hedging efficiency and effectiveness above the use of a pure interest rate hedge. Nevertheless, their study did not give us perceptiveness into whether such recently created hedging instruments will add any meaningful worth to a simple T-Bond and S&P futures protection. Also, their study did not discuss the use of a simple equity hedge as examined in Marcus and Ors (1996). In addition, the request for a distinct hedging instrument for each of the rating category must be high enough for any newly created product to be successful.

4.2.5 Credit derivatives and their usage in handling or controlling bank risk

4.2.5.1 Impact of credit derivatives on banks

Duffee and Zhou (2001) in their study made an initial effort to model the influence of the introduction of credit derivatives on banks. This piece of research is looked into in detail.

Banks are regarded as buyers, that is, end-users of credit derivatives instruments. They contend that the unpredictability of a facility's full payment can be separated into two parts which is contingent on bank's private facts and figures. First, the advantage of bank's information is comparatively little. Conversely, it is comparatively enormous. The bank will transmit the previous risk to outside investors by using credit derivatives but keeping the last on the bank balance sheet.

Consequently, the bringing in of credit derivatives that transmit loan risk to outside investors could advance enhancement of risk distribution and do good to banks. In contrast, banks with high-quality facilities could decide on transferring a portion of their risk with credit derivatives and hold whatever is left of any other portion of their risk; with the low-quality loans held by banks, credit derivative could be used to transmit a portion of their risk and dispose off the other portion in the loan-sale market. Ultimately this will damage the combining symmetry in the loan-sale market. The overall result can be very poor.

(i) Combining symmetry in contrast with isolating symmetry

The information disproportionately involving banks and outside investors is something notable in the banking industry. For the reason that banks have facts and figures advantage in comparison to outside investors, banks are aware of the standard of their facilities more than external investors. Where the standing or other issues that could alleviate the effects of information unevenness is not considered, we can imagine that external investors are not aware of the real standard of the facilities disposed off in the loan-sale marketplace. This postulation is significant for the critical analysis of the symmetrical situation of the loan-sale market place.

The symmetrical situations in the loan-sale marketplace are two types: Combining symmetry and Isolating symmetry. Once the marketplace is in combining symmetry, the high and low standard facility's are jumbled in the loan-sale marketplace and are all disposed off at the identical prices, specifically, high-worth facility's are disposed off at comparatively reduced than their reasonable price and low-worth facility's are disposed off at comparatively better than their reasonable price. Consequently, a portion of the liquidity from the financial markets where high-worth facilities are packaged is moved to the financial markets where low-worth facilities are packaged.

Where the loan-transaction marketplace is in isolating symmetry, external investors regard the totality of the loans on sale as low-worth. Banks with high-worth facilities will hold back from disposing off their facilities unless the financial risk of distress triggered by the inability to payback of the facility given out surpass the loss of disposing off their high-worth facility at a poor price. Banks with low-worth facilities dispose them off at their reasonable prices. The liquidness from the condition of the high-worth facility sphere to the condition of the low-worth facility sphere exists not in the isolating symmetry.

In view of the fact that banks with high-worth facilities and low-worth facilities can only dispose off their facilities at a reduced price in an isolating symmetry than in a combining symmetry, it is clear that banks averagely will lose wealth if a combining symmetry is inoperative.

(ii) Combining symmetry and Credit derivatives

Duffee and Zhou (2001) used the health insurance market as a comparison in appreciating the combining symmetry drawback instinctively. Considering the fact that health insurance firms allow customers to buy health insurance that leaves out attention for a specific hereditarily-associated illness. The innovative policy will diminish the two issues of unfavourable selection and moral risk. For low-risk customers, they will decide to purchase additional insurance. For the high-risk customers, they will comfortably look after themselves. To whatever degree, the general public all together might be lacking for the reason that the outlays of getting this illness are not widely distributed well sufficiently.

In the same way, bringing in credit derivatives might bring about similar combining symmetry drawback as depicted in the health insurance marketplace case in point. Prior to the bringing in of credit derivatives, the existing loan-sale marketplace function as the means that distributes facility risk besides the banks. Banks in most cases do have privileged facts regarding their loan worth, which characteristically heads to possible poor selection drawback.

Caristrom and Samolyk (1995) in their study of facility disposal as a reaction to market centred capital restrictions and limits, investigated banks' capacity to dispose off facilities in which they have privileged processed facts. They discovered that the overall cost of bank bankruptcy is immeasurable, and banks have no real balance connecting the keeping of their facilities and disposing them off. Banks have to dispose off a portion of their facilities irrespective of their worth to forestall the overall charge related with bank bankruptcy, which could result to a combining symmetry in the loan-transaction marketplace. Since external investors do not completely differentiate involving low-worth facilities and high-worth facilities, the risk of low-worth facilities is split by the totality of the external investors. A bank that packages a high-worth facility earns less income by disposing off a high-worth facility at a reduced value. However, with this, it forestalls experiencing financial distress. For a bank that packages a low-worth facility makes more income for the reason that it can dispose off its low-worth facility at a comparatively above average amount.

The influence and result of credit derivatives instruments on the loan-transaction markets is contingent on a number of circumstances. We review the findings and analysis of Duffee and Zhou's (2001) model:

(a) Dealing Banks are favourably placed with the credit derivatives market if a combining symmetry is not in place in the loan-transaction market ahead of the commencement of credit derivatives market, looking at an economy short of credit derivatives, for example. If a combining symmetry is not in place in the loan-transaction marketplace, external investors will take for granted that any loan disposed off is of low standard.

Short of credit derivatives, a bank with high-worth facility must dispose off a portion of its facilities at the value of low-worth facilities to forestall financial distress risk. If the bank is chanced to distribute a portion of this risk at a reasonable value by the utilisation of credit derivatives, it can lessen the likelihood of financial distress short of disposing its high-worth facilities at reduced value. Consequently, the ushering in of a credit derivative market will help banks with high-worth facilities, while banks with low-worth facilities are not influenced. Considering everything, banks are favourably placed;

(b) Likely bank income is not influenced by the credit derivatives market if the combining symmetry persists-- The combining symmetry persists after the ushering in of credit derivatives, which suggests that the bank is reluctant to assume the risk of likely financial distress throughout the lifespan of its facilities regardless if they are of high standard. Rather than utilising credit derivatives, the bank disposes off portions of its facilities in their infancy; and

(c) Likely bank income and returns is reduced with the existence of the credit derivativesmarket than its absence if the ushering in of the credit derivatives market will collapse the prevailing combining symmetry.

Typically, banks have superior returns and income with a combining symmetry compared to credit derivatives pooled with isolating symmetry in the loan-transaction marketplace. Our review state three potentials of the influence of ushering in credit derivatives market to bank returns. As noted above, (b) is very little, it expresses the fact that the combining symmetry will persists after the ushering in of credit derivatives just if banks do not transact in credit derivatives.

In view of the fact that banks are the main players in the credit derivatives, they are likely to continue to patronise and use the products for a long time to come. If these products can assists banks with high-worth facilities to protect against financial distress, it is rational for banks to transact in credit derivatives compared to disposing off their high-worth facilities at unreasonable value. As a result, (a) and (c) are more credible.

The influence of credit derivatives to bank returns is contingent on the presence of a combining symmetry preceding the ushering in of the credit derivatives market if we bring together (a) and (b). If a combining symmetry is in place previously in the loan-transaction market, banks will be lacking and struggling with credit derivatives.

To reduce to the bare bones, the model of Duffy and Zhou (2001) is premised on a variety of supposition. One of the lot is the "not any reputation effects" which is one of the most important but debatable. As a matter of fact, reputation effects are crucial in the loan-transaction market for external investors to know the standard of facilities. The facility of the bank will be deemed as high worth if the bank has a generally accepted opinion of disposing off high-worth facilities. To some degree, reputation effects could compensate for the information irregularity consequences.

In addition to reputation effects, external investors could classify the loan worth through other means. As an example, the standard of a facility is reflected on the interest rate charged. As posited by Duffee and Zhou (2001), some external investors are not unaware, in most cases, from the actual worth of bank facilities. As a result, there could be other class of symmetry in the loan-transaction marketplace but combining symmetry and isolating symmetry expressed by Duffee and Zhou (2001). Ultimately, if investors are privy to the facts and figures of the standard of a facility, individual facility will be disposed off at a reasonable market value.

It is the assumption of Duffee and Zhou (2001) that banks that carry high-worth facilities will exclusively consider utilising credit derivatives with a maturity gap to hedge them from their facilities' premature default. For example, if a company with some present assets takes an investment decision to invest in a Greenfield project and gets assistance from a bank through a facility to execute the project, the initial cash flow from the project may not be enough to service the repayment of the facility except for the interest charge. However, the inability to pay on any other commitment of the company will activate the inability to pay on the facility because of the general default resulting from another default provisions on the facility.

Consequently, in the initial days of the facility, the likelihood of default rests on other assets of the company and not the Greenfield project on its own. Taken for granted that the bank and external investors have comparable facts and figures to evaluate the present assets, consequently, the bank is not expected to have information lead in the initial days of the facility. Since the bank has enhanced facts about the price of the new project as time goes on, the bank's evaluation of the inability to pay on the facility as it matures is probably to be dissimilar from external investors. As a result, banks with high-growth facility will utilise credit derivatives to hedge them from risk of failure to pay early in the life of the facility and keep the risk of failure to pay.

This belief without proof of Duffee and Zhou (2001) is not absolutely necessary to the model on the whole. Nevertheless, it is significant to point (b) which affirms that banks will dispose off portions of their facilities rather than utilising credit derivatives if they want to evade facing financial distress risk during total life span of their facilities. In effect, consequently, banks do have the power to choose in utilising credit derivatives in their facilities' matured stage. Banks with high-worth facilities are very much probably likely to hedge themselves from the late inability to pay by utilising credit derivatives since they are unable to get a reasonable value if they dispose off the facilities.

Duffee and Zhou (2001) in conclusion only examined and discussed banks as the protection buyers of credit derivatives and paid no attention to banks' market maker position in the credit derivatives market. Their opinion and position on credit derivatives in terms of their impact to bank portfolio management is biased. Banks are known to purchase credit derivatives to protect their credit risks and likewise dispose off credit derivatives to take advantage of the risk of financial loss for a variety of desired effect, to wit, portfolio diversification, asset arbitrage, creating more loans to improve their bottom line etc. As explained by Duffee and Zhou (2001) credit derivatives are additional means for bank risk management.

To put succinctly, Duffer and Zhou (2001) discovered that if the unequal-information drawback is not significant sufficiently to control the application of the loan-transaction marketplace, the ushering in of a credit derivatives market does not of necessity profit the banks. Still, their conclusions are premised on a plethora of suppositions which are not pragmatic.

4.2.6 Theoretical and practical study into credit default Swaps

As expected, the financial and credit crisis has increased research into derivatives especially credit default swaps (Stulz 2010; Heyde and Neyer 2010; Oehmke and Zawadowski 2013, 2014) and the pricing of counterparty credit risk in the derivatives markets. As shown earlier, credit default swaps constitute the largest chunk of the credit derivatives instruments.

4.2.6.1 Pricing of Credit Default Swap

The work of Skinner and Diaz (2003) is the first empirical study on the pricing of credit default swaps in which they investigated the pricing of credit default swaps that traded from 1997 through 1999, especially Asian and non-Asian swaps. This paper is looked at in detail.

The study investigated the economic value of credit default swaps. The economic value is described as deducting the credit default swap premium monetary worth from expected settlement in the event of default. The premium estimated values and expected full payment are reduced to present values. They examined thirty one default swaps of which reference security, fixed rate bond, is denominated in US dollars. While the credit default swap premium monetary worth is established straight from the swap ticket, the current value of money paid from the credit default swap in the event of failure to pay has to be assessed.

They used Jarrow and Turnbull (1995) as well as Duffie and Singleton (1999) credit risk models to assess the expected default monetary worth. As discussed, the models are in reduced intensity, they need the price of the reference bond, the default and recovery rate of the reference bond in the event of inability to pay, calculations of the treasury yield curve, treasury interest rate volatility, volatility of credit risk, credit risk yield curve relevant to the reference bond and, the relatedness of the variables between the official interest rate and the interest rate relevant to the reference bond. They suggested that the economic value of credit default swap should be zero when financial markets are complete and frictionless.

Nevertheless, due to the possible effect of liquidity, the economic values of a credit default swap calculated in Skinner and Diaz (2003) tend to be certain and not in doubt. The reference bond default rate in both Duffie and Singleton (1999) as well as Jarrow and Turnbull (1995), are exogenously and firmly fixed by the credit spread. Skinner and Diaz (2003) contended that the credit spread will be of great size in comparison to what a frictionless market would throw up on the basis that Treasury bonds are to a greater extent marketable compared to the reference bond with similar maturity. Put differently, the credit spread mirrors both liquidity and credit risk. Because of this, the default rate and the expected settlement of credit default swap to the purchaser in the event of inability to pay will be more than the actual value. Accordingly, the economic values of credit default swaps are on the basis of present calculations taken to be sure and conclusive.

Skinner and Diaz (2003) examined thirty one credit default swaps in their study, grouped into those that had the exposure and knowledge of the Asian currency crisis and those that did not. Their findings show affirmative economic monetary worth for non-Asian credit default swaps and negative economic values for Asian credit default swaps which is free of contradiction with their expected standard.

They considered the possibilities that the pessimistic economic monetary worth of Asian credit default swaps are the reasons for the moral hazard puzzle in which the protection buyer will not feel the pain of financial losses where there is an inability to pay off the reference bond and is therefore to a smaller degree likely to stop the inability to pay from materialising. The firm that is selling credit protection is confronted with asymmetric information and is given the confidence to demand a higher premium on the swap to counterbalance for the financial losses caused by moral hazard situation.

Of note from their findings, from the assessment of the protection buyer is that the economic monetary worth of credit default swaps is indicative of the losers and beneficiaries from the credit default swap contracts. On average, if they are positive, the protection buyers benefit while the protection sellers are at a disadvantage. Again, on average, if they are pessimistic, the protection sellers benefit while the protection buyers are at disadvantage. Furthermore, their findings explain the validity that credit default swap purchasers will benefit in the absence of moral hazard. However, this is debatable. As explained earlier, sellers' credit derivatives will not go into such transaction if they are not sure of making profit. Likewise, protection sellers will not provide the protection if they are not sure of making profit or expect losses.

The reason for buying protection with credit derivatives is to decrease credit risk at the expense of a fee or premium payment. As such, the pricing of credit derivatives are supposed to be in a way that protection sellers will benefit financially.

To understand the argument and their findings, we look at the following observations. The findings of Skinner and Diaz (2003) are not based on econometric tests. None was conducted whatsoever. They looked at thirty one credit default swaps in total divided into twenty three non-Asian credit default swaps and eight Asian default swaps which is a small sample size. They used the models of Jarrow and Turnbull (1995) to analyse their data.

The Jarrow and Turnbull (1995) models have a draw back in that they are unable price derivatives or financial instruments that have a credit element that is more complicated than the binary credit occurrence of default. That is, the models are unable to price credit risky instruments where credit upgrades or downgrades play a fundamental and important part in their valuation, for example, in the case of a credit risk option. In addition, the model are unable to price susceptible options that are at risk, that include attributes which are reliant on a credit upgrade or downgrade, which includes a downgrade condition.

Skinner and Diaz (2003) analysed ten out of the twenty three non-Asian credit default swaps which have negatives economic monetary worth while twelve of them have positive values. The authors drew a conclusion based on these two numbers, that non-Asian credit default swaps have a sure and certain economic monetary worth overall. A simple and dispassionate sample t-test on the twenty three economic values returns an insignificant result of a probability of 0.2245 and mean of 0.2127. Analytically and logically, it is inappropriate to deduce that non-Asian credit default swaps have definite economic monetary worth.

Skinner and Diaz (2003) findings is deduced by employing two theoretical models with several assumptions, while conversely it can be deduced directly and instinctively. Skinner and Diaz (2003), expected settlement of credit default swaps may have been calculated too highly in the models of Duffie and Singleton (1999) and Jarrow and Turnbull (1995) for the reason that the rate of default is externally influenced by credit spread that mirrors liquidity and credit risk. Looking at it differently, employing Duffie and Singleton (1999) and Jarrow and Tumbull (1995) to test the economic monetary worth of credit default swaps based on observation and experiment is distortion of results. The monetary worth of credit derivatives for purchasers may have been calculated too highly in the study of Skinner and Diaz (2003).

The findings and results of Skinner and Diaz (2003) is premised on a risk-neutral belief without proof for the reason that Duffie and Singleton (1999) as well as Jarrow and Turnbull (1995) need a risk-neutral postulation. Risk-neutral is a suitable hypothesis for a lot of derivative-pricing suppositions. In actual fact though, risk-averse instead of risk-neutral is a more suitable supposition for credit derivatives instruments. Purchasers of credit protection are happy to dispense with some funds in a switch for a lower variance at every level of yield on the quoted credit.

In addition, sellers of credit protection would need a superior premium compared to the expected default settlement. Where buyers of credit protection are risk neutral, buying credit derivatives would not be necessary at all for the reason that they would agree to take any credit risk at the similar level of expected yield. Where, on average, sellers of credit protection experience challenges in making good returns on selling credit derivatives, then they need not sell the protection. For example, the workings of the insurance industry would suffice here. The risk-averse postulation is the basis and grounds why some economic activity is driven by the purchase of insurance protection from the insurance companies from which such firms also derive their survival till now.

Of note is that the research of Skinner and Diaz (2003) is a business deal or operations investigation, in contrast, this study is focussed at financial institutions level, specifically the US Banking institutions. The economic monetary worth of credit default swaps in the study of Skinner and Diaz (2003) mirrors, just in case, participants in the market will benefit or miss from specific credit default swap deals isolated from other actions or deals.

Credit derivatives, in this study, are set in the perspective in the portfolio of a bank. The benefit or deficit from specific credit derivative contracts will influence the bank portfolio yield, although in more complex means. The deficiency from trading a credit derivative product may not automatically result to a loss to the portfolio yield since it could be neutralised by a profit from a different asset whose yield is negatively correlated to the specific credit derivative deal.

4.2.7 Issues on the impact of credit derivatives to bank portfolio management vis-a-vis the financial and economic value of credit default swaps.

Duffe and Zhou (2001) lead research into the results of the bringing in of the market for credit derivatives on banks. Their example and object integrated the setting of bank financing schemes. Until project starts and ends, future loan liquidation is contingent on making sure on a win-win situation for the borrower and the bank. Their pattern, as a result, takes for granted erraticism in unequal information and statistics during the life span of a facility, and they suggest that the bank can deploy derivatives to mitigate just the doubtful or risky phases of the facility. The results show that the enhanced risk dispersal thinning out brought about by derivatives, is inadequate to assure its advantages in mitigating risk.

Skinner and Diaz (2003) on the other hand, investigated the pricing as well as the financial and economic value of a specific credit derivative product, credit default swaps, to mitigate risk. The economic value is explained as subtracting the credit default swap premium economic value from expected payment in the event of default. Using the Jarrow and Turnbull (1995) and Duffie and Singleton (1999) credit risk models to evaluate the likely default value, they examined in total, thirty one credit default swaps divided into twenty three non-Asian credit default swaps and eight Asian default swaps traded from 1977 through 1999, which is a small sample size. They studied the potential that the negative economic value of Asian credit default swaps are the causes for the moral hazard problems in which the protection buyer will not feel the impact of financial losses where there is default in the reference bond and is therefore to some extent likely to stop the default from happening. The seller of credit protection is challenged with unequal information and is given the assurance to ask a higher premium on the swap to offset for the financial losses triggered by moral hazard problem. They submitted that the economic and financial value of credit default swap should be nil when financial markets are perfect and in a frictionless state. However, this is controversial and unsettled. The motivation for mitigating risk or buying protection with credit default swap is to reduce credit risk at the expense of a premium payment or extra charge. Thus, the pricing of credit derivatives are hypothesised to be in a manner that sellers of protection will profit from monetarily.

Duffe and Zhou (2001) contended that, if credit derivatives just substitute loan sales as risk distribution means, the results for banks could comprise a crash or failure in other loan risk distribution markets.

Skinner and Diaz (2003) on the contrary did not consider the effects of the introduction or replacement of credit derivatives on the loan sales market. Rather, their results is grounded on a risk-neutral principle without evidence for the basis that both Duffie and Singleton (1999) and Jarrow and Turnbull (1995) need a risk-neutral hypothesis. Risk-neutral is an appropriate hypothesis for many derivative-pricing assumptions. In reality however, risk-averse rather than risk-neutral is a more suitable assumption for credit derivatives instruments. Protection buyers are pleased to pass on some funds in exchange for a reduced variance at every point of return on the quoted credit. Furthermore, protection sellers would need an enhanced premium in comparison to the likely default payment.

Duffee and Zhou (2001) contended that hypothesis alone cannot ascertain or establish if the market for credit derivatives will assist banks manage their loan credit risks better. In contrast, Skinner and Diaz (2003) did not only theorise on the usefulness of credit default swap but investigated the economic value of the instrument on bank credit risk management though their findings are not based on mathematical and statistical tests. The monetary value of credit default swap for protection buyers may also have been estimated too highly in their study. Their results show positive economic monetary value for non-Asian credit default swaps and negative economic values for Asian credit default swaps which is free of disputation with their expected specification.

It is worth mentioning that the work of Skinner and Diaz (2003) is more of an operations study, while the work of Duffee and Zhou (2001) was an attempt to model the effect of the introduction of credit derivatives on banks.

On the other hand, this work is focused at the banking level, in particular, US banks. The economic monetary value of credit default swaps in the study of Skinner and Diaz (2003) illustrate participants in the market will gain or lose from specific credit default swap transactions separate from other transactions.

In view of these gaps and limitation in the investigations of Duffee and Zhou (2001) and Skinner and Diaz (2003), to wit:

- the life span of individual loans are characterised by uneven information and statistics and bank use credit derivatives to hedge just the doubtful or risky phases of their loans.
- The economic and financial value of credit default swap is theorised to be zero when financial markets are in perfect state which is not feasible in real life situation.
- The investigation of the usefulness of economic value of credit derivatives on bank credit risk management are not based on mathematical and statistical tests.
- The researches are operations study and only model the effect of the introduction of credit derivatives on banks.

- The effect of the usage of credit derivatives is not measured on the performance of the bank portfolio.
- The impact of credit derivatives is not tested on different macro-economic periods and environment.
- The transaction of credit default swap does not ascertain whether it reduces the standard deviation of bank investment and portfolio performance.
- That the transaction on credit default swap causes more bank defaults is not proven

Credit derivatives are set and evaluated from the standpoint of the portfolio of a bank in this work. The profit or loss from definite credit derivative transactions will sway the bank portfolio return on investment, though in more complicated way. The shortage from trading credit default swap, for example, may not inevitably lead to a shortfall to the portfolio return on investment since it could be cancelled out by income from a different asset class whose return on investment is negatively correlated to the distinct credit derivative transaction.

The literature will proceed with the review of the credit meltdown in 2007 to 2009 in relation with the use of credit derivatives, the accuracy and consistency of ratings as a standard of credit risk, risk management and financial derivatives, the determinants of bank working effectiveness, the impact of financial derivatives and bank working effectiveness. Furthermore, the literature will review the theoretical underpinnings of modern portfolio management and its application to bank portfolio management.

4.2.8 The credit meltdown of 2007 to 2009 and credit derivatives

It is without surprise that already, a good array of research papers have begun and still continue the exercise of asking questions pointedly on the financial crisis which started in the U.S. during the third quarter of 2007, which led to relentless vibrations throughout the world, the impact of which is close to the last great depression. As expected, researchers have tried to dissect the crisis, make comparisons with the Great Depression of the 1930's, make macroeconomic policy lessons, for example, the upward and downward spiral of the financial leverage and the market failures etc.

Barrell et al. (2008) attempted to use the stochastic dynamic general equilibrium model of the United Kingdom National Institute of Economic and Social Research, to bring out the brunt of expected financial controls on economic growth in which a financial sector was transplanted. They find that reforms and tighter bank regulation is a panacea for a future reoccurrence of the financial crisis but it is entirely irrelevant to the stochastic dynamic general equilibrium model used in the research. No convincing result was gleaned from the model as expected.

Reinhart and Rogoff (2008) in their study of the past financial crisis conducted their research on eight centuries of data, encompassing all regions including emerging (India, China etc) and advanced countries. All together it involved sixty six countries. The huge data set looked at the fourteenth-century England credit default to the US credit and financial crisis. They find that as countries transit and struggle from emerging markets to advanced economies, progressive delinquency is a nearly global event.

Policymakers and investors are under the illusion that there are different and specific reasons for each credit or economic crisis due in part that they occur some years or decades from each other. For example, there is the wrong understanding that local debt which sometimes runs into trillions of dollars sometimes is a new highlight of the contemporary financial scene. They also find that financial crises commonly rear their head from the international financial centers such as New York, London, Tokyo etc with dissemination through interest rate shocks and commodity financial value crash. Accordingly, the recent US sub-prime credit crisis of 2007 to 2009 is comparatively not different as their data documents other financial crisis preceded and accompanied by default in addition to inflation, severe exchange rate volatility, banking crises, and currency devaluation (Reinhart and Rogoff 2008).

Micheal (2008) in his work on the historical perspective of the financial crises notes the similarities of the crisis to past financial storms which was generated by the collapse of the US housing market. He notes that the financial crisis was similar and to some respects, different to the crisis that the economy experienced in 1857, 1893, 1907 and the great depression from 1929 to 1933. He mentioned some key macroeconomic policy lessons bordering on solvency, liquidity and the stability of the financial system and the responses of the regulators in the US and EU region to arrest the situation. Furthermore, he identified the implication of the repeal of the Glass-Steagall act in 1999 which encouraged the less regulated investment bank to increase leverage and move liabilities off-balance sheet to increase profitability while competing with the more regulated commercial banks thereby increasing risk which contributed largely to the financial crisis.

Informational asymmetries between dealers on the newly securitised assets were recognised by Gorton (2009) as the root of the problem. The school of thought and assumptions of the mainstream Chicago School is that of convex environments, continuous, complete, rational, and efficient markets and with complete information which implies that in such a convex environment, failures and crises are impossible but asymmetry is an externality, which points to the failure of these school of thought and assumptions which the Chicago School chooses to ignore as it is a clear recognition of a form of market failure (Geanakoplos 2009).

Conversely, Cecchetti (2008) in his study asks some salient questions which can be grouped into six on the treatment of the identified externalities as there is no agreement on the answers proffered yet. Some of the questions asked were: (a) The function of credit risk: Should a central bank take responsibility for this in its lending operations, or the U.S. Treasury is responsible for this; (b) What is the central bank's and monetary policy makers responsibilities when a complex financial and highly leveraged institution experiences huge losses; (c) Should the central bank and policymakers react to illiquidity of assets in the market for specific assets, and how; (d) What should be the responses of policy makers and central banks to the associated increase in risk premia and the slide in the price of risky assets; and (e) what the responses of policymakers and central banks should be when prices of leveraged assets are on the increase While these are good policy questions and are pertinent to developing future macro-economic policies in orderly fashion, their depth do not give a structural treatise as to what happened in which the severity of the crisis almost consumed the global financial markets and bringing some economies to their knees save for the intervention of the Brentton wood and regional institutions.

As argued in his study, Leamer (2007) blamed the neglect of the Taylor rule (Woodford 2001) by the US Federal Reserve in setting interest rate as the cause of the crisis in which money supply was loose. Furthermore, he argued that the business cycle was housing, that had some dosage of the Taylor rule been applied, the crisis would have been avoided. Taylor (2009) in his treatise agreed with Learner (2007). He argued that had the US Federal Reserve followed the Taylor rule in managing the interest rate regime, the subprime debacle would have been averted.

Dore and Singh (2012) examined the financial crisis, the business cycle downturn and credit, giving a comprehensive account of the institutional characteristics that followed the downturn and the function of leveraging by using a Vector Error Correction model and Granger-causality to U.S. data for the period 1975 through to 2007 with which they examined aggregate spending, credit, income and profits. They selected some key variables such as revolving credit, U.S. available-for-use income, business profits, and total expenditure (periodically fine-tuned, yearly rates) and attempted to capture short-run and long-run connections, reciprocal action, and feedbacks which they might wish to test analytically. The study also produces some new inter-relationships and interesting assumptions which should be investigated on the data for other developed economies. They calculated the generalised impulse reaction in the Vector Error Correction model to explain the workings of the extreme unpleasantness of the crisis and show that legislative modification that break down into parts the limits placed on the banking industry and the resulting structural changes after 1980 energised the development of the new financial engineering instruments. They find that the credit expansion was over accelerated when returns and property prices were receding in 2005 through 2006 and global asymmetries on the standard of credit and its unexpected removal in 2007 brought the economy almost to a standstill and resulted in the massive recession.

There have been series of suggestions and proposals on how to manage and avoid a repeated reoccurrence. These include (Hull 2009; Schmudde 2009): (a) Institutions in the shadow banking system should be well regulated; (b) Establishment of an early warning system to detect systemic risks; (c) Restrict the leverage in financial institutions, (d) Nationalise all insolvent banks; (e) Break up financial institutions too big to be allowed to fail; (f) Financial institutions must have required capital to back up commitments; (g) Restrict the leverage that financial institutions can assume; and (h) Imposition of global taxes on institutions and many more.

4.2.9 The Accuracy and consistency of ratings as a standard of credit risk

This section looks at the issue of ratings allocated by credit rating agencies, for example, Standard and Poor's and Moody's, whether they are dependable standards for credit risk in view of the role played by these institutions during the credit crisis (Hull 2004; Mathews 2009). The subject can be divided into three points at issue, to wit, whether ratings maintain the same standard with one another, across industry/subject of concern, through a particular point in time, whether ratings fluctuations bring new information to the financial market or if the changes just reflect the pricing information that has already been made available in the financial market and, whether the nature of credit ratings change over time, or if they are reliable through time.

The models and hypothesis to be advanced in this study are affected by credit ratings as a measure of credit risk; therefore, these issues are crucial in the setting of this study. If ratings are contradictory through time and across industry, then the soundness of using external ratings on the grounds of facts, data and statistics in the models of the kind that we looked at in this study is debatable

The first point at issue of whether credit ratings are consistent across time is looked at. Several researches have investigated the general standard of US corporate debt with the use of rating agencies such as Moody, Standard and Poor etc. Lucas and Lonski (1992) in their study from 1970 through 1990, used simple mathematical analysis and the information on the database of Moody's, they find that there were more rating downgrades than upgrades for all years besides the period from 1970-1971, 1973-1974 and 1975-1976.

Carty and Fons (1994) found similar results in their investigations as well. Carty and Fon's in their study, during these periods, found that downgrades were equally distributed across ratings but the lower rating divisions were most likely for upgrades. If a corporate bond is at the present time rated A, if it does not experience nonpayment over the first time, then at the least good, it stays rated A and, at finest, is enhanced to Aa or higher. The research result of moving to a lower level rating movement has led people in practice and academicians to ask if the credit standard of the US corporate bonds has been in steady deterioration over some time or if credit ratings levels of quality are being used more rigorously. This may be a situation of 'been able to only do well'.

Altman and Kao (1992) in their research result find that initial high-yield bonds with the exception of the fallen angels, which are corporate bonds that were delivered at investment grade but downgraded to speculative grade, have no tendency to be either downgraded or upgraded, thus submitting that the high-yield market has not failed or gone downhill. Nevertheless, we conclude from their result that the investment grade segment has been immune from a deterioration of corporate credit standard.

Blume et al. (1998) in their investigations used a probit model, they discovered that the touted decline in credit standard of high yield bonds is actually a fairy tale and it is by reason of a mistaken classification and recognition of the basis nonetheless. They established that the reason for this is the fact that rating agencies were becoming more rigorous in the use of their rating principles through the time from 1973 through 1992.

The second point at issue as to whether ratings changes bring new information to the market or the pricing information released into the market is first, to think through and reflect what the responsibility of rating agencies is in the financial market, especially the corporate bond market. The belief of a lot of people is to think that rating and the fluctuations with time and level of transactions can be looked at from the light of facts and figures reaching the financial markets on the well-being of a corporate bond. Wakeman (1990) in his classical book on the function of bond rating agencies is of a different opinion with these investigations and evaluation. He submitted that a rating adjustment and variation does not influence but just a sign of the financial market's transformed estimation of a bond's monetary worth.

Delianedis and Geske (2003) in their study on rating migrations information and defaults, agreed with wakeman (1990) views. Using a sequence of firm data gathered at uniformly spaced intervals of time, they used the models developed by Merton (1974) and Geske (1977), to produce series of risk-adjusted default probabilities. Furthermore, using a study showing effect of event and to investigate its causes and events, they discovered that risk-adjusted probabilities of default can forecast credit migrations and default for periods ahead of time. After examining prices rather than risk-adjusted default probabilities, Wakeman (1990) uncovered a type similar to the study of Delianedis and Geske (2003).

The research of wakeman (1990) discovered insignificant variation in the value of the asset or security on the rating change statement. On the other hand, he stated that the rating change subject will have previously had variation in price, comparable to a suitable standard. He advocated that this might be for the reason that these agencies usually vary the rating of a security just due to a variation in accounting news. To buttress this, he noted that majority of the ratings variations happen when firms release their accounting results, which is around May and June of the each year in the U.S.

Wakeman (1990) submitted that rating agencies exist because they provide the investing public with a cost effective way of evaluating a bond's risk, although not real time, where the company's economic essentials varies in the middle of the dates of financial statements. This brings to the fore the reason why firm's have to pay for the ratings of their bonds issue to the market. A plausible reason why firm's pay for the credit rating of their bonds is because where a bond issue was not rated, the investing public would request for a higher coupon rate due to the unpredictability of the firm's financial shape and well-being. Rating reduces this unpredictability for the investing public which maximises their takings from the bond issue.

However, a study conducted by Sorenson (1980) which focused only on revenue bonds reveals that a key element in the decision on the course of bond issue as regards the risk premium is how the proceeds is utilised. In his study on the estimation of the term formation of corporate debt, Schwartz (1998), discovered that ratings tackiness or stickiness which he referred to as a situation where these agencies only update their information about a bond after the change and modification in the market has been effected, is a weighty determining factor of the maturity, prices and bond rating. For that reason, due to stickiness or tackiness, the ratings of a bond may not mirror the news and information in the market or in the public space. The suggestion proffered by Wakeman (1990), Delianedis and Geske (1998) as well as Schwartz (1998), gives the impression to buttress the fact that ratings are not suitable and well-timed gauge of credit risk.

Wakeman (1990) investigations found partial agreement with Hand et al. (1992) who suggested that in some instances, the variations to changes in rating do make announcement of new facts into the financial market. Hand et al. (1992) performed an event study in their research work and examined the likely effect, influence and result of bond rating agency notice on the prices and returns of bond and stocks. The proceedings are addendum to the credit watch record of the rating agencies and the authentic rating variations news made public by the agencies (for example, Moody's and Standard and Poor). Generally, they discovered that supplement to a credit watch record on its own does not lead to excess yield. Through a straightforward model, they reordered the total credit watch record into two groups by defining supplements as expected or unexpected. They found evidence that the rating agencies are a rich source of news to the investing public. They found that the unexpected bond credit watch downgrades have an important non-zero bond yield while the upgrades was still not essentially dissimilar from zero.

Ederington et al. (1998) investigated whether the knowledge of bond rating agencies' is more useful and well-timed than that of stock analysts. This problem is worth being examined for the reason that stock prices respond to rating news and profit predictions from analysts. They examined and discussed the Granger causality of rating news and profit projection reviews. They discovered that rating downgrade is effected on the news of a downward review in profit projections by stock analysts. In support with the findings of Hand et al. (1992), they likewise discovered that there is a negative reaction from the market to such news.

Moreover, as with the findings of Hand et al. (1992), they discovered that the effect of the rating upgrades is of an identical significance. An expansion of this research work would be to take the direction of the method and approach of Ederington et al. (1998) but applying the model of Hand et al. (1992) to classify rating revisions as whichever is taken as expected or unexpected. In answer to question two, the present proof and indication seems a confirmation of the theory that rating agencies will fall behind the market, because any rating change will have by now been valued in the market. From time to time nonetheless, a rating revision communicates latest news, or stale news integrated, to the markets. Still, the issue of if bond ratings are well-timed is not well defined enough, besides the capacity of banks to use internal ratings in valuing models if required should water down some of the fears and matters highlighted earlier.

Another of the questions we asked is if ratings are consistent cross-sectionally. Schwartz's (1998) as indicated earlier, investigated a problem connected to the term structures of corporate debt. In estimating these term structures, he grouped bond rates of various bond issuers in the same credit class as this allows for the interpretation of the term as being `non-specific' bend or arc depicts each rating category. He finds that that the bends he has created showed irregular intersections. This signals that, at some specific period, bond ratings might not always be logically harmonious with one another. He also discovered that this lack of consistency is not due to the sticky or tacky ratings as previously explained.

Perraudin and Taylor (2004) in their study clearly thought through the issue of whether ratings are consistent with bond market yields. They interrogated if bond prices are uniform with the ratings that they have been ascribed. They evaluated the generic returns for the attached ratings (AAA, AA, and A) and for diverse bond maturities, by calculating the term structures of corporate bonds using data collated for the period under review. Thereafter, they valued the bonds in their data sample using these generic bend or arc. They discovered that for the AAA bonds, eighty percent are even so wrongly classified after one month, and seventy percent are yet wrongly classified after six months. They also discovered that about one-third of the AA bonds are wrongly classified given the rating attached to them. They also discovered that after controlling for tax, about one-quarter of the bonds are wrongly classified and consequently their prices are contradictory with their ratings. Even then the contradictions are not provisional.

The research work examined seems to submit confirmation that ratings might be conflicting given the prices of bond. In that situation, the cogency of using ratings issued by external rating agencies in pricing a model might be debatable. In brief, the papers reviewed submit the proof that ratings might not be ideal as credit standard in pricing models. Nonetheless, this proof is not overarching. Future research is still needed before some of the issues raised can be resolved emphatically. Still, if it is established that ratings are not ideal standards, internal ratings can be considered to assuage the fears identified above.

4.3 Overview of Banking Risks

Essentially, financial services firms are faced with two principal risks: business and financial risks.

(a) Business Risk

Business Risk is "threat that an event, action or failure to act will adversely affect an organisation's ability to achieve its business objectives and to execute its strategies effectively" (Harris and Bergin (1998). This is the risk that entire lines of business may succumb to competition or obsolescence. For example, the traditional market for large, low-risk corporate lending has been largely replaced by commercial paper. In the language of strategic planners, commercial paper is a 'substitute' product for large corporate loans. Those banks that placed high emphasis on large corporate loans (sometimes called wholesale banking) experienced the risk that this business would disappear during the 1980s, leaving expense base that built upon a shaky revenue base.

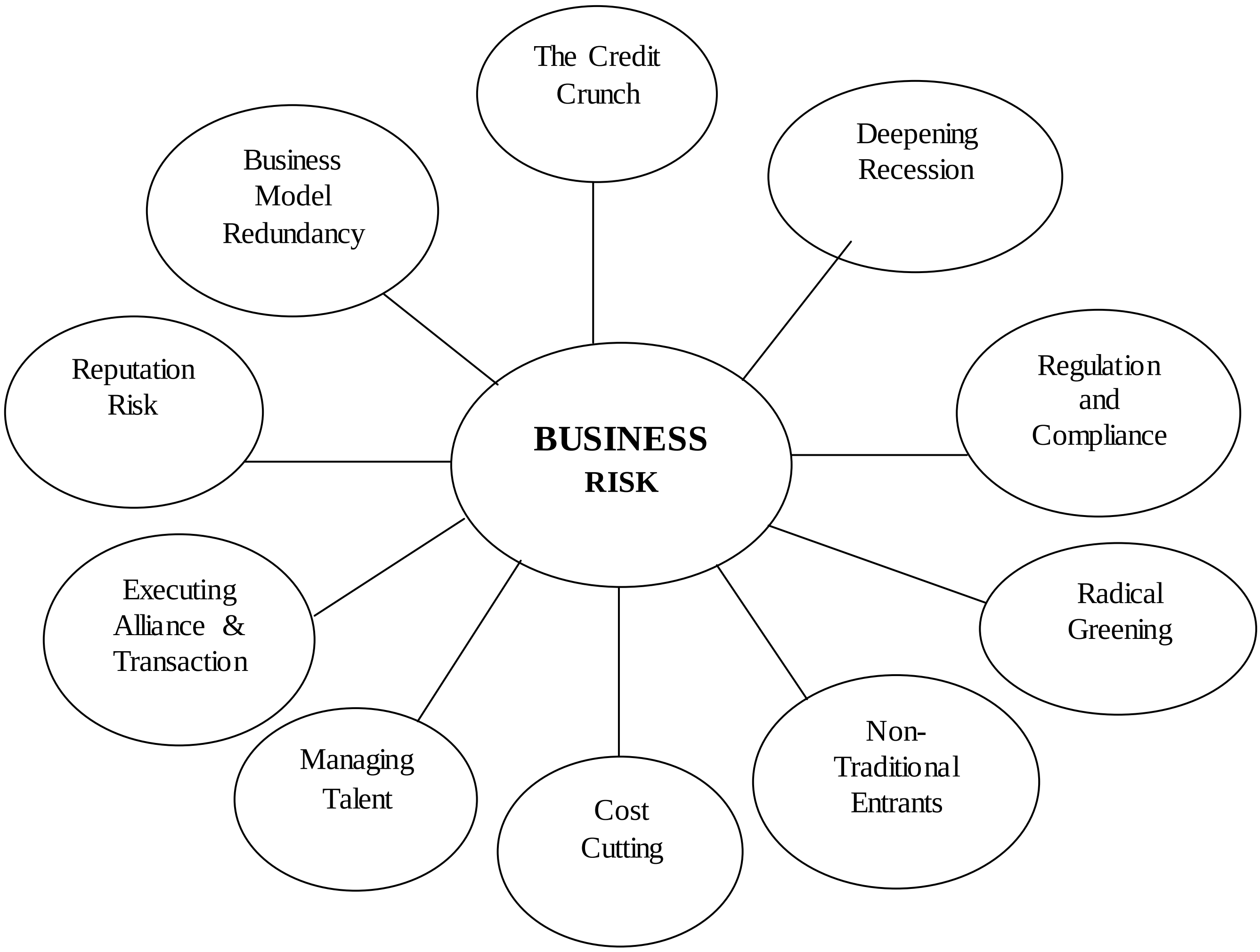
Another case in point of business risk is when a bank is not ready or able to compete in newly developing lines of business. Late entry by some banks into credit cards and home equity loans made it difficult for them to achieve a competitive gain and lead. Early entrants enjoyed a unique advantage over newer entrants. The seemingly conservative act of waiting for the market to develop posed a risk in itself. Business risk accrues from investing too quickly into new lines of business but also from staying out too long (Berger et al. 2004). This explains the increasing importance of strategic planning and research by banks in a period of globalisation, credit crisis and economic recession.

(b) Management of Business Risk

Business risk is managed with a long-term focus. Techniques include the careful development of business plans and appropriate management oversight. Book value accounting is generally used so the issue of day-to-day performance is not material. The focus is on achieving an adequate return on investment over an extended horizon, (Arnold 2002).

Business risk should be managed from two different sides. First, company will have to evaluate the impact of the potential risk on its operations. Second, a company must decide whether or not to use external techniques to manage the business risks.

Figure 4.1: Business risk



Source: Arnold (2002)

If the company uses external techniques, this will obviously make the company vulnerable to the factors that are apparent in the business environment and which will then impact on the different portfolios (Arnold 2002).

Companies including banks have to manage a potential business risk throughout the lifetime of a business. Most business risk is managed because of past experience and by skilled managers, who possess the unique acumen, coupled with a natural instinct. In today's business environment, there is prevalent fraud and it is highly difficult to predict movement in financial markets. Another problem is that business risk is on the increase because companies tend to transfer it and therefore some sectors will be affected more than others, such as financial institutions. In addition, technology has also impacted on business risk. Lastly, due to global markets and the increase in mergers and acquisitions, companies are purchasing outside their area of expertise, thus adding to the overall business risk, (Arnold 2002).

Once a business risk is identified and assessed, a company must take a decision on whether to retain (that is, manage) or transfer the risk. The isolation and transfer of the risk is part of the classic risk management market by the use of derivatives (Bodnar et al. 1998). However it must be remembered that a company cannot offload the volatility of its complete portfolio of business risk. Some exposure is therefore, retained and a funding mechanism is used to spread the losses over a certain period (Lawrence 1996).

(c) Financial Risk

Financial risk "is the uncertainty and potential for loss associated with movements in interest rates, foreign exchange rates, stock prices, or commodity prices" (Chance 2001). McMenamin (1999) defined it as "the additional variability in firms returns to the shareholder which arises because the financial structure contains debt". This in essence is any risk associated with liquid funds as the stock in trade of the financial services industry. Suppose a bank issues a fixed rate loan to a customer. The risk to the bank is that of interest rates rising after the loan is advanced. The funds advanced could have been invested elsewhere to earn a higher return. This would be reflected in the bank's net interest income. The bank customer is equally exposed to the risk of interest rates falling after funds are borrowed.

Exposure to interest rate risk can easily be identified from a bank's balance sheet; this may be due to a mismatch of maturities for assets (loans) and liabilities (deposits). However, a firm may face economic or competitive exposures that are not reflected in the balance sheet (Blasko and Sinkey 2006). Bank would prefer to issue debt when rates are low and vice versa for debt holders.

Relationship between credit risk and other financial risks

A brief discussion of credit risk, as explained in Chapter 1, which is the risk of loss that emerges if customers and other person or institution entering into a financial contract or transaction cannot meet up their repayment commitments, in relation to other banking risks would suffice here.

Banks are deemed to be steady, secure, dependable and boring in the eyes of the world, or that is what most would prefer they look like. Rather, banks are characteristically, risk managers, as we have now exactly known in the past few years from the credit crisis. Banks can be organisation with serious financial problems if they manage risk poorly or high yield investment structures if they manage risk competently, but then again, it is all about risk management (Bauer and Ryser 2004). This is because banks create income from lending and the skill of lending is to make sure the borrower will repay and repay at a profit with borrowing charge. This is the fundamentals of banking and dates back to moneylending in the period of the Roman Empire (Temin 2001).

It all seems so easy, and it is, but the complicated nature of the contemporary world is breaking that easiness. Just three decades ago, the easiness was there since the markets had just two types of risk to deal with, to wit, market risk and credit risk. Market risk is the risk of transformation to the results of a business which happens as a result of changes in market prices, and this includes equity risk, interest rate risk, spread risk and currency risk (Chance 1999; Alexander 2009). Again, as discussed in chapter 1, credit risk expresses itself: will the borrower pay back the loan? Whilst market risk is also reasonably clear: are the markets excellent and sound enough to aid and boost our position? Then Barings Bank caved in and another type of risk, operational risk, becomes visible as explained in chapter 1 : It is the chance of losses emanating from unreliable or disordered business processes or organisation, man made mistakes or outermost events, in addition to legal risk (Kühn and Neu 2003). That is, the risk of where a business mismanages and makes mess of itself through insufficient and ineffective internal controls. This risk appears not complex, although difficult to manage for the reason that change of direction of internal rules is also without difficulty attainable if the well-being of the few control and dictate the continued existence of the rest, in particular if the well-being of the few lie close to the top of the hierarchy.

For example, there is the persistence of rogue traders (Wexler 2010), today, we think of Jerome Kerviel, the derivatives trader, who in January 2008, while working for French bank Societe Generale's incurred losses (exactly 4.9 billion Euros) closing out arrangements over three days of trading starting from the third week of January, 2008, a time in which the financial market was going through a significant drop in equity indices.

Again, Kweku Adoboli, the rogue trader at Swiss bank UBS Global Synthetic Equities Trading desk in London who was incarcerated for fraudulent activities and therefore the biggest trading loss in the annals of British banking history (of over 1.5 billion British pounds) as operational risk example of modern day businesses that got out of hand, on the other hand, it would not be inappropriate to include the following in this area, to wit: Dick Fuld (Lehman Brothers), John Thain (Merrill Lynch), Bob Willumstad (AIG), Adam Applegarth (Northern Rock), Fred Goodwin (Royal Bank of Scotland), and James Crosby (Halifax Bank of Scotland).

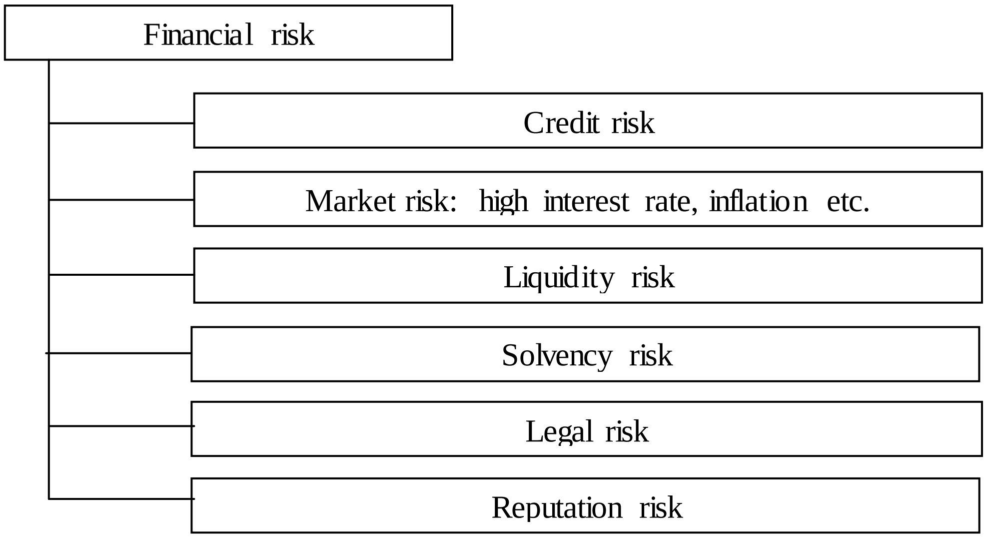
Another form of risk, liquidity risk, appeared at the front burner post--2007 though it had gone under the radar pre the credit crisis (Cornett 2011). It is the risk that the business cannot meet its commitments when they crystallise without acquiring undesirable but substantial costs in the shape of very high-priced increase or change in the financing or the need to dispose off assets. That is, the risk of not being able to keep a financial institution funded. It is the capacity for a bank to stay afloat and resilient and a bank goes downhill if its funds finishes. The responsibility of a bank is to make the most returns by controlling its lending to the extent that it can. That is how a bank earns and brings in income by lending it and receiving interest back. As is generally admitted, banks also earn profit by investing it, and that is where market risk comes into the picture.

From the explanation above, these four kinds of risk are mutually doable, mutually reliant on each other and mutually connected. Nonetheless, they have to be treated distinctly and in coordination and synchronisation to make sure that one does not blow up at the detriment of the others (Jarrow and Stuat 1999; Acharya and Naqvi 2012.). For example, Lehman Brothers, Merrill Lynch, Northern Rock, Royal Bank of Scotland, Halifax Bank of Scotland etc. were all sound banks that went distressed because they had patterned and handled and controlled their market and credit risk methodologies, on the other hand, they had not considered the risk of markets shutting the doors to funds. It was when their exposure to liquidity risk surfaced that they also knew that they had an operational risk, to wit, their Chief Executive Officers that had been overdriven and who had overleveraged the balance sheet because they had confidence that the markets would make accessible all-available funding (liquidity).

Another instance is the UK Co-operative bank which was a Mutual bank but now converting to a private shareholder owned bank. The bank found itself in some mess because it recorded £1.5 billion capital deficit under the new supervisory regime, and has to block up that shortfall by changing over bondholders into shareholders (UK Reuters

Business News, June 17, 2013). As expected, the bondholders are not pleased about the arrangement nonetheless, if they refuse to go along with the arrangement, they will most likely end up owing nothing as the bank will close shop. The bank got into such difficulty because like some other banks that ran into problems during the credit crisis, they outstretched the balance sheet and generated uncontrollable liquidity risk. The root of the banks' problem can also be traced to the conceit and overconfidence of the banks' management in biting more than they can chew thus overleveraging their balance sheet in the purchase of Britannia bank which was a bad bank thus creating another form of risk in its wake better known today as compliance risk. This is the risk of violating legal authorisation, lawful requirements, other appropriate official authorised arrangements and internal rules which include the warning of authoritative embargoes and punishment, reputation loss and risk of financial loss. But then again, the whole mess is entangled in the four risk discussed earlier. Following the UK application of the Basel III regulations like other jurisdictions as discussed in chapter 2, the Co-operative bank had a capital ratio of 9% which they keep to guard against a crisis but this has been adjudged unsatisfactory. Under this governance, banks must reach a target capital ratio of at least 10%, as a consequence, the Bank of England not long ago came out with an examination and determination that said most UK banks each had some form of deficit. For big UK banks like Royal Bank of Scotland, Barclays, Lloyds etc such a deficit can be made good by disposing off non-core assets or issuing rights to existing shareholders, that is why sourcing a huge amount like £1.5 billion by a non-proprietary mutual could be a challenge to a bank like Co-operative bank, this explains the reason why they are transforming £1 billion of bond debt into shareholder equity and then disposing off their insurance business to survive, for example.

Figure 4.2: Financial risk



Source: Dolde (1993)

(d) Management of Financial Risk

Brigham and Weston (1992) postulate that a firm's optimal capital structure is that mix of debt and equity, which maximises the price of a company's share. At any point in time, the company's management has a specific target capital structure in mind, presumably the optimum, although this may change.

Generally, financial risks, for example, market risks are non diversifiable since they relate to the vagaries of the economy. On the other hand, business risk, for example, firm-specific risks can be diversifiable as they relate to specific firm. The risk can be avoided if a firm invests in securities that are not positively correlated to each other. Equally, an investor can diversify a large chunk of total risks in a portfolio by also investing in securities not positively correlated to each other, in which case, firm-specific risks can be neutralised by a portfolio of well chosen shares with a combination of returns and yield.

4.4 Risk Management

The connection linking the value of a business and its financial strategies was established by Modigliani and Miller (1958). This is known as the Modigliani and Miller Proposition I which states the requirements for insignificance of financial structure for corporate value. This approach states that hedging leads to reduced instability of cash flow and therefore lessened instability of the firm value. With respect to risk management, this proposition can be summarised as follows: in a world of no taxes, no transaction costs and a fixed investment policy, investors can create their own ideal risk management by holding broadened portfolios. Consequently, if risk management were to affect the value of a business by increasing its real cash flows, it would do so by affecting tax liability, transaction costs or investment decisions.

The underlying reasons for risk management were figured out from the irrelevance circumstances and they include: (a) Higher debt capacity of the firm (Miller and Modigliani 1963); (b) reducing corporate tax liability and lower likely costs of bankruptcy (Smith and Stulz 1985; Stulz 1996; Leland 1998; Graham and Smith 1999); (c) Securing internal financing (Froot et al. 1993); (d) information asymmetries (Geczy et al. 1997); and (e) eliminating all hedgeable risk where businesses have analogous advantage (Stulz 1996). Financial economics method to risk management has so far been the most dynamic in terms of theoretical model extension and empirical research, but proof to support the predictions of the method has so far been mixed.

4.4.1 Hedging and firm market value

Allayannis and Weston (2001) argued that firms that hedged with foreign currency derivatives experience an increased market value than firms that do not. In a study of seven hundred and twenty large nonfinancial firms between 1990 and 1995, they investigated if the use of foreign currency derivatives is compensated by investors with a higher market valuation. Using Tobin's Q as a proxy for a business's market value, expressed as the proportional relationship of the market value of the business to replacement cost of assets and assessed at the end of the fiscal year for each business, they find substantial evidence that the use of foreign currency derivatives is positively correlated with business market value. They find that the value of businesses that mitigate with currency derivatives, averagely have a 5% higher value than businesses that do not use currency derivatives.

With a median market value of about four billion dollars, this converts into a mean value added of almost two hundred million for businesses using foreign currency derivatives, which is a substantial effect. They also find proof that businesses that start a protection strategy feel an increase in value above those businesses that choose to remain unprotected and that businesses that quit protection feel a lessened value in comparison to those businesses that indicate to remain unprotected, finding support with the investigations of Nguyen and Faff (2002). Nevertheless, the research does not show the source of value, that is, why protection may result into higher business value. Conversely, Bartram et al. (2003) investigated larger sample of seven thousand, two hundred and ninety two US and non US firms. They reported insignificant effects on currency protection but find a higher Q ratio for businesses that engage in interest rate protection.

Carter et al. (2005) examined the fuel hedging behaviour of businesses in the US airline industry from 1994 through 2000 of twenty seven airlines. Adopting the approach of Allayannis and Weston (2001) to investigate if fuel protection affects airline estimation and appraisal, the ordinary least square (OLS) result reveal that airlines accelerate in value by jet fuel protection measures. They reported a higher mean premium of about 14%, though with significant confidence interval. They discovered that the positive relation connecting hedging and value accelerates in additional capital investment especially when there is a low patronage in the industry, assuring continued business expansion. They show proof that airline on average accelerate business value by using derivatives to protect against the unpredictability in fuel prices, consistent with the results of Allayannis and Weston (2001). However, the findings are still a subject of intense debate.

Guay and Kothari (2003) examined the use and exposure mitigated by financial derivatives by two hundred and thirty four large non-financial corporations. In particular, they analysed the magnitude of the risk inherent in corporations' financial derivatives portfolios; compared the scale to the scale of firm risks that mitigating theory predicts are possibly expensive and explored if the scale of risks inherent in firm's derivatives portfolios are likely to explain conclusions drawn in the empirical literature on derivatives. Using data from Compustat annual data base, they reported their research with descriptive statistics and regression analysis. They find that for most of the firms, the cash flow and market value sensitivities are small in comparison to the scale of operating and investing cash flows, the absolute values of the changes in operating cash flows and accounting income, cash holdings and firm size. They find some proof of accelerated use of derivatives for bigger firms and for firms with better investment chances. There was accelerated derivatives use among more geographically varied firms and among firms for which the CEO's sensitivity to wealth share price is comparatively bigger.

It is noted that the scales of the derivatives positions are quite small for all the divisions of the data. Their multivariate tests show that geographic variation and investment chances have the greatest function to explain firm's mitigating concentration.

Their result also suggest that implications about determinants of derivatives use are different when cash flow and market value considerations are used as proxies for the scale of derivatives use rather of the more usually used proxy of notional principal.

Conclusively, their explanation is that either the discerned increase in market values is motivated by other risks management activities, for example, operational hedges, that are value adding and positively correlated with derivatives positions, or it is spurious.

Their conclusion show the mixed findings of some research that tested if economic suppositions of optimal protection predict the use of derivatives by businesses (Nance et al. 1993; Mian 1996; Geczy et al. 1997; Guay 1999; Allayannis and Ofek 2001; Knopf et al. 2002). For example, nearly all of the studies tested the theory of the connection between firm leverage and derivatives use. Three out of the studies find support for a positive connection linking protection and leverage while three did not show proof of such a connection.

Coles et al. (2007) investigated firm value and managerial ownership and discussed endogeneity variables as shown in the association linking protection and firm value. The research specifies a structural model of the firm, The Homstrom and Milgrom (1987) model, amplified with investment decision, and thereafter uses the model to conduct and evaluate the empirical work on the connection linking performance and ownership.

Using data from Execucomp and Compusat, it is observed that to some point, higher levels of ownership are associated with Q ratios across industries (defined as the ratio of market value (MV) to replacement value assets). It is noted that this may reflect varied levels of labour efficiency and Q ratios across industries. For example, labour is more productive in service industry in comparison to say the extractive industries, which accounts for higher ownership. Similarly, the reason for higher Q ratios is that some service industries are more profitable and grow faster than others. This explains the reason why endogeneity creates the association between the Q ratio and managerial ownership.

In a study of the hedging activities of one hundred and nineteen US oil and gas producers from 1998 to 2001, Jin and Jorion (2006) evaluated their effect on firm value by testing for the risk management theory that protection should increase the firm's market value. Using data from Compustat, the valuation of oil and gas reserves and Q ratios constructed with various measures of market to book values, they find that there is more or less no difference in firm values between firms that protect and firms that do not protect against risks. This is at variance to the findings of Allayannis and Weston (2001) for sample of U.S multinational firms. This can be explained in the context of the variance connecting the nature of the commodity risk exposure of oil and gas companies and the foreign currency risk of big US multinational firms.

Commodity risks are relatively easy to isolate and protect and individual investors can readily use futures contracts traded on organised exchanges (Broadstock and Filis, 2014). Conversely, currency risks are difficult to isolate by external investors and could involve unusual currencies which could be difficult to protect with currency derivatives.

Tufano (1996), in his widely sited work on the North American gold mining industry find little support for the predictive power of hypothesis that view risk management as a way to boost shareholder value. Rather he finds that businesses with managers holding more options deal with reduced gold price risk and businesses whose managers hold more stock handle more gold price risks, suggesting that the effect on managerial predilection may affect risk management.

4.4.2 Hedging and financial distress

Generally, risk management theories bring to light the benefit from protecting risks that accelerate the likely costs of financial distress (Smith and Stulz 1985). The transaction costs of financial distress can induce businesses to protect financial price risks since the chances of attracting the costs are lessened. The savings in the likely costs will be at variance directly with the chances of financial distress if the business does not protect and with the costs of financial distress.

Most empirical studies test this theory using proxies only for the likelihood of grappling with financial distress (Francis and Stephen 1993; Nance et al. 1993; Asquith et al. 1994; Opler and Timan 1994; Berkman and Bradbury 1996; Mian 1996; Tufano 1996; Wysocki 1996; Fok et al. 1997; Gay and Nam 1998; Andrade and Kaplan 1998; Haushalter 2000, Allayyannis and Ofek 2001; Purnanandam 2007).

The two favoured substitute for the pre-hedging likelihood of financial distress are gearing, which is a measure of the quantity of debt compared to the equity size of the business and the interest cover ratio, which is a firm’s ability to service its debt.

The lower a firm’s interest coverage ratio, the more is its gearing ratio, therefore, the more the likelihood of financial distress. Judge (2006) finds credit rating and tax loss carry forward useful as substitutes. The studies conducted by Berkman and Bradbury (1996) and Fok et al. (1997) find a negative association between hedging and interest cover while the studies conducted by Berkman and Bradbury (1996), Gay and Nam (1998) and Haushalter (2000) find a positive connection between gearing and hedging.

The latter three researches use a continuous evaluation of hedging and explain this finding as proof that the more expected financial distress costs calls for more protection. When investigating the connection linking the cost of financial distress and hedging, these researches suppose that the sum of ex ante (usually indirect costs, for example, the decline in the relationships with customers and suppliers) and ex post cost (direct transaction cost, for example, legal fees) are positively associated with the likelihood that the business enters into financial distress. Consequently, the expected cost of financial distress are forecasted to be more for those businesses with more gearing and/or lower interest cover ratios, signifying that these categories of businesses have better motivation to hedge. However, the use of these variables as substitutes for likely financial distress costs does create some anxiety.

These researches suppose that exogenous bankruptcy costs are stable across businesses and consequently unsuccessfully address the likelihood that exogenous bankruptcy costs could affect the businesses capital structure preferences.

As an example, a business with high exogenous bankruptcy costs might decide on a low level of debt or, on the other hand, a business with low exogenous bankruptcy costs might decide on a high level of debt. Notwithstanding having more level of debt signifying greater chances of distress, the latter business may have a little motivation to hedge. It is not unthinkable that these two businesses might have similar likely costs of financial distress notwithstanding having varied chances of distress.

An attempt to address this issue was made by Dolde (1996), Geczy et al. (1997), Howton and Perfect (1998), Graham and Rogers (2000) and Davidson (2008). Dolde uses measures for product uniqueness as substitutes for financial distress costs but finds statistically insignificant evidence.

However, in both univariate and multivariate tests, he checks for the level of primitive risk and finds analytically significant proof in support of a positive connection linking gearing and hedging. Without checks, the connection loses its analytical significance. In addition for limiting for primitive risk, Dolde (1996) takes on another approach in an effort to model correctly the connection between hedging and gearing. He designs a direct measure of expected financial distress costs, on the premise of differential credit risk premium analogous to bond ratings (Sorenson 1980).

Dolde (1996) estimates for each rating class the spread linking its bond returns and ten year treasury notes. This spread is known as credit risk spread. The use of the spreads on a business's actual debt issues would blur credit risk differences in callability and maturity.

In ordinary least square regressions, Dolde (1996) finds that gearing has an important and positive effect on his measure of likely financial distress costs and that hedging variables mitigate the effects of gearing on likely financial distress suggesting that it might not be out of place to use gearing as a substitute for the likely costs of financial distress.

4.4.3 Hedging and cash flow Volatility

In a review conducted in 1995 by Bodnar et al. (1995) on the usage of derivatives, 91% of derivatives users cite instability in cash flows or earnings as the most significant reasons for using derivatives. Hedging theories identify the need to lessen risk by emphasising the issues that make cash flow or income instability expensive. In addition, the theories accept that, the more unpredictable cash flows are, the more expensive these issues become. Therefore, the need to lessen risk is also contingent on the level of cash flow instability faced by the firm. Therefore, businesses with extremely unpredictable operating earnings are most expected to mitigate risk. Yet, the probability of protection or the level of protection activity should be positively correlated to the need to lessen risk. It is essential to handle the size of a business's cash flow instability professionally when evaluating the determinants of corporate protection from risk.

In the studies conducted by Francis and Stephen (1993), Nance et al. (1993), Mian (1996) and Gay and Nam (1998) no attempt was made to capture the effect of cash flow volatility on a firm's hedging decision. More than a few research work investigated this drawback by making an attempt to manage for the level of cash flow instability across businesses. Three approaches have been looked into here. The dimension of cash flow instability is the first approach, (Titman and Wessels 1988; Dolde 1995). This evaluation of risk should be fashioned in a way that is autonomous of both gearing and hedging. Timan and Wessels (1988) in their study use operating income to obtain a volatility computation autonomous of financial policies in their elucidation of gearing.

Dolde (1995) uses the standard deviation of the ratio of past operating earning before depreciation to book value of assets to gauge the instability in operating earnings. The issue with this is that it is an ex post quantification of risk, while management's decision to protect against risk is premised on likely risk exposure. Nance et al. (1993)

contends that since protection lessens cash flow instability, the differences in cash flow instability between firms that protect and those that do not ex post may not be noticeable, finding support with the findings of Hentschel and Kothari (2001) in their analysis of the risk attributes of large US firms where there is little difference between users and non-users of foreign currency derivatives in their exchange rate exposures. Likewise the findings of Allayannis and Ofek (2001) show that when managing for the level of foreign disposals, the more the use of foreign currency derivatives by a business, the lessened is its exchange rate exposure. Another issue is that the relevant computation of operating earnings is pre-protection income before interest and tax.

Under the International Accounting Standard (IAS) 39, profit and deficits from protection activities are documented in the consolidated statements of income as modification to earnings or the cost of the fundamental physical transaction. However, for most businesses, protection profit or deficits are not precisely classified as such. Rather, they are embedded in the standard computation of a business's cash flow based on net profit or earnings before interest and tax and cannot be split due to disclosure restrictions.

An example will suffice here; for currency and commodity derivatives, the risk that is being protected is usually connected with the management of the main business, so the profit or deficit on these derivatives are reflected in earnings before interest and taxation (Choi and Elyasiani 1997; Chiang and Lin 2005; CIMA 2009). In commodity based businesses, derivatives contracts influence earnings from operations in that takings from sales is a role of the given commodity value (Chowdhry and Howe 1999).

Consequently, instability of income from operations would not be ideal since it would underestimate the level of risk (Tufano 1996). In most cases, it may not be feasible to adjust these earnings before interest and taxation cash flows to a basis of management level before risk by totalling or deducting back in derivatives deficit (profit), since this fact and figures is not autonomously reported. As a result, the firming up of the influences of the protection with the matching operating cash flows makes the instability of operating income an underestimation of risk.

4.5 Determinants of Bank Working Effectiveness

To be uniform with the generally accepted idea of portfolio performance, the meaning of bank portfolio performance in this research work is stated as risk-adjusted return on a bank portfolio.

The US Federal Deposit Insurance Corporation makes public the Uniform Bank Performance Reports (UBPR) for each quarter for all insured banks in its books. Generally, bank working effectiveness is a broader term for the reliability of a bank. It is more evaluated in diverse ways, sometimes as ratios: Return on assets (ROA); Return on equity (ROE); Liquidity ratio; Bank share yield; loans/assets ratio; Net charge off on loans; Net interest margin; Market share; Credit ratings; and Bank rating.

Bank working effectiveness has attracted a lot of research more so in the light of their performances during the recent credit crisis. Varied research interests have also investigated the factors and strategies that impact on the working effectiveness of banks for maximum performance. One of the strategies used by banks is the strategy of diversification of their streams of income, sometimes this makes some to end up as bank holding companies. The diversification strategy is also used in portfolio management to diversify portfolio risk and return.

Drawing from the theoretical underpinnings of the modern portfolio theory in portfolio management and asset diversification as explored and implemented by banks on the whole, is a sound business practice which is also good for the management of bank portfolio in maximising their risk-adjusted return.

Jayaratne and Strahan (1998) investigated the effect of removing the barriers to bank expansions geographically. They show that the working effectiveness of banks became stronger and healthier after these limits were removed. They discovered that the operating costs and loan losses reduced significantly after bank branching and interstate banking were allowed which impacted on their bottom line and portfolio.

Cerasi and Daltung (2000) posit that if a bank is debt financed, portfolio diversification enhances the motivation of banks to monitor loans. However, where the bank is sole equity financed, the effect of diversification may be seen as unnecessary.

4.6 Financial Derivatives and Bank Working Effectiveness

As previously stated in chapter 1, the market makers in the US credit derivatives market are big banks and they control a large chunk of the market (OCC 2008-2011). The plans followed by big banks are distinct to their lesser equals in upholding their driven gain and success. Fundamentally, the main differences between big and smaller banks are the level of customer service rendered to their customers. Now and again, small savers at big banks get missing in the mix up. As an example, there are drawbacks to the loan-by-loan kind of selection which describes small banks procedures. Big banks must consider the costs and advantages of long and stringent selection procedure. Furthermore, standard bank assets contain residential mortgage facilities and commercial facilities with a payback period drawn-out to more than twenty five years sometimes.

Except the facilities become unpaid, banks may not be able to ask for the outstanding balances on such facilities, thus making these assets difficult to convert to cash or marketable securities. Derivatives present a way for banks to redesign and restructure their portfolio. In view of their technology and ability to pay, they are able to recruit and keep qualified hands required to appreciate and take part in the derivatives market. At the introduction of derivatives as a novel means for mitigating risks, some disquiet was expressed about the use of the means by banks, mainly at the initial stage of the development of the market.

Becketti (1993) investigated whether derivatives were excessively risky for banks. They find that the anxiety and worry about the competence of banks to administer, and watchdog skill and proficiency to regulate users of derivatives among banks seem exaggerated. This was for the reason that banks that transact in derivatives were some big banks more so these banks are accustomed with some of the risks encountered in traditional activities already. Consequently, they should already have the skill set and means essential, to effectively screen and administer the peculiar derivative risks, to wit, exposure, settlement, cross-market disturbances, valuation, legal etc. The research established that notwithstanding the extra supervision and precaution that may be required, and watchdog's requirement to apply more watchfulness, the derivatives activities by banks in the banking industry should not present administrative and regulatory harm.

Brewer et al. (1996) explored the effects of derivatives on the financial working effectiveness of depository institutions, the connection linking derivative transactions meant to protect the erraticism in interest rates, and a savings and loan's mortgage lending. In detail, the work examined if the moral hazard inducement produced by cheapened deposit insurance, made the Savings and Loans institutions to employ interest rate derivatives to augment their risk of financial loss , by means of that impacting on the Savings and Loan deficits through the 1980s.

The outcome of the examination of quarterly data for ninety nine Savings and Loans institutions from 1985 through 1989 reveal that notwithstanding this moral hazard inducement, a small number of Savings and Loans institutions employed derivatives to transfer risk throughout the later part of the 1980s. The outcome of their research in addition backed up derivative instruments supporting inducements for Savings and Loans institutions to accelerate their lending, notwithstanding the interest rate risk. The option to enhanced lending would be changing commercial and corporate combination, and migrating from conventional lending business to non customary business.

Carter and Sinkey (1998) investigated the use of interest rate derivatives by large banks. Further research built on the reason why in the mid 1990s, notwithstanding the upsurge in the use of derivatives, just 5% of commercial and large banks used derivatives to mitigate their risk (Sinkey and Carter 1999, 2000). The purpose of the research was also to look at how users of derivatives change from nonusers. It was an effort to provide evidence of the connection linking financial attributes and derivatives use by commercial banks in the US. The sample data was bank level derivative data as of the end of 1996. By controlling for bank size and dealer business, they showed that while both large and small banks used derivatives, it was mainly the larger banks that were dealers and market makers. This was chiefly due to obstacles to access to risk-takers, on account of the considerable financial outlay, intellectual wealth and good opinion.

The sample data reveal that averagely, banks that use derivatives were fifty times bigger than non users. They also show that these banks have precarious capital structures, more asset and liability maturity mismatches, bigger notes and debentures, greater net loan charge-offs, and lesser net interest margins. Banks were classified into two, to wit, big banks with total assets more than one billion dollars and small banks with total assets less than one billion dollars. The outcome indicated that larger banks using derivative had insecure capital structures and lesser net interest margins compared to their equal non-user banks. Conversely, small user banks were out in the open to additional interest rate risk, had extra notes and debentures and added net loan charge-offs compared to derivative non users. The investigations however did not reveal that robust capital base were necessary to take part in derivative business, finding support in earlier research on non financial firm hedging (Nance et al. 1993; Mian 1996) and on non bank financial firm hedging (Colquitt and Hayt 1997).

Hentschel and Kothari (2001) examined whether companies increase or lessen risks with the use of derivatives. Their sample data looked at three hundred and twenty five financial organisations and one hundred financial organisations. They show that a lot of the big companies in the US actively use derivative. The results also show that financial organisations hold more interest rate derivatives compared to non financial organisations while non financial organisations hold more foreign exchange derivatives in comparison to financial organisations. They also show that about forty percent of the big non financial companies did not participate in the derivatives market. A limitation of the study was whether or not the extent of derivatives disclosure in the notes to the accounts showed any beneficial effect of the use of derivatives. The views in the court of public opinion were whether or not, the use of derivatives by active participants in the market who think the concerns of the regulators are exaggerated derivatives has helped reduced risks.

In their study of the capital structure, lending and the effect of risk management at financial companies, Cebenoyan and Strahan (2004) looked at how the loan sales market influence the capital structure of banks with the use of their in-house capital markets. They show in their analysis that the utilisation of the loan sales market is advantageous to banks since this approach makes it possible for banks to duplicate the reduced capital ratios and superior lending of the bigger banks that are sometimes bank holding conglomerates. They debated the loan sales marketplace as a means that banks can utilise to support the objectives of management like robust risk management, lending to profitable businesses and household and sound capital structure. They find that banks that harmonise their portfolios through loan sales and purchases actually have reduced liquid assets compared to other banks in their categories. They can also key into beneficial investment chances, manage liquidity and capital much better. They also tend to be more adaptable and assertive in their operations. They are adaptable since they are likely to hold additional capital and high yielding liquid assets. Being assertive enables them to boost their asset base. They posit that since controlling risks through loan sales is useful, and then managing risk through derivatives should be beneficial which leads to the availability and access to credit by business and the domestic household.

On the other hand however, banks are known financial intermediaries. The non fluidness of bank loans and assets emanates from the costs of privileged facts and figures, which are factored in by banks when lending decisions are made (Diamond 1984). Bank loans that were thought as being non easily convertible are now easily sold in the loan sale market as part of the risk management policy and scheme of financial organisations even though the theories of financial intermediation posit otherwise. Conversely, the Modigliani-Miller theory is of the view that since companies or banks stockholder are able to successfully deal with risks by holding a broad portfolio, therefore, banks should not bother about managing risk. To reinforce the Modigliani-Miller theory however, Bauer and Ryser (2004) examined the risk management approaches for deposit taking institutions and banks by using a one-period model. They show that mitigating risks is not necessary with the implementation of controls rather than shifting risks to bank customers.

Interest rate derivatives and the connection with bank lending were investigated by Brewer et al. (2000). The sample period was from 1985 through 1992, using all Federal Deposit Insurance Corporation insured commercial banks with asset base of three hundred million dollars and above, that has Commercial and Industrial loans in their portfolio. The connection in the development in Commercial/Industrial loans and interest rate derivatives was used to gauge the connection relating the intermediation of financial institutions and their use of derivative. They find that a beneficial relationship exists between interest rate derivatives and Commercial/Industrial loans which indicate that interest rate derivatives enhance bank intermediation and public need.

They also investigated the connection linking loan development and loan attributes which is calculated by loan charge off ratio, submitting that a low charge-off ratio can be suggestive of robust economic growth in the geographic location of a bank. This can portend pressures from the regulatory authorities on loan expansion as the authorities in most cases compel banks to augment their charge-off ratios. They posit that using interest rate derivatives leads to a broadened portfolio that impact on the decline in the costs of monitoring contracts, supporting the claims of Diamond (1984). They also find that limiting guidelines on bank derivatives activities could lead to the reduction in bank lending activities to the economy.

In their study of the use of interest rate derivatives in mitigating risk at US banks, Brewer, Jackson and Moser (2001) investigated the main financial disparities of these banks. They used the sample data of 154 publicly traded bank holding companies up to June 1986.The banks were categorised based on their asset sizes, to wit, above ten billion dollars (57), between five to ten billion dollars (35) and those with assets less than five billion dollars (62). They find that big banks are more prone to using the instruments due to the benefits of economies of scale in view of the enormous fixed costs connected with the learning curve of perfecting the technicalities involved in using the instruments. Their findings also show that the use of derivative did not seem likely to be less good than between the user and non users of the instruments. Users appeared to have less bankruptcy risk, suggesting that derivative usage made banks to reduce their overall risk or low risk banks were able to surmount the entry barriers as well as maintain their low risk profile.

Users were also found to have reduced levels of costly capital in their balance sheet suggesting that banks replaced costly capital for less costly risk management. Their results seem to suggest that users of interest rate derivatives are in a less risky position compared to non users. The implication of their findings seems to indicate that the intervention of the regulators might increase risk in the long run if their usage is discouraged.

4.7 Portfolio Risk and Return

Investors are faced with multiple risks on their investments but the behaviour of a rational investor is to avoid or reduce risks through a well balanced and diversified portfolio of securities. Markowitz (1952) in his classical work on portfolio selection, hypothesised on the behaviour and character of investors not only to attain the best yield possible but also to minimise risk, proposing on the expected mean return (E) of the portfolio and the variance of portfolio return (V) as a basis for selecting securities in a portfolio. Markowitz further showed the validity of the concept of efficient portfolio and inefficient portfolios, also known as the concept of optimal portfolio. An efficient portfolio is assumed to have a right combination of mean-variance relationship which maximises returns and reduces risk. His work pioneered how portfolio diversification can reduce risk. However, his pioneer work suffered from four fatal technical errors. For example, the measure of dispersion in a portfolio was taken as variance rather than the portfolio standard deviation.

Markowitz (1959) laid the ground work of modern portfolio theory with the quantification of risk. It addressed the errors in Markowitz (1952), more precisely, the contribution, performance, choice and selection of securities to a portfolio. He postulated that an efficient portfolio should be able to provide an investor maximum expected returns at minimal risks and not only accommodate performing debt and shares. Furthermore, a rational investor is risk averse and would like to diversify their portfolio to minimise risk. For a minimum level of risk, an investor would readily choose an optimal level of expected return. Also, a rational investor would rather choose the maximum expected return for any given level of risk.

4.8 Portfolio Theory

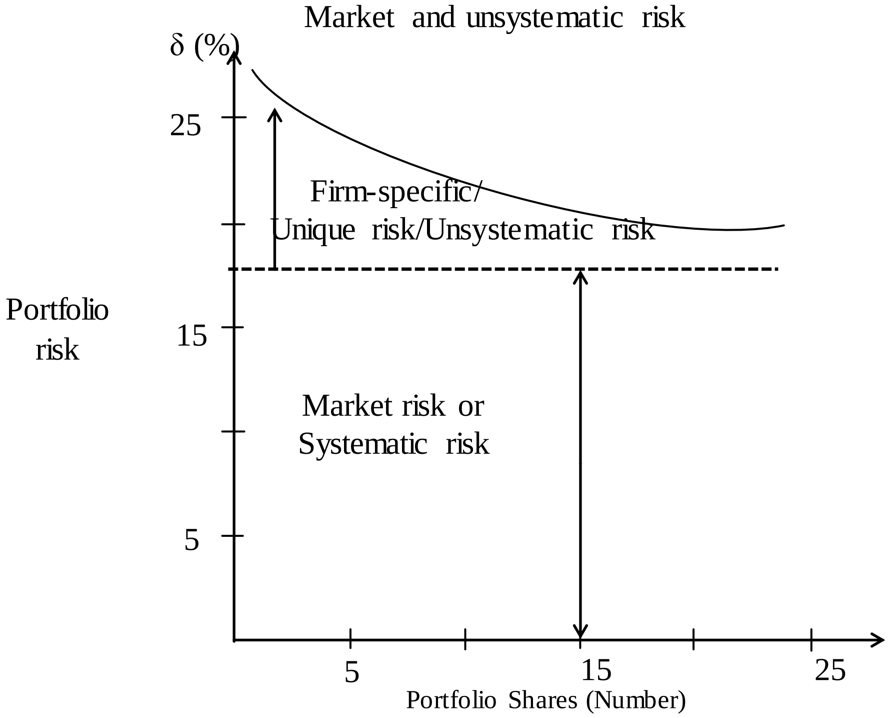
The elementary form of portfolio theory relates to rule of behaviours. It is concerned with efficient techniques for selecting portfolios based on the knowledge, experience and performance of individual securities (Markowitz 1991,1999). Based on the earlier works of Marschak (1938), Von Newmann and Morgenstern (1947), Markowitz

(1952) developed a mean-variance approach of allocation of asset and securities.

As a measure of risk, Markowitz (1952) uses variance (V). To ascertain the total risk (standard deviation) in a portfolio, an investor would have to calculate the covariance (V_{ij}) between the asset proportions (X_i) in a portfolio. For diversification strategy, an investor or fund manager should ascertain the covariance (where two sets of numbers generally move above or below their means at the same time over a period of time) of the securities in comparison with other securities in the portfolio. The size of the covariance influences the size of the standard deviation, for example, the lower the covariance between the securities in a portfolio, the lower the total risk (standard deviation) in the portfolio.

Markowitz (1952) demonstrated the characteristics of an efficient and inefficient portfolio using three and four securities as examples. The combined fit of all efficient portfolios is widely known as "efficient frontiers". Statistically, analysis of the mean, variance and covariance in addition to the good sense of a portfolio analyst was deduced and presented to the investor for the desired risk-return mixture for decision making.

Figure 4.3: Market and firm-specific risks

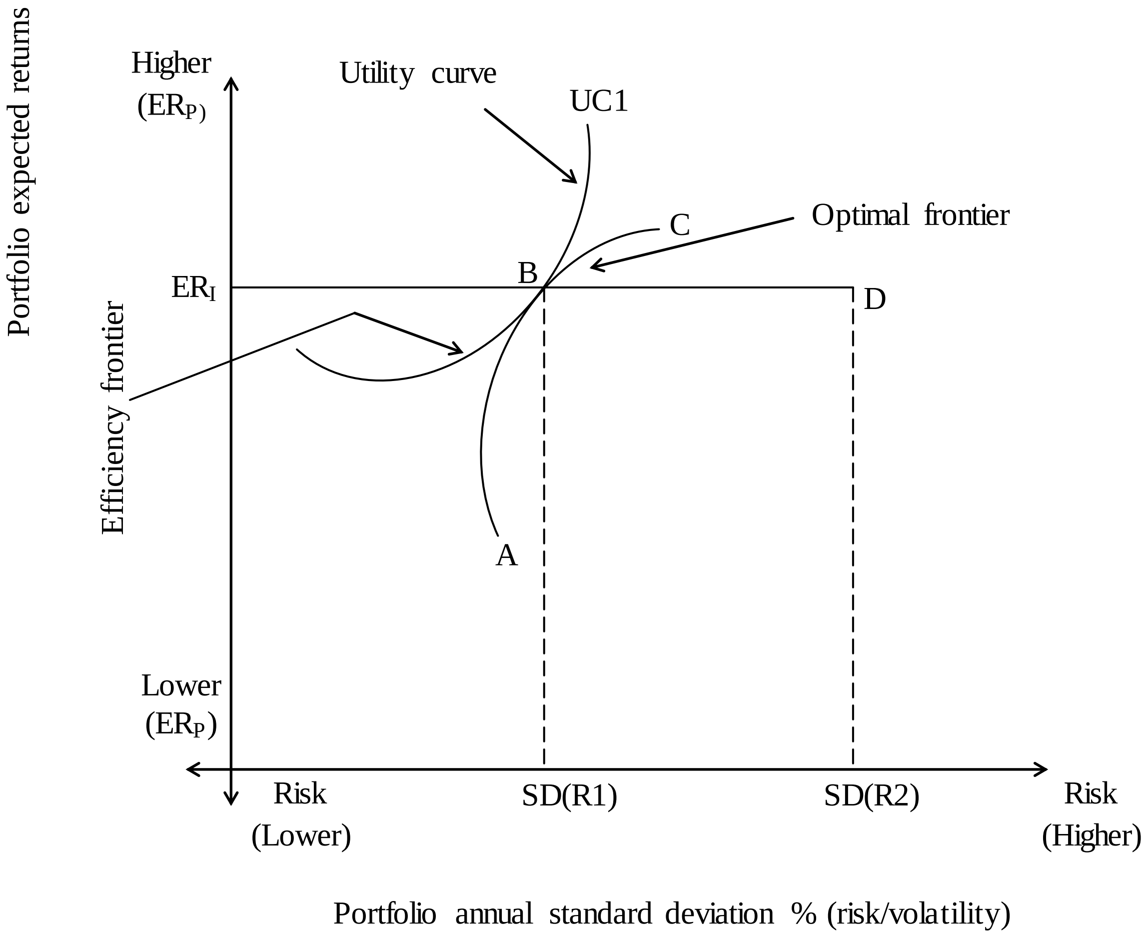


Source: Markowitz (1952)

Thus the investment strategy of a portfolio analyst or fund manager will depend on the objectives, constraints, risk appetite, preferences (personal or social), investment life cycle and utility function of an investor in making the selection of securities, asset allocation and quality of a portfolio. For an investor to choose between the level of risk and return in a portfolio, the asset allocation and investment strategy in portfolio management assumes that: (a) where any two portfolios have the same total risk and distinct expected returns, obviously an investor will chose the portfolio with superior returns; (b) where any two portfolios have the same expected return and different total risk, an investor will chose the portfolio with the lowest total risk; and (c) Where any portfolio has superior returns and a low total risks, an investor would choose to settle for the maximisation of returns.

In his seminal paper, Tobin (1958) extends the work of Markowitz (1952). The result of his work resulted in the widely known "Tobin Separation Theorem" or "Two-Fund Separation Theorem". He included marketable securities that were presumed to be free of default risk, for example, cash. However, because the assets were marketable assets, the inherent risks were market risks and not default risks. Tobin's work was built on efficient cash holding in a portfolio in which given the statistical analysis of mean-variance and covariance among well organised portfolios with the inclusion of cash, the relationship and ratio among risky stocks (consoles) will amount to the same result.

Figure 4.4: Markowitz efficient frontier



Source: Markowitz (1952)

For example, Tobin (1958) examined the portfolio and decision of an investor with two assets--risky assets or non-cash assets and cash to empirically explain portfolio diversification. While risky assets had a yield more than zero, the yield of the cash assets was zero at the end of the period. He asserts that risky assets can be likened to a mutual fund (a composite) in which investors would find it desirable to mix their portfolio of non-cash or risky assets with cash. The pursuit and investment by an investor in an appropriate linear combination of any two mutual funds which are also mean-variance efficient portfolios by an investor can be achieved with a given expected return and variance (Hendrick et al.1993).

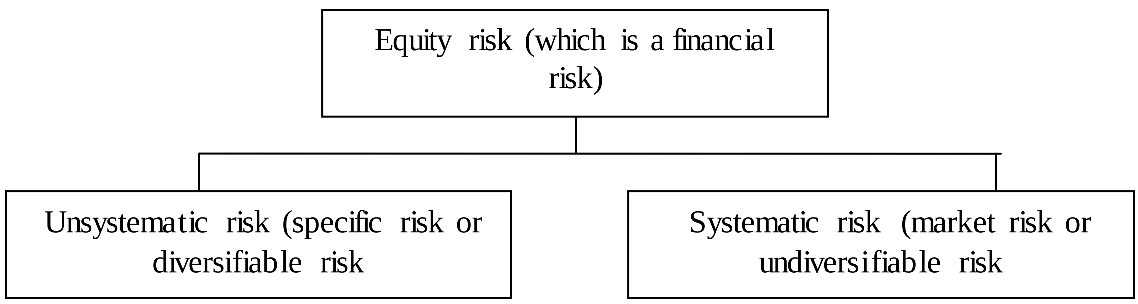
4.9 Capital Asset Pricing Model (CAPM)

The structure around which the Markowitz (1952) and Tobin (1958) mean-variance optimisation theory is built is from the consideration of investors' conditional on given expected excess returns and measure of risk of assets. The practical application of the theory in real life was not very feasible as the derivation of diversification benefits would involve the calculation of the covariance of returns between each assets class and securities in a portfolio. The capital asset pricing model (CAPM), which was deduced from modern portfolio theory, was developed by Sharpe et al. (1964), Lintner (1965) and Mossin (1966), preceded by the earlier works on asset pricing by Treynor (1961), was interested on the premise of the values of the mean returns that will be required to clear the capital market realities at equilibrium if (a) markets are efficient, for example, there is a reliable interest rate where investors can access credit (b) Homogeneity of investor expectations of returns, for example, all investors have identical information, and (c) the standard deviation of risky securities and asset class, for example, investors minimise volatility and maximise the expected return.

They set out to determine the connection linking the risks and characteristics of assets and their prices. They also aimed to use the theory of portfolio selection to build a market equilibrium theory of asset prices under state of risk. Their model shows that the benefits of diversification could be arrived at with the calculation of the covariance of each asset class in a portfolio in terms of the subsisting market aggregate value, for example, the Standard and Poor's 500 index.

Under the capital asset pricing model, Sharpe et al. (1964) and Lintner (1965), classified equity risk into two components:

Figure 4.5: Equity risk



Sources: Reilly and Brown (2006); Black et al. (1972)

Investors with a risk-return preference who attach a considerable importance to the expected return and reduced risk would like a portfolio with parallel weights and ratio where the marginal role to portfolio expected return to the marginal contribution to risk will be the same. The expected and reasonable excess returns, on balance, are taken to be the same across investors. Let us assume the following:

R_f, be risk-free rate of interest (for example, the yield on treasury bills),

$Z_i = R_i - R_f$, be the excess return,

Therefore, on equilibrium,

$E(Z_i) = \beta_{im} E(Z_m)$, be the expected excess

And

$$\beta_{im} = \frac{Cov(Z_i, Z_m)}{Var(Z_m)}$$

where,

Z_m, be the excess return on the market portfolio of assets,

$Z_m = R_m - R_f$, with R_m being the return on the market portfolio.

Black (1972), in his work on capital equilibrium and restricted borrowing, deduced a general variant of the capital asset pricing model, in the absence of a risk free asset. In his contribution, the expected return of asset *i* in equilibrium is equal to:

$$E(R_i) = E(R_{om}) + \beta_{im}\{E(R_m) - E(R_{om})\}, \beta_m = \beta_m = \frac{Cov(Z_i, Z_m)}{Var(Z_m)} \tag{4.3}$$

where, R_{om} is the return on the zero-beta portfolio (the portfolio that has the minimum variance among all the portfolios that are not correlated with m) associated with m.

Based on the work of Sharpe (1964), Lintner (1965) and Mossin (1966) on the capital asset pricing model, the security market line was theorised as the relationship at equilibrium between expected yield and market risk for the individual securities and asset. Further, the extra yield on a risky asset is identical to the extra yield on the market portfolio augmented by the beta coefficient. They argued that the risk component of the asset that is deduced from its correlation is undiversifiable. They also argued that with diversification, the investor can remove all the risks in the asset except the risk which is directly correlated with the general economic and market activity. In which case, asset price changes until there are linear connections and relationships between systematic risk and the expected return of the securities. The security market line (SML) can be introduced as follows:

$$(R_i - R_f) = \beta(R_m - R_f) \tag{4.4}$$

where,

R_i: The required return of asset I,

R_m: The required return of market portfolio,

R_f: The risk free rate of return,

β: is the beta coefficient, (This measures a security's sensitivity to market fluctuations), it is expressed as follows:

$$\beta = \frac{CoVar_m}{Var_m} \tag{4.5}$$

(R_i – R_f): The excess security rate of return, (it is explained as the security rate of return less the one-month yield on treasury bills),

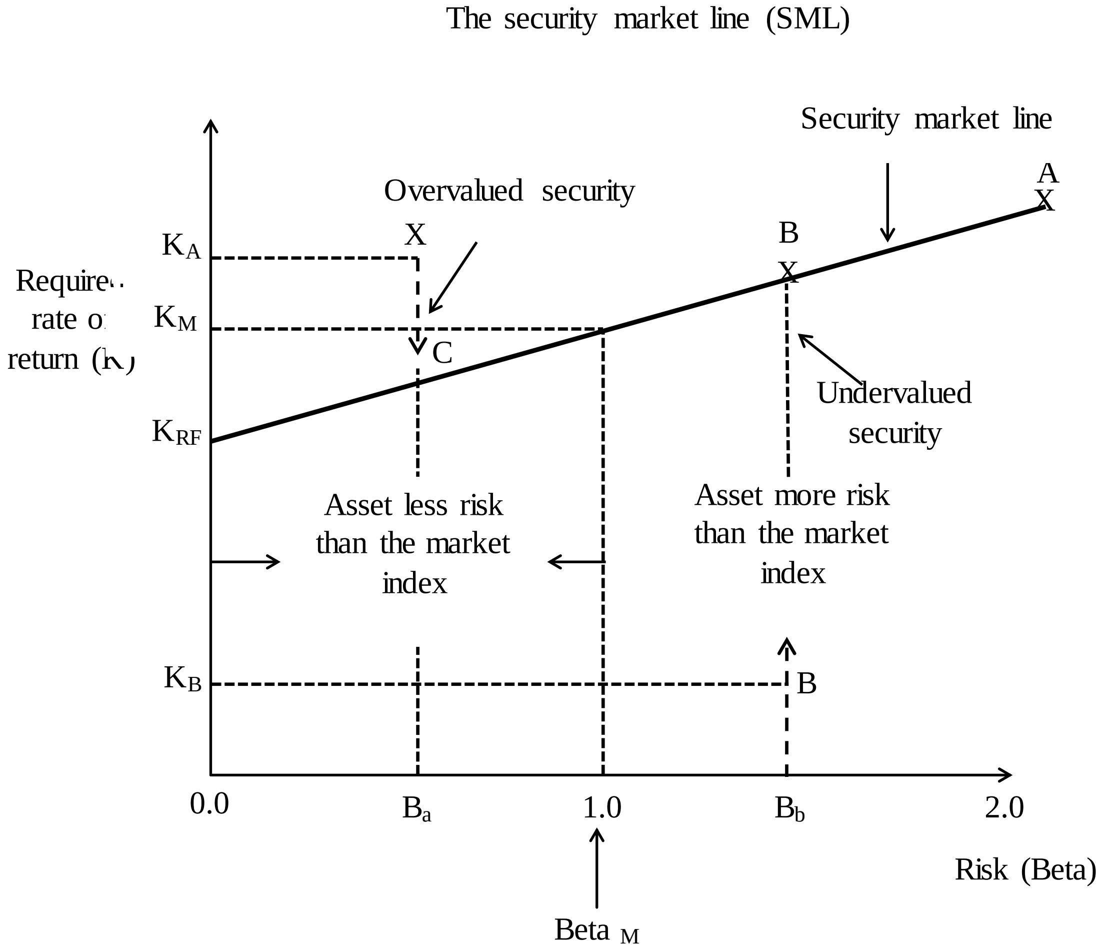
(R_m – R_f): The excess market return or market risk premium,

β (R_m – R_f): The risk premium on asset i.

For the beta coefficient (β), $CoVar_m$ is the covariance of returns on security (ith) with those of the market portfolio (m). Beta measures the variability of a security's return with respect to the market portfolio. To clarify, if an asset's return ordinarily changes (upward or downward) by half in relation to that of the market, its beta will be 0.5.With the beta at 0.5, we know just about little information about the asset's variance of returns. Typically, beta tells us only how the asset's return follows those of the overall market, as a relative measure of volatility. Betas more than 1.0 have securities that are more riskier and volatile than the market or, better still, have securities that are readily responsive to the systematic risk than the market; these assets' average returns are larger in absolute value, no matter what the market return is, betas less than 1.0 have assets that are less risky and volatile than the market, or assets with less market risk. In absolute value, the returns of these assets' are usually less than those of the market.

The security market line equation above is illustrated in Figure 4.6 below:

Figure 4.6: Security Market Line



Sources: Reilly and Brown (2006); Black et al. (1972)

Figure 4.6 shows security market line as the graphical depiction of the capital asset pricing model. From the graph, assuming there were financial asset "X" with the mix of return Ka and beta Ba, this would right away be identified as overvalued. Theoretically, asset "X" would attract an excess demand and the price of "X" would rise until the expected return recedes to the security market line, thus in "equilibrium" state. In the context of asset B, an undervalued asset, the procedure would work the other way. Thus the equilibrium state of the security market line can be explained as an "equilibrium construct". In effect, within a time frame, and given the fundamentals of the market, pricing of a financial asset can be explained as to its fair or actual value, whether it is over valued or under valued and how it is adjusted to equilibrium by the market.

4.9.1 Assumptions of the capital asset pricing model

Because the capital asset pricing model (CAPM) as developed by Sharpe et al. (1964) as well as Lintner (1965) and Mossin (1966) was deduced from modern portfolio theory, it requires some assumptions but the significant criticisms of the CAPM are those debatable assumptions when deriving the CAPM, its investigation and testability.

- All investors can be taken as Markowitz efficient, risk averse, seeks to target the efficient frontier points and long to maximise the expected risk-return utility function of wealth. They are particularly concerned with the expected return and overall risk of a security.
- Investors have unlimited pool of funds they can borrow or lend from at the risk-free rate.
- All investors have homogenous evaluation of the probability distributions of expected returns from assets traded in the market.
- Normal distributions of returns.
- One-period investment horizon.
- No transaction costs involved in trading securities in a frictionless market.
- All assets and securities are marketable.
- Capital markets are in equilibrium with all investments well priced in line with their level of risks.
- There is expected return-variance or E-V rule for all investors.
- There is no inflation or inflation is fully anticipated. There is no change in interest rates.
- The existence of risk-free assets.

With respect to banking portfolio, it can be assumed that some of the assumptions seems rational based on the utility function and efficient frontier discussed earlier. Clearly, some of the assumptions are not valid.

As we shall see later in this chapter as well as in chapters 5 and 7, there are some differences in the mean and standard deviation by various categories of banks. In addition, transaction costs are always incurred in trading securities and banks hold assets, loans and securities that are illiquid in their balance sheet and portfolios.

4.9.2 Empirical test of the capital asset pricing model

A great degree of pragmatic work has been done towards testing the rationality of the CAPM. The research work of Black et al. (1972) and Fama and McBeth are in confirmation of the CAPM. Conversely, Fama and French (2004) as well as Banz (1981) challenged the rationality of the model.

4.9.2.1 Black, Jensen, and Scholes pragmatic test

Black et al (1972) conducted the first practical research into CAPM. The goal of their research was to establish that a linear, completely sloped connection is present midway the betas and the likely rate of return. They discovered that the sample data were harmonious with the forecast of the CAPM, in view of the fact that the CAPM is an estimate to actuality as in the case of every other model.

Using the sample data from the New York Stock Exchange (NYSE), they used the entirety of the stocks to form ten portfolios with dissimilar past beta approximation. By regressing mean monthly excess yield on beta and plotting the data on a scatter diagram, they find that there is an existence of a relationship between beta and the mean excess monthly yield since a large chunk of the data could be fitted on a direct line. The risk-free asset used for these ten portfolios was the thirty-day Treasury bill. As forecasted by the CAPM, the assessed slope for the subsequent regression line was 1.08% rather than 1.42 %. Notwithstanding the resulting t-statistics showed that the slope and the intercept of their regression line were not the same compared to their hypothetical values, this itself does not mean that the outcome do not validate the CAPM. Black (1993) in their study of beta and return explains that the rationalisation for these outcomes concerns the inaccuracy of measurement and model specification that comes up as a result of the use of a proxy rather than of the real market portfolio. As a result, this inaccuracy slant the regression line's projected intercept. In conclusion, we can summarise that the research work of Black et al's pragmatic tests does not provide the confirmation of non-linearity of the assessed security market line. Consequently, there is a positive connection linking betas and the likely rates of return.

4.9.2.2 Fama and French studies

As indicated by CAPM, the percentage profits that can reasonably be expected from a particular investment fluctuate through assets only on account of the fact that the asset's betas are not the same. Consequently, one or two ways to investigate if the CAPM sufficiently encapsulates all key aspects of representativeness is to test if other precise-asset features can clarify the cross-sectional changes in beta. Investigators would like to know whether beta is the only feature that is essential in empirical tests of CAPM. In their study, Fama and French (1992) projected the connection linking betas and likely rates of return for the time from 1963 (July) through 1990 (December). They came up with one hundred portfolios in all, assembled into ten size groups and after that, ten beta groups from firms listed on New York Stock Exchange and the National Association of Security dealers Automated Quotations. For a substantial group of stocks, beta could not clarify the cross-sectional change in mean returns; while in contrast, size had considerable explanatory power as shown by their approximate calculations.

They came to the conclusion that for some times, the connection linking mean return and beta is entirely even, proof that is against the rationality of CAPM. In contrast, Fama and Macbeth (1973) investigated the connection linking rates of return and betas for portfolios. They found that a connection exists linking the monthly return and beta. The overall results validated the CAPM even if the monthly results changed over time. Tole (1981) in addition stretched the argument that concentrated on the investigation of relative stability and researched the standard deviation of the betas for portfolios with distinct sizes. He established that there was significantly more constancy and firmness in beta as the portfolio size enlarged and a direct connection with excess returns.

4.9.3 Review of CAPM criticism

Roll (1977) in their study, investigated and critiqued the acid test of the asset pricing theory. The review was on the empirical tests of CAPM instead of the hypothetical structure of the model itself. Roll's critique on the whole can be grouped into two major segments. To begin with, he was of the opinion that the experiential tests carried out by

Black et al. (1972) were unnecessary, to wit, they would obtain the result that they desired irrespective of how the stocks were valued during the times in connection to real world practicalities in view of the outline and blueprint of the test. It cannot be said that The CAPM was tested robustly in view of this. Next, he was of the opinion that the CAPM statement about the future that should be tested is the real forecast that the market portfolio is efficient.

Nonetheless, the market portfolio should be representative of the asset and securities in the market that is accessible to the investing public. It suggests that CAPM is not able to be tested practically, where such a portfolio is real, testing the productive use of resources of such a portfolio would be unachievable. Black et al. (1972), in their test based on observation and experiment used the portfolio of stocks traded on the New York Stock Exchange as the substitute of the market portfolio. To start with, the stocks traded on the NYSE are a small amount of those traded on the international market; they do not represent all stocks traded in the world financial market hence a small fraction. Next, as well as equity stock, the market portfolio in CAPM can hold other variants of securities and assets. Consequently, Roll (1977) is of the opinion that the market portfolio is not discernable and noticeable. Similarly, he maintains without proof or evidence that so much as the excellent proxy (an index) used by Black et al. (1972) for market portfolio, the effectiveness of the index will not ensure the effectiveness of the market portfolio for the grounds that the index utilised is just a part of the aggregate assets. The CAPM's particular forecast is that the market portfolio is on the efficient collection.

Therefore, the main criticism of Roll (1977) on the work of Black et al. (1972) is that the empirical tests were not done directly. Rather, the test investigated the dynamics of the security market line drawn accurately making use of a correspondingly weighted substitute for the market. As a result, if the market portfolio is assumed to be efficient, the connection linking the expected return and beta will be a seamless definite linear slope. That is not to say, however, that a definite or positive linear connection linking the expected returns and beta will mean that the proxy or the market portfolio is efficient.

Conversely, Banz (1981), in their study of the connection linking the market value of common stocks and their yield, investigated if the size of the firms concerned could clarify the residual variation in mean returns through assets that are not clarified by the beta of the CAPM. The approach that he used is comparable to the portfolio grouping approach used by Black et al. (1972). He used firms from the New York Stock Exchange. To begin with, he allocated the assets to one of five subcategory based on their past betas.

The stocks in each of the subcategory were thereafter allocated to five additional subcategories based on the firm's equity market value. As a result, twenty five portfolios were created at the end. They were brought up-to-date at the end of each calendar year. They found that from 1936 through 1975, the mean yield to stocks of small firms, that is, firms with low values of market equity, were considerably more than the mean yield of bigger firms after modifying for risk with the use of CAPM. As a result, a firm's comparative size appears to be able to clarify a greater part of cross-sectional disparity in mean yield than the CAPM beta could do.

Still, in spite of the imperfections of the CAPM, its wide-ranging method appears to be well noted. This agrees with the opinion of Reilly and Brown (2006) in their classic book. They wrote on the benefit and valuableness of CAPM. They wondered on the acceptance of the CAPM in the academia if it is that flawed. Their response is premised on the fact that a flawed theory is better substituted by another superior theory. As a result, it can be assumed that CAPM can offer some understanding into the risk and return reciprocity connected with investments as well as offer an improved grasps connecting the link of risk and likely return. Moreover, the beta coefficient (β) can be perceived as a valuable means for calculating the riskiness of a security or that of a portfolio.

4.9.4 Multifactor models of risk and return

As discussed earlier, the CAPM has been one of the widely used financial economic theories ever established at any time in the past. Conversely, many of the research discussed also indicated some of the drawbacks in the model as an elucidation of the connection linking risk and return. For instance, the CAPM tests showed that the beta coefficients (β) for specific securities were not firm but that portfolio betas usually were steady supposing extended sample periods and sufficient trading volume. The support for a positive linear relationship linking rates and return and systematic risk for portfolios of stock was mixed, even some latest facts point to the need to think through more risk variables or a requirement for dissimilar substitutes or proxies. Furthermore, because of its reliance on a market portfolio of risky assets that is not currently available, more than a few research works disapprove the tests of the model and its usefulness in portfolio assessment and evaluation.

4.9.5 Arbitrage Pricing Model (APT)

In the early 1970s, Financial Economists began to ponder seriously on the effects of the usefulness and effectiveness of the CAPM. Specifically, the academia explored for another asset pricing theory to the CAPM that was rationally insightful with only few assumptions, and permits for several scope of risks in investment. The outcome was the development of the arbitrage pricing model (APT) by Ross (1976, 1977). It has three main suppositions: (a) capital market allow for easy entry and exit, that is, perfectly competitive; (b) Investors continuously desire more riches to less riches with assurance and certainty; and (c) The stochastic procedure making asset returns can be stated as a linear function of a collection of K risk factors (or indexes).

More comprehensively, CAPM's core in mean variance analysis establishes that it is ideal for the investor to select investments on the foundation of the percentage profit that can reasonably be expected from a particular investment, standard deviations or mean-variance analysis. In addition, CAPM take cognisance of a single factor, the market portfolio, to clarify security yields, connecting them to the security's beta coefficient. The inability of CAPM to clarify sufficiently the variation in yields of the range of assets using the beta expressions gave way to the growth of additional asset pricing models.

Conversely, arbitrage pricing model is a broader approach to asset pricing since it takes into consideration the likelihood that numerous factors can be employed to clarify security yield. The arbitrage pricing model can consist of several numerals and amount of risk factors that could ascertain the requisite yield. The rational growth of the arbitrage pricing model is comparable to that of CAPM, to wit, that investors should get uncomplainingly satisfied for receiving non-diversifiable risk. Arbitrage pricing model take for granted that yield are made by a factor model, unlike CAPM.

Additionally, even though CAPM rests on robust supposition about investor's choices, no such assumptions is made by APT. APT is not comfortable with the suggestion that investors perceive portfolios in terms of likely yields and standard deviations. It stands on the regulation of a single price, to wit, two similar articles cannot put up for sale at dissimilar values in a perfect market. The account of symmetry is more wide-ranging than CAPM, suggesting that the face value can be influenced away from means and variances. The supposition of investors using a mean variance structure is substituted by a supposition of the procedure creating security yields. APT begins by declaring that the yields on any stock are linearly connected to a collection of logical factors without stating them precisely:

$$\left(R_i - R_f\right) = \beta_1 F_1 + \beta_2 F_2 + \beta_3 F_3 + \beta_4 F_4 + \cdots + \beta_n F_n + \in_i \tag{4.6}$$

where,

$(R_i – R_f)$: excess security rate of return

This is described as the security rate of return minus the one-month risk-free rate of return (Treasury bill rate)

$\beta_{1, 2, 3, \ldots, n}$: the betas with regard to factors $F_{1, 2, 3, \ldots, n}$ and

ε_i: is the disturbance or random error term

Equation (4.6) above state that the yield on a security is influenced distinctly by the *n* factors. These factors may well incorporate company-precise features, specifically, book-to-market influence, size etc. Equation (4.6) differentiates with Equation (4.4) of the CAPM for the reason that it has more than a few beta coefficients instead of one. Further more, the CAPM is concerned with market risk whereas arbitrage pricing theory has no market risk coefficients, the whole line of reasoning of the model is that market risk is impersonal and unknown.

The advocates of the arbitrage pricing model contend that it has more than a few merits over the CAPM:

1. It does not make suppositions in connection with the experiential distribution of asset yields.
2. According to Ross (1976, 1977), arbitrage pricing model can without difficulty be stretched to a multi-period framework.
3. It does not make suppositions in connection with distinct utility function.
4. The CAPM entail that the investor’s utility function is built on the likely yields and the standard deviation of the systematic risk. The arbitrage pricing model does not necessitate that standard deviations be utilised as a degree of risk.
5. Arbitrage pricing model does not need a monitored and watched market index.

4.9.6 Empirical tests and criticisms of the arbitrage pricing model

Conversely, the arbitrage pricing model has its own drawbacks. It is not clear what the appropriate and significant factors are or even the number of significant and appropriate factors there are. We can contend that even though the arbitrage pricing model disposes off the drawback of a noticeable market index, it has been unsuccessful to make available a way out for selecting substitute factors.

Chen et al. (1986) in their research work discovered four analytically important macroeconomic explanatory variables, to wit, risk premia, changes in inflation, industrial production, the spread between return on short-term and long-term treasury bonds, to be valued in the US stock exchange market. Burmeister and McElroy (1988) disagreed with Chen et al. (1986) in two respects in their attempt to distinguish between CAPM and arbitrage pricing model. First, they change the description of noticeable factors and take for granted that there are three noticeable factors instead of one. Secondly, they utilised three portfolios to stand for these noticeable factors: (a) the yield on twenty year bonds; (b) the yield on twenty year corporate bonds; and (c) the yield of the S&P 500 index. They came to the conclusion that at a significance level of 1%, CAPM can be discarded and substituted by arbitrage pricing theory. The arbitrage pricing theory limitations cannot be discarded at whatever significance level. Their research work is the robust proof in support of arbitrage pricing theory up to this point as a valuable and fruitful clarification of likely yield.

Arbitrage pricing theory is still queried for its advantage over CAPM although more unified factors tend to clarify the likely returns on investments much better. Dhrymes et al. (1984) in their study conducted a test and discovered that a multi factor arbitrage pricing model has enhanced explanatory power unlike CAPM which is a one factor model. This confirms the theory that multiple factors create expected yield on assets. Chen et al. (1983) in their research work discovered that CAPM's deviation from the norm and peculiarity of size effect in the yields is mainly jettisoned by arbitrage pricing theory. The researches above appear to suggest the arbitrage pricing theory is an enhancement over the CAPM, especially when the yields take account of some irregularity when considered by CAPM.

4.9.6.1 The three-factor model of Fama and French (1993)

The model of Fama and French (1993) was an extension of asset pricing investigated in Fama and French (1992). The model was put together and applied on a range of portfolios stocks to clarify a variety of abnormality in financial markets, for example, book to market ratio, size etc. The model was an improvement over the paper of Fama and French (1992) on the following issues:

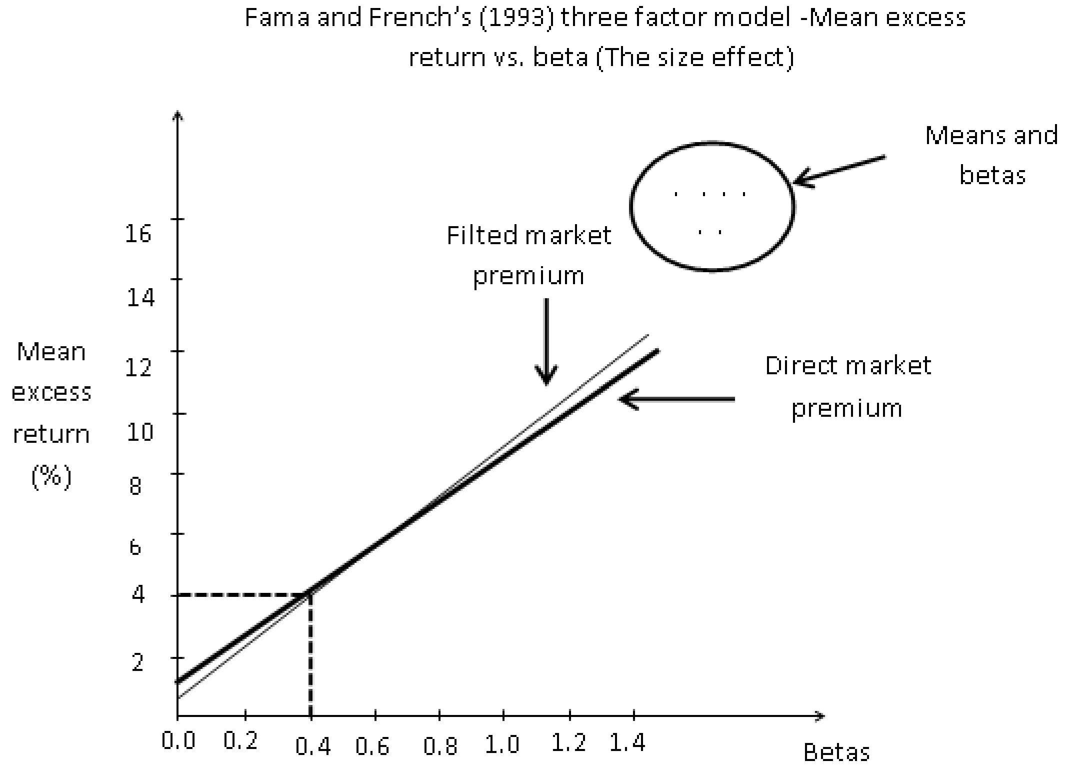
1. They increased the collection of explanatory variables utilised to clarify yield. Fama and French (1992) directed the size and book-to-market variables at stocks. Additionally, the term-structure variables were taken into account as they are likely to play a specific function in bond yield; and

2. They also increased the collection of asset yield to include bond yield. Their investigation and tests included US treasury and corporate bonds in addition to stocks.
Fama and French (1993) verified yields through assessment on the fundamental principle of the following model:

$$R_i - R_f = \infty + \beta_1 (R_m - R_f) + \beta_2 (R_s - R_b) + \beta_3 (R_h - R_v) + \in_t \tag{4.7}$$

where,
(R_{it} - R_f): Excess security rate of return (expressed as the security rate of return less one-month risk-free rate of return),
(R_m-R_f): Excess market return,
(R_s-R_b): size factor, to wit, small minus big (expressed as the change between the yield on a portfolio of small stocks and the yield on a portfolio of large stocks),
(R_h-R_v): book market factor, to wit, high minus low (expressed as the change between the yield on a portfolio of high book-to-market stocks and the yield on a portfolio of low book-to-market stocks),
ε_{t} : disturbance term.

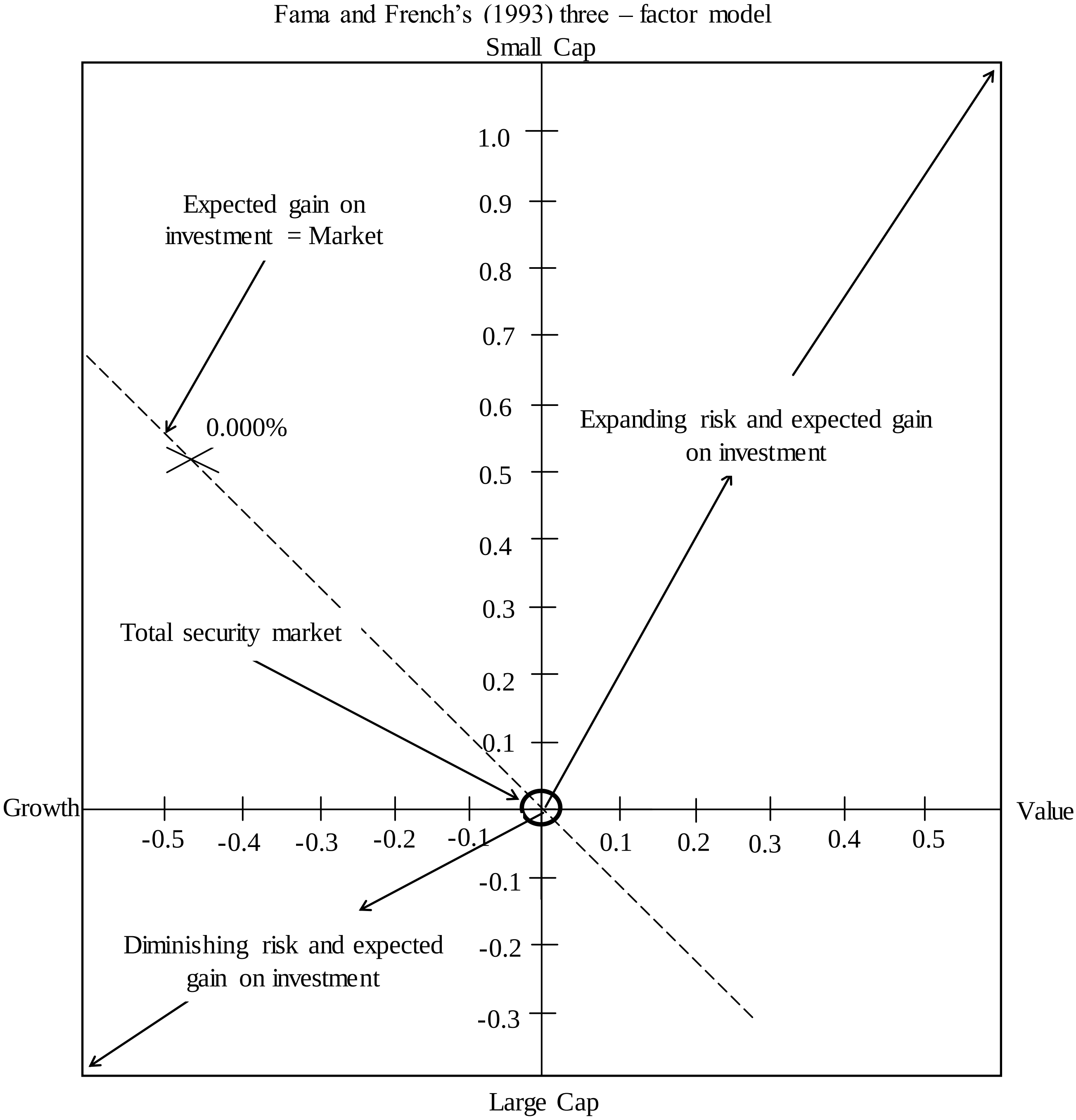
Figure 4.7: Fama and French (1993) Three Factor Model-Mean Excess Return Versus Beta (The Size Effect)



Sources: Black et al (1972); Fama and French (1993); Reilly and Brown (2006).

The "size effect", on the basis of the research work of Banz (1981), was the first identified irregularity in the financial markets. Typically, shares of small firms (gauge by their market value) have a tendency for enhanced yield than shares of bigger firms. Figure 4.7 encapsulates one of the main important drawbacks of CAPM. The least companies (the portfolios in the far right signified by the dots within the rectangle) appear to make a mean yield of a small number of percentage that is abnormal or above average going by their betas. Banz (1981) in their study found the famous small-firm influence; the deviation was statistically important and weighty.

Figure 4.8: Fama and French's (1993) Three Factor Model



Sources: Black et al. (1972); Fama and French (1993); Reilly and Brown (2006).

The "value effect" is one more discerned irregularity in financial markets. Value shares are lowly priced shares compared to their assets, evaluated by low book-to-market ratio. Conversely, growth shares are highly priced comparative to their assets, gauge by a high book-to-market ratio. They tend to be shares of firms with very high income progression and development over past years. Thus Value shares are more risky and unsafe than growth shares as encapsulated in Figure 4.8.

Fama and French (1993), in their study posited that the observed irregularities are considered of the fact that there is more than one kind of risk, to wit, market risk, book-to-market ratio, firm size, etc must also be considered.

The deduction of Fama and French (1993) indicating that book-to-market equity and size are the most important factors in clarifying stock yields for the US had consequences for the CAPM. Fama and French (1992) in their cross section regressions analysis, show that the time series regressions of the book-to-market and size factors can clarify the changes in mean yield through stocks. The portfolios (for bonds) for the term structure factor encapsulate most of the difference in the yield on their treasury and corporate bond portfolios. The conclusions of their research suggest that the CAPM was unstated and more weight should be put on book-to-market equity and size in any novel model. The key weakness in their research work is the fact that not all risk factors have been recognised and explained accurately. It is tricky to take for granted that investors have superior facts about the risks connected with shares than the academia has.

4.9.6.2 The four-factor model of Carhart (1997)

Another exciting feature-based method in calculating a multifactor model of risk and return is the Carhart (1997) four factor model. His data for the research work includes diversified equity funds determined monthly from January 1962 through December 1993. In a mean calendar year, his sample includes five hundred and nine funds with mean full net assets of two hundred and eighteen million dollars and average expenses of 1.14% per calendar year. The Carhart (1997) four factor model was an extension of Fama and French's (1993) three-factor model by including a fourth common risk factor postulated by Jegadeesh and Titman (1993) which he described as a one year momentum factor or anomaly that explains the propensity of firms with positive (negative) past yields to make positive (negative) future yields and calculates it by taking the mean yield to a set of shares with the finest accomplishment over the previous year less the mean yield to shares with the poorest yields.

Momentum can be explained as the capacity of portfolio managers to outclass the market over a relatively short time frame of between one to twelve calendar months. The three-factor models of Fama and French (1993) lacked the capacity to clarify cross sectional changes in momentum-adjusted portfolio yields. Chan et al. (1996) submitted that the momentum irregularity is market inadequacy and disorganisation due to sluggish responses to news and facts though the result is strong and healthy to time periods (Asness et al. 1997.

The four-factor model is harmonious with a model of market symmetry with four risk factors. As postulated by Carhart (1997), it may be explained as an effective and functional model in which the coefficients of a variety of factors are utilised to clarify the amount of the explanatory variables that can clarify the changes of the dependent variable.

Carhart (1997) defines the momentum factor- which he labels PRIYR and assesses his four factor model comparative to the CAPM and three-factor model by proposing:

$$(R_i - R_f) = \infty + \beta_1\left(R_m - R_f\right) + \beta_2\left(R_s - R_b\right) + \beta_3\left(R_h - R_v\right) + \beta_4 + PRIYR_t + \in_t \qquad (4.8)$$

where,

$(R_{it} - R_f)$: excess security rate of return (stated as the security rate of return less the treasury one-month risk-free rate of return),

$(R_m\text{-}R_f)$: excess market return,

$(R_s\text{-}R_b)$: size factor, that is, small less big (the changes between the yield on a portfolio of small shares and the yield on a portfolio of large shares),

$(R_g\text{-}R_v)$: the book-to-market factor, to with, high less low (the changes between the yield on a portfolio on high book-to-market shares and the yield on a portfolio of low book-to-market shares),

$PRIYR_t$: the momentum factor (stated by Carhart (1997) as one-year momentum in yield of shares).

Jegadeesh and Titman (1993), more specifically, states that the momentum effect suggest positive serial correlation of yield and occur mainly over a short space of time, say from one to twelve calendar months.

A financial and economic clarification is that the market incorporates news into asset prices only after some point (Chatziantoniou et al. 2016). This is also known as 'low response' to news. Investors might want to make gains from this occurrence if they know that the asset price will only progressively regulate. They could follow the momentum strategy which infer purchasing shares with a good track record in the immediate one to twelve calendar months and fine tuning the portfolio soon enough. Afterwards averagely, investors with portfolio of past success will make superior profit since successful investors will continue to be successful and the failures will continue to fail.

Load fees and Fund performance are robustly and adversely associated almost certainly due to higher full transaction outlay for load funds. While holding expense ratios steady, as stated by Carhart, load funds do less than expected compared to no-loads funds by nearly eighty basis points per calendar year. The proof in their study to reinforce the presence of share-picking skill of mutual fund manager is negligible. The funds that he verified established alphas that are slightly different from zero. His research work extends the present literature by adjusting for survivor bias, and also by recording shared factor and cost based reasons and clarification for mutual fund persistence.

4.9.7 Empirical research and criticism of multifactor risk models

The examination by Fama and French (1993) established a regular form in mean share yields not clarified by CAPM and so characteristically suggested to as irregularities or anomalies. Their data for the research was a wide-ranging sample of US data from 1963 through 1992. In recent times, Davis et al. (2000), Titman and Wei (2001) have made some efforts to repeat the outcomes by utilising extended past data.

Conversely, Kothari et al. (1995) posits that a considerable part of the variation and changes of the three-factor model is traced to survivor bias. The data resource for book equity comprises of unbalanced number of high book-to-market companies that endure distress, in which the mean yield for book-to-market companies is exaggerated. A further opinion is that irrational investors could be the grounds for the misspecification of the model excessive active response that gives rise to cheapened troubled shares and overrating of growth shares (Haugen 1995,2001).

Jegadeesh and Titman (1993) recorded the extension of the short-term yields. An additional weakness of the three factor model is that it cannot give reasons to justify it. The momentum effect, as defined, infer positive serial correlation of yields and appears mainly over short time frame of approximately one to twelve calendar months as we noted above. Conversely, the four factor model considerably enhances on the mean pricing mistake of the three-factor model and the CAPM. The three-factor model enhances on the mean pricing mistakes from the CAPM, in view of the fact that it incorporates two factors, to wit, the book-to-market equity and size factors.

On the other hand, the four factor-models decreases the mean pricing mistakes comparative to the three-factor model signifying that it properly explains the cross sectional changes in mean stock yields. Size and momentum factors are responsible for the majority of the account. The yields on the highest docile funds are positively and strongly correlated with the one year momentum factor, in contrast, the yields in the lowest docile funds are negatively and strongly correlated with the factor. Out of the sixty seven basis point increase in average monthly yield from dociles one to ten, the momentum factor elucidate thirty one basis point, or nearly fractional.

The effect of Carhart (1997) submit that of the momentum suggested by Jegadeesh and Titman (1993) in their research work, mutual funds do not go along the route of the momentum approach nonetheless are funds that by chance turn out holding past year's frontrunners. He finished off that transaction costs can only clarify the out of the ordinary deficit of the least good funds as long as these funds in addition possess greater cost per business deal.

5. Application of Modern Portfolio Theory (MPT) and Capital Asset Pricing Model (CAPM) to Bank Portfolio Management

The modern portfolio theory, for many decades, has been the portfolio means broadly deployed by equity portfolio managers. It also gives a very helpful structure for handling credit and bank loan portfolios. The customary method to bank loan portfolio organisation and administration is the 'originate-and hold' approach. Financial institutions keep their loans in their balance sheet until they season. However, of recent, banks are discarding this customary method and put into operation the 'efficient portfolio' method by augmenting the risk-adjusted yield. The applications of the modern portfolio theory on bank credit and loan portfolios have to do with many teething troubles.

The behaviour of financial intermediaries was investigated by Pyle (1971) as well as Hart and Jaffee (1974) in their classical research work. They demonstrate that the mean-variance theory (the E-V rule) developed by Markowitz (1952) to examine the combination/diversification of dangerous assets in order to downgrade there risk (that is, the variance of return) can provide a useful means for modelling the organisation of bank portfolio. The record in the balance sheet of a bank can be processed in likewise manner as a portfolio of a specific investor. Proportional relationships or conditions such as solvency ratios, liquidity ratios, reserve provisions, short-sales provisions, etc cannot be brought in as a linear limit on the distinct records of the bank's balance sheet. In his classical work, Szego (1980) examined portfolio theory and its relevance to bank asset organisation and administration. In practice, there is no exclusive risk-free rate. Rather, it is taken for granted that: (a) The risk-free rate for amount borrowed is greater than the risk-free rate for loans for ordinary and normal investors and (b) The risk-free rate for amount borrowed, which is, rate paid on deposits, is less than the risk-free rate for loans, which is, interest on loans, for banks. In addition, banks beside the point neither mobilise unlimited deposits nor apportion limitless loans.

Szego (1980) creates new model with these limitations. He demonstrated, with alteration, the CAPM and the E-V rule are helpful and sensible in bank asset organisation and administration.

Three other issues, to wit, unobservable yields and correlations, non-normal yields etc were identified and analysed with the application of modern portfolio theory to credit portfolio management by Altman (1996) and Smithson (2003) in their the research work.

One of the propositions of modern portfolio theory and CAPM is the normal distributions of yields. As postulated by Fama (1971), non-normal yield is not a significant setback for equity portfolio in as much as the distribution is balanced and steady. The distribution of yield for loans and bonds on the other hand, is generally inclined to be not only normal but rather irregular. To a greater extent, precisely, the spread of statistics or distribution is left-hand tilted. The submission of Smithson (2003) is to the effect that the mistakes made by equity portfolios managers by not paying attention to the deviation from normal distribution of yields are not enormous since equity portfolio managers seem to pay attention to the area surrounding the mean.

On the other hand, portfolio managers in charge of credit concentrate on the tail region of the distribution in which a little miscalculation in the details of the distribution will have an enormous effect. Consequently, the portfolio managers in charge of equities cannot simply disregard the non-normal return drawback. Several methods have been designed by a range of risk models to address the drawback.

As an example, the Credit Suisse Group launched the Credit Risk + Model several years ago (Smithson 2003). Its fundamental principle is the Poisson spread of statistic with a long right-hand tail that looks like the spread of statistics of the credit assets. Other complications to put into operation the modern portfolio theory to portfolio management in credit are the yields and observable covariance among asset yields. Majority of bank loans are not bought and sold or are bought and sold over-the-counter at irregular intervening period of time. Not much of past pricing or bulk high velocity data are accessible. Where this is available, expected yields cannot just be employed as past yields since past data does not suggest credit risk. Likewise, the default probability cannot be deduced straight from past yields, because of that, the supposed yields is assessed with other methods. Significantly, the supposed yield of a credit asset is contingent on its supposed losses due to failure to pay back debts owed. The assessment of the supposed yield and unpredictability of a credit portfolio in general encompass the computation of the likelihood of failure to pay and the rate of recovery for every single, separate credit asset inside the portfolio and the covariance of failure to pay for these assets. Several high-level methods have been worked out to accomplish this goal. Comprehensive examination of these methods and the credit risk pricing models are not looked into since they are further than the range covered in this thesis.

In the research conducted by Stevenson and Fadil (1995) on whether modern portfolio management can be successful for commercial bank loans and assets, they augmented a real portfolio of approximately one thousand four hundred syndicated loans to demonstrate how modern portfolio management can be effective for commercial loans and credit. Their sample data spanned from January 1992 through March 1994, it was extracted from the Loan Price Corporate Dealscan database that contains comprehensive information on public debt rating and all-in-spread with restricted information on the borrowers. Risk is calculated as the instability of losses. The all-in-spread is computed by totalling the up-front and annual charges to the legally agreed range over Libor. The yield of all loans is calculated as: all-in-spread over Libor less the likely losses, this is replicated taking into account the default risk connected with the public rating of the debtor and the deficit criticality related by means of non-accruing commercial facilities. They effectively put together an efficient frontier. The outcome of their research submitted that a bank can boost its portfolio yield short of acquiring additional risk by piecing together a better efficient portfolio.

To state the main points, the modern portfolio theory is relevant to bank portfolios with fitting alterations and adaptation. In practice, banks are now known to manage their portfolios on the foundation of mean-variance theory (E-V rule) or risk adjusted return.

Notwithstanding that they are not talked over in specifics in this place, a variety of multivariate models for portfolio credit risk and complex methods have been built and expanded to effect modern portfolio theory to bank credit portfolios, to wit: KMV model, Credit metrics model (Gordy 2000; Crouhy et al. 2000; Frey and McNeil 2000), model of

Li (credit metrics monitor 1999) and pricing models for evaluating credit risk (Litterman and Iben 1991; Jarrow and Turnbull 1995; Jarrow et al. 1997; Kijima and Komoribayashi 1998; Duffie and Singleton 1997). Therefore, this work see credit derivatives as a means to skilfully administer bank portfolio persistence and return/risk arrangement in the context of modern portfolio theory and demonstrably examine whether credit derivatives have enhanced or added value to bank portfolios risk adjusted returns.

6. Financial Derivatives and Bank Regulation

The recent credit crisis raised a lot of worry about the financial stability of the banking system and the level of regulation of the banking system and the securities markets. In their investigation of the declining of the banking system risk control system in the U.S. during the 1980s, Galloway et al. (1997) find that banks with better charter value had more self-control with low risk exposure compared to banks with lesser charter values. Banks with lesser charter value also took higher risks from the start of the 1980s through the early 1990s. They used a sample data of eighty six commercial banks which was classified into four periods covering: from 1977-1994, that is, 1977-1979; 1980-1982; 1983-1989 and 1990-1994 spanning the pre-deregulatory, deregulatory, post-deregulatory, and re-regulatory periods, they used Market-to-book-equity ratio as a substitute for bank charter value and consequently bank risk-taking incentive. They show that charter value was a voluntary risk discipline factor suggesting that it should be included as a predictor for banking problems and solvency.

Nolan (2006) investigated the use of derivatives by banks; they raised significant issues on the regulatory capital treatment of these derivatives transactions in addition to how they are treated within the group due to operational intricacies due to the rapid growth and expansion of banks and their increased risk appetite.

7. The subject of concern

We have reviewed literature on the survey of credit research, modern portfolio theory and its transition into Capital Asset Pricing Model, the implementation of Modern Portfolio Theory to bank portfolios, and the determinants of bank performance. Modern portfolio theory has been extensively utilised in portfolio administration and is confirmed to be valid to bank portfolios. Credit derivatives could function as valuable means in making it easy for the application of Modern Portfolio Theory to bank portfolios. Moreover, the diversification of bank through credit derivatives is not inhibited by the issues discussed by the traditional means of bank diversification.

To this degree, credit derivatives may have beneficial effect on bank portfolio functioning and operation. In spite of this, our review of the investigations by Duffee and Zhou (2001) and Skinner and Diaz (2003) show otherwise. Duffee and Zhou (2001) posit that banks may struggle if the ushering in of the credit derivatives marketplace brings about a failure of the combining symmetry in the loan-transaction marketplace. Skinner and Diaz examined the undesirable elements of CDS connected with the Asian debt crisis, which could be as a reason of moral hazard. For CDS connected with the non-Asian debts, they discovered beneficial elements for banks that buy protection, notwithstanding that it is not analytically meaningful.

The connection linking credit derivatives and bank working effectiveness is in the final analysis an issue characterised by observation and experiment instead of theory. It is a considered opinion that credit derivatives make available beneficial means for bank portfolio administration and organisation, as substantiated by the Modern portfolio theory and pragmatic investigation on the diversification of bank. However, the specific gaps, limitations and unresolved issues in the literature are looked at in detail in the empirical section, to wit, (a) whether the usage of credit derivatives affects bank investments and portfolio performance, (b) the effects of the use of credit derivatives under different macro-economic environment especially in the light of the credit crisis of 2007 to 2009 and the subsequent contagion up to 2011, (c) whether buying credit derivatives reduces the standard deviation (risk) of bank investment and portfolio performance (d) whether selling credit derivatives increases the return of bank investment and portfolio performance and (e) whether buying credit derivatives causes more bank defaults.

The issues bothering on moral hazard could create some difficulties for banks, to wit, additional non-payment of loans and escalation of premiums priced by protection sellers. The escalation of premiums is not as much an issue as the problem thrown up by moral hazard to bank working effectiveness. Where the protection seller asks for more premiums to offset for the possible deficiency as a result of moral hazard, the protection buyer will not be disposed to buying the high-priced safety protection. The protection buyer has the facts and statistics advantage on the primary assets and will only consider buying cheapened credit derivatives instruments. Conversely, the non-payment of loan due to moral hazard could be very bad and undesirable factor on bank portfolio operation and administration.

Furthermore, the past record number of asset write down, defaults and bankruptcies in 2007 and 2009 presents an exceptional chance to investigate whether credit derivatives have assisted banks to treat the surge in credit risks during a financial crisis. Banks transacting in credit derivatives could deal with their credit risks successfully than other banks, and because of this, banks with credit derivatives succeed in having a higher standard of performance in contrast to banks that do not deal in credit derivatives during a financial and credit crisis.

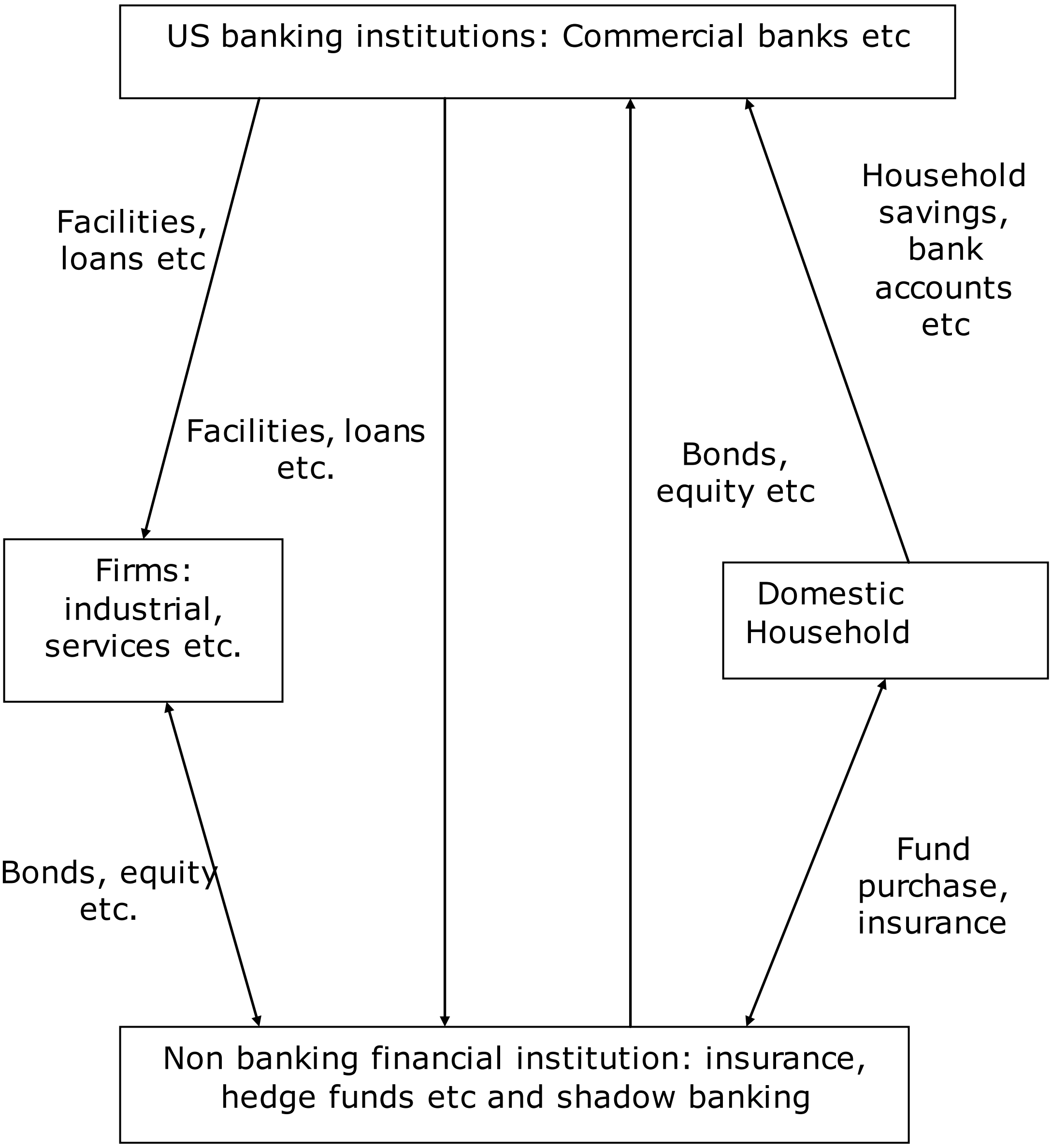
8. Theoretical Framework

Having now provided the background as to why firms use credit derivatives for portfolio enhancement and diversification, this section presents the theoretical framework which is captured in figure 4.9 below and supporting evaluation methods and criteria developed from a review of the literature on innovations in credit risk transfer and in particular why banks are likely to use credit derivatives, Insterford (2005). Credit derivatives can be classified into two different classes: first, the default and then the spread products, specifically. This research will focus more on the default products. The default product is an instrument which payoff depends on a predetermined credit event related to a specific reference obligor; the events might encapsulate the following: failure to pay interest and principal of a loan, obligation default, obligation acceleration, bankruptcy, restructuring, moratorium/repudiation and changes in the credit ratings below given benchmark or changes in the credit spread alters the payoff of the spread product (ISDA). The spread product is a credit spread contracts payoff based on the creditworthiness of the reference asset; default is thus one state in a continuum of creditworthiness (Ayadi and Behr 2009).

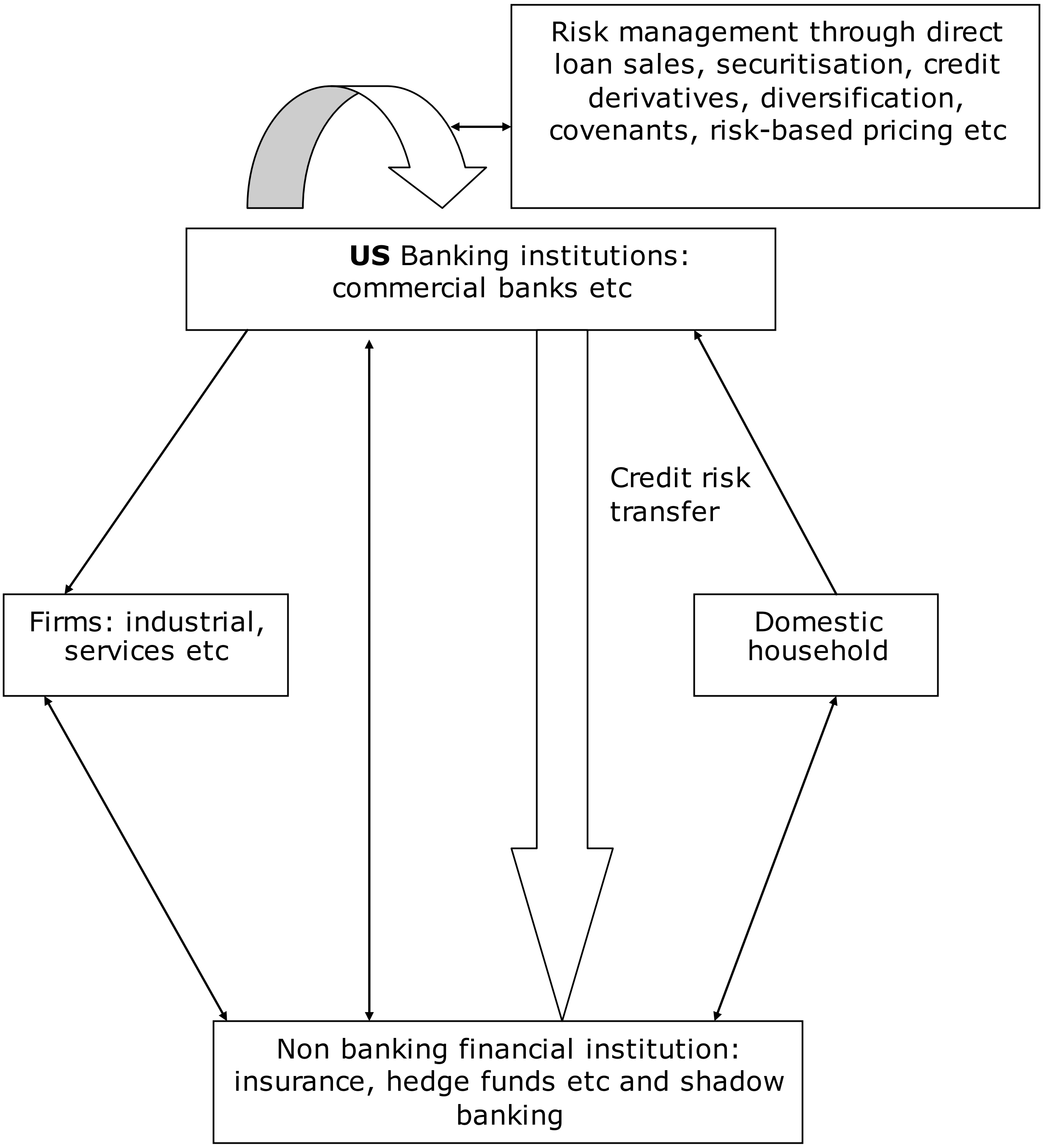
As explained earlier, the predetermined credit event in a credit derivative contract is defined in relation to a reference credit which can be an underlying bond, loan or any other baskets of financial asset. Where a credit event happens as defined in a contract, then the counterparty will redeem his obligation by paying a default payment, which is an important characteristic of most credit derivatives contracts. A typical credit derivatives transaction involves a buyer or seller of credit protection who are usually referred to as protection buyers and protection sellers.

Figure 4.9: Theoretical framework

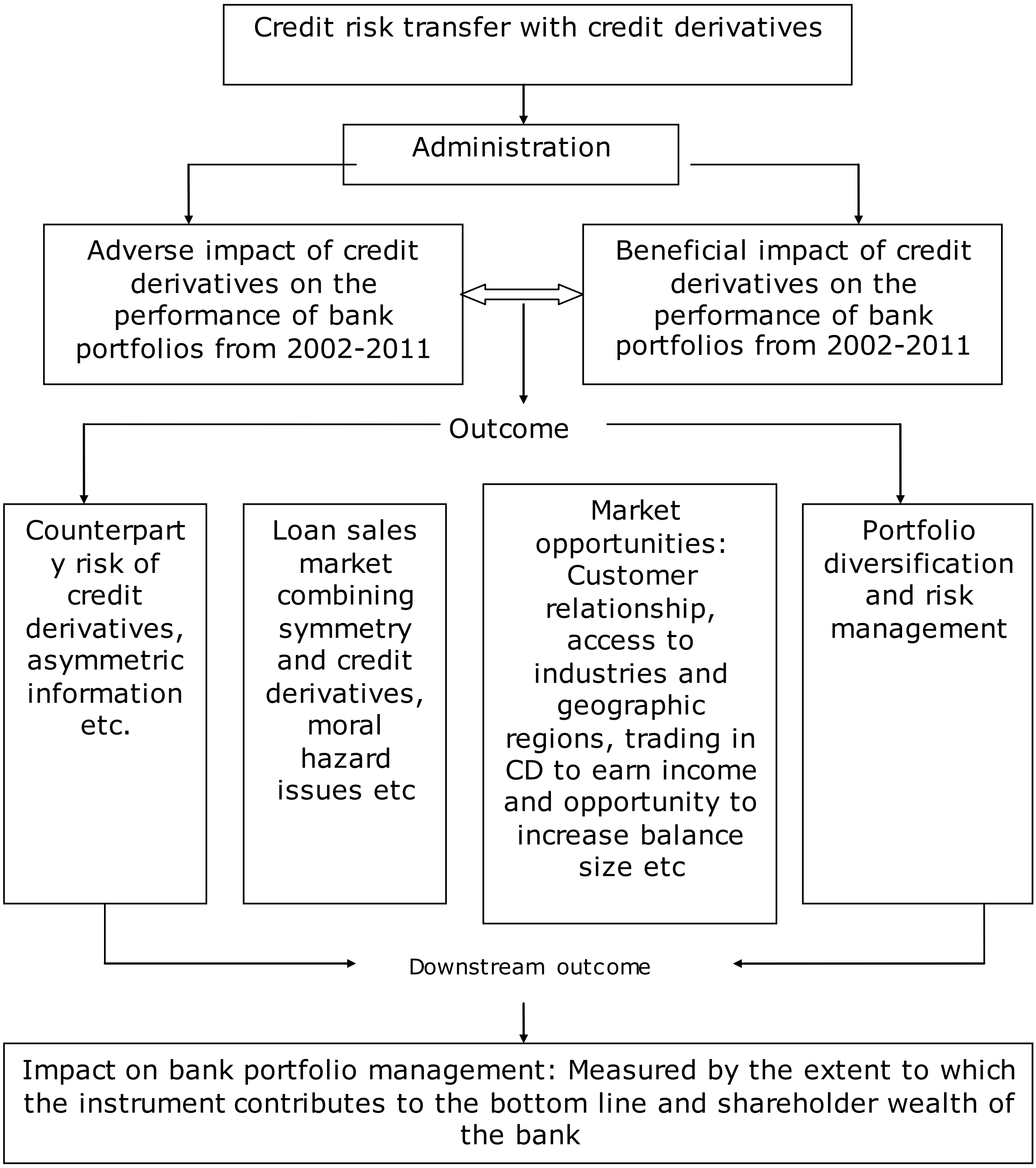
Theoretical framework (I)



Theoretical framework (II)



Theoretical framework (III)



9. Summary

This chapter discussed the overview of credit research, risk management and financial derivatives, portfolio theory and its application to bank portfolio management, credit derivatives and bank risk management. The chapter also reviewed the literature on the use of credit derivatives and its impact on the regulation of the financial system. Going forward, this research will now test the connection linking credit derivatives and the working effectiveness of banks and the management of bank portfolios. Chapter 5 discusses the methodology of this work.

CHAPTER FIVE

METHODOLOGY

5.1 Introduction

This chapter describes the methodology and methods used to address the primary and secondary research questions: (1) Analyse if the usage of credit derivatives affect the performance of bank portfolios persistence, risk and return; (2) Examine what motivates banks to use credit derivative instruments; (3) investigate the influence of the use of credit derivatives in varied macro-economic situations taking into consideration the credit crisis of 2007 to 2009 and the contagion effects to 2011; (4) investigate whether purchasing credit derivatives decreases the total risk of bank portfolios; (5) test if selling credit derivatives increases the return of bank portfolios; (6) test if buying credit derivatives causes more bank defaults; and (7) perform and analyse sensitivity analysis across banks depending on the size, ownership etc.

The rest of the chapter is organised as follows: The research philosophy applied in the study, measurement issues relevant to the definition of bank portfolio performance, research questions and hypotheses. We then summarise the models, explain the dependent variables, independent variables and explain the research design.

5.2 Selecting the Suitable Methodology: Methodological Issues

Research philosophy refers to the investigation of the way of finding and getting knowledge, the development of knowledge, their theories and the plausibility on which they are based (Hughes 1980; Creswell 2009). Its nature can be thought of as follows:

(1) Epistemology;

(2) Ontology; and

(3) Axiology.

Epistemology is related to the nature of knowledge and what constitutes acceptable knowledge in a field of study. Ontology is concerned with the nature of social phenomena as entities that are to be admitted to a knowledge system while axiology is concerned with judgement about value, Saunders et al. (2007).

The debate about the nature of knowledge and the philosophy of research has gone on for many centuries. Different arguments and theories have been advanced on the practice of research by philosophers pitched into different camps (Walliman 2001). These groups are positivist, relativist and Interpretivist. Collier (1994) in Walliman (2001) posits that:

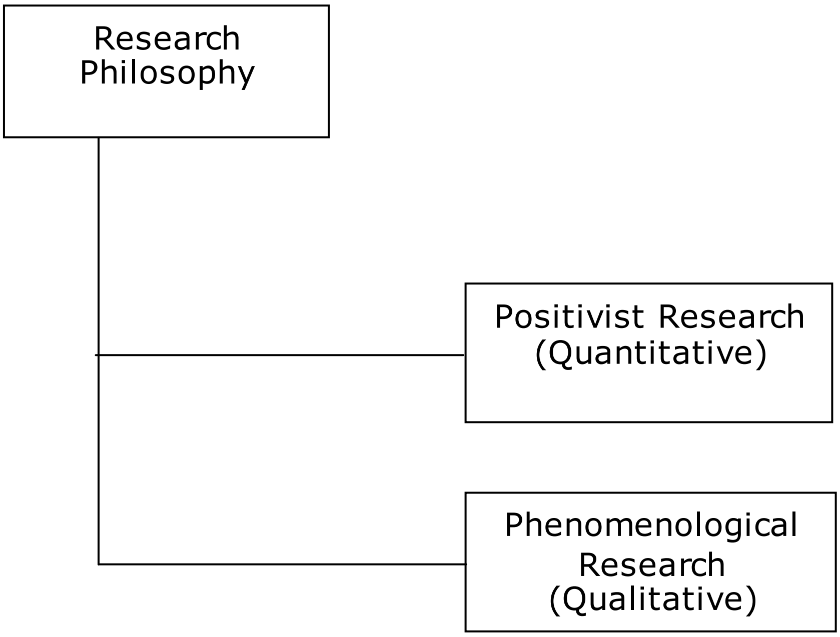
"The alternative to philosophy is not philosophy but bad philosophy. The 'unphilosophical' person has an unconscious philosophy, which they apply in their practice-whether of science or politics or daily life".

We are all taken as philosophers because we have a concept of the world we live in. Issues, concepts and ideas can be critically investigated and made clearer where philosophy is seen to work. To do a critical evaluation of a research, a philosophical bent is advocated (Grazano and Raulin 1993). This is necessary to enable the researcher to dissect the underlying assumptions upon which reports are based when there seems to be no agreement. The researcher would then be able to gauge the appropriateness of the methodology used and the validity of the hypotheses and conclusions. Clearly, the divergent views advocated by philosophers have centred on the link between data and theory. The consensus is that these issues enhance the quality of a research. Philosophical issues are important in social sciences and management for the following reasons (Frankfort-Nachmias and Nachmias 1996; Bryma 2004; Burns 2000):

1. It enables the researcher to construct and articulate their research designs. A research design is the programme that guides the researcher to collect, analyse and interprets observations and data in order to achieve research objectives;
2. Researcher is able to streamline the scope of their work to avoid spurious results and helps to set defined boundaries for proper time management; and
3. The knowledge of the philosophy of research assists the researcher to adapt to the constraints they may encounter in their research designs. It also helps them to broaden their knowledge of structures, concepts, theories and subject.

Several views have been canvassed especially in the social sciences about which philosophical position or method should be used between the two main traditions in philosophy: Phenomenology (Hughes and Sharroack 1997) and Positivism (Cohen and Crabtree 2008).

Figure 5.1: Research philosophy



Source: Appignanesi (2005)

5.2.1. Phenomenology

Phenomenology as a discipline has been practiced in various forms for hundreds of years. The 20th century contributions of G.W.F Hegel (Hegel 1830; Taylor 1975), Martin Heidegger (Murray 1978), Jean Paul-Sartre (Aronson 1980) and Simone de Beauvoir (Appignanesi 2005) sparked a healthy debate among many philosophers which has continued to the present day.

Basically, it is understood in two different ways: a disciplinary field in philosophy or as a movement in the history of philosophy. Some of these issues have centred on intentionality, consciousness, qualia and first-person perspective philosophy of the mind (Hughes and Sharroack 1997). Intentionality is the study of the intentional activities of man which includes embodied action, bodily skills, cultural context, language and other social practices and social back ground. Quale is the sensory data that appears in the mind of man such as objects, clear and concise ideas, noise etc.

Hegel (1807) in Hughes and Sharroack (1997) postulates that phenomenology is the study of a "phenomena". The appearances of objects, ideas, events, tools, the flow of time, the self, images etc, the way we experience them and the meanings they make to us. He called this "dialectical phenomenology". For example, the late footballer, George Best could be likened to a phenomenon because of the glory he brought during his football playing days. On the other hand, Husserl et al. (1900) in their popular book "Logical investigations", likened phenomenology to "descriptive psychology", the intentional structures of mental acts and how they are directed at both real and ideal objects, ideas, etc. To him, phenomenology is the study of the "essence of consciousness as experienced from the first- person point of view". That is, the importance and features of what we experience first hand.

On the contrary, Heidegger (1927) in Hughes and Sharroac (1997) disagreed on the posturing of Husserl as it overlooked the "basic structural features of both the subject and object of experience". He expanded phenomenology to include the method of the study of ontology, the experience of being. The different views canvassed by Husserl and Heidegger influenced the development of existential phenomenology and existentialism in France as argued in the work of Jean-Paul Sartre and Simone de Beauvoir.

Phenomenology is a qualitative approach in methodology which is not considered suitable for this research.

5.2.2 Positivism

Auguste Comte (1853,1877) in Mill (1961) who is regarded as the first true sociologist, refers "positivist philosophy" to that perspective that has made the following claims:

1. The only authentic knowledge is scientific knowledge; and
2. That such knowledge can only become positive affirmation of theories through scientific method.

The positivism view is sometimes referred to as "scientisism" or scientist ideology (Hughes 1990). The postulations of Comte have intrigued many thinkers and writers which have pitched them into two camps (positivist and anti-positivist).

Interestingly, the two camps see sociology in two lights. First, sociology is a science.

Popper (1959) in agreement with positivists contends that sociology can be scientific if it is made to follow scientific procedure. This can be justified if the research can generate evidence and have testable hypothesis.

The other camp disagrees with this assertion and states that sociology is not a science.

Kuhn (1962) supports the anti- positivist. He was of the opinion that sociology cannot be a science as sociologists cannot be said to agree on one paradigm. Keat and Urry (2011) support the opinion of Popper (1959). From their perspective, the underlying structure of society is developed by sociology which can be evaluated with empirical evidence. They find support in Durkheim (1897). He argued that science is a study of "things" and sociology and social sciences should not be an exception. He pointed out that objectivity is achievable within sociology by adopting a "scientific" methodology. For example, this can be generated through "social facts" e.g., statistics of death through cancer, statistics of school drop out between male and female, statistics of divorce among university lecturers in England, the number of immigrants in Bournemouth etc.

Weber (1948) differed with Keat and Urry (2011). He asserts that sociology cannot guarantee complete value-freedom or scientific objectivity, finding support in Gouldner (1971). From his findings, he concluded most sociologists commit themselves and are directed by a specific set of "domain" assumptions.

The arguments in support of positivism have been criticised on the premise that man is a subjective being; therefore it would not be feasible for research to be subjective. On the other hand however, the anti-positivism school of thought have been criticised on their positions on the fact that it is possible for a research to be biased due to the subjectivity of the researcher where all or part of the result of the research has been predetermined. Therefore, the outcome could be "fictional".

The research methodology of the anti-positivist is through participant observation (Devlin et al. 2006), unstructured interviews (Miller et al. 2001) and interviews (Clough and Nutbrown 2012).

The research methodology of the positivist is through experiments (Hughes 1990), structured surveys and questionnaires (Blumberg 2001), regression analysis (Black 1999) etc. This is based on the assumptions that:

i. The person undertaking the research is independent of the research study;

ii. The researcher should in effect have the freedom of choosing the area of research, aims and objectives rather than by human conviction; and
iii. The analysis arising from the research aims and objectives should be made simple and easy to understand.

5.2.3 Research framework

Essentially, the study mirrors and envisions the positivist or scientist ideology (Hughes 1990), which is premised on its immense dependability and accuracy of research result.

The focal point, therefore, of the methodological approach for this PhD work is wholly quantitative.

The quantitative methodological approach provides an understanding of phenomenon that is puzzling and mystifying by making it cloudless through theoretical model development, inferences testing, and evaluation of hypotheses formulated based on logic, reason and arguments presented from the theories discussed in the literature review. Interconnections and relevance are adduced based on currently accepted hypotheses which are tested with numerical data.

The collection, analysis of empirical data and the application of appropriate statistical test is preceded by the hypotheses formulation. The data used in this study was sourced principally from the United States Federal Deposit Insurance Corporation (FDIC), The United Office of the Comptroller (OCC).

There are three types of quantitative methodological approaches -descriptive research, comparative research and prescriptive research (Black 1999; Hardy and Bryman 2004).

5.2.3.1 Descriptive research

Put simply, it is the use of frequency, histogram, standard deviations and multivariate techniques to describe phenomena with the use of numbers (Black 1999). This method has some drawbacks like lack of comparison between groups and it does not envisage the outcome of the analysis.

5.2.3.2 Comparative research

Basically, comparative research is often used when the research involves secondary analysis of historical data. Comparative research involves two strategies which are:

- The study of events or groups that differ in many ways but have one thing in common, for example, different countries that have experienced coup d'état in Africa and Asia, and
- The study of societies or groups that have high similarities but are still different in one major respect, for example, the G8 countries that account for roughly 65% of the world economy (United States, Canada, France, Germany, Japan, Italy, Russia and the United Kingdom) and their different educational systems (Black 1999).

Comparative research compares statistical data between two or more groups. For example,

$$y = a + b_{x1} + c_{x2} + c_{x3} \tag{5.1}$$

where, y is the dependent variable, a is the intercept , $x1$, $x2$, $x3$ are the independent variables while b and c are the slope of the independent variables.

Comparative research helps management to compare techniques in order to isolate the determinants of say, the pattern of labour turnover in different departments.

5.2.3.3 Prescriptive research

Prescriptive research is the use of models to predict and verify an issue (Vogt 1993). For example, the use of ordinary least square, logistic regression to predict the determinants of capital structure, the reasons why banks fail, the extent to which banks use foreign exchange derivatives to hedge foreign exchange risks, the determinants of multinational companies in expanding to other territories, why banks use credit derivatives etc. To be meaningful, the models used in a prescriptive research must be able to analyse mathematical equations and be explicit. The researcher must be able to interpret the models so that a third party or a layman can understand the result of the research.

In dealing with some inherent problems in regression analysis, some attention would have to be given to some associated principles, for example, measurement errors in panel study are very likely to occur in panel data of firms, households, individuals etc. (Baltagi 2001) .To ascertains that the reasonableness and assumptions of the models built are met; statistical and mathematical tests are applied in evaluating them. The desirable properties of objectivity, reliability, competence and effectiveness of the estimated coefficients of the models are satisfied only if these assumptions are met. Due to the stochastic relationships of regression equations, they must be modified to include a random disturbance or error term.

5.2.4 Statistical tests

As noted by Baltagi (2001) and Gujarati (2003), the most widespread difficulties connected to regressions using panel data study are multicullinearity, heteroskesdacity, random effects, cross sectional dependence, serial correlation, unit roots/non-stationarity etc. We shall make a diagnosis of these in Chapters 7 and 8.

(a) Heteroskedasticity

A number of restrictive assumptions are usually made when using econometric techniques such as multiple regression analysis, panel data analysis etc. Simply, statistical tests of significance can be contradictory and ineffective with the existence of heteroskedasticity in a subdivision or subset of a population where it is assumed that the effect and residual (error) variances do not have causal relationship and are not normally distributed, this can make the regression analysis to produce wrong results that may lead to spurious inferences with the hypotheses test (White 1980; Gujarati 2003).

For example, it is assumed that the error or stochastic term has a constant variance. This may not always be true, for example, if the error term is even selected from similar probability distributions. Further, it is assumed that the disturbances in standard error component of panel data model have homoskesdastic variances and constant correlation through the random effects (Baltigi et al. 2010; Tsay and Ando 2012). However, the assumptions may not hold if, for example, the robustness of the results from the cross-sectional units and regression varies in sizes, as a result, this may exhibit heteroskedasticity. Heteroskedasticity can be tested by means of Breusch-Pagan test.

(b) Multicullinearity

Generally, this not regarded as a statistical or mathematical problem but rather the problem lies in the correct interpretation of the coefficients. In regression analysis or panel data analysis, it is assumed that none of the independent or explanatory variable should be highly correlated with one or more of the other independent variable; multicollinearity becomes a problem where this assumption is violated, the effect on the dependent variable becomes difficult to isolate (Gujarati 2003).

In a situation where the R^2 equals to 1 when one explanatory variable is regressed on the other explanatory variable, then the dependence and interrelationship among the explanatory variables is singular with no unique solution for the coefficients. However, if the variables are only highly correlated but not perfectly correlated, the standard errors may be large or possibly the t-ratios could be very low though there exists a solution for the regression coefficients but the estimates while unbiased, are unstable. The confidence intervals of the parameters are thus very wide. The resultant effect is that it becomes difficult to isolate the effects of the explanatory variable on the dependent variable. Multiculliniarity can be tested and overcome by rationalising the violating variables, additional data gathering, use of analytical procedures etc.

(c) Non-stationarity

In economic forecast and financial market analysis, for instance, Gross Domestic Product, asset prices, exchange rates, macro economic indicators etc non-stationary data and series used often display non-deterministic gradual movements or the same trends, random walks, cyclical and secular, over a time frame etc or non-stationary variances which in most cases show spurious results that may indicate or assume the relationships between two variables where none does not exist. In order words, they may show high correlation and a large R^2 value which may make it difficult to specify a model. In real world however, it is rare to find a series or data that is truly stationary. The three most popular methods of modelling non- stationary series are (Intriligator 1978):

- A deterministic function of time;
- An explosive autoregressive moving average process; and

- A unit root or integrated process. Put simply, autocorrelation analysis and unit root tests.

(d) Autocorrelation

Time series data display some changes over some frequency, usually slowly. One of the assumptions of regression analysis is that the covariance of two adjacent stochastic disturbance terms is zero (Gujarati 2003).

This is to ensure that the dependent variable depends only on the explanatory variables and not on stochastic disturbance terms. Where the covariance is not zero, then the assumption is violated. In order words, where the disturbance term in one period is positively correlated with the stochastic disturbance terms in the previous period, a research faces the problem of first-order autocorrelation (also referred to as lagged correlation or serial correlation) with the consequences of biased standard errors; this will result in the hypothesis tests and confidence intervals being flawed. In order words, this will lead to spurious statistical tests and confidence intervals, disturbing the model by reducing the number of independent observations. For example, the null hypotheses would be rejected when it should be otherwise and the confidence interval would be too restricted thus giving an erroneous impression of accuracy. Autocorrelation can be detected with the test of the Durbin-Watson Test.

5.2.5 The models to be assessed

Under this section, the statistical and mathematical tests that will be used in subsequent chapters will be discussed. In chapter 6, we discuss the data analysis methods and data analysis procedures. In chapter 7, we focus on the accuracy and error testing, statistical data analysis, descriptive test analysis, correlation, multicullinearity, stationarity and the empirical tests of the hypotheses. The chapter is about the analysis and test of the determinants of the use of credit derivatives by US banks for the period from 2002 through 2011. We try to investigate if a bank is less likely to purchase credit protection if it has more capital and quality asset, if a bank is more likely to purchase credit protection if it is larger (size) and has more diversified loan portfolio, test if banks with consumer loans are less likely to purchase credit protection since they can be sold or packaged and securitised and if banks reporting other types of derivatives are more likely to use credit derivatives for protection.

The fact that the results are mixed encourages us that there are sufficient grounds enough for us to explore the effects on the risk, return and the impact of these instruments on bank portfolio in chapter 8. Altogether, we applied forty two random effects logistic models in chapter 7: an extension of the model used by Minton et al. (2009). In chapter 8, we concentrate on a further extension completely omitted by Minton et al. (2009) to expound and make clear the impact and effectiveness of credit derivatives on bank portfolio persistence, risk and return during the time under review.

5.2.6 Measurement matters

This segment deals with measurement subjects connected to the dependent and explanatory variables.

5.2.6.1 Banking portfolio efficiency and effectiveness

The lending portfolio structure of banks, generally, consists of facilities such as retail, commercial, corporate, institutional loans to their customers representing various segments of the economy etc. In more detail, according to the FDIC, a bank portfolio, in addition to credit risk assets, includes other assets, deposits base and other liabilities, equity capital, and off-balance-sheet activities, for example, derivatives transactions.

Where a bank is known as a one shop financial supermarket consisting of subsidiaries of more than a bank or a group of banks, they are classified as bank holding companies by the FDIC. Its consolidated accounts would consist of a combined portfolio of the banks which may include offshore assets and liabilities.

This study will examine banks with a cut-off of $500 million in asset base and above. This will effectively have a wider sample not captured previously by other studies.

In the seminal work of Oldfield and Santomero (1997), financial institutions risk management strategy in managing their portfolios can be decomposed as follows:

(1) Eliminate risks that are not necessary in the course of business;

(2) Transfer risks to other financial institutions rather than sharing them; and

(3) Actively manage risks that are embedded within the business with the assumption that it cannot be fully eliminated.

The overriding principle of banks is to reduce risk to the barest minimum while targeting maximum returns on their investments (Naik and Yadav 2003). As discussed in

Chapter 4, despite their drawbacks, the capital asset pricing model (CAPM) and the modern portfolio theory (MPT) have been very useful in portfolio selection and management. Though there applications to bank portfolio management have been in practice for many years, they were not fully deployed as a tool until the advent of the credit derivatives trading and the underlining subprime assets and liabilities.

As discussed in chapter 4, Markowitz (1952) developed the mean-variance theory (also known as E-V rule), which is used to analyse the combination/diversification of risky assets in order to reduce their risk, that is, the variance of return. Again, as discussed in chapter 4, the comfort zone in which investors usually like to be placed is called the efficient frontier, the place where their mean-variance combinations is maximised and their risk is well diversified (Halliwell 1995).

The E-V or mean variance theory is not without debates though widely settled in the academia and in practice. Put simply, E-V assumes that: Investors do not like to take risks and that the reason for portfolio selection is to maximise the risk-adjusted return of their portfolio.

In this work, the performance of bank portfolio persistence, risk and return will be defined as there risk adjusted return, that is, the standard deviation or absolute deviation of their returns on asset (ROA). This study will follow the E-V supposition/dictates.

In practice, a lot of financial ratios are used to gauge the risk and return of a bank's portfolio, among which are profitability ratios, balance sheet ratios and Solvency ratios.

In this work, the dependent variables in chapter 8 that will define bank portfolio return are the return on asset, the risk adjusted return on bank portfolio (the portfolio risks), and the provisions on loans to total loans (the net charge off to loans).

5.2.6.2 Bank Portfolio return

The return on asset (ROA) and return on equity (ROE) are some of the most widely used profitability ratios to measure bank portfolio returns.

Return on assets (ROA) can simply be defined as the level or extent in which the assets of a company were deployed to generate profits. It can also be taken as the net income generated to cover the total assets of the company (Jewell and Mankin 2011). For example, It is one of the indicators used to measure company distress, business failure or bankruptcy etc.

The US FDIC defined it as "net income after taxes and extra ordinary items (annualised) as a percent of average total assets". A healthy ROA of a company is an indicator of managerial efficiency, effectiveness and profitability of the managers.

The return on equity (ROE) is another profitability ratio used in practice. The US FDIC defined it as "Annualised net income as a percent of average equity on a consolidated basis". It is the return generated on capital invested by ordinary shareholders in a company. Simply, it can be taken as the net income divided by the total shareholders equity of a company or the average shareholders' equity (Jewell and Mankin 2011).

Financial leverage is the major difference between ROA and ROE in practice. As a measure of profitability, ROA is preferred over ROE in evaluating banking portfolios, it as an indicator of managerial effectiveness which fits into vision of bank managers to optimise their profit and asset through the deployment of credit derivatives to manage their credit risks, as a measure of risk management. Moreso ROA looks at all sources of funds as a profitability measure. A major drawback of ROE is that it is more complex than ROA due to financial leverage. The use of ROA is supported extensively in extant literature in evaluating portfolio returns (Jewell and Mankin 2011).

5.2.6.3 Bank Portfolio risks

In this study, risk is taken as the average absolute deviation of ROA. This gives us σ and the standard deviation of ROA. This can be represented in a formula as:

$$P = ROA/\sigma \tag{5.2}$$

where, P represents Performance, ROA stands for Return on Asset and σ connotes the absolute average deviation of ROA.

Chapter 6 discusses the data set in more detail. However, there is need to discuss the standard deviation or absolute average deviation of the ROA at this juncture. In the data set, each bank has got a ROA data. The moving standard deviation of the ROA can not be calculated due to the absence of ROA data on daily, weekly or monthly periods. To get over the drawback, the standard deviation of the ROA was calculated by estimating the measure for 40 quarters immediately proceeding and up to the last quarter. This method of computing standard deviation is supported in the literature; Dong (2005) calculated the standard deviation of 29 quarters of past ROA. Equally, Charest (1978) and Reinganum (1981) used this method to calculate the beta of stocks and tests the hypotheses that portfolios with similar beta risks would have similar returns respectively. In theory, beta and standard deviation are positively correlated.

5.2.7 Econometric analysis of data

To respond and satisfy the primary research questions in this work, panel data model is implemented. This involves time-series examination on individual numerous cross-sectional components, to with, entities, companies, states, regions, countries etc over a period of time. Banks examined are the cross sectional units in this research. Each of the banks has time-series studies and scrutiny for the time period covered, that is, they are repeatedly observed over some years spanning the length of the research. Therefore, these types of data allow us to control for unobserved individual heterogeneity that is constant over time.

5.2.8 Advantages of panel data in this study

Panel data has the following advantages in comparison to the real and untainted cross-sectional data or unmixed time-series data:

i. Panel data provides more information and variation, Hsiao (1985, 2014): Time series data are known to be troubled by multicullinearity; Panel data deliver extra variation among the data set which makes multicullinearity less probable among the variables as it offers added independent variables and efficiency. Also, it is a lot more trouble-free to generate dependable approximations with additional information. This is relevant to this research as panel data has the ability to gauge how the correlation linking credit derivatives and bank portfolio performance varied through banks and how this correlation varied over time especially pre and post the credit crisis of 2007-2009.
ii. Take into consideration the controlling for specific diversity (Baltagi 2001): the risk of getting subjective outcomes from defective analytical assessment where time series and cross section are not controlled for specific variables is high. The assumption of Panel data is that entities, companies, regions, countries etc are a combination of separate and isolated portions. As an example, Hajivassilou (1987) examined how some developing countries settled their external debt using a panel

data set of seventy nine countries across Africa, Asia and America. They find that these countries had different fundamental characteristics, to wit, colonial history, types of government, depth of financial services etc which influenced how the countries managed their debt portfolio and their perception by local and external creditors. By application, this is useful to our study as it permits us to manage unnoticed variables that vary through time but not across sections. As an example, each bank in the panel data set have got different characteristics such as risk appetite, receptiveness to financial innovation, organisational structure and culture, credit standing with other financial institutions, location, operational agility, reputation, etc Due to measurement issues, some of the characteristics are not captured in the models as they are difficult to measure. However, with some variation over the years, this method is robust enough to isolate there influence in the model.

iii. Panel data are better able to study the dynamics of adjustment (Ashenfelter and Solon 1982): Cross sectional spreads of statistics that seem to be comparatively steady conceal a variety of fluctuations. Therefore, in view of the explosive growth of credit derivatives in recent times, the recent credit crises of 2007 through 2009 and the contagion that followed, this work is better analysed by panel data set instead by real cross-sectional data.

5.2.8.1 One or two-way error component models

In making the statistical and mathematic analysis of panel data, we cannot suppose observations are on there own evenly distributed across the period of the research. For example,unobserved variables (portfolio performance enhancing solutions and technology) affecting a bank's portfolio performance in 2007 will also affect the bank's portfolio performance in 2008. For these reasons, special models and methods have been developed to analyse panel data. First, we examine the two usually used panel regression models, Fixed Effects model (FEM) and Random Effects model (REM). Empirically, the residuals (errors) of the Ordinary Least Square methods (OLS) are not random but correlated in one or more ways; this makes the application of the method on a panel data unhelpful. In the same vein, if errors are correlated in one or more ways, a violation of one of its assumptions, it will result in heteroskedasticity issues. Likewise, where errors are serially correlated over time, it will result in autocorrelation issues.

Following Baltagi (2001), in general, the model is:

$$Y_{it} = \beta 0 + x_{it1}\beta_1 + x_{it2}\beta_2 + \cdots + x_{itk}\beta_k + \eta_i + v_{it} \tag{5.3a}$$

$$Y_{it} = X^{i}{}_{itk}\beta_k + \eta_i + v_{it} \tag{5.3b}$$

where,

η_i are the unobserved constant individual effects

Y_{it} is the dependent variable, where, i = 1…N; t = 1,…..,T, with N large (cross-sectional observations) and T small (years)

χ_{it} represents independent variable

β_1 is the coefficient for the independent variables

u_{it} is the error term

Three common specifications to deal with η_i are random effects, fixed effects and first differences. In the model (Equation 5.3b)

$$Y_{it} = X^{I}{}_{itk}\beta_k + u_{it} \tag{5.4}$$

where, $u_{it} = \eta_i + v_{it}$

It was assume that:

$$E(v_{it}) = 0; E(v_{it}/X_{it})$$

5.2.8.2 Fixed Effects Model (FEM)

Also known as least square dummy variable estimator (LSDV), it assigns a dummy variable to every distinct item or individual in estimating there fixed effects. It assumes that every item's heterogeneity is represented by the disturbance term (Baltagi 2011). For example, every individual has his own intercept while the slope coefficients are constant. That is, the Fixed Effects Model assumes that the slope coefficients are constant across sections but allows the intercept to vary for each section. This also means that there is a connection between the individual heterogeneity and the regressors on the right hand side of the model. To put this in operation, it uses (N-1) dummy variables to represent N cross sections. For instance, we have the following model:

$$Y_{it} = a_i + \beta_i X_{it} + \beta_2 \eta_i + u_{it} \tag{5.5}$$

where,

η_i is an unobserved variable that varies from one section to another,

α_i (i=1…n) is the unknown intercept for each entity (n entity-specific intercepts).

Y_{it} is the dependent variable, where, i = 1 … N; t = 1 ... T, with N large (cross-sectional observations) and T small (years)

χ_{it} represents independent variables

β_1 is the coefficient for the independent variable

u_{it} is the error term

It varies from one section to another without changes over time. With its constancy, we have the following model:

$$Y_{it} = a_i + \beta_1 X_{it} + Y_1^{M_1} + Y_2^{M_2} + \cdots + Y_{N-1}^{M_{N-1}} + u_{it} \tag{5.6}$$

where, M_1, M_2….. , M_{N-1} are dummy variables representing different sections.

One can perform ordinary least square regression (OLS) on the model generated by 5.6 to obtain α, β and µ. However, where N is large, the model will have too many dummies and cumbersome to calculate due to too many regressors to be estimated. This can be mitigated by the use of a simple time demeaned regression method which is less cumbersome than plain OLS regression to obtain the same estimators. In that case, we have the following model from Equation (5.6):

$$\hat{Y}_i = a_i + \beta_1 \ddot{X}_i + Y_1^{M_1} + Y_2^{M_2} + \cdots + Y_{N-1}^{M_{N-1}} + \bar{u}_i , \tag{5.7}$$

where, $\hat{Y}_i = \frac{1}{T}\sum_{t=1}^{T} Y_{it}$

Recall Equation (5.5). Intercept and dummy variables are constant over time so are there averages. Subtracting Equation (5.7) from Equation (5.6), we get the following model:

$$Y_{it} - Y_i = \beta(X_{it} - X) + u_{it} - \bar{u}_i, \tag{5.8}$$

Equation (5.6) has a lot more regressors than Equation (5.8) making it more time consuming to estimate though they give the estimates.

As depicted in Equation (5.5), Z_1, for example, the Fixed Effects Model reduces heteroskedasticity as it allows for the correlation between unobserved time-invariant variables and independent variables (Baltagi 2001). The FEM is known to suffer from a large loss of degrees of freedom. For instance, with the estimation of N-1 in the example, extra parameters and too many dummies may worsen the problem of multicullinearity. Likewise, autocorrelation may be reduced if we deploy T-1 dummy variables to represent T time periods to control for unobserved section-invariant variables. Another short coming of FEM is that for explanatory variables that is not constant over time for all i or cross sections for all k cannot be included in FEM.

5.2.8.3 Random effects model

The Random Effects Model (REM) is also known as Variance Components Model (VCM), Random Intercept Model (RIM) and Partial Pooling Model (PPM) in Econometrics. In comparison to Fixed Effects Models, Random Effects Models are somewhat difficult to estimate. An important assumption of REM is that the disturbance term of the entity is not associated with the forecasters which permit time-invariant variables to have a specific function as explanatory variables (Baltagi 2011).

In REM, the specific attributes that may or may not possibly affect the predictor variables needs to be specified. The drawback with this is that some variables may not be available therefore leading to omitted variable bias in the model. REM allows generalising the inferences beyond the sample used in the model.

The multiplicity of parameters and the loss of degrees of freedom discussed as drawbacks of FEM can be avoided if the *ui* can be assumed random rather than fixed. In effect, the validity of unobserved variables are treated as random rather than fixed.

$$Y_{it} = a_i + \beta_1 X_{it} + v_{it} + u_{it}, \tag{5.9}$$

where, v_{it} is the random effects of unobserved variables.

We assume $w_{it} = v_{it} + u_{it}$. Therefore, we have:

$$Y_{it} = a_i + \beta_1 X_{it} + w_{it} \tag{5.10}$$

Since v_{it} is in the residual in each time period, the w_{it} has a certain degree of serial correlation over time. To estimate the unknown parameters in the model due to the unequal observations, for example, where there is evidence of heteroscedasticity (when there is a definite degree of correlation between observations); Generalised Least Square rather than Ordinary Least Square is used to estimate the model. The drawback of OLS in this instance is that it can generate statistically and mathematical spurious results and conclusions (Baltigi 2001).

One of the advantages of random effects over fixed effects is that REM allows for explanatory variables that are constant over time. However, the underlying assumption is that the unobserved variables are uncorrelated with all explanatory variables, no matter the explanatory variables are constant over time or not. If the unobserved effect is correlated with one or more explanatory variables or heterokesdastic exists, FEM should be used.

Similar to FEM, REM could be one-way or two ways, depending on whether the random effect exists both over time and across sections.

5.2.8.4 Fixed effects model contrasted with random effects model

To answer the difficult question of which of the two models to choose from needs careful analysis and as expected, this has sparked some considerable debates in econometric literature (Wallace and Hussain 1969; Hausman 1978). In the seminal work of Green (2008), he posits that “the fundamental differences between REM and FEM is whether the unobserved individual effect embodies elements that are correlated with the regressors in the model, not whether these effects are stochastic or not”. In order words, FEM treats the unobserved effects as parameters to be estimated while REM treats them as random. It is only sensible to use FEM if there is reason to believe that the observations cannot be drawn from a large population. Again, if there is cause to believe that the disparities across entities have some bearing on the dependent variables then it is only sensible to use REM. Where the unobserved variable is treated as random variables, a decision has to be made if they are correlated with the independent variables, If they are correlated to one or more variables, it is only sensible to use FEM.

In deciding which of the models to choose, the Hausman test is run to know whether the unique errors (Ui) are correlated with the regressors. In order words, it tests whether there is a correlation between the unobserved effects and independent variables. FEM is chosen where the Hausman test is significant, that is more than 0.05% (Green 2008).

Using numerical and simulation evidence, Baltigi (2001) posit that the values of T and N can significantly determine the choice between FEM and REM. In cases where T is large and N is small, FEM would be preferred since it is easier to compute more so there would be little significance between the values of the parameters estimated by both models. Conversely, in a situation where *N* is large and *T* is small, REM would be preferred as there would be significant differences between the estimates obtained from both models. In addition, the statistical inference of REM is unconditional except it is taken that the observations are not random samples.

The benchmark for banks in this study is for banks with $500 million asset base for the 10 year period from 2002 to 2011.The selection do not suggest random but since *N* is more than 1000 and *T* is 40, *N* is large while *T* is small.

Research Method Chosen

From our analysis above, it was decided to rule out Fixed Effects Model and Random Effects Model methods because they are not feasible at this instance as both methods do not satisfy the specification of our data analysis. Instead, two methods readily come to mind: Random Effects Logistic Models (RELM) and The Arellano and Bond (1991) Generalised Method of Moments (GMM) approach.

5.2.8.5 Random Effects Logistic Models (RELM)

This method is a well-accepted technique to examine the shape and make up of multilevel (hierarchical) data with binary or ordinal results (Lesaffre and Spiessens 2001; Rodriguez and Elo 2003). Hierarchical data arrangement also arises in longitudinal research where measurements are grouped within individuals. The multilevel arrangement generates correlation issues when test are done within the subset of the statistical sample, for example, between credit derivatives users and non users from the same asset base (Li et al. 2011). An approach to analyse a subset of data in a statistical sample is the use of a multilevel or random effects regression analysis. In our work, to elucidate on why and how random effects logistic regression method was considered and used in the analysis as presented in Chapter 7, it is important to explain the background to logistic regression technique.

Logistic regression is a type of regression which is utilised when the dependent variable is a dichotomy, to be precise, the dependent variable can take the value 1 with the probability of success Φ, or the value 0 with probability of failure 1-Φ (Hosmer and Lemeshow 1989; Hosmer et al. 1991). This kind of variable is known as binary variable and the independents are of any kind.

Multinomial logistic regression occurs to address the situation of dependent variable with groups more than two. In situations where multiple groups of the dependent can be ranked, in that case ordinal logistic regression is favoured to multinomial logistic regression. Continuous variables are not utilised as dependents in logistic association between variables. Contrasting with logit regression, there can be only one operative dependent variable.

Logistic regression is frequently utilised for the forecasting of a likely outcome or modelling in econometric and statistical studies (Peng et al. 2002). To wit:

(a) It is utilised to forecast a dependent variable on the foundation of continuous and/or categorical independent variable and to establish the fraction of variance in the dependent variable clarified by the explanatory variable;

(b) To categorise the comparative significance of the explanatory variable;

(c) To measure interaction effects, the existence of which can have significant consequences for the clarification and analysis of statistical models;

(d) To comprehend the strong effect of covariate control variables; and

(e) Chiefly, logistic regression can differentiate between equally exclusive groups by a set of variables and it is as a result possible by using this technique to ascertain the features of different groups of banks (net protection buyers and non net protection buyers) in the use of credit derivatives and to predict how banks under certain conditions may behave.

Logistic regression utilises maximum likelihood assessment once converting the independent variable into logit variable, to wit, the natural log of the odds of the dependent variable happening or not. As a result, logistic regression assesses the probability of a particular event occurring, that is, it estimates the probability that a collection of attributes or characteristics makes it more likely for a firm/choice to belong to one set rather than to another.

Logistic regression computes variations in the log odds of the dependent variable, not the variation in the dependent variable itself as ordinary least square regression does. In a straightforward state, if we have only one predictor variable X_1, the logistic regression equation from which the probability of Y is forecasted is given by Equation (5.11):

$$P(Y) = \frac{1}{1+e^{-(b_0+b_1X_1+\varepsilon_i)}} \tag{5.11}$$

where,

$P(Y)$: is the chance of Y occurring,

e: is the base of natural logarithms,

b_0 :is the constant,

X_1: is the predictor variable,

b_1: is the coefficient (weight) attached to the predictor.

In a situation where there are more than a few predictors, the equation becomes:

$$P(Y) = \frac{1}{1+e^{-(b_0+b_1X_1+\cdots+b_nX_n+\varepsilon_i)}} \tag{5.12}$$

Equation (5.12) is similar as the equation used when the predictor is just one apart from the fact that the linear arrangement and blend has been stretched to embrace several numbers of forecasters. As a result, while the logistic regression equation with one predictor is limited to the straightforward linear regression equation inside it, the multiple predictor equation comprises the multiple regression equation.

Logistic regression has many similarities to ordinary least square regression, to wit, logit coefficients stands for b coefficients in the logistic regression equation, the standardised logit coefficients stands for beta weights, and a pseudo R^2 statistic is on hand to review and sum up the potency of the correlation (Hosmer and Lemeshow 1989).

In contrast to ordinary least square regression, on the other hand, logistic regression does not allow for the following:

(a) Linearity of correlation connecting the explanatory and the dependent variables;

(b) Does not need normally distributed variables;

(c) Does not take on homoscedasticity; and

(d) Generally have less rigorous obligations.

Conversely, it does, nevertheless, need that examinations are independent and that the explanatory variables be linearly connected to the logit of the dependent variable.

The accomplishment of the logistic regression can be examined on the following basis by perusing (Hill et al. 2012; Field 2013):

(i) The classification table: this displays the accurate and inaccurate groupings of the dichotomous, ordinal, or polytomous dependent variables.

(ii) goodness-of-fit tests: for example the model chi-square is on hand as pointers of model appropriateness

(iii) The Wald statistics: this examines the importance and impact of each explanatory variable.

As we attempt to put in plain words the background to logistic regression, it is also imperative to explain the important conditions and perception concerned with this method. The maximum likelihood method (MLE), are used to assess the values of parameters of the logistic regression model, which chooses coefficients that constitutes the examined values probably to have arisen. In utilising this technique, it is essential to build a likelihood function that states the probability of the examined data as a variable quantity of unidentified parameters. The maximum likelihood approximations of these parameters are selected to be those values that make the most of this variable quantity. The logistic model is non-linear and repeat algorithms are utilised for parameter estimation.

The model can be written in terms of odds, to wit, the probability of an event happening/the probability of an event not happening.

$$Odds = \frac{P(event\ y)}{P(no\ event\ Y)} \tag{5.13}$$

$$P(event\ Y) = \frac{1}{1+e^{-(b_0+b_1X_1+\varepsilon_i)}} \tag{5.14}$$

$$P(no\ event Y) = 1 - P(event\ \mathrm{Y}) \tag{5.15}$$

The odds of an event happening are shown clearly as the chance of an event happening, deflated by the chance of that event not happening. The coefficients can be taken as the variation in the log odds connected with one unit variation in the explanatory variable. The Exp *(B)* statistics, to wit, the balanced variation in odds, provides the factor enlarge in the odds connected with a unit variation in the explanatory variable.

$$\Delta odds = \frac{\text{Odds after a unit change in the predictor}}{\text{Original odds}} \tag{5.16}$$

Consequently, we can explain exp *b* in relation of a variation in odds: if the value is more than 1, then it shows that as the predictor augments, the odds of outcome happening increases. On the other hand, a value less than 1 shows that as the predictor swells, the odds of the outcome shrinks.

The fraction of collection of cases accurately categorised by the model is a pointer of the forecasting attributes of the model. On the other hand, when the categorisation rate is not the final goal of the close examination, the categorisation rate should only be utilised to enhance more demanding evaluation of fit. Such an arduous evaluation is the likelihood, which is the chance of the scrutinised outcome given the parameter approximation. The likelihood is a little figure less than one and it is usual to use -2 multiplied by the log of the likelihood (-2LL).

The model needs an above average model chi-square value, to wit, the change between -2 multiplied by the log likelihood with only a constant and -2 multiplied by the log likelihood for the real model, to explain that it generates an above average likelihood of the examined results. The model chi-square examines the null hypothesis so that the coefficients for all the variables held in the model, apart from the constant, are zero and is analogous to the general *F* test in the regression. The enhanced chi-square is the variation in -2 multiplied by the log likelihood in consecutive paths of the model construction and is similar to the F-change examination in the regression. The goodness of fit statistic can be utilised to measure up the examined and forecasted values.

The level of significance for the variables in the calculation examines the null hypothesis to show the coefficients are not dissimilar than zero. A low point significance level that is less than 0.05 is needed if the hypothesis is to be disproved and the variable can be contained within the model.

The Wald statistic is another identical test which is the ratio of the coefficient to the standard error squared, to wit, it is used to examine the statistical importance and meaning of each coefficient (b) in the model. Nevertheless, if the coefficient is large it can generate an inconsiderable standard error, and hence a low Wald statistic and a high level of significance, thus making the researcher to miss in disallowing the null hypothesis when it should be disallowed. To get around this when a huge coefficient is in existence, the model should be constructed with and without the appropriate variable and the proposition should be on the basis of the variation in the log likelihood as suggested by Hauck and Donner (1977) as well as Jennings (1986) in Hosmer and Lemeshow (1989).

Complications of multicollinearity could ensue as logistic regression also contends with a number of variables. As a result, a drawback of logistic regression is required to gain a useful function as not many variables as possible need to be utilised.

The partial correlation connecting the dependent and each of the explanatory variables in the calculation is made available by the R statistic in the model. A positive *R* value signpost that as the variable accelerates in value, so does the likelihood of the forecast happening, a negative *R* value point towards the opposite to be true. The *R* statistic makes available an approximation of each variable's input to the model, with *R* statistic values signifying that the variable is making an important partial influence and impact to the model.

Diagnostics can in addition be utilised to examine how well the model fits. As an example, the deviance is the square root of -2 multiplied by the log of the forecasted chances and cannot be overly substantial if the model is to be regarded as a good fit. The studentised residual work out the variation in the deviance if a case is left out and consequently, it can classify rare cases. Given that a model preferentially fits a sample from which it is originated than it will fit a different sample from a similar population, in precisely employing this method, the sample should be separated and one portion utilised to approximate the coefficients and the other portion utilised to examine how good and fittingly the model operates.

There are two essential established methods of variable selection in binary logistic regression:

(a) The forward stepwise technique, not any of the variables are originally in the model and a variable chosen at each pace; and

(b) The backward stepwise technique, the whole of the variables are contained within the model at the beginning and then evaluated for elimination, gradually, at each stage.

The two techniques should give identical outcomes; consequently, forward stepwise selection technique is better adopted to conserve time in choosing the appropriate variables from the sample data. The model under this technique begins with a constant, at each stage, variables are considered for admission and one is selected on the foundation of the least significance level for the score statistic, that is, it is centred on a derivative of the log likelihood. The variables can in addition be eliminated from the model until a preceding model is well planned or no more variables have the chance of the admission or elimination standards. The likelihood ratio, which looks at the variation in the log likelihood when a variable is removed, should be picked out to eliminate the variables from the model. The conditional statistics performs the same job, but it is not as much rigorous as it does not necessitate the model to be re-approximated devoid of each of the variables at each phase. The Wald statistic can as well be utilised to carry out this work, but then again it does have disadvantageous attributes, as discussed previously. Notwithstanding the tests and process of evaluating the goodness of fit, a mathematical difficulty with this type of method which is also found in regression and discriminant analysis, is that not any of the algorithms result in the "finest" conclusive and final model in any statistical and mathematical reason and view.

A number of models should be considered and uniquely selected on the foundation of clarification, elucidation, manageable number of variables and smoothness of variable development and selection.

The foundation of connectedness on balance rests in supposition instead of the analysis of the association linking variables.

The analysis of the association between variables can invalidate a theory that there is a connection linking two variables as by means of cross tabulation analysis, but then again it cannot demonstrate and sustain such theory, only reinforce it for the reason that a high level of association connecting two variables may have no instrumental relationship of any kind. Additional techniques can carry out identical and useful kind of examination but were discarded for some reasons.

As an example, multiple regression analysis has need of normal distribution of the dependent variable for the whole groupings of the explanatory variables, likewise discriminant analysis entail the explanatory variables utilised to be from a normal population while cluster analysis is more appropriate to looking for variations connecting a considerable amount of assemblage and assembling cases when cluster membership is unidentified.

In chapter 7, most of the variables were dichotomous and did not satisfy the suppositions of normal distribution and cluster association required to be recognised when managing the analysis.

Advantages of Logistic Random Effects Model (Molenberghs and Verbeke 2007; Molenberghs et al. 2010):

(a) We may possibly desire to approximate the effect of the covariates at the group level, for example, type of users (main credit derivatives users versus non-credit derivatives users). With a fixed effects regression, it is not likely to pull out group effects from the effect of covariates at the group level.

(b) Employing a fixed effects regression, extrapolation and deduction cannot be made beyond the groups in the population sample. In contrast, Random effects regressions handle the groups as a random sample from a population of groups.

(c) Traditional regression methods do not distinguish the multilevel arrangement and will make the standard errors of regression coefficients to be wrongly approximated resulting to an exaggeration or underestimation of statistical impact for the coefficients of both the higher and less important level of the covariates, therefore, statistical inference may be incorrect. Therefore, random effects regression is ideal and chosen over a traditional fixed effects regression.

Random Effects Logistic model on full data set

Li et al. (2011) posits that a binary or dichotomous random effects logistic model has a binary result in which $Y = 0$ or 1. It regresses the log odds of the outcome of the mathematical likelihood of event on a variety of forecasters to approximate the mathematical likelihood of event that $Y = 1$ occurs, assuming the random effects.

A straightforward dichotomous 2-level model is specified by:

$$In\left(\frac{P\left(Yij = 1 \middle| X_{ij}, u_j\right)}{P\left(Y_{ij} = 0 \middle| X_{ij}, u_j\right)}\right) = a_1 + \sum_{k=1}^{K} \beta_k X_{kij} + u_j \tag{5.17}$$

where,

Y_{ij} is the dichotomised Net protection buyer (NPB) variable (with Y_{ij} = 1 if the i_{th} bank in the US j_{th} uses credit derivatives to mitigate risk as a Net protection buyer and Y_{ij} = 0 if otherwise),

$x_{ij} = (x_{1ij},...,x_{kij})$ stands for the covariates,

α_{1}: is the intercept and

β_{k}: is the k_{th} regression coefficient.

μ_j is the random effect characterises and exemplifies the effect of the j_{th} banks in the US financial markets. Furthermore, u_j is the random effect standing for the effect of the j_{th} US economy. It is anticipated that u_j follows a normal distribution with Zero (0) mean and variance (σ^2).

The coefficient β_k gauges the effect of enlarging and increasing x_{kij} by one unit on the log odds ratio.

At this point, x_{kij} embodies the covariates (independent variables) as shown in section 5.2.9 below.

5.2.8.6 Review of Dynamic Panel Data Models

Several application of mathematical or statistical techniques to economic data, problems and relationships are dynamic in character and one of the merits of panel data is that they make it easier for us to appreciate the dynamics of change better, for example, the study conducted by Houtrakker et al. (1974) on dynamic demand for fuel and residential electricity, Arellano and Bond (1991) on a dynamic model of service, engagement and pay, Blundell et al. (1992), Arellano and Bover (1995) on a dynamic model of company asset investment, etc. These dynamic associations are depicted by the existence of a lagged dependent variable among the variable determining value of others or independent variable. In a simple model, that is (Baltagi 2011):

$$y_{it} = \delta y_{i,t-1} + x_{it}^{1}\beta + \mu_{it} \qquad i = 1,\cdots,N; \quad t = 1,\cdots,T \tag{5.18}$$

where,

δ: is a scalar,

x_{it}^{1} : is *1 x K* and

β: is *K x 1*.

It is expected that the u_{it} go along the route of a one-way error component model.

$$u_{it} = u_i + v_{it} \tag{5.19}$$

where,

$u_i \sim IID\left(0, \sigma_u^2\right)$and

$v_{it} \sim IID\left(0, \sigma_u^2\right)$, are free of each other and with themselves.

The dynamic panel data regressions described in Equations (5.18) and (5.19) are typified by two basis of persistence ultimately: Autocorrelation and Individual effects.

(a) Autocorrelation as a result of the existence of a lagged determined number with the explanatory variables

(b) Individual effects exemplifying the extensiveness and range among the individuals.

We review the essential teething problems introduced by the existence of a lagged dependent variable for this model.

As y_{i1} having being a function of μ_i, it right away follows that $y_{i,t-1}$ is likewise a function of μ_i. Accordingly, $y_{i,t-1}$, the right side regressor in Equation (5.18), is associated with the disturbance term. This reduces the least square assessor or estimator subjective and contradictory although the v_{it} are not serially associated, (Sevestre and Trognon 1985).

(i) The systematic distortion of the Fixed Effects estimator in a dynamic Panel data model

In respect of the estimator in this model, the within change cancels out the u_{it} , nevertheless for $\left(y_{i,t-1} - \bar{y}_{i,t-2}\right)$,

where,

$\bar{y}_{i,t-1} = \sum_{t-1}^{T} y_{i,t-1} / (T-1)$, will be associated with $\left(\bar{v}_{it} - \bar{v}_{i,t-1}\right)$ though the v_{it} are not consecutively associated.

This is for the reason that $y_{i,t-1}$ is associated with $\bar{v}_i$ by geometric shape. The last mean encompasses $v_{i,t-1}$ which is clearly associated with $y_{i,t-1}$. As noted by Nickell (1981), the Within estimator will systematically distort O(l/*T*) and its reliability will be contingent on *T* being substantial. Kiviet (1995) investigated the bias, discrepancy and effectiveness of a variety of estimators in dynamic panel models. They got an estimate for the tilt and influence of the within estimator in a dynamic panel data model with repeatedly unassociated disruptions and robustly exogenous regressors. The study also suggested a precise Within estimator that takes away a reliable estimator of this bias from the first Within estimator. Consequently, for the usual labour panel in which *N* is substantial and *T* is predetermined, the Within estimator is subjective and conflicting. It is important to highlight because just if $T \rightarrow \infty$ will the within estimator of δ and β be reliable for the dynamic mathematical difference constituent model.

Islam (1995) investigated growth convergence with dynamic panel data approach. Examining long-run growth for example, the sample data covers a substantial number of countries *N* over a reasonable size *T*. In this situation, *T* is not very significant comparative to *N*. Therefore, some investigators may nonetheless prefer the Within estimator contending that its influence may not be substantial. Judson and Owen (1999) examined the effectiveness of various diverse approaches drawn up to diminish the bias of the projected constant for extended, slim panels usually set up for macro data employing a Monte Carlo approach of which test for $N = 40$ or 200 and $T = 10$, 20, 30 and 40 and discovered that the influence in the within estimator can be fairly large, even when $T = 40$. This bias accelerates with *S* and decelerates with *T*. Even when for $T = 40$, this effect could be as large as 30% of the actual worth of the constant of interest.

(ii) The systematic distortion of the Random Effect estimator in a dynamic Panel data Model

The random effect, generalised least square (GLS) estimator is likewise biased in the model. In the application of the use of generalised least square, semi-demeaning is carried out and $(y_{i,t-1} - \theta \bar{y}_{i,t-2})$ will be associated with $(\mu_{it} - \theta\mu_{i,t-1})$. Another alteration that erases out the individual effects is the first difference (FD) change. The first-difference (FD) estimator is a method utilised to deal with the drawback of missing variables with panel data in mathematical economics, econometrics etc. The estimator is found by administering a pooled ordinary least square approximation for the association between variables of Δy_{it} on Δx_{it}. In this situation, association between the programmed independent variables and the residue inaccuracy is straightforward to deal with. Anderson and Hsiao (1981) in their study of the evaluation of dynamic panel data models with error components, put forward, as a first step, the differencing of the model to eliminate the μ_i and thereafter $\Delta y_{i,t-2} = (y_{i,t-2} - y_{i,t-3})$ or just $y_{i,t-2}$ as a means for $\Delta y_{i,t-1} = (y_{i,t-1} - y_{i,t-2})$. These means will not be connected with $\Delta v_{it} = v_{it} - v_{i,t-1}$ given that the v_{it} themselves are not successively connected. Ahn and Schmidt (1995) in their examination of the effective approximation of dynamic panel data models noted that the instrumental variable (IV) approximation technique, which is utilised to calculate causal associations when regulated tests are not possible or when the handling is not well transported to all unit in a shuffled test, results to coherent although not essentially effective calculations of the limiting factors in the model because it is not expected to utilise all the existing moment conditions without taking cognisance of the differenced construct on the residual errors (Δv_{it}).

Arellano (1989) in their examination of the notice on the Anderson-Hsiao estimator discovered that for straightforward models, the estimator that utilises differences $\Delta y_{i,t-2}$ instead of levels $y_{i,t-2}$ for instruments has a distinctiveness position and extremely huge differences throughout a substantial category of mathematical values. Conversely, the estimator utilising instruments in levels, i.e. $(y_{i,t-2})$ has no distinctiveness and minute inconsistencies and differences which makes it often endorsed. Meanwhile, Ahn and Schmidt (1995) discovered further nonlinear moment restrictions not investigated by Arellano and Bond (1991) put forward a generalised method of moments (GMM) approach, better and more effective than the Anderson and Hsiao (1982) estimator.

Furthermore, Ahn and Schmdt obtained extra nonlinear restrictions not exploited by the Arellano and Bond (1991) generalised method of moments estimator. Furthermore, Keane and Runkle (1992) proposed another approach of approximation of the model which is premised on the higher refining belief in time-series analysis. We now focus on the contributions to the estimation and testing of the model by Arellano and Bond (1991).

5.2.8.7 The Arellano and Bond (1991) Generalised Method of Moments (GMM) approach

This section reviews the proposition of Arellano and Bond. They argue that extra instruments can be acquired in a dynamic panel data model if one utilises the orthogonality specification that exist between lagged values of y_{it} and the errors v_{it} (Baltagi 2011).

With simple autoregressive model without regressors, we elucidate this:

$$y_{it} = \delta y_{i,t-1} + \mu_{it} \qquad i = 1,\cdots,N; \quad t = 1,\cdots,T \tag{5.20}$$

where,

$u_{it} = u_i + v_{it}$

$u_i \sim IID\left(0, \sigma_u^2\right)$ and

$v_{it} \sim IID\left(0, \sigma_u^2\right)$, are relaxed and inhibited in operation.

To get a reliable approximation of δ as N → ∞ with T not changing, we proceed to difference Equation (5.20) to remove the distinct effects

$$y_{it} - y_{i,t-1} = \delta\left(y_{i,t-1} - y_{i,t-2}\right) + \left(v_{it} - v_{i,t-1}\right) \tag{5.21}$$

and we take notice that $\left(v_{it} - v_{i,t-1}\right)$ is MA(1) by means of unit root.

As for t = 3, the first time we examined this connection, this gives us:

$y_{i3} - y_{i2} = \delta\left(y_{i2} - y_{i1}\right) + \left(v_{i3} - v_{i2}\right)$

In this situation, y_{i1} is a reasonable instrument, as it is very much associated with $\left(y_{i2} - y_{i1}\right)$ and not related with $\left(v_{i3} - v_{i2}\right)$ in as much as the v_{it} are not successively related.

But then again notice what occurs for t = 4, the next time we examine and view Equation (5.21):

$$y_{i4} - y_{i3} = \delta(y_{i3} - y_{i2}) + (v_{i4} - v_{i3})$$

With this, y_{i2} in addition to y_{i1} are reasonable instruments for $(y_{i3} - y_{i2})$, because both y_{i2} and y_{i1} are not associated with $(v_{i4} - v_{i3})$. We can proceed with this trend, adding an additional stable instrument with each onward time, in which for time T, the collection of stable instruments turns out to be $(y_{i1}, y_{i2\ldots}, T-2)$

However, the instrumental variable approach fails to explain for the differenced disturbance term in Equation (5.21). In effect,

$$E(\Delta v_i \Delta_i^1) = \sigma_v^2 (1_N \phi G) \tag{5.22}$$

where,

$\Delta v_i^1 = (v_{13} - v_{12}, \cdots, v_{iT} - v_{i,T-1})$ and

$$G = \begin{pmatrix} 2 & -1 & 0 & \cdots & 0 & 0 & 0 \\ -1 & 2 & -1 & \cdots & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ 2 & -1 & 0 & \cdots & -1 & 2 & -1 \\ 0 & 0 & 0 & \cdots & 0 & -1 & 2 \end{pmatrix}$$

is (T — 2) x (T - 2), in view of the fact that Δv_1 is MA(1) by means of unit root. Express:

$$Wi = \begin{bmatrix} [yi1] & & & 0 \\ & [y_{i1}, y_{i2}] & & \\ & & \ddots & \\ & & & [y_{i1}, \cdots, y_{i,T-2}] \end{bmatrix} \tag{5.23}$$

In that case, the matrix of instruments is $W = [W_1^i, \cdots, W_N^i]$ and the moment equations stated above are specified by $E(W_i^1 \Delta_{vi}) = 0$

Holtz-Eakin (1988), Holtz-Eakin et al. (1988) and Ahn and Schmidt (1995) have also investigated these moment conditions. But before multiplying the differenced Equation (5.21) in vector form by W^1, we get:

$$W^1 \Delta y = W^1 (\Delta y - 1)\delta + W^1 \Delta v \tag{5.24}$$

Executing generalised least square in Equation (5.24), this results to the Arellano and Bond (1991) initial one-step reliable and stable estimator:

$$\hat{\delta}_1 = \left[(\Delta y - 1)' W (W'(1_N \phi G) W)^{-1} W'(\Delta y - 1) \right]^{-1} \tag{5.25}$$

$$x = \left[(\Delta y - 1)' W (W'(1_N \phi G) W)^{-1} W'(\Delta y) \right]$$

Like in Hansen (1982), the most desirable generalised least square estimator of $\hat{\delta}_1$ for N → ∞ and T inflexible utilising only the above stated moment limits generate the same mathematical expression like the expression in Equation (5.25) but that

$$W'(I_N \phi G) = \sum_{i=1}^{N} W_1^{i} G W_1$$

is substituted by

$$V_N = \sum_{i=1}^{N} W_i^{1} (\Delta v_i)(\Delta v_i)' W_i$$

This generalised least square estimator need no specific information in respect of the first state or better still, the distributions of v_i and μ_i. To operate this, Δv is substituted by differenced residuals from the introductory reliable estimator $(\hat{\delta}_1)$. The subsequent estimator is the two-step Arellano and Bond (1991) generalised least square estimator (Baltagi 2011):

$$\hat{\delta}_2 = \left[[(\Delta y - 1)] W \hat{V}_N^{1} W'(\Delta y - 1) \right]^{-1} \left[(\Delta y - 1)' W \hat{V}_N^{-1} W'(\Delta y) \right] \tag{5.26}$$

A reliable approximation of the asymptotic variable $(\hat{\delta}_2)$ is stated by the initial expression in Equation (5.26),

$$\hat{\mathrm{var}}(\hat{\delta}_2) = \left[(\Delta y - 1)' W \hat{V}_N^{-1} W'(\Delta y - 1) \right]^{-1} \tag{5.27}$$

It is noted that $(\hat{\delta}_1)$ and $(\hat{\delta}_2)$ are comparable to a line whose space to a given curve tends to zero if the v_i are $IID(0, \sigma_v^2)$.

In summary, the Arellano–Bond and Arellano–Bover/Blundell–Bond (Arellano and Bond 1991; Arellano and Bover 1995; Blundell and Bond 1998) dynamic panel estimators are more and more well-liked and accepted among researchers. Together they are general estimators conceived for conditions with:

(a) "Small *T*, large *N*" panels, that is, fewsome though not many time periods and many individuals;

(b) One left-hand-side variable that is dynamic, contingent on its own past comprehensions;

(c) Explanatory variables that are not rigorously exogenous, that is, they are related with past and perhaps current comprehension of the error;

(d) Heteroskedasticity and autocorrelation within individuals but not across them;

(e) A linear functional connection; and

(f) Fixed individual effects.

Arellano–Bond assessment and evaluation starts by converting all regressors and exploits all possible instruments. Using the Generalised Method of Moments (GMM), they got hold of estimators using the moment conditions produced by lagged levels of the dependent variable ($y_{i,t-2}$, $y_{i,t-3}$ with Δy_{it}). These estimators are called difference GMM estimators (Hansen 1982). Chapter 8 follows the Arellano and Bond Generalised Method of Moments (GMM) technique.

Advantages of the Arellano and Bond Generalised Method of Moments (GMM) technique.

(a) Comparable to all instrumental variables regressions, generalised method of moments estimators are balanced and unbiased. Arellano and Bond (1991) contrasted the implementation of difference generalised method of moments, ordinary least square, and within groups' estimators. Employing simulations, they found that generalised method of moments estimators revealed the least variance and prejudice.

(b) The generalised method of moments estimators are known to be reliable, asymptotically stable and resourceful in the class of all estimators that do not use any additional statistics regardless from that contained in the moment conditions.

(c) Generalised method of moments is an appropriate method when a dynamic macro data Panel data is employed, on the whole firm data, to control for endogeneity issues. On the contrary, this is different when macro panels (countries) are used where variables are not stationary and in which some invariant variables may be accommodated in the model.

(d) Generalised method of moments methods also permit us to state moment conditions from distinct data sets that have distinct units of examination. Petrin (2002), for instance, examined Complete Entertainment Exchange (CEX) retailers which used micro data on end users preferences of automobiles to compliment market-level transaction data. The significant change between model forecasts of vehicles transactions and the "recognised" worth and rates from the CEX can be turned into moment conditions. Consequently, generalised method of moments takes into consideration the incorporation of more "recognised" information without difficulty.

5.2.8.8 Linearity

In Econometrics, there are two methods to evaluate linearity in a model (Berndt 1991; Fattouh et al 2008; Hanck 2009):

i. The graphical method (interpreting scatter plots); and

ii. Statistical body of techniques (analytic hypothesis tests for linearity and investigating patterns of association).

Where there is nonlinearity in a model, this can lead to spurious results and interpretation. The model in this study assumes that there is linearity between the dependent and explanatory variables. A slight deviation may not create a problem but a major deviation will result otherwise.

Generally, the approach for ascertaining if or not an association is linear will be centred on significance tests for Pearson *r* correlation coefficient: If the correlation coefficient between a dependent variable and explanatory variable is analytically significant, in which case, its probability is less than or equal to a stated level of significance, it can be assumed that the association is linear. However, if the significance test for linearity cannot be confirmed, then the bivariate scatterplot of the variables of interest will be examined. The scatterplot visualises a relation (correlation) between two variables. The most commonly recommended strategy for evaluating linearity is visual examination of a scatter plot.

5.2.9 Description of some selected explanatory variables

Table 5.1: Variable description

Groupings	Variables	Variable description
Dependent variable	NPB_DUM	Net protection buyer=1;Non net protection buyer=0
Independent variables		
Asset quality	NCLTASST	Non-performing loans/total assets
	CLPNCS	Credit loss provision to net charge-offs
	LLANL	Loan loss allowance to noncurrent loans
Capitalisation	TEQT1AC	Capital /Tier 1 risk adj capital
	RWATLS	Risk weighted assets ratio
	TDTA	Total deposits/total asset
	VLTL	Volatile liability to total liability
Credit management and derivatives	CEQTDTA	Commodity & equity derivatives to total assets
	SUBTT1C	Subordinated debt to Tier 1 risk adj cap
Credit risk	LSTTS	Loan sales to total assets
	CILEAST	C&I loans/earning assets
	NCOLS	Net charge-offs to loans
Interest rate risk	ITDR_DUM	use of interest rate derivatives
Liquidity risk	LR1	Highly liquid assets/Total liab
	NLLDS	Net loans and leases/deposits
	TLTAS	Total loans to total assets
Loan portfolio	LSRETLNS	Loans secured by real estate loans/ total loans
	AGLTLN	Agricultural loans to total loans
	TFLTTLN	Total foreign loans to total loans
Macroeconomic ramifications	FFR	Federal funds rate
Profitability	ROE	Return on equity
	ERT	Efficiency ratio
Size/Reputation	LASSET	Total assets

Table 5.2: Summary description of variables used in this study and those used by Minton et al. (2009)

Dependent variable used by Minton et al	Dependent variable used in this study	Independent variables used by Minton et al	Independent variables used by Minton et al and in this study	Independent variables used by Minton et al not used in this study	Independent variables used in this study to extend Minton et al
Net buyer of credit protection	Net protection buyer	Total assets	Total assets (LASSET)	US C&I loans	Net charge-offs to loans (NCOLS)
		Total loans	Total loans to total assets (TLTAS)	Consumer loans	Credit loss provision to net charge-offs (CLPNCS)
		Total deposits	Total deposits/total asset (TDTA)	Interest margin/total assets	Efficiency ratio (ERT)
		Total C&I loans	C&I loans/earning assets (CILEAST)	Tier 1 risk-adjusted capital ratio	Loan loss allowance to noncurrent loans (LLANL)
		US C&I loans	N/A	Total risk-adjusted assets/total assets	Net loans and leases to deposits (NLLDS)
		Loans secured by real estate	Loans secured by real estate loans to total loans (LSRETLNS)		Subordinated debt to Tier 1 risk adj cap (SUBTT1C)
		Agriculture loans	Agricultural loans/total loans (AGLTLN)		Volatile liability to total liability (VLTL)
		Consumer loans	N/A		Commodity & equity derivatives to total assets (CEQTDTA)
		Total foreign loans (including C&I)	Total foreign loans to total loans (TFLTTLN)		Loan sales to total assets (LSTTS)
		Return on assets	Return on assets (ROA)		Federal funds rate (FFR)
		Return on equity	Return on equity (ROE)		Use of interest rate derivatives (ITDR_DUM)
		Interest margin/total assets	N/A		
		Total equity capital/total assets	Total equity capital /Tier 1 risk adj capital (TEQT1AC)		
		Total risk-adjusted capital ratio	Risk weighted assets ratio (RWATLS)		
		Tier 1 risk-adjusted capital ratio	N/A		
		Total risk-adjusted assets/total assets	N/A		
		Nonperforming loans	Non-performing loans/total assets (NCLTASST)		
		Liquid assets	Highly liquid assets/Total liab (LR1)		

Some selection, description and explanation of main explanatory variables

Following the model utilised for this research to answer the primary research question (see research design), a number of explanatory variables are selected for this study. The definitions of the FDIC are adopted for the explanatory variables.

(a) Development and increases of total assets, measured in rate change from previous time period (ASSETS). As defined by the FDIC, bank total assets consist of the combined assets; this includes liquid assets, fixed assets and other assets except off-balance sheet accounts. The size of a bank is defined by its size, that is, its asset base. The original criterion in the data collation was to look at banks with at least US$10 billion asset base but this was scaled down to $500 million so as not to shut out critical data needed for the study, yet the problem associated with scale of economies is not considered an issue. The direct value of a banks' asset can be very large sometimes and this can lead to a very small coefficient and spurious regression due to its trending growth and subsequent variables in a model. The growth and rate of change in assets is calculated using the previous quarter as a base. For example, the total assets in quarter 5 is subtracted from quarter 6, and then divided by quarter 5 total assets. This method of calculating bank asset growth was used by Dong (2005) in a study of large banks.

(b) Total equity capital, computed as a proportion of total assets (TECTA). This variable comprises of preferred and ordinary shares, surplus, and complete earnings (FDIC). This is computed as total equity capital deflated by total assets. Chen et al. (2011) used a sample of 13,140 organisations spanning fifteen years from 1990 through 2004 to investigate the influence of shareholder rights on cutting down the cost of equity capital and how it affects agency costs from free cash flows. They argued that managers are more incentivised if a firm is more debt financed, suggesting that firm performance is enhanced with low equity capital (Jensen 1986). However, studies by Berger (1995) and Kwan and Eisenbeis (1996) suggest otherwise. Studies by Wheelock and Wilson (1995) indicate that weakly capitalised banks with high financial leverage face the prospects of disappearing and liquidation.

(c) Total loan and leases as a percentage of total assets (TLLAR). This refers to total loans plus lease financing receivables after deductions of unearned income (FDIC). This is worked out as total loans and leases divided by total assets. This variable is an important indicator of bank profit efficiency, and had been used by Brewer et al. (2000). A definite association is likely to connect this variable and bank portfolio performance.

(d) Total derivatives as a percentage of total assets (TDAR). This is calculated as total derivatives deflated by total assets. According to the Federal Deposit Insurance Corporation, total derivatives are the combined total of:

(i) Interest rate derivative contracts;

(ii) Futures, forward and option derivative contracts;

(iii) Foreign exchange rate derivative contracts;

(iv) Commodity derivative contracts; and

(v) Equity derivative contracts.

The literature on the impact of derivatives on bank portfolio has been mixed. Dai and Lapointe (2011) suggests that derivatives were not the root cause of the bank crisis in 2008, rather the failure of the banks to control the inherent risk in the financial system. Gorton and Rosen (1995) as well as Peek and Rosengren (1996) find no evidence that derivatives transactions affect the credit reclassification of individual banks. Previous studies with this proxy were conducted by Brewer III et al. (1996), Chaudhry et al. (2000) as well as Sinkey and Carter (2000).

Extension of Minton et al. (2009)

(a) Net charge-offs as a proportion of total loans (NCOLS): This variable is computed, according to the FDIC as gross loans and lease financing receivable charge-offs, excluding gross recoveries, (annualised) as a proportion of mean total loans and lease financing receivables. As one of the performance condition ratios of banks with impact on bank profitability and hence return on assets, it is used as proxy for credit risk but this bring about a question of if it is fitting to incorporate it as an explanatory variable to extend the model. This could be looked at from different perspectives: (a) in as much as the net charge-offs to total loans ratio does not a have multicullinearity issue with other explanatory variables, it will not affect the cogency and soundness of the model (b) net charge-offs to total loans and return on assets are not of necessity faultless for some reasons. The variable is a degree of the bank's condition, which has a considerable effect to the bank's return on assets It is one of the explanations for the return on assets, but it is not comparable to the return on assets (c) To a certain degree, the bank can control the variable by how strict its loan policy and procedure is and how carefully the bank watch and examine its loans. Banks would need to take some risk to increase their bottom line. The variable is a consequence of what risk level the bank considers is ideal. A tighter loan guideline can cut down the rate of loan delinquencies, nevertheless may possibly damage the bank's bottom line. A careful one-to-one care of bank loans can lessen the rate of loan delinquencies; nonetheless, this could bring additional costs to the bank. In the same vein a reduced net charge-offs to total loans does not of necessity work for the bank well or enhance its bottom line.

(b) Credit loss provision to net charge-offs (CLPNCS): Credit loss provision in accounting is an approximation of possible losses that a firm might incur due to credit risk. Prearrangement for credit losses is a projected sum to be lost and is dealt with as an expense on the firm's balance sheet. Most banks agree the provision for credit losses premised on the statistics that explain the probability that a delinquent and bad debt will be repossessed. This variable is calculated as the gross credit loss provision, as a proportion/percent of the net charge-offs. This variable is used as a proxy for credit risk as it impacts on the profitability and income of financial institutions

(c) Efficiency ratio (ERT): Efficiency Ratio, according to the FDIC is calculated as the total non-interest expense as a percentage of adjusted operating income (tax equivalent) of financial institutions. It is used to contrast, at a given time, how much a bank is making compared to their expenditure. That is, the measure of the ability of a bank to make assets and profit from their non-funding connected expenditure base. This tells us how a bank is using their assets to make profits. Banks try to achieve lessened Efficiency Ratios since a reduced Efficiency Ratio shows that the bank is making more revenue than its expenditure. This is of mutual benefits to both the bank and its shareholder. A generally reliable method is that 50% is the highest optimal Efficiency Ratio. Any ratio more than 50% shows that the bank has an outflow more than 50% of what it is making in Net-income on Non-interest Expense. Usually, a bank with a lessened Efficiency Ratio has stronger ability to make profit.

(d) Loan loss allowance to noncurrent loans (LLANL): This is calculated, according to the FDIC as the total loan loss allowance as a proportion of total loans past due 90 days or more plus non-current Loans. The loan loss allowance, at first known as the 'standby for bad debts,' contains the sum held in backup to safeguard projected loan losses; to a large extent, the sum that a bank projects will not be collectible from its existing portfolio. In comparison, non-current loans, the number below the line of this ratio, contain the real total sum loans that are presently either past due ninety days or more and non-accrual loans, which are facilities that do not produce the prescribed specified sum or interest rate because of default. This ratio is used to assess after a while the suitability of the amount accommodated in the loan loss allowance for covering loans that could lead to additional default. According to the FDIC, it is imperative for banks to sufficiently keep their allowance as part of a good risk management procedure. Loan portfolios encompass credit risk at the same as the loan loss allowance restricts that risk by protecting for the bank's losses from non-current loans. Imbalance between loss allowance and noncurrent loans can result to a fall in capital and profitability.

(e) Net loans and leases to deposits (NLLDS): Expressed as a percentage, this is a frequently used figure for gauging a bank's liquidity by dividing the banks total loans by its total deposits. Where the ratio is too high, it shows that banks might not have adequate liquidity to protect any unexpected fund obligations, on the other hand, where the ratio is too low, banks may not be making as much as they could be. For example, the FDIC reported that state-wide net loans and leases to deposits ratios in the United States varied from a low 56% in Utah to a high 170% in North Dakota in 2008.The state-wide ratios evaluate net loans to all deposits for banks with their home base in their respective state and are used to determine if a bank will be permitted to open shop outside of its home state of incorporation. Usually, the ratio is every so often used by policy makers to establish the lending habit and procedures of banks.

(f) Subordinated debt to Tier 1 risk adj cap (SUBTT1C): This variable is calculated as the subordinated debt as a proportion of a bank's Tier 1 risk adjusted capital. Subordinated debt which can also be known as subordinated loan, bond, and debenture is debt which ranks after other debts if a bank becomes insolvent and goes into liquidation or bankruptcy. Subordinated bonds are usually issued as part of the debt securitisation, for example, asset-backed securities, collateralised mortgage or debt obligations. Corporate issuers in most cases are not disposed to issue subordinated bonds due to the higher interest rate expected to make up for the higher risk, on the other hand, they may be compelled to do so if contract on previous issues support their status as senior bonds. In addition, subordinated debt may be combined with preferred shares to create supposed monthly income preferred shares, a crossbreed security compensating with dividends for the lender and funded as interest outlay by the issuer.

(g)Volatile liability to total liability (VLTL): The latest Basel Capital Accord (Basel III) emphasises in Pillar 3 the position of market discipline to limit risk-taking behaviour of banks. Empirically, depositories deeply dependent on uninsured deposits are prone to be unsuccessful swiftly than banks funded by other streams as owners of uninsured claim can react to imminent failure with taking out of funds. On the other hand, banks going downhill will attempt to replace the cash depletion with insured deposits therefore growing the deposit insurer's risk of financial loss. This variable is derived by using the volatile liability or net non-core liabilities less short term investments deflated by the total liability as a measure of bank's dependency on potentially volatile liabilities. Volatile liability indicates the extent of a bank's dependence on potentially volatile liabilities (time deposits greater than $100,000, large CD'S over $100,000, federal funds purchased, deposits in foreign offices, repurchased agreements, other borrowings with maturities less than 1 year and public funds).The variable tries to capture the reliance on volatile liabilities that may lead to bank stress, loss rate etc.

(h) Commodity and equity derivatives to total assets (CEQTDTA): This variable is worked out as commodity derivatives and equity derivatives as a proportion of total assets. The markets for Commodity derivatives have been in existence for hundreds of years, energised by the activities of commodities producers, users and investors to manage their business and financial risks. Producers want to manage their risk of financial loss to changes in the prices they get for their commodities. End-users want and need to mitigate the prices at which they can buy commodities. Together, investors and financial intermediaries can either purchase or dispose off commodities through the use of derivatives. The commodity derivatives market today is global, and includes both exchange-traded and over-the-counter (OTC) derivatives contracts. It encompasses an extensive range of division, to wit, coal, crude oil, oil and gas products, petro chemical products, commodity index products, precious metals, weather, agriculture, emissions etc.

Likewise, investors can use equity derivatives to mitigate the risk related with taking a position in shares by limiting the losses experienced by either a short or long position in a company's shares. The investor gets this insurance by making payments for the cost of the derivative contract, which is usually known as a premium. If an investor buys shares, he or she can mitigate against a loss in share value by buying a put option. Conversely, if the investor has shorted shares, he or she can mitigate against a gain in share price by buying a call option. The ratio is used to gauge the effect of risk management policy of financial institutions whether the use of commodity and equity derivatives also warrants the use of credit derivatives.

(i) Loan sales to total assets (LSTTS): This variable is calculated as the total loan sale as a proportion of the total assets and used to gauge the risk management strategy of banks under consideration. A loan sale is usually referred to the sale of loans or loan pools. Loans acquired by the Federal Deposit Insurance Corporation from unsuccessful financial institutions may be disposed off in pools by means of sealed bid sales. Loan sale is also used by solvent banks as an investment and risk management strategy compared to securitisation. Generally, loan sales comprise loans that have similar attributes. The loans are distilled into pools according to distinctive yardstick. Pooling standards as set by the FDIC sometimes may include the size of the loan, performance status of the loan, type of loan, collateral attached to the loan and the location. The loan portfolio offered for sale would comprise a variety of performing and non-performing loan products which includes consumer, commercial, mortgage loans, etc.

(j) Federal Funds Rate (FFR): A significant factor in the profitability of financial institutions is interest rate which is also a critical factor in the macro economy. Profitability of banks stem from bank's earning assets over liabilities which results in the net interest margin, thus banking business revolves around interest rate. As a source of financial intermediation, banks are impacted by the macro economic situation. For example, if there is economic recession, the demand for bank facilities tend to be low in comparison to when there is economic boom.

Theoretically, the connection linking interest rates and bank performance proposed that a higher interest rate will upset a bank that uses short term borrowing with long-term lending approach and policy. Empirically in contrast, the connection linking interest rate and bank performance has been found to be without importance (Flannery 1981,1983) or beneficial (Goudreau and Whitehead 1989; Hancock 1985; Sinkey and Carter 2000; Grigorian and Manole 2006; Athanasoglou et al. 2008). The interest rate employed in this research is the Federal Fund Rate. It is the interest rate charged by banks with extra or surplus reserves to other banks to meet up with their overnight reserve requirements (bank's reserve is centred on two-week average). It is also the most sensitive pointer of the management and target of interest rates. It is settled on by the market daily in contrast with the Prime Rate and the Discount Rate which are adjusted at regular intervals by banks and the Federal Reserve Board correspondingly. However, as noted in chapter 3, a targeted Federal Fund Rate is set by the Federal Open Market Committee (FOMC). This affects the Federal Fund Rate by means of the open market operations.

(k) Use of interest rate derivatives (ITDR_DUM): From our data, it is apparent that most banks used interest rate derivatives to manage their interest exposure to the market. However, this variable is a dummy used to capture the banks that employed this instrument compared to those that did not and to ascertain if using this instruments also leads to the use of credit derivatives to mitigate the risks thrown up by credit risks.

Independent variables used by Minton et al. (2009) not used in this study

(a) US C&I loans and Consumer loans: This variable was not considered useful in this work since we have these loans captured in total loans.
(b) Interest margin/total assets: We did not find this variable useful since this has been captured under return on assets which is more encompassing.
(c) Tier 1 risk-adjusted capital ratio and Total risk-adjusted assets/total assets: These variable more or less capture the same information. We are satisfied that the need for these variables have been captured in three other variables used in our study: Total equity capital /Tier 1 risk adj capital (TEQT1AC), Risk weighted assets ratio (RWATLS) and Subordinated debt to Tier 1 risk adj cap (SUBTT1C).

5.2.10 Research Questions and Hypotheses in Chapter 8

Reason 1 in Relation to Hypothesis 1

To test if the selling of credit derivatives affects bank investment and portfolio performance.

Ho: The usage of credit derivatives does not affect bank investment and portfolio performance or there is an adverse association linking the selling of credit derivatives (bank is guarantor) and the risk adjusted rate of return of banks.

Ha: The usage of credit derivatives improves bank investment and portfolio performance or there is a positive correlation between selling credit derivatives (bank is guarantor) and the risk adjusted rate of return of banks.

Reason II in Relation to Hypothesis 2

To test if the purchasing of credit derivatives affects bank investment and portfolio performance.

Ho: There is an adverse association linking the buying of credit derivatives (bank is beneficiary) and the risk adjusted return on assets.

Ha: There is a positive correlation between buying credit derivatives (bank is beneficiary) and the risk adjusted return on assets.

Reason III in Relation to Hypothesis 3

To test if buying credit derivatives reduces the effect on the average absolute deviation (risk) of bank investment and portfolio performance.

Ho: The relationship between credit derivative outstanding (CDTD) and bank investment and portfolio performance (P) does not differ before 2007 and after 2007.

Ha: The relationship between CDTD and P becomes more positive after 2007 than before 2007.

Reason IV in Relation to Hypothesis 4

To test if dealing in credit derivatives does not affect (negative) the return of bank investment and portfolio performance.

Ho: Selling credit derivatives (guarantor) does not affect the return of bank portfolios performance.

Ha: Selling credit derivatives (guarantor) increases the return on bank portfolios performance.

Reason V in Relation to Hypothesis 5

To tests the constructive effects of purchasing credit derivatives on bank portfolio returns on asset.

Ho : There is an effective correlation between purchasing of credit derivatives (bank is beneficiary) and the return on asset (ROA) of bank portfolio.

Ha : There is an ineffective correlation between purchasing of credit derivatives (bank is beneficiary) and the return on asset (ROA) of bank portfolio.

Reason VI in Relation to Hypothesis 6

To test if buying credit derivatives causes more bank defaults.

Ho: The estimated sum of unsettled credit derivatives is not correlated to the bank's net charge-offs to loans ratio.

Ha: The estimated sum of unsettled credit derivatives purchased by the bank is definitely associated to the bank's net charge-offs to loan ratio.

Table 5.3 : Summary of the connection of the objectives to the Hypotheses in Chapter 8

No.	Objectives	H	Hypotheses	Models
1	The first objective is to examine in detail, the impact of credit derivatives as a credit risk management tool on portfolio persistence, risk and return and whether banks can make better, increase the value of their assets or achieve a superior risk adjusted return, pre and post credit crisis 2002 to 2011.	HI (**Data type:** Sellers (Guarantor) and non-users)	There is definite (negative) correlation between dealing in credit derivatives and the risk adjusted return of banks	$RAR_{it} = \alpha + S_1 RAR_{i(t-1)} + S_2 RORO_{it} + S_3 CCLGR_{it} + S_4 NCLTASST_{it} + S_5 TEQT1AC_{it} + S_6 RWATLS_{it} + S_7 SUBTT1C_{it} + S_8 NLLDS_{it} + S_9 CDAR_{it} + S_{10} MBSTAS_{it} + S_{11} ABSTATS_{it} + S_{12} LSRETLNS_{it} + S_{13} FFR_{it} + S_{14} ERT_{it} + S_{15} NOPIAS_{it} + S_{16} REAEY_{it} + S_{17} TDAR_{it} + S_{18} LASSET_{it} + u_{it}$
		H2 (**Data type:** Buyers (Beneficiary) and non-users)	There is definite (positive) correlation between purchasing credit derivatives and the risk adjusted return of banks	$RAR_{it} = \alpha + S_1 RAR_{i(t-1)} + S_2 RORO_{it} + S_3 CCLGR_{it} + S_4 NCLTASST_{it} + S_5 TEQT1AC_{it} + S_6 RWATLS_{it} + S_7 SUBTT1C_{it} + S_8 ITDR_{DUM\,it} + S_9 NLLDS_{it} + S_{10} MBSTAS_{it} + S_{11} ABSTATS_{it} + S_{12} LSRETLNS_{it} + S_{13} AGLTLN_{it} + S_{14} FFR_{it} + S_{15} ROA_{it} + S_{16} ERT_{it} + S_{17} NOPIAS_{it} + S_{18} REAEY_{it} + S_{19} TDAR_{it} + u_{it}$
		H3 (**Data type:** Net protection buyers)	The relationship between outstanding CD and performance of bank portfolios(p) does not differ before 2007 and after 2007	$Di_{it} = \alpha + S_1 Di_{i(t-1)} + S_2 CCLGR_{it} + S_3 NCLTASST_{it} + S_4 TEQT1AC_{it} + S_5 RWATLS_{it} + S_6 SUBTT1C_{it} + S_7 NLLDS_{it} + S_8 TLTAS_{it} + S_9 CDAR_{it} + S_{10} MBSTAS_{it} + S_{11} ABSTATS_{it} + S_{12} LSRETLNS_{it} + S_{13} AGLTLN_{it} + S_{14} FFR_{it} + S_{15} ERT_{it} + S_{16} NOPIAS_{it} + S_{17} REAEY_{it} + S_{18} PROA_{it} + S_{19} TDAR_{it} + S_{20} LASSET + u_{it}$
		H4 (**Data type:** Sellers (Guarantors))	Dealing in CD does not affect (negative) the return of bank portfolios	$ROA_{it} = \alpha + S_1 ROA_{i(t-1)} + S_2 RORO_{it} + S_3 CCLGR_{it} + S_4 NCLTASST_{it} + S_5 TDTA_{it} + S_6 VLTL_{it} + S_7 RWATLS_{it} + S_8 CDAR_{it} + S_9 MBSTAS_{it} + S_{10} ABSTATS_{it} + S_{11} STASST_{it} + S_{12} LSRETLNS_{it} + S_{13} RESLTL_{it} + S_{14} AGLTLN_{it} + S_{15} CILEAST_{it} + S_{16} FFR_{it} + S_{17} NOPIAS_{it} + S_{18} PROA_{it} + S_{19} ECNCS_{it} + S_{20} TDAR_{it} + S_{21} LASSET_{it} + u_{it}$

		H5 (**Data type:** Net protection buyers)	Purchasing CD does affects (positive) the return of bank portfolios	$ROA_{it} = \alpha + S_1 ROA_{i(t-1)} + S_2 RWATLS_{it} + S_3 VLTL_{it} + S_4 LSTTS_{it} + S_5 CDAR_{it} + S_6 MBSTAS_{it} + S_7 ABSTATS_{it} + S_8 IBTLTLS_{it} + S_9 LSRETLNS_{it} + S_{10} STASST_{it} + + S_{11} FFR_{it} + S_{12} ERT_{it} + S_{13} NOPIAS_{it} + S_{14} REAEY_{it} + S_{15} PROA_{it} + S_{16} ECNCS_{it} + S_{17} TDAR_{it} + u_{it}$
2	The secondary objective of the research is to test the impact of the moral hazard problem on portfolio performance. This problem is prevalent when there is inadequate monitoring of loans supported with credit derivatives contracts as lenders are in most cases unable to do proper follow up on their borrowers resulting in loan loss defaults.	H6 (**Data type:** All users)	The notional amount of outstanding CD is not correlated to the bank's net charge-offs to loan ratio	$NCOLS_{it} = \alpha + S_1 NCOLS_{i(t-1)} + S_1 NCOLS_{i(t-2)} + S_2 RORO_{it} + S_3 CCLGR_{it} + S_4 NCLTASST_{it} + S_5 TDTA_{it} + S_6 VLTL_{it} + S_7 ITDR_{DUM\,it} + S_8 NLLDS_{it} + S_9 TLTAS_{it} + S_{10} MBSTAS_{it} + S_{11} ABSTATS_{it} + S_{12} STASST_{it} + S_{13} LSRETLNS_{it} + S_{14} AGLTLN_{it} + S_{15} FFR_{it} + S_{16} NOPIAS_{it} + S_{17} REAEY_{it} + S_{18} PROA_{it} + S_{19} ECNCS_{it} + S_{20} TDAR_{it} + S_{21} LASSET_{it} + u_{it}$

As explained above (measurement matters), the following were used as dependent variables:

(a) *RAR* (ROA/STDEV)

(b) *Di* (STDEV)

(c) *ROA*

(d) *NCOLS*

Where,

RAR (Risk adjusted return), is the ratio between ROA and the standard deviation of ROA.
Di (Risk), is defined as the standard deviation of ROA.
ROA (Return on assets), measures bank portfolio returns from a point of view of all sources of funds rather than equity holders.
NCOLS (Net charge-off to loans), measures gross loans and lease financing receivable charge-offs, excluding gross recoveries, (annualised) as a proportion of mean total loans and lease financing receivables.

Explanation of the equations and the changes in variables

HI: This equation is testing if there is definite (negative) correlation between dealing in or selling credit derivatives and its impact on the risk adjusted returns of banks. The dependent variable used is the risk adjusted returns as explained above. The independent variables are grouped under leverage, asset quality, capitalisation, liquidity, profitability, risk management, size/reputation, credit risk management and derivatives, and the effect of the macro-economic vagaries. In total, 18 variables are in this equation as defined in the description of explanatory variables, to wit, lagged Risk adjusted return, Financial leverage, Core capital ratio (Operational), Non-performing loans/total assets, Total equity capital /Tier 1 risk adjusted capital, Risk weighted assets ratio, Subordinated debt to Tier 1 risk adjusted capital, Net loans and leases to deposits, Mortgage-backed securities/Total assets, Asset backed securities/Total assets, Loans secured by real estate loans to total loans, Federal funds rate, Efficiency ratio, Net operating income to assets, Retained earnings to average equity, Total derivatives to total assets and Natural log of total assets.

H2: This equation is testing if there is definite (positive) correlation between purchasing credit derivatives and risk adjusted returns of banks. The dependent variable used is the risk adjusted returns as explained above. The independent variables are grouped under leverage, asset quality, capitalisation, liquidity, credit risk management and derivatives, profitability, risk management, interest rate risk, loan portfolio and the effect of the macro-economic vagaries.

The equation relaxes the size/reputation which measures the banks total assets and introduces the interest rate component which shows how banks mitigate the volatility of interest rates with interest rate derivatives in the market which impacts on the interest margin and profitability of banks. In total, 19 independent variables are in this equation as defined in the description of explanatory variables, to wit, lagged Risk adjusted return, Financial leverage, Core capital ratio (Operational), Non-performing loans/total assets, Total equity capital /Tier 1 risk adjusted capital, Risk weighted assets ratio, Subordinated debt to Tier 1 risk adjusted capital, Dummy/interest rate derivatives, Net loans and leases to deposits, Total credit derivatives to assets ratio, Mortgage-backed securities/Total assets, Asset backed securities/Total assets, Loans secured by real estate loans to total loans, Agricultural loans to total loans, Pre-tax return on assets, Federal funds rate, Efficiency ratio, Net operating income to assets, Retained earnings to average equity and Total derivatives to total assets.

H3: This equation is testing if the relationship between outstanding credit derivative and performance of bank portfolios (p) does not differ before 2007 and after 2007.The dependent variable used is the average absolute deviation (risk) as explained above. The independent variables are grouped under leverage, asset quality, capitalisation, liquidity, credit risk management and derivatives, profitability, risk management, interest rate risk, size/reputation and the effect of the macro-economic vagaries.

The equation relaxes financial leverage which was used to measure the use of debt to acquire additional assets and earnings. It introduces the size/reputation component which measures the banks total assets. In total, 20 independent variables are in this equation as defined in the description of explanatory variables, to wit, lagged average absolute deviation (risk), Core capital ratio (Operational), Non-performing loans/total assets, Total equity capital /Tier 1 risk adjusted capital, Risk weighted assets ratio, Subordinated debt to Tier 1 risk adjusted capital, Dummy/interest rate derivatives, Net loans and leases to deposits, Total loans to total assets, Total credit derivatives to assets ratio, Mortgage-backed securities/Total assets, Asset backed securities/Total assets, Loans secured by real estate loans to total loans, Agricultural loans to total loans, Pre-tax return on assets, Federal funds rate, Efficiency ratio, Net operating income to assets, Retained earnings to average equity, Natural log of total assets and Total derivatives to total assets.

H4: This equation is testing if dealing in credit derivatives does not affect (negative) the return of bank portfolios. The dependent variable used is the return on assets as explained above. The independent variables are grouped under leverage, asset quality, capitalisation, liquidity, market risk, profitability, risk management, credit risk, size/reputation, loan portfolio and the effect of the macro-economic vagaries. In total, 21 independent variables are in this equation as defined in the description of explanatory variables, to wit, lagged return on investment, Financial leverage, Core capital ratio (Operational), Non-performing loans/total assets, Risk weighted assets ratio, Total credit derivatives to assets ratio, Mortgage-backed securities/Total assets, Asset backed securities/Total assets, Loans secured by real estate loans to total loans, Agricultural loans/total loans, Federal funds rate, Pre-tax return on assets, Net operating income to assets, Total derivatives to total assets, Natural log of total assets, Total deposits/total asset, Volatile liability to total liability, Stocks to total asset, restructured loans to total loans, Commercial and industrial loans/earning assets and Earnings coverage of net charge-offs.

H5: This equation is testing if purchasing credit derivatives does affects (positive) the return of bank portfolios. The dependent variable used is the return on assets as explained above. The independent variables are grouped under capitalisation, credit management and derivatives, liquidity, market risk, profitability, risk management, loan portfolio and the effect of the macro-economic vagaries. In total, 17 independent variables are in this equation as defined in the description of explanatory variables, to wit, lagged return on investment, Risk weighted assets ratio, Total credit derivatives to assets ratio, Mortgage-backed securities/Total assets, Asset backed securities/Total assets, Loans secured by real estate loans to total loans, Federal funds rate, Net operating income to assets, Total derivatives to total assets, Volatile liability to total liability, Stocks to total asset, Earnings coverage of net charge-offs, Loan sales to total assets, Efficiency ratio, Retained earnings to average equity and Pre-tax return on assets.

H6: This equation is testing if the notional amount of outstanding credit derivatives is not correlated to the bank's net charge-offs to loan ratio. The dependent variable used is the Net charge-off to loans as explained above. The independent variables are grouped under Financial and operational leverage, asset quality, interest rate risk, capitalisation, liquidity, market risk, loan portfolio, the effect of the macro-economic vagaries, profitability, risk management and size/reputation. In total, 22 independent variables are in this equation as defined in the description of explanatory variables, to wit, lagged Net charge-offs to loans, financial leverage, core capital ratio (operational), Non-performing loans/total assets, Total deposits/total asset, Volatile liability to total liability, Dummy/use of interest rate derivatives, Net loans and leases to deposits, Total loans to total assets, Mortgage-backed securities/Total assets, Asset backed securities/Total assets, Stocks to total asset, Loans secured by real estate loans to total loans, Agricultural loans/total loans, Federal funds rate, Net operating income to assets, Retained earnings to average equity, Pre-tax return on assets, Earnings coverage of net charge-offs, Total derivatives to total assets and Natural log of total assets.

5.2.11 Research design

The functional model to be estimated has the following form:

$$NPB_{DUM\,it} = S_0 + S_1TEQT1AC_{it} + S_2RWATLS_{it} + S_3ROE_{it} + S_4NCOLS_{it} + S_5CLPNCS_{it} + S_6ERT_{it} + S_7LLANL_{it} + S_8NLLDS_{it} + S_9CILEAST_{it} + S_{10}LSRETLNS_{it} + S_{11}AGLTLN_{it} + S_{12}TFLTTLN_{it} + S_{13}SUBTT1C_{it} + S_{14}TDTA_{it} + S_{15}TLTAS_{it} + S_{16}NCLTASST_{it} \; S_{17}LASSET_{it} + S_{18}LR1_{it} + S_{19}VLTL_{it} + S_{20}CEQTDTA_{it} + S_{21}LSTTS_{it} + S_{22}FFR_{it} + S_{23}ITDR_{DUM\,it} + \varepsilon_{it} \quad (5.28)$$

where,

$NPB_{DUM\,it}$ is the “dependent” or “endogenous” variable,

S_o is the “intercept” or “constant”,

S_1 to S_{23} is the “coefficients” of the explanatory variables and

ε_{it} is the “disturbance” or “noise” term.

The dependent and independent variables are as defined in section 5.2.9.

5.3 Conclusions

This chapter contained a description of the methodological issues, to wit, the research philosophy, research framework, the models to be estimated, measurement matters, econometric analysis of the data, the benefits of panel data in this research, the research questions and hypothesis, dependent variables, a description and explanations of the independent variables and the research design were discussed. The research methodology (Random Effects Logistic Models and The Arellano and Bond (1991) Generalised Method of Moments approach) used was chosen on the basis of operability, painstakingly put together and executed and shown to be effective as all needed information was obtained. The statistical package (STATA) used provided the requisite results as it is very versatile and practical for examining straightforward as well as complex puzzles. Chapter 6 discusses the data description of this work. The results of the research findings are presented in Chapters 7 and 8.

CHAPTER SIX

DATA DESCRIPTION

This section offers a discussion of the data used for the analysis of this research. The primary sources of data in this research are detailed in Table 6.1.

Table 6.1: Sources and types of data

Sources		Type of Data
www.fdic.gov	i.	Reports of condition and Income
www.occ.treas.gov	ii.	Banks statutory filings
www.federalreserve.gov	iii.	Consolidated Derivatives reports
www.isda.org	iv.	Credit Derivatives reports
www.bis.org	v.	Credit ratings downgrade
www.bba.org.uk	vi.	Income statement data
www.fitchratings.com	vii.	Balance sheet data
www.standardandpoors.com	viii.	Federal fund rate
www.moodys.com		
www.creditflux.com		
www.gtnews.cm		
www.Thomson.com		
www.economagic.com		
www.ffiec.gov		
Database: Fame		
Various Banks website		

Table 6.2: Sample data by period (40 Quarters)

Year	Sample of banks (commercial and savings banks)	Benchmark ($ millions)
2002	1,050	500
2003	1,106	500
2004	1,130	500
2005	1,208	500
2006	1,300	500
2007	1,333	500
2008	1,384	500
2009	1,417	500
2010	1,369	500
2011	1,358	500
Total	12,655	500

6.1 The data Sources

6.1.1 The United States Federal Deposit Insurance Corporation (FDIC)

The principal data for this research was obtained from the database of the United States Federal Deposit and Insurance Corporation (FDIC) database. The FDIC publishes quarterly individual and aggregate data such as Report of Changes, Institution Directory (ID), Call and Thrift Financial Reports (CDR), Summary of Deposits (SOD), Deposit Market Share (DMS), Report Statistics on Depository Institutions (SDI), Statistics at a Glance (SG), Historical Statistics on Banking (HSOB) etc. Statutorily, banks operating in the US are compelled to report the breakdown of their derivatives operations and contracts, performances etc to this body thereby providing a robust and rich data for this research. The data extracted from the FDIC are from the following schedules: Assets and Liabilities; Securities; Income and Expense; Total Deposits; Letters of Credit; Derivatives and off Balance Sheet Items; Banks Assets Sold and Securitised; Net Loan and Leases; Loan and Lease Financing Receivables; Loan Charge offs and Recoveries; Net Charge-offs to Loans; Performance and Condition Ratios; Changes in Bank Equity Capital; Demographics etc

6.1.2 The United States office of the comptroller of the currency (OCC)

The OCC provided consolidated reports for only the largest 25 banks. The OCC publishes Quarterly Report on bank Trading and Derivatives Activities. This report describes what the Call Report information discloses about banks derivative activities provided by all insured U.S commercial banks and trust companies, reports filed by US financial holding companies, and other published data.

As of the fourth quarter of 2011, more than 1,000 commercial banks reported the use of derivatives. Large financial institutions account for 95.5% of the total derivatives transactions and activities in the banking sector, they also account for 86% of the industry net current credit exposure. The original criterion in the data collation was to look at banks with at least US$1 billion asset base. It was discovered that this would not be feasible as it would shut out banks with critical data needed for this research. To get round this limitation and capture the relevant data, a cut-off minimum of $500 million was used for each year. In effect, the data set is unbalanced.

To ascertain the completeness and validity of the data available by these bodies, checks were conducted by verifying through the banks income statement and balance sheet data. Also, research conducted by other bodies like the Bank for international Settlement (BIS), the International Swap and Derivatives Association (ISDA), US Federal Reserve Board, fitchratings etc. did not show any significant variations from what was reported. The data obtained spanned 10 years (2002-2011). Prior studies by Dong (2005) used 22 time period. However, this study is more robust with 40 quarters with an enlarged sample size of 1,000 banks and above per annum for the ten years period.

6.2 Data Analysis Procedures

The sample was categorised into institutions that use credit derivatives and those that do not. To determine the robustness and significance of the models derived and analysed in this study, some diagnostic tests were carried out following that the study makes use of panel secondary data.

Descriptive statistics was used to summarise the data and describe the central tendency of the variables and variability within the values.

Correlation analysis was used to determine whether there was a relationship between the variables. The criterion for the rejection of the null hypothesis was a determination of statistical significance at the $p < 0.05$ level of probability.

Variance inflation factor (VIF) was calculated to determine if there was a multiculinearity problem in the data.

To determine the stationarity or non stationarity of the temporal properties in the model through the unit root tests, the Augmented Dickey-Fuller test (ADF) and the Maddala and Wu-Fisher test (1999) was calculated. Likewise, to determine if the variables are co-integrated, that is, to check the long run equilibrium relationship among the explanatory variables, the Engle-Granger Cointegration test and the Augmented Engle-Granger Cointegration test was calculated.

Regression analysis, that is, Random Effects Logistic Regression was used to analyse the linear relationship between the dependent and independent variables in chapter 7. This method has been used by Sohn and Kim (2007) to examine default prediction of technology credit guarantee fund while Erdogan (2016) examined Bank failure and crashes.

On the other hand, Dynamic panel data model, The Arellano and Bond (1991) Generalised Method of Moments use the lags of the dependent variable as independent variables in Chapter 8. The admission of these lags gets critical to control for the drift of the process and valuable when the dependent variable depends on its own past comprehension. The exact performance specification let us know new or different connection between the dependent and independent variables. This method has been used by Letendre and Smith (2001), to examine prudent saving and portfolio allocation; Clark et al. (2008), to analyse capital assimilation, currency crisis and exchange rate control and administration; Farnsworth (2009), to evaluate stochastic discount factors from term structure models; Nagel and Singleton (2011), to analyse conditional pricing models of managed portfolios and consumption-based models of stock returns; Chien-Chiang (2012), to investigate how foreign bank ownership in the banking sector impacts domestic bank performance and management; Brendea (2013), to examine the effect of the recent financial crisis on capital structure of listed firms on the stock exchange; Lee and Hsieh (2013), to investigate the effect of bank capital on risk and returns; Faff and Treepongkaruna (2013), reinvestigated the empirical efficiency of the Longstaff and schwartz two-factor term structure using real yield data; Waqar et al. (2014), to analyse banking board size and independence; Vitorino (2014), to evaluate the effect of advertising on stock returns and firm value using structural model; López-Andión et al. (2015), to examine the financial competence of financial institutions; and Ur-Rehman and Man (2015), to investigate firm cash holdings and adjustment behaviour.

The panel data used in estimating the models were processed with Stata software. It was preferred over SPSS, E-view and R econometric packages due to its capacity to handle panel data more effectively.

Table 6.3: Segmentation of data timeline

Period (Crisis Breakdown)	Period (Quarterly data)	NBER Recession dates	Duration (Quarters)	Comments	Literature
Pre-crisis	2002:1 - 2007:2		22	On **February 7, 2007**, HSBC declared losses connected to US subprime mortgages. On April 3, 2007, New Century Financial, with speciality in sub-prime mortgages, applied for "Chapter 11" bankruptcy protection and reduces its staff strenght by 50%.	
Crisis Period	2007:3 - 2009:2	2007:4 - 2009:2	8	On **August 9, 2007**, BNP Paribas (Investment Bank) notified investors it will not be feasible to dip their hands in two of its funds as it was having difficulties in valuing the assets domiciled in them due to the dissipation of the liquidity in the financial market. This was a trigger for the European Central Bank to reflate the banking market with €95 billion. In another couple of days,it added another €108.7 billion. The Central banks of the US, Canada and Japan also intervened to provide liquidity in the market.This also followed series of interventions by other bodies to tame the crisis. On **June 24, 2009**, The Organisation for Economic Cooperation and Development annouced that in the post-war history, the world economy is near the bottom of the barrel in the most unpleasant recession. On **June 26, 2009**, a government survey showed that US consumer sureness rose in the month of June to its maximum level since February 2008 which suggested that the most unfavourable of the recession may have come to an end. On **June 29, 2009**, the Confedeartion of British Industry quarterly survey showed that there were signs that the financial services sector was coming out from the most unfavourable of the crisis.	
Post-Crisis	2009:3 - 2011:4		10	On **July 8, 2009**, the International Monetary Fund announced that global economic growth was expected to recover to 2.5% in 2010.	

6.3 Limitations

Due to the availability a robust data set from the US regulatory authorities, the study is heavily skewed to banks in the US alone. This does not allow for comparison with other jurisdictions especially the Euro Zone countries. This makes it difficult to generalise the research outcome to other regions and countries.

The credit derivatives market until 2008 was not a well regulated market compared to other derivatives market. The lack of uniform definitions and accounting treatment of credit derivatives data in the early years may result in a minor part of the data not been reliable pre 2008. The issues of data entry errors could not be ruled out due to the number of banks involved.

From the returns and structure of the data submitted to the FDIC, transactional details of credit derivatives are not available except for the only two positions of when a bank is held as guarantor or a beneficiary. Additional data in respect of pricing, maturity, type, underlying assets would have gone a long way to enhance the analysis on the effectiveness and impact on of bank portfolio management.

According to the returns of the last quarter of 2011 filed by banks, the usage of credit derivatives is heavily skewed towards the big players, as such, the distribution of credit derivatives is not normal but skewed towards the left.

Notwithstanding the shortcomings, the FDIC, is a credible federal agency backed by law in which banks are compelled to make statutory returns on their operations. The checks made from other organisations indicate the data are reliable and verifiable. On balance, the data is credible.

6.4 Conclusions

This chapter discussed the sources and types of data, the data analysis procedures, the segmentation of the data timeline and the limitations.This research will now proceed with the analysis in chapter 7, investigating the role of credit derivatives as determinants of bank use to mitigate risks before, during and after the credit crisis from 2002 to 2011.

CHAPTER SEVEN

THE ROLE OF CREDIT DERIVATIVES AS DETERMINANTS OF BANK USE TO MITIGATE RISK (PRE AND POST CREDIT CRISIS 2002 TO 2011)

7.1 Introduction

The purpose of this chapter is to analyse and test the determinants of the use of credit derivatives by US banks for the period from 2002 to 2011. The results are mixed but sufficient enough for us to explore the effects on the risk, return and the impact of these instruments on bank portfolio in this chapter. The chapter has several objectives. First, it is to investigate whether a bank is less likely to buy protection if it has more capital and quality asset. Second, it is to test if a bank is more likely to buy protection if it is larger (size) and has more diversified loan portfolio. Third, it is to test whether banks with consumer loans are less likely to buy protection since they can be sold or packaged and securitised. Fourth, it is to test whether banks reporting other types of derivatives are more likely to use credit derivatives. It will also test whether banks that sell loans or securitise loans are more likely to buy protection, and lastly, it will test whether banks that are less liquid and profitable are more likely to buy protection.

Relying on the hedging theories postulated by early researchers in finance literature, for example, Nance et al. (1993), Geczy et al. (1997), Mian (1996) and Stulz (2003), Minton et al. (2005) ran a series of probit models to test the likelihood of the use of these instruments to mitigate risks and hedge credit default over a period of four years (1999 to 2003) among US bank holding companies. Ashraf et al. (2007) investigated the usage and motivations of credit risk management through credit derivatives from 1997 to 2004 with a total of 3,162 observations using descriptive statistics among large US banks. We digress by investigating the determinants by running random effect logistic models to test these determinants split over a period ten years compartmetalised into pre-crisis,crisis period and post crisis period.

Ten seminal papers, in chronological order, Ashraf et al. (2007), Duffee and Zhou (2001), Gibson (2007), Gonzalez et al. (2012), Insterfjord (2005), Sinkey and Carter (1997, 2000), Mahieu and Xu (2007), Minton et al. (2009), Morrison (2005), Shao and Yeagar (2007) have investigated the argument that bank size, barriers to entry, regulatory pressure, risk management, credit risk management, diversification, trading opportunities, hedging and dealing in other derivatives as reasons why banks use credit derivatives but results have been mixed. One of the seminal papers, Minton et al. (2009) is looked at in more detail with the models provided to predict the reasons why banks use credit derivatives to hedge loans and risk.

7.2 Minton, Stulz and Williamson (2009)

This paper first appeared originally as a US national bureau of economic research working paper series in August 2005. It looked into the use of credit derivatives by bank holding companies in the USA from 1999 to 2003 with a sample size of 345 banks. Out of the sample examined, only 19 banks used credit derivatives in 2003. Using eighteen explanatory variables, they focused on two years, 2002 to 2003 due to holes in the data for the earliest years. The research used 2003 as the base year. They found that the use of credit derivatives to hedge risk is strongly correlated with the volume of commercial and industrial loans in a bank's portfolio and negatively correlated with other types of loans.

The extensions of the 2009 paper compared to the paper published in 2005 can be segregated into several parts. The sample of bank holding companies with assets in excess of $1 billion was extended from 1999 to 2005. The sample size examined increased from 345 to 395. Just 23 of the 395 large banks examined used credit derivatives. In all, eighteen explanatory variables were considered. They focused on 2003 and estimated fourteen sets of probit regressions for the four years from 2002 to 2005 split equally into Panel A and B; the earliest years were ignored due to incomplete data on all the variables used as the market for credit derivatives was still in its infancy. First, accounting for clustering of residuals at the firm level, they estimated pooled regressions from 2001 to 2005 using year indicator variables. Second, they estimated probit regressions separately for 2002 and 2003. They also estimated probit regressions for 2002 and 2003 allowing for a common component in the residuals for each year. These regressions lead to qualitatively similar conclusions. Third, this is followed by probit models for 2003 as base year, except for model (1) which includes all sample years; the research concluded that adverse selection and moral hazard difficulties and the problems associated with the use of hedge accounting when hedging with credit derivatives limited the use of credit derivatives by banks to mitigate risks.

7.2.1 The theory behind the models used

Before the weaknesses in the paper are examined, the theory behind the models used is first examined. Probit is an abbreviation for probability unit. As a regression technique that is used with categorical dependent variables, probit models is most commonly used with binary dependent variables that can assume only the values of 0 or 1, such as the occurrence of a specific event, for example, a credit default. The parameters of probit regression are estimated by maximum likelihood estimation rather than by ordinary least squares. Probit regressions have the drawback of normality assumptions violations and over or under estimation.

To overcome these limitations, Minton et al. (2009) considered reporting marginal effects to provide a good estimation of each regressor and the associated probability value (p-value) of the test that the marginal probability is equal to zero. For each indicator variables, the coefficient represents the change in the probability associated with moving the indicator from 0 to 1.

Minton et al. (2009) used two distinct proxies to test for capitalisation in their models. These are:

- Equity capital (Panel A); and
- Tier 1 risk-adjusted capital ratio (Panel B).

The capitalisation proxy used in Panel B reported negative coefficients and it is statistically significant in all regressions that did not control for total assets. Generally, the regressions coefficients in Panel B were identical to the comparable coefficients reported in Panel A.

7.2.2 Weaknesses in Minton, Stulz and Williamson (2009)

The data used in estimating the regressions was effectively for four years (2002 to 2005), average sample was 395 bank holding companies with a benchmark of $1 billion. This did not adequately capture all the categories of credit derivatives users during this period. The models estimated with the data have the advantage being simple to understand and easy to implement. For example, the models developed investigated the effect of the balance sheet-- bank size, profitability, capitalisation and derivative use. However, on the down side, the definition of variables used was not specific. For example, credit risk and interest rate risk was not defined with clarity. Likewise, measurement issues were not properly identified. For the underlying assets (e.g. bonds etc.), the research assumes that transaction cost is small. It also assumes that spread is only a reflection of default risk and not liquidity risks.

7.3 Econometric Specification and Approaches

We report discrete results with random effect logistic regression. We extend the explanatory variables by five to twenty three in total and make comparisons. We expect some of the variables not to be statistically significant in view of the depth of data captured and seasonality. In particular, we use a panel of US banks extending the sample over a period of 10 years from 2002 to 2011. For ease of analysis, we split this into three phases each (pre-crisis period, crisis period and the post-crisis period).

The definition and measurement of the variables is specific. For example, credit risks are defined with clarity and measurement issues identified. We also use different measures of credit risk. In total, we estimated 28 random effects logistic models in this chapter. By extension, we study the impact of the credit crisis on bank credit risk and the determinants to use credit derivatives to mitigate risks, the structural break over the years and the reasons why credit derivatives failed to protect from credit crunch.

Table 7.1 shows the explanatory variables of the model and there description. The model has one dependent variable and twenty three explanatory variables. We use quarterly data from January 2002 to December 2011

Table 7.1: Description of selected explanatory variables

Groupings	Variables	Variable description	Expected impact on NPB_DUM	Theoretical rationale	This Chapter	Data characteristics	Data sources
Dependent variable	NPB_DUM	Net protection buyer=1;Non net protection buyer=0			Minton et al. (2009)	Dummy	US FDIC
Asset quality	NCLTASST	Non-performing loans/total assets		Mahieu and Xu (2007)	Minton et al. (2009)	ratio	US FDIC
	CLPNCS	Credit loss provision to net charge-offs				ratio	US FDIC
	LLANL	Loan loss allowance to noncurrent loans				ratio	US FDIC
capitalisation	TEQT1AC	Total equity capital /Tier 1 risk adj capital (Panel A&C)			Minton et al. (2009)	ratio	US FDIC
	RWATLS	Risk weighted assets ratio (Panel B&D)		Ashraf et al. (2007)		ratio	US FDIC
	TDTA	Total deposits/total asset		Mahieu and Xu (2007)	Minton et al. (2009)	ratio	US FDIC
	VLTL	Volatile liability to total liability				ratio	US FDIC

Table 7.1 (Cont'd)

Groupings	Variables	Variable description	Expected impact on NPB_DUM	Theoretical rationale	This Chapter	Data characteristics	Data sources
Credit management and derivatives	CEQTDTA	Commodity & equity derivatives to total assets			Minton et al. (2009)	ratio	US FDIC
	SUBTT1C	Subordinated debt to Tier 1 risk adj cap				ratio	US FDIC
	LSTTS	Loan sales to total assets			Minton et al. (2009)	ratio	US FDIC
Credit risk	CILEAST	C&I loans/earning assets				ratio	US FDIC
	NCOLS	Net charge-offs to loans				ratio	US FDIC
Interest rate risk	ITDR_DUM	use of interest rate derivatives		Brewer et al.(2000),Purnanandam(2007):		Dummy	US FDIC
Liquidity risk	LR1	Highly liquid assets/Total liab		Chamberlain (1980),Ashraf et al. (2007), Purnanandam(2007):	Minton et al. (2009)	ratio	US FDIC
	NLLDS	Net loans and leases to deposits				ratio	US FDIC
	TLTAS	Total loans to total assets		Chamberlain (1980),Mahieu and Xu (2007)		ratio	US FDIC
Loan portfolio	LSRETLNS	Loans secured by real estate loans to total loans				ratio	US FDIC
	AGLTLN	Agricultural loans/total loans			Minton et al. (2009)	ratio	US FDIC
	TFLTTLN	Total foreign loans to total loans			Minton et al. (2009)	ratio	US FDIC

Table 7.1 (Cont'd)

Groupings	Variables	Variable description	Expected impact on NPB_DUM	Theoretical rationale	This Chapter	Data characteristics	Data sources
Macroeconomic ramifications	FFR	Federal funds rate				Quarterly average	US FDIC
Profitability	ROE	Return on equity		Chamberlain (1980)		ratio	US FDIC
	ERT	Efficiency ratio				ratio	US FDIC
Size/Reputation	LASSET	Total assets		Ashraf et al. (2007), Mahieu and Xu (2007)	Minton et al. (2009)	Natural log of total assets	US FDIC

7.4 Diagnostic Analysis

Before proceeding with the empirical model, it is necessary to note potential data-related problems which involve the possibility of the existence of a unit root in the output, for example. As indicated in chapter 5, data was sourced from the US FDIC. Traditionally, diagnostics tests for models starts with the visual inspection of the selected time series. It is also traditional to examine the level and differenced variables. The significance of the diagnostic analysis is to validate the data and resulting models. First, we proceed with the descriptive statistics.

7.4.1 Descriptive statistics

Table 7.2, 7.3 and 7.4 shows the descriptive statistics of the independent variables used in our regressions which was run with Stata software. Descriptive statistics such as mean, median, mode, standard deviation, variance, kurtosis, skewness, range, min, max etc. form the basis of a rigorous data analysis. They help to examine the tendencies, spread, normality, and reliability of a data set. An understanding of descriptive statistics is also essential for the appropriate and effective use of all normative and cause-and-effect statistical techniques, including hypotheses testing, correlation, and regression analysis. They are useful to help in exploring and examining data before performing statistical tests and subsequently carrying out statistical analysis and data interpretation. Where descriptive statistics is not properly grasped, data can be misunderstood, thereby misrepresented.

Table 7.2: Descriptive statistics of the independent variables (Pre-Crisis)

Table 7.2(a)

Statistics	Roe	Ncols	clpncs	ert	llanl	nllds	cileast	lsretlns	agltln	tflttln	subtt1c	teqt1ac
Mean	12.89	0.32	211.38	62.04	1605.33	5125.73	0.10	0.71	15013.14	43992.56	0.00	1.15
Median	12.21	0.08	114.74	59.62	214.98	89.22	0.07	0.76	468	0.00	0.00	1.04
Standard Deviation	11.96	1.30	8826.35	137.74	22216.02	170238.30	0.29	0.23	67822.72	1075718	0.01	0.42
Kurtosis	1635.59	432.63	1757.84	16981.63	1730.31	9745.25	3333.38	4.98	231.77	1278.65	1186.05	196.89
Skewness	20.70	16.17	-13.00	119.01	36.88	87.26	51.43	-1.40	13.34	34.63	26.21	9.62
Range	1202.78	66.81	1078500	23632.43	1515600	2.12E+07	22.06	1.01	1709000	4.85E+07	1.00	16.64
Min	-222.12	-8.87	-655450	-3432.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	980.66	57.94	423050	20200	1515600	2.12E+07	22.06	1.01	1709000	4.85E+07	1.00	16.64

Table 7.2(b)

Statistics	tdta	Tltas	ncltasst	rwatls	lasset	lr1	vltl	ceqtdta	lstts	ffr	itdr_dum
Mean	0.73	0.65	0.00	5.08	14.28	0.80	0.28	0.00	0.08	2.99	0.32
Median	0.77	0.68	0.00	1.08	13.84	0.68	0.23	0.00	0.00	2.63	0.00
Standard Deviation	0.15	0.16	0.00	381.17	1.23	1.87	0.17	0.28	12.14	1.69	0.46
Kurtosis	10.08	5.02	174.32	13695.32	6.46	4972.36	5.05	10379.58	27171.25	1.33	1.54
Skewness	-2.29	-1.15	9.88	116.15	1.77	62.72	1.38	98.29	164.83	0.19	0.73
Range	0.95	0.99	0.24	47774.43	7.85	179.37	0.99	32.94	2002	4.28	1.00
Min	0.00	0.00	0.00	0.00	13.12	0.00	0.00	0.00	0.00	0.98	0.00
Max	0.95	0.99	0.24	47774.43	20.97	179.37	0.99	32.94	2002	5.26	1.00

Source: calculated by author

Table 7.2(a) to 7.2(b) shows the calculated descriptive statistics for the independent variables

Table 7.3: Descriptive statistics of the independent variables (Crisis-Period)

Table 7.3(a)

Statistics	roe	ncols	clpncs	ert	llanl	nllds	cileast	lsretlns	agltln	tflttln	subtt1c	teqt1ac
Mean	5.45	0.78	467.19	74.09	370.13	10787.97	0.10	0.74	22138.06	50987.06	0.00	1.15
Median	6.59	0.25	152.17	64.96	86.06	94.23	0.09	0.79	1327.50	0.00	0.00	1.03
Standard Deviation	259.26	1.72	13218.76	737.28	6712.40	222797.90	0.09	0.21	98981.12	1368062	0.00	0.38
Kurtosis	9426.11	169.34	2085.62	9520.61	6657.19	621.13	16.10	6.48	297.94	1346.41	63.06	56.84
Skewness	96.28	8.97	30.18	96.98	76.30	23.96	2.46	-1.78	15.00	36.16	5.77	5.18
Range	26088.01	50.35	1190233	77026.80	601900	6839539	1.00	1.00	2639000	5.54E+07	0.13	9.27
Min	-699.21	-1.57	-320833	-4587.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.55
Max	25388.80	48.77	869400	72439.26	601900	6839539	1.00	1.01	2639000	5.54E+07	0.13	8.71

Table 7.3(b)

Statistics	Tdta	tltas	ncltasst	rwatls	lasset	lr1	vltl	ceqtdta	lstts	ffr	itdr_dum
Mean	0.74	0.69	0.01	1.14	14.22	0.66	0.26	0.00	0.00	1.57	0.40
Median	0.77	0.72	0.00	1.08	13.79	0.58	0.23	0.00	0.00	1.81	0.00
Standard Deviation	0.13	0.15	0.02	1.30	1.21	0.51	0.14	0.04	0.03	1.41	0.49
Kurtosis	13.47	7.03	49.00	1089.23	8.04	449.44	8.13	983.45	290.05	2.17	1.14
Skewness	-2.58	-1.61	5.23	30.50	2.05	11.79	1.74	28.97	14.71	0.56	0.38
Range	1.00	0.99	0.37	58.68	8.17	23.33	0.99	2.02	0.97	4.08	1.00
Min	0.00	0.00	0.00	0.00	13.12	0.00	0.00	0.00	0.00	0.16	0.00
Max	1.00	0.99	0.37	58.68	21.29	23.33	0.99	2.02	0.97	4.24	1.00

Source: calculated by author

Table 7.3(a) to 7.3(b) shows the calculated descriptive statistics for the independent variables

Table 7.4: Descriptive statistics of the independent variables (Post-Crisis)
Table 7.4 (a)

Statistics	roe	Ncols	clpncs	ert	llanl	nllds	cileast	lsretlns	agltln	tflttln	subtt1c	teqt1ac
Mean	0.91	1.26	212.67	68.38	135.76	5130.45	0.09	0.74	24859	46813.87	0.00	1.12
Median	5.65	0.68	115.79	66.72	65.01	82.15	0.08	0.80	1671.50	0.00	0.00	1.05
Standard Deviation	99.98	1.83	2619.90	48.01	714.65	130404.40	0.08	0.21	113631.70	1377347	0.00	0.69
Kurtosis	5397.41	44.75	1030.49	969.4	1821.1	892.89	19.07	6.85	347.24	1345.64	40.04	9624.48
Skewness	-57.69	4.54	11.93	-8.42	37.2	28.96	2.68	-1.86	16.34	36.42	5.03	89.82
Range	12432.50	42.9	227500	4204.09	46040	5049231	0.99	1.10	3064000	5.43E+07	0.13	82.19
Min	-9151.58	-6.71	-77500	-2305.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-6.79
Max	3280.91	36.18	150000	1898.14	46040	5049231	0.99	1.10	3064000	5.43E+07	0.13	75.39

Table 7.4 (b)

Statistics	Tdta	tltas	ncltasst	rwatls	lasset	lr1	vltl	ceqtdta	lstts	ffr	itdr_dum
Mean	0.78	0.64	0.02	23.92	14.2	0.75	0.14	0.00	0.00	0.13	0.43
Median	0.81	0.66	0.01	1.07	13.79	0.67	0.10	0.00	0.00	0.12	0.00
Standard Deviation	0.11	0.15	0.02	2003.48	1.19	0.52	0.12	0.03	0.03	0.04	0.49
Kurtosis	19.56	5.87	18.39	13118.50	8.7	565.38	12.74	864.28	140.31	1.59	1.07
Skewness	-3.18	-1.25	3.10	113.45	2.14	12.81	2.46	27.24	10.33	-0.09	0.27
Range	1.02	0.99	0.34	232031	8.20	27.79	0.99	1.45	0.70	0.12	1.00
Min	0.00	0.00	0.00	0.00	13.12	0.00	0.00	0.00	0.00	0.07	0.00
Max	1.02	0.99	0.34	232031	21.32	27.79	0.99	1.45	0.70	0.19	1.00

Source: calculated by author

Table 7.4(a) to 7.4(b) shows the calculated descriptive statistics for the independent variables

Interpretation of Tables 7.2 to 7.4

The mean is important in econometrics and other statistical tests, for example, in calculating a *t*-test. The mean is the arithmetic average across the distribution of the data set. It is calculated by summing all the values in the particular variable and then dividing the sum by the total number of observations (*N*) in that variable field. For example, in Table 7.2, the calculated mean for the explanatory variable ROE, NCOLS and CLPNCS are 12.89, 0.32 and 211.38, respectively.

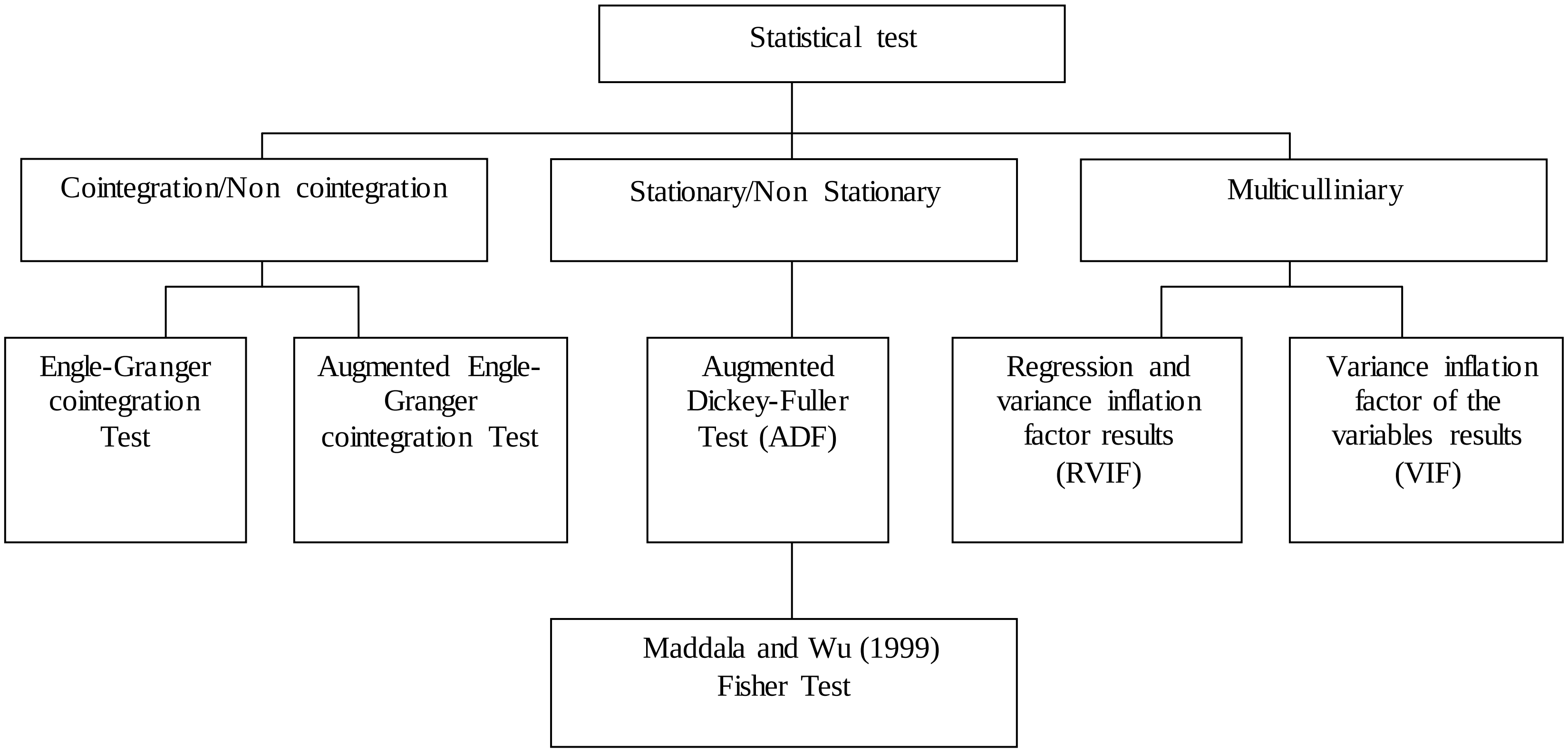
The standard deviation is a widely used and common measure of dispersion in econometrics and statistics. It measures the spread of observations about the mean. That is, it explains how widely the values in a data set are spread around the mean. In statistics, it is the root mean square deviation of values from the arithmetic mean. The larger the standard deviation, the more spread out the observations are. It is easier to interpret than variance since the standard deviation is in the same units as the original variable. It is the square root of the variance. For example, in Table 7.2, the standard deviation for the variable ROE and NCOLS are 11.96 and 1.30, respectively.

Kurtosis measures how concentrated data are around a single value, usually the mean. In order words, kurtosis assesses how peaked or flat is the data distribution, the lightness or heaviness of the tails of the distribution and how much of the distribution is actually located in the tails. In statistics and probability theory, a normal distribution has a kurtosis value of 0 and said to be mesokutic. A positive kurtosis value means that the tails are heavier than a normal distribution and the distribution is said to be leptokurtic, (with a higher or more acute peak). A negative kurtosis value means that the tails are lighter than a normal distribution and the distribution is said to be platykurtic (with a smaller, flatter peak).

Skewness measures how concentrated data points are at the high or low end of the scale of measurement. Thus, skewness measures the degree and direction of symmetry or asymmetry of the distribution. The more skewed the distribution, the higher the variability of the measures, and the higher the variability, the less reliable are the data. Skewness is calculated by either multiplying the difference between the mean and the median by three and then dividing by the standard deviation or by summing the cubes of the differences between each observation and the mean and then dividing by the cube of the standard deviation. More conceptually, skewness defines the relative positions of the mean, median, and mode of a distribution. A distribution may be skewed to the right or left.

The calculated descriptive statistics has distinctively summarised and organised the ten year data in a straight forward process, translating the variables and results into the mean, standard deviation etc, identified further areas of research and laid the groundwork for more sophisticated statistical analysis.

Figure 7.1: Statistical tests flowchart



Source: Author generated

7.4.2 Test for multicullliniarity

Tables 7.5 and 7.6 show the VIF results of the model independent variables. The abbreviations have been defined above. We use quarterly data from January 2002 to December 2011.

Table 7.5: Variance Inflation Factor (VIF) Results

Variable	VIF	1/VIF
TDTA	1.70	0.587006
LASSET	1.57	0.637926
VLTL	1.55	0.643226
LSRETLNS	1.35	0.741384
NCOLS	1.26	0.796488
ITDR_DUM	1.20	0.835986
TLTAS	1.19	0.843307
AGLTLN	1.16	0.86549
SUBTT1C	1.13	0.884864
NCLTASST	1.11	0.90012
TEQT1AC	1.10	0.906719
LR1	1.07	0.93665
ROE	1.06	0.946628
FFR	1.05	0.949382
LSTTS	1.05	0.949954
TFLTTLN	1.04	0.957035
CILEAST	1.04	0.958498
NLLDS	1.02	0.97941
RWATLS	1.02	0.981944
CEQTDTA	1.01	0.989899
ERT	1.01	0.992903
LLANL	1.00	0.997019
CLPNCS	1.00	0.998646
Mean VIF	**1.16**	**0.88**

Source: Calculated by author

Table 7.6: Regression and VIF Results of the Model Independent Variables

Independent variable Variables	NPB_DUM Estimates/t-statistics	VIF
ROE	0.0000611 -0.99	1.06
NCOLS	-0.00367*** (-6.38)	1.26
CLPNCS	-0.000000348*** (-4.29)	1
ERT	-0.00000281 (-0.59)	1.01
LLANL	0.00E+00 -0.8	1
NLLDS	2.23E-09 -0.53	1.02
CILEAST	-0.00566* (-2.50)	1.04
LSRETLNS	-0.0336*** (-9.56)	1.35
AGLTLN	0.000000283*** -24.14	1.16
TFLTTLN	9.84e-09*** -14.07	1.04
SUBTT1C	0.640*** -12.7	1.13
TEQT1AC	-0.0138*** (-7.56)	1.1
TDTA	0.0470*** -7.99	1.7
TLTAS	-0.0500*** (-11.02)	1.19
NCLTASST	0.153 -1.74	1.11
RWATLS	-0.0000455 (-1.62)	1.02
LASSET	0.0253*** -35.4	1.57
LR1	-0.00106** (-2.89)	1.07
VLTL	0.0110* -2.3	1.55

Table 7.6 (Cont'd)

Independent variable	NPB_DUM	
Variables	**Estimates/t-statistics**	**VIF**
CEQTDTA	0.0334***	1.01
	-14.71	
LSTTS	0.0641***	1.05
	-3.98	
FFR	0.00105*	1.05
	-2.26	
ITDR_DUM	0.00939***	1.2
	-5.66	
_cons	-0.324***	
	(-25.61)	
N	23180	
F	237.1	
df_m	23	
df_r	23156	
r2	0.191	
bic	-37428.1	

Source: Calculated by author

where,*, **, *** represents t-value that is statistically significant at 0.10, 0.05 and 0.01 respectively.

Interpretation of Tables 7.5 and 7.6

Theoretically, the ideal VIF is 1. Generally, a VIF more than 4 indicates a multicullinearity problem. However, some texts have suggested a cut-off of between 5 to 10. A high VIF is a sign that a collinearity problem exists while a VIF less than 10 indicates that there is unlikely to be collinearity problem. As shown above in both Tables, the mean VIF is 1.16, none of the calculated correlation coefficients is greater than 0.2, the independent variables are not strongly correlated. Another method of detecting multicolliniarity is the variance-inflation factor (VIF) which is calculated as: $VIF_1 = 1/(1 - R^2)$.

The VIF is the variance-inflation factor and R^2 is the squared multiple correlation coefficients obtained from a regression of the *ith* independent variable on the other independent variables. As shown in Table 7.5, there is a VIF for each independent variable. The VIF for each explanatory variable is the projection of how much the variance of its coefficient measurement has been extended by multicullinearity. From our calculations, there is no multicollinearity problem in the data, in order words; the predictor variables in our model are not correlated.

7.4.3 Stationarity and Non-stationarity

This study is based on panel data and hence requires the examination of the stationarity of the variables used in the models. Where a data set is non-stationary, the regression results given may result in a statistically spurious correlation and conclusions. As a precondition for testing for cointegration in the panel data, we proceed to test the data if it follows a random walk, random walk with drift and trend or are stationary. To wit:

H_o : (Non Stationary) - (Unit Root) – (No Cointegration)

H_a :(Stationary) - (no Unit Root) – (Cointegration)

The null hypothesis is the existence of a unit root and where the variables are not co-integrated. The alternate hypothesis is the nonexistence of unit root and where the variables are co-integrated.

7.4.3.1 Unit root test

In econometric research, Unit root test is widely used to test for stationarity (Breitung and Das 2008). This is represented by the following formulae: $\Delta Y = \gamma Y_{t-1} + \varepsilon_t$ The null hypothesis in the formulae to be tested is: $\gamma = 0$. The stochastic error term, $\mathcal{E}_t$ is assumed to be non-autocorrelated with a zero mean and with a constant variance. Another name for the error term is the white noise error term. Generally, the challenge in calculating a unit root test (augmented Dickey-Fuller test) is whether to know if to include a constant term and a linear trend or do nothing (Dickey and Fuller 1979,1981). The standard principle is to choose a specification that is a plausible description of the data under both the null and alternative hypotheses (Kmenta 1971; Breitung and Pesaran 2008). Where a series seems to contain a trend, we should include both a constant and a trend in the test regression. If the series seems not to contain a trend, we should include neither a contant nor a trend in the test regression. We proceed with the ADF test of the variables as shown in Tables 7.7, 7.8 and 7.9.

Table 7.7: ADF test (Pre-Crisis)

Variables	MacKinnon approximate p-value for z(t)	DF test statistic	Interpolated Dickey-Fuller critical value** 1%**	5%	10%
NPB_DUM	0.000	-56.93	-3.430	-2.860	-2.570
ROE	0.000	-96.57	-3.430	-2.860	-2.570
NCOLS	0.000	-74.44	-3.430	-2.860	-2.570
CLPNCS	0.000	-148.21	-3.430	-2.860	-2.570
ERT	0.000	-162.11	-3.430	-2.860	-2.570
LLANL	0.000	-134.98	-3.430	-2.860	-2.570
NLLDS	0.000	-136.15	-3.430	-2.860	-2.570
CILEAST	0.000	-151.81	-3.430	-2.860	-2.570
LSRETLNS	0.000	-55.21	-3.430	-2.860	-2.570
AGLTLN	0.000	-45.82	-3.430	-2.860	-2.570
TFLTTLN	0.000	-53.85	-3.430	-2.860	-2.570
SUBTT1C	0.000	-60.84	-3.430	-2.860	-2.570
TEQT1AC	0.000	-50.56	-3.430	-2.860	-2.570
TDTA	0.000	-34.78	-3.430	-2.860	-2.570
TLTAS	0.000	-34.99	-3.430	-2.860	-2.570
NCLTASST	0.000	-46.59	-3.430	-2.860	-2.570
RWATLS	0.000	-89.14	-3.430	-2.860	-2.570
LASSET	0.000	-28.44	-3.430	-2.860	-2.570
LR1	0.000	-138.22	-3.430	-2.860	-2.570
VLTL	0.000	-34.83	-3.430	-2.860	-2.570
CEQTDTA	0.000	-160.65	-3.430	-2.860	-2.570
LSTTS	0.000	-164.84	-3.430	-2.860	-2.570
FFR	0.000	-38.98	-3.430	-2.860	-2.570
ITDR_DUM	0.000	-53.87	-3.430	-2.860	-2.570

**MacKinnon critical values for rejection of hypothesis of a unit root

Source: calculated by author

Table 7.7 shows an ADF for the data for the pre-crisis period for three critical values (1, 5 and 10%).

Table 7.8: ADF Test (Crisis Period)

Variables	MacKinnon approximate p-value for z(t)	DF test statistic	Interpolated Dickey-Fuller critical value** 1%**	5%	10%
NPB_DUM	0.000	-30.14	-3.430	-2.860	-2.570
ROE	0.000	-92.49	-3.430	-2.860	-2.570
NCOLS	0.000	-48.96	-3.430	-2.860	-2.570
CLPNCS	0.000	-84.46	-3.430	-2.860	-2.570
ERT	0.000	-97.63	-3.430	-2.860	-2.570
LLANL	0.000	-94.43	-3.430	-2.860	-2.570
NLLDS	0.000	-29.80	-3.430	-2.860	-2.570
CILEAST	0.000	-28.25	-3.430	-2.860	-2.570
LSRETLNS	0.000	-26.92	-3.430	-2.860	-2.570
AGLTLN	0.000	-21.63	-3.430	-2.860	-2.570
TFLTTLN	0.000	-27.25	-3.430	-2.860	-2.570
SUBTT1C	0.000	-30.20	-3.430	-2.860	-2.570
TEQT1AC	0.000	-38.38	-3.430	-2.860	-2.570
TDTA	0.000	-32.77	-3.430	-2.860	-2.570
TLTAS	0.000	-31.03	-3.430	-2.860	-2.570
NCLTASST	0.000	-42.20	-3.430	-2.860	-2.570
RWATLS	0.000	-48.90	-3.430	-2.860	-2.570
LASSET	0.000	-27.61	-3.430	-2.860	-2.570
LR1	0.000	-38.02	-3.430	-2.860	-2.570
VLTL	0.000	-32.12	-3.430	-2.860	-2.570
CEQTDTA	0.000	-29.59	-3.430	-2.860	-2.570
LSTTS	0.000	-37.42	-3.430	-2.860	-2.570
FFR	0.000	-75.87	-3.430	-2.860	-2.570
ITDR_DUM	0.000	-32.50	-3.430	-2.860	-2.570

**MacKinnon critical values for rejection of hypothesis of a unit root

Source: calculated by author

Table 7.8 shows an ADF for the data for the crisis period for three critical values (1, 5 and 10%).

Table 7.9: ADF test (Post-Crisis)

Variables	MacKinnon approximate p-value for z(t)	DF test statistic	Interpolated Dickey-Fuller critical value** 1%**	5%	10%
NPB_DUM	0.000	-35.36	-3.430	-2.860	-2.570
ROE	0.000	-116.19	-3.430	-2.860	-2.570
NCOLS	0.000	-48.24	-3.430	-2.860	-2.570
CLPNCS	0.000	-95.70	-3.430	-2.860	-2.570
ERT	0.000	-108.76	-3.430	-2.860	-2.570
LLANL	0.000	-81.36	-3.430	-2.860	-2.570
NLLDS	0.000	-42.97	-3.430	-2.860	-2.570
CILEAST	0.000	-29.51	-3.430	-2.860	-2.570
LSRETLNS	0.000	-27.81	-3.430	-2.860	-2.570
AGLTLN	0.000	-21.50	-3.430	-2.860	-2.570
TFLTTLN	0.000	-27.19	-3.430	-2.860	-2.570
SUBTT1C	0.000	-33.89	-3.430	-2.860	-2.570
TEQT1AC	0.000	-103.80	-3.430	-2.860	-2.570
TDTA	0.000	-33.95	-3.430	-2.860	-2.570
TLTAS	0.000	-32.74	-3.430	-2.860	-2.570
NCLTASST	0.000	-37.58	-3.430	-2.860	-2.570
RWATLS	0.000	-110.77	-3.430	-2.860	-2.570
LASSET	0.000	-27.85	-3.430	-2.860	-2.570
LR1	0.000	-37.54	-3.430	-2.860	-2.570
VLTL	0.000	-45.22	-3.430	-2.860	-2.570
CEQTDTA	0.000	-28.87	-3.430	-2.860	-2.570
LSTTS	0.000	-42.80	-3.430	-2.860	-2.570
FFR	0.000	-47.69	-3.430	-2.860	-2.570
ITDR_DUM	0.000	-32.04	-3.430	-2.860	-2.570

**MacKinnon critical values for rejection of hypothesis of a unit root

Source: calculated by author

Table 7.9 shows an ADF for the data for the post-crisis period for three critical values (1, 5 and 10%).

With a large sample size of more than 100 observations and a significance level of 1 percent, the critical value of the t-statistic from the Dickey-Fuller's Tables for no intercept and no trend is -3.430. According to Tables 7.7 to 7.9, we can reject the null hypotheses, namely the existence of a unit root with one percent significance level. The ADF statistic is -56.93. In other word, the data is stationary.

Maddala and Wu (1999) Fisher combination test-panel unit root test

The Fisher test by Maddala and Wu (1999) is based on combining the p-values of the test-statistic for a unit root in each cross-sectional unit. Thus, it can be performed with any unit root test on a single time-series in each cross section. In addition, it does not require a balanced panel like the Im-Pesaran-Shin (2003) test, so T can differ over cross sections.

The Maddala and Wu (1999) Fisher test reports the Fisher statistic and associated p-value[1]. Like the Pesaran (2007) test, the null hypothesis for both tests is that all series are nonstationary. Lags indicate the lag augmentation in the Dickey Fuller regression employed. We augment the Dickey Fuller regression with a constant. The results from the three Tables 7.10 to 7.12 produced significant test statistics, which allowed rejecting the unit root hypotheses at 5%. Conclusively, the test showed that the panel data was confirmed to be stationary.

[1] We used the Stata routines xtfisher written by Scott Merryman for the Maddala and Wu (1999) Fisher test.

Table 7.10: Maddala and Wu Fisher (Pre-Crisis)

Table 7.10 (a)

Lags	NPB_DUM	ROE	NCOLS	CLPNCS	ERT	LLANL	NLLDS	CILEAST	LSRETLNS
0	385.00(1.00)	1.3600(0.00)	1.4600(0.00)	1.9200(0.00)	1.3800(0.00)	1.4500(0.00)	1.4200(0.00)	1.6200(0.00)	1.5900(0.00)
1	198.69(1.00)	8040.31(0.00)	7812.95(0.00)	1.1600(0.00)	7580.88(0.00)	8449.47(0.00)	7038.91(0.00)	8363.88(0.00)	8405.06(0.00)
2	168.87(1.00)	6496.65(0.00)	6265.77(0.00)	9311.01(0.00)	4831.50(0.00)	6697.01(0.00)	5263.15(0.00)	7032.54(0.00)	6829.98(0.00)
3	106.45(1.00)	3096.36(0.00)	6182.23(0.00)	5383.28(0.00)	3773.33(0.00)	3419.76(0.00)	2708.50(0.99)	2950.00(0.50)	3168.12(0.00)

Table 7.10(b)

Lags	AGLTLN	TFLTTLN	SUBTT1C	TEQT1AC	TDTA	TLTAS	NCLTASST	RWATLS	LASSET
0	1.1300(0.00)	2661.66(1.00)	742.66(1.00)	5736.02(0.00)	6193.55(0.00)	5215.57(0.00)	6347.40(0.00)	6118.14(0.00)	5088.94(0.00)
1	5913.40(0.00)	1730.10(1.00)	728.85(1.00)	4199.29(0.00)	4602.09(0.00)	4626.87(0.00)	5525.19(0.00)	4785.10(0.00)	4436.36(0.00)
2	4386.40(0.00)	1493.82(1.00)	738.70(1.00)	3607.57(0.01)	3204.73(0.00)	3844.74(0.00)	4016.88(0.00)	4902.16(0.00)	3255.67(0.00)
3	2118.17(0.00)	667.42(1.00)	756.56(1.00)	3673.25(0.00)	2912.99(0.00)	3351.38(0.00)	3331.95(0.00)	4269.14(0.00)	3852.63(0.00)

Table 7.10(c)

Lags	LR1	VLTL	CEQTDTA	LSTTS	FFR	ITDR_DUM
0	1.3300(0.00)	4928.53(0.00)	1222.21(1.00)	6915.90(0.00)	3785.82(0.00)	5147.09(0.00)
1	8476.85(0.00)	3963.45(0.00)	910.00(1.00)	4919.74(0.00)	2141.81(1.00)	2677.16(1.00)
2	4775.10(0.00)	3185.14(1.05)	365.03(1.00)	3663.97(0.00)	7516.50(0.00)	2007.08(1.00)
3	3114.16(0.01)	2813.67(0.96)	229.40(1.00)	5382.36(0.00)	1.5700(0.00)	1645.20(1.00)

Table 7.11: Maddala and Wu Fisher (Crisis Period)

Table 7.11(a)

Lags	NPB_DUM	ROE	NCOLS	CLPNCS	ERT	LLANL	NLLDS	CILEAST	LSRETLNS
0	3.3822(1.00)	5202.00(0.00)	5441.16(0.00)	1.0900(0.00)	6731.37(0.00)	1.1500(0.00)	3657.21(0.00)	4642.30(0.00)	5296.72(0.00)
1	2.7281(1.00)	3601.38(0.00)	3237.22(0.00)	9730.73(0.00)	3963.75(0.00)	9744.22(0.00)	7808.14(0.00)	7899.36(0.00)	7694.88(0.00)
2	0.4933(1.00)	0.0000(1.00)	27.1954(1.00)	32.9332(1.00)	1.1231(0.00)	16.9559(0.00)	0.0000(1.00)	0.3910(1.00)	0.2668(1.00)
3	0.2647(1.00)	0.0000(1.00)	0.6417(1.00)	0.2750(1.00)	0.0000(1.00)	0.8596(1.00)	0.0000(1.00)	0.0000(1.00)	0.0000(1.00)

Table 7.11(b)

Lags	AGLTLN	TFLTTLN	SUBTT1C	TEQT1AC	TDTA	TLTAS	NCLTASST	RWATLS	LASSET
0	4034.40(0.00)	882.18(1.00)	672.66(1.00)	5359.24(0.00)	5059.19(0.00)	4651.67(0.00)	3254.55(0.00)	4409.93(0.00)	5676.28(0.00)
1	5561.36(0.00)	755.00(1.00)	1267.53(1.00)	8877.98(0.00)	6816.47(0.00)	8241.96(0.00)	4889.64(0.00)	7052.28(0.00)	6048.64(0.00)
2	9.2096(1.00)	9.2346(1.00)	4.5188(1.00)	5.4051(1.00)	0.0000(1.00)	0.0000(1.00)	13.4387(0.00)	0.0000(1.00)	0.0000(1.00)
3	1.0104(1.00)	3.7677(1.00)	0.7818(1.00)	0.0000(1.00)	0.0000(1.00)	0.0000(1.00)	0.3223(1.00)	0.0000(1.00)	0.0000(1.00)

Table 7.11(c)

Lags	LR1	VLTL	CEQTDTA	LSTTS	FFR	ITDR_DUM
0	5280.90(0.00)	5434.83(0.00)	645.01(1.00)	3243.13(0.00)	3868.60(0.00)	179.44(1.00)
1	6853.19(0.00)	7338.26(0.00)	298.57(1.00)	4220.47(0.00)	810.79(1.00)	83.479(1.00)
2	0.0000(1.00)	0.0000(1.00)	0.5047(1.00)	149.11(1.00)	0.0000(1.00)	31.697(1.00)
3	0.0000(1.00)	0.0000(0.00)	0.2971(1.00)	14.6514(1.00)	0.0000(1.00)	12.429(1.00)

Table 7.12: Maddala and Wu Fisher (Post-Crisis)

Table 7.12 (a)

Lags	NPB_DUM	ROE	NCOLS	CLPNCS	ERT	LLANL	NLLDS	CILEAST	LSRETLNS
0	45.7013(1.00)	5340.47(0.00)	4450.50(0.00)	8516.69(0.00)	4758.73(0.00)	6684.50(0.00)	5985.73(0.00)	5054.18(0.00)	4653.99(0.00)
1	15.7078(1.00)	1.4400(0.00)	8417.60(0.00)	9982.99(0.00)	1.0800(0.00)	5794.82(0.00)	4546.70(0.00)	4846.32(0.00)	4495.00(0.00)
2	10.9652(1.00)	4180.18(0.00)	3974.51(0.00)	7081.72(0.00)	3884.49(0.00)	5252.44(0.00)	3608.27(0.00)	3835.49(0.00)	3582.87(0.00)
3	7.5047(1.00)	1.1200(0.00)	1.0400(0.00)	1.3300(0.00)	1.0100(0.00)	9190.45(0.00)	8472.00(0.00)	7646.68(0.00)	7227.53(0.00)

Table 7.12(b)

Lags	AGLTLN	TFLTTLN	SUBTT1C	TEQT1AC	TDTA	TLTAS	NCLTASST	RWATLS	LASSET
0	2952.64(0.61)	577.91(1.00)	312.93(1.00)	6810.32(0.00)	7503.18(0.00)	4702.34(0.00)	5575.46(0.00)	5695.03(0.00)	4896.59(0.00)
1	3134.06(0.00)	850.71(1.00)	421.75(1.00)	6530.23(0.00)	5241.24(0.00)	4725.50(0.00)	4213.07(0.00)	4580.58(0.00)	4642.15(0.00)
2	3676.01(0.00)	509.94(1.00)	241.94(1.00)	4757.88(0.00)	4918.01(0.00)	3827.58(0.00)	4786.26(0.00)	4970.04(0.00)	3710.77(0.00)
3	5192.50(0.00)	1680.50(1.00)	799.96(1.00)	8301.58(0.00)	8302.02(0.00)	7021.52(0.00)	9239.60(0.00)	7057.58(0.00)	7705.05(0.00)

Table 7.12(c)

Lags	LR1	VLTL	CEQTDTA	LSTTS	FFR	ITDR_DUM
0	4194.88(0.00)	6715.17(0.00)	537.74(1.00)	3691.74(0.00)	1033.25(1.00)	311.24(1.00)
1	4606.53(0.00)	4.5700(0.00)	652.78(1.00)	4336.48(0.00)	3204.55(0.00)	210.54(1.00)
2	3721.60(0.00)	5137.93(0.00)	458.35(1.00)	3728.77(0.00)	2077.71(1.00)	94.8242(1.00)
3	7465.46(0.00)	1.0600(0.00)	489.39(1.00)	7015.47(0.00)	3268.37(0.00)	32.8187(1.00)

7.4.4 Test for cointegration

We now proceed to test our data for cointegration having satisfied that the panel data is stationary, more so, our panel data spans ten years. Theoretically, where two variables, x_t and y_t, are integrated of order one, I (1), and where they have a chance of a long-run relationship, a test to ascertain the level of cointegration is necessary. By definition, in a situation where two or more time series have nonstationary properties, but a linear combination of them is stationary, then they are classified as cointegrated (Kennedy 1992; Mallik 2008).

In econometric literature, the earliest test used for cointegration is the Engle-Granger cointegration Test. Other first generation tests used are the Kao (1999), Pedroni (1999, 2000, 2004) and McCoskey and Kao (1998) tests. The second generation cointegration tests developed recently are Westerlund (2007) and Gengenbach et al. (2009). We proceed with the Augmented Engle-Granger Cointegration test.

Computationally and conceptually, the Augmented Engle-Granger cointegration test is straight forward to run[2].

Interpretation of Tables 7.13(a), 7.13(b) and 7.13(c)

Tables 7.13(a), 7.13(b) and 7.13(c) are the output from the cointegration regression. The p-values are less than 0.05 and therefore we can reject H_0 that the residuals are I(1).The residuals X_t are therefore I(0) and are stationary. It follows that the explanatory variables in the model are cointegrated.

Summary of the entire test

The series of diagnostic tests (multicullinearity, stationarity, cointegration etc.) calculated to ascertain the significance and sturdiness of the models has enabled the study to proceed with the estimation of the empirical models with the assurance that the relationships and contributions of each independent variable will not lead to spurious interpretations. In conclusion, based on the econometric tests, we are satisfied that there are no strong linear

[2] We used the Stata routine, lmeg, written by Shehata, Emad Abd Elmessih.

Augmented Engle-Granger Cointegration Test at Higher Order Autoregressive process (model) of order p (AR (p))

Table 7.13(a): AEG Test (Pre-Crisis)

Sample (n)	Independent Variables	p-value> (t) Significance level for rejection of the null hypothesis(no cointegration)	Cointegration t test (Lag length (3)) Dependent variable: NPB_dum			
			AR(0)	AR(1)	AR(2)	AR(3)
27173	ROE	0.000	-56.97	-43.69	-40.32	-38.64
27173	NCOLS	0.000	-56.95	-43.63	-40.36	-38.60
27173	CLPNCS	0.000	-57.01	-43.66	-40.33	-38.53
27173	ERT	0.000	-56.93	-43.60	-40.34	-38.58
27173	LLANL	0.000	-56.93	-43.61	-40.34	-38.58
27173	NLLDS	0.000	-56.93	-43.60	-40.34	-38.57
27173	CILEAST	0.000	-56.97	-43.24	-39.26	-37.84
27173	LSRETLNS	0.000	-58.34	-44.56	-41.23	-39.27
27173	AGLTLN	0.000	-59.63	-45.30	-41.87	-39.80
27173	TFLTTLN	0.000	-58.60	-44.45	-40.89	-38.94
27173	SUBTT1C	0.000	-58.62	-44.95	-41.59	-39.65
27173	TEQT1AC	0.000	-56.93	-43.62	-40.36	-38.59
27173	TDTA	0.000	-57.13	-43.82	-40.52	-38.76
27173	TLTAS	0.000	-57.18	-43.85	-40.58	-38.84
27173	NCLTASST	0.000	-56.93	-43.60	-40.34	-38.58
27173	RWATLS	0.000	-56.93	-43.60	-40.34	-38.57
27173	LASSET	0.000	-61.47	-47.10	-43.63	-41.50
27173	LR1	0.000	-56.93	-43.60	-40.34	-38.57
27173	VLTL	0.000	-57.05	-43.71	-40.44	-38.67
27173	CEQTDTA	0.000	-57.04	-43.77	-40.47	-38.68
27173	LSTTS	0.000	-57.00	-43.67	-40.40	-38.64
27173	FFR	0.000	-56.92	-43.60	-40.33	-38.56
27173	ITDR_DUM	0.000	-57.64	-44.41	-41.14	-39.33

Table 7.13(b): AEG Test (Crisis Period)

Sample (n)	Independent Variables	p-value > (t) Significance level for rejection of the null hypothesis(no cointegration	Cointegration t test (Lag length (3)) Dependent variable: NPB_dum			
			AR(0)	AR(1)	AR(2)	AR(3)
9750	ROE	0.000	-30.14	-29.45	-30.72	-31.65
9750	NCOLS	0.000	-30.14	-29.45	-30.72	-31.66
9750	CLPNCS	0.000	-30.14	-29.45	-30.72	-31.66
9750	ERT	0.000	-30.14	-29.45	-30.72	-31.65
9750	LLANL	0.000	-30.14	-29.45	-30.72	-31.66
9750	NLLDS	0.000	-30.14	-29.46	-30.72	-31.66
9750	CILEAST	0.000	-30.15	-29.51	-30.79	-31.72
9750	LSRETLNS	0.000	-30.34	-29.63	-30.90	-31.90
9750	AGLTLN	0.000	-31.01	-30.22	-31.51	-32.54
9750	TFLTTLN	0.000	-30.39	-29.65	-30.94	-31.90
9750	SUBTT1C	0.000	-31.01	-30.23	-31.44	-32.53
9750	TEQT1AC	0.000	-30.23	-29.51	-30.77	-31.68
9750	TDTA	0.000	-30.17	-29.48	-30.75	-31.69
9750	TLTAS	0.000	-30.34	-29.55	-30.68	-31.72
9750	NCLTASST	0.000	-30.13	-29.45	-30.72	-31.66
9750	RWATLS	0.000	-30.26	-29.34	-30.50	-31.75
9750	LASSET	0.000	-31.85	-30.87	-31.95	-33.11
9750	LR1	0.000	-30.15	-29.47	-30.72	-31.66
9750	VLTL	0.000	-30.31	-29.61	-30.87	-31.78
9750	CEQTDTA	0.000	-32.29	-31.66	-33.27	-34.68
9750	LSTTS	0.000	-30.16	-29.50	-30.74	-31.66
9750	FFR	0.000	-30.14	-29.45	-30.72	-31.65
9750	ITDR_DUM	0.000	-30.44	-29.66	-30.89	-31.85

Table 7.13(c): AEG Test (Post-Crisis)

Sample (n)	Independent variables	p-value > (t) Significance level for rejection of the null hypothesis(no cointegration	Cointegration t test (Lag length (3)) Dependent variable: NPB_dum			
			AR(0)	AR(1)	AR(2)	AR(3)
13713	ROE	0.000	-35.35	-31.74	-29.58	-29.15
13713	NCOLS	0.000	-35.36	-31.74	-29.58	-29.16
13713	CLPNCS	0.000	-35.36	-31.74	-29.58	-29.15
13713	ERT	0.000	-35.37	-31.75	-29.58	-29.15
13713	LLANL	0.000	-35.36	-31.75	-29.58	-29.16
13713	NLLDS	0.000	-35.36	-31.74	-29.58	-29.15
13713	CILEAST	0.000	-35.35	-31.74	-29.58	-29.15
13713	LSRETLNS	0.000	-35.49	-31.86	-29.61	-29.17
13713	AGLTLN	0.000	-36.31	-32.35	-30.79	-30.56
13713	TFLTTLN	0.000	-35.82	-31.98	-29.80	-29.35
13713	SUBTT1C	0.000	-37.00	-32.71	-30.60	-30.13
13713	TEQT1AC	0.000	-35.46	-31.77	-29.60	-29.16
13713	TDTA	0.000	-35.38	-31.75	-29.59	-29.13
13713	TLTAS	0.000	-35.64	-31.98	-29.74	-29.27
13713	NCLTASST	0.000	-35.35	-31.74	-29.57	-29.14
13713	RWATLS	0.000	-35.35	-31.74	-29.58	-29.15
13713	LASSET	0.000	-36.88	-32.85	-30.93	-30.55
13713	LR1	0.000	-35.37	-31.78	-29.59	-29.15
13713	VLTL	0.000	-35.72	-32.09	-29.68	-29.18
13713	CEQTDTA	0.000	-36.33	-32.43	-30.85	-30.68
13713	LSTTS	0.000	-35.39	-31.77	-29.59	-29.14
13713	FFR	0.000	-35.35	-31.74	-29.58	-29.15
13713	ITDR_DUM	0.000	-35.72	-32.03	-29.87	-29.40

relationships between the explanatory variables, no unit root issues and that the model variables are cointegrated.

7.4.5 Correlation analysis

Correlations measure the strength and direction of the linear relationship between two variables. The threshold for explanatory variables included in our models is less than 0.3, thus we did not include variables that are highly correlated with each other. The correlation coefficient can range from -1 to +1, with -1 indicating a perfect negative correlation, +1 indicating a perfect positive correlation, and 0 no correlation at all. A variable correlated with itself will always have a correlation of 1.

Findings of the matrix

Tables 7.14(a) to 7.14(d) are the output from the correlation matrix for the independent variables. The highest figure was 1 while the lowest was -0.5356. For example, the correlation between ROE and ROE is 1. By definition, the correlation between any variable and itself is always 1.The correlation between NCOLS and ROE is 0.1173. It is positive. Indicating that as NCOLS increases so does ROE. The correlation between CLPNCS and ROE is -0.0002. It is negative. This indicates that as CLPNCS decreases, ROE increases. The matrix indicates the association, strength and direction of the relationship between explanatory variables used in the empirical models.

Table 7.14: Correlation matrix of the independent variables

Table 7.14(a)

	ROE	NCOLS	CLPNCS	ERT	LLANL	NLLDS	CILEAST
ROE	1						
NCOLS	0.1173	1					
CLPNCS	-0.0002	-0.0015	1				
ERT	-0.0717	-0.0123	-0.0014	1			
LLANL	0.0004	-0.0142	0.0128	-0.0043	1		
NLLDS	0.0193	0.0075	0.0004	-0.0075	-0.0018	1	
CILEAST	0.0411	0.0311	-0.0034	-0.0091	-0.0068	-0.0082	1
LSRETLNS	-0.0866	-0.3528	0.016	-0.0171	0.026	-0.0141	-0.1492
AGLTLN	0.0266	-0.0099	-0.0014	-0.0075	-0.0022	-0.0054	0.0877
TFLTTLN	0.0107	0.025	-0.0004	-0.0014	-0.0027	-0.0011	0.065
SUBTT1C	0.0263	0.038	-0.0142	-0.0038	-0.0064	0	0.0228
TEQT1AC	-0.1259	-0.0148	-0.0161	0.0045	-0.0086	-0.0149	0.0145
TDTA	-0.0452	-0.1619	0.0105	0.018	0.0059	-0.1213	-0.0024
TLTAS	0.0959	-0.0048	-0.0033	-0.0174	-0.0108	0.0201	0.056
NCLTASST	0.0298	0.2656	0.0002	0.0049	-0.0384	-0.0054	0.0209
RWATLS	-0.0151	0.0051	-0.0006	-0.0008	-0.0013	-0.0011	-0.0057
LASSET	0.0605	0.1012	0.0026	-0.0114	-0.0192	0.0235	0.0132
LR1	-0.0203	-0.0123	-0.0018	0.0001	0.003	0.0153	-0.0119
VLTL	0.0303	0.1425	-0.0014	-0.0051	-0.0075	0.0302	-0.0066
CEQTDTA	0.0035	0.0042	0.0002	-0.0023	-0.0002	0.0139	-0.0021
LSTTS	0.0557	0.0756	-0.0029	-0.0049	-0.0108	-0.0039	0.0097
FFR	-0.0108	-0.0797	-0.0055	-0.0194	0.0172	-0.0043	-0.0029
ITDR_DUM	0.0207	0.0265	-0.0183	-0.0068	-0.0194	-0.0047	0.0384

Table 7.14(b)

	LSRETLNS	AGLTLN	TFLTTLN	SUBTT1C	TEQT1AC	TDTA	TLTAS
LSRETLNS	1						
AGLTLN	-0.0686	1					
TFLTTLN	-0.0781	0.0842	1				
SUBTT1C	-0.2071	0.0952	0.0559	1			
TEQT1AC	-0.091	0.0692	0.0131	0.0578	1		
TDTA	0.2439	-0.0092	-0.0175	-0.217	-0.1297	1	
TLTAS	0.1575	0.0271	-0.0209	-0.0637	-0.1316	0.0574	1
NCLTASST	-0.0919	0.0157	0.0157	0.0074	-0.0289	-0.0483	0.1401
RWATLS	-0.0594	-0.0042	-0.0006	0.0623	-0.002	-0.0597	-0.0945
LASSET	-0.2457	0.3225	0.1769	0.2603	0.1615	-0.3402	-0.0919
LR1	-0.026	-0.0134	-0.005	0.0138	0.0029	-0.081	-0.2245
VLTL	-0.0861	-0.0286	0.0617	0.0553	-0.065	-0.5356	0.0785
CEQTDTA	-0.0308	0.0122	0.0247	0.0146	0.0158	-0.0425	-0.0285
LSTTS	-0.0569	0.0437	0.0006	0.0605	-0.0093	-0.1042	0.0777
FFR	0.0885	0.0343	0.0023	-0.0367	0.0022	0.0432	0.118
ITDR_DUM	-0.1879	0.1473	0.0499	0.1332	0.0764	-0.0981	-0.0306

Table 7.14(c)

	NCLTASST	RWATLS	LASSET	LR1	VLTL	CEQTDTA	LSTTS
NCLTASST	1						
RWATLS	-0.0119	1					
LASSET	0.0238	0	1				
LR1	-0.0417	0.0167	0.0158	1			
VLTL	0.0792	0.002	0.2464	0.016	1		
CEQTDTA	-0.0026	-0.0005	0.0444	0.0792	0.0153	1	
LSTTS	0.0514	-0.0049	0.1155	-0.025	0.0708	0.0077	1
FFR	-0.0776	-0.0089	-0.0185	-0.0248	0.0756	0.012	-0.0423
ITDR_DUM	0.0058	-0.0051	0.3456	0.001	-0.0128	0.0327	0.1541

Table 7.14(d)

	FFR	ITDR_DUM
FFR	1	
ITDR_DUM	0.0407	1

Source: calculated by author

7.5 Empirical Model

The various diagnostic tests (as explained in the flowchart) carried out in this study shows that our regressions will not lead to spurious conclusions. For example, our empirical model will follow a trend stationary case. Therefore the technical form for the random effects logistic regression of the determinants to use credit derivatives is defined below:

$$\begin{aligned} NPB_{DUMit} = {} & S_0 + S_1 TEQT1AC_{it} + S_2 RWATLS_{it} + S_3 ROE_{it} + S_4 NCOLS_{it} + S_5 CLPNCS_{it} + \\ & S_6 NLLDS_{it} + S_7 CILEAST_{it} + S_8 LSRETLNS_{it} + S_9 AGLTLN_{it} + S_{10} TFLTTLN_{it} + \\ & S_{11} SUBTT1C_{it} + S_{12} TDTA_{it} + S_{13} TLTAS_{it} + S_{14} NCLTASST_{it} + S_{15} LASSET_{it} + \\ & S_{16} LR1_{it} + S_{17} VLTL_{it} + S_{18} CEQTDTA_{it} + S_{19} LSTTS_{it} + S_{20} FFR_{it} + S_{21} ERT_{it} + \\ & S_{22} LLANL_{it} + S_{23} ITDR|\_DUMit + \varepsilon_{it} \end{aligned} \qquad 7.1$$

where,

$NPB_{DUM_{it}}$ is the “dependent” or “endogenous” variable,

S_o is the “intercept” or “constant”,

S_1 to S_{23} is the “coefficients” of the explanatory variables and

ε_{it} is the “disturbance” or “noise” term.

7.6 Empirical Results from Random Effects Logistic Regression of the Determinants of Using CDS to Mitigate Risks

We turn to the empirical results presented from the random effects logistic regression on the role of credit derivatives as determinants of bank use to mitigate risk from 2002 to 2011 in Tables 7.15 to 7.18, in which following Minton et al. (2009), US bank holding companies with assets in excess of $1 billion were examined as to what extent they use credit derivatives to hedge.

Table 7.15: Random effects logistic regression estimates of the determinants of using credit derivatives (Panel A:Pre-Crisis)

Dependent Variable: NPB_DUM			Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Description	**Capitalisation measure**	**TEQT1AC**	**Pre-crisis (2002:1 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**
	Variable	**Variable description**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**
			p-value	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**
Asset quality	NCLTASST	Non-performing loans/total assets				0.27	0.114	-0.923	0.102
						(0.28)	(0.62)	(0.71)	(0.65)
	CLPNCS	Credit loss provision to net charge-offs	-0.025	-0.059	-0.063				
			(0.380	(0.29)	(0.25)				
	LLANL	Loan loss allowance to noncurrent loans			-0.000	-0.000*	-0.000	-0.000*	-0.000
					(0.12)	(0.07)	(0.11)	(0.07)	(0.26)
capitalisation	TEQT1AC	Total equity capital /Tier 1 risk adj capital	-0.155***	-0.737*	0.121	0.171	0.174	0.306	0.285
			(0.00)	(0.07)	(0.12)	(0.60)	(0.57)	(0.31)	(0.330
	TDTA	Total deposits/total asset			0.126	-0.455***	-0.384**	-0.108***	-0.899***
					(0.193)	(0.01)	(0.02)	(0.00)	(0.01)
	VLTL	Volatile liability to total liability				0.168*	0.206**	0.327***	
						(0.09)	(0.03)	(0.00)	

Table 7.15 (Cont'd)

Description	Capitalisation measure	TEQT1AC	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
		Dependent Variable: NPB_DUM	**Pre-crisis (2002:1 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**
	Variable	**Variable description**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**
			p-value	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**
CR mgt and derivatives	CEQTDTA	Commodity & equity derivatives to total assets			0.547***	0.143			
					(0.01)	(0.28)			
	SUBTT1C	Subordinated debt to Tier 1 risk adj cap				0.531***	0.559***		
						(0.00)	(0.00)		
	LSTTS	Loan sales to total assets					0.409**	0.438**	0.471***
							(0.04)	(0.02)	(0.01)
Credit risk	CILEAST	C&I loans/earning assets	-0.278**	0.360**	0.120	0.407**			
			(0.05)	(0.05)	(0.12)	(0.04)			
	NCOLS	Net charge-offs to loans				-0.354	-0.324	-0.262	-0.359
						(0.35)	(0.35)	(0.46)	(0.32)
Interest rate risk	ITDR_DUM	Dummy/use of interest rate derivatives	0.576***	0.675	0.566	0.271***	0.256	0.300	0.290
			(0.00)	(0.89)	(0.86)	(0.00)	(0.99)	(0.98)	(0.980

Table 7.15 (Cont'd)

Dependent Variable: NPB_DUM			Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Description	Capitalisation measure	TEQT1AC	Pre-crisis (2002:1 to 2007:3)	Base Year (2006:4 to 2007:3)	Base Year (2006:4 to 2007:3)	Base Year (2006:4 to 2007:3)	Base Year (2006:4 to 2007:3)	Base Year (2006:4 to 2007:3)	Base Year (2006:4 to 2007:3)
	Variable	Variable description	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value
Liquidity	LR1	Highly liquid assets/Total liab	0.035	0.112***	0.925***				
			(0.65)	(0.00)	(0.00)				
	NLLDS	Net loans and leases to deposits				-0.042***	-0.038***	-0.083***	-0.059**
						(0.00)	(0.00)	(0.00)	(0.02)
	TLTAS	Total loans to total assets						0.824**	0.469
								(0.05)	(0.23)
Loan portfolio	LSRETLNS	Loans secured by real estate loans to total loans	0.156	-0.142*	-0.410***	-0.150*	-0.200***	-0.299***	-0.339***
			(0.79)	(0.08)	(0.00)	(0.10)	(0.01)	(0.00)	(0.00)
	AGLTLN	Agricultural loans/total loans	-0.009	-0.012	0.021***	0.013*	0.015*	0.022***	0.021***
			(0.22)	(0.19)	(0.00)	(0.09)	(0.06)	(0.00)	(0.00)
	TFLTTLN	Total foreign loans to total loans							0.001*
Macroeconomic context	FFR	Federal funds rate	0.311***	0.744	0.714	0.897	0.569	0.614	0.669
			(0.00)	(0.49)	(0.41)	(0.34)	(0.54)	(0.49)	(0.45)

Table 7.15 (Cont'd)

Dependent Variable: NPB_DUM			Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Description	**Capitalisation measure**	**TEQT1AC**	**Pre-crisis (2002:1 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**
	Variable	**Variable description**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**
			p-value	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**
Profitability	ROE	Return on equity	0.014**	-0.012	0.005	0.015			
			(0.03)	(0.28)	(0.70)	(0.27)			
	ERT	Efficiency ratio					0.001	-0.005	0.004
							(0.82)	(0.56)	(0.49)
Size/Reputation	LASSET	Natural log of total assets	0.253***	0.122***					
			(0.00)	(0.00)					
		Constant	-53.96	-93.74	-63.81	-29.01	-25.84	-25.45	-25.56
			(0.00)	(0.85)	(0.84)	(0.83)	(0.99)	(0.99)	(0.99)
		No of observations	27174	5311	5311	5311	5311	5311	5311

p-values in parentheses: * p<0.10; ** p<0.05; *** p<0.01

Table 7.16: Summary (Panel A: Pre-Crisis)

Models	Variable	Variable Description	Capitalisation measure	Differences	Key Results
1	2002:1 to 2007:3-Pre-crisis	NPB_DUM	TEQT1AC significant at 1% level.	Ten explanatory variables tested. Four significant variables at 1% level	Banks with more capital, larger and profitable less likely to buy protection. Banks with non-performing loans likely to buy protection
2	2006:4 to 2007:3-Base year	NPB_DUM	TEQT1AC significant at 10% level	Same explanatory variables in model 1.Two significant variables at 1% level	Banks with more commercial and industrial loans, loans secured by real estate and have highly liquid assets to total liabilities are more likely to buy protection
3	2006:4 to 2007:3-Base year	NPB_DUM	TEQT1AC not significant at any level	Twelve explanatory variables tested. Four significant variables at 1% level	Banks with larger agricultural loans likely to buy protection
4	2006:4 to 2007:3-Base year	NPB_DUM	TEQT1AC not significant at any level	Fifteen explanatory variables tested. Four significant variables at 1% level	Banks with use of other types of derivatives and volatile liabilities to total liability are more likely to buy protection
5	2006:4 to 2007:3-Base year	NPB_DUM	TEQT1AC not significant at any level	Fourteen explanatory variables tested. Three significant variables at 1% level	Banks with liquidity problems likely to buy protection
6	2006:4 to 2007:3-Base year	NPB_DUM	TEQT1AC not significant at any level	Fourteen explanatory variables tested. Five significant variables at 1% level	Banks with volatile deposit base likely to buy protection
7	2006:4 to 2007:3-Base year	NPB_DUM	TEQT1AC not significant at any level	Fourteen explanatory variables tested. Seven significant variables at 1% level	Banks who originate foreign loans and with unstable cost and income level are more likely to buy protection

Table 7.17: Random effects logistic regression estimates of the determinants of using credit derivatives (Panel B: Pre-Crisis)

	Dependent Variable: NPB_DUM		Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Description	Capitalisation measure	RWATLS	Pre-crisis (2002:1to 2007:3)	Base Year (2006:4 to 2007:3)	Base Year (2006:4 to 2007:3)	Base Year (2006:4 to 2007:3)	Base Year (2006:4 to 2007:3)	Base Year (2006:4 to 2007:3)	Base Year (2006:4 to 2007:3)
	Variable	Variable description	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value
Asset quality	NCLTASST	Non-performing loans/total assets				0.256	0.109	-0.126	0.830
						(0.31)	(0.65)	(0.61)	(0.71)
	CLPNCS	Credit loss provision to net charge-offs	-0.068*	-0.051	-0.065				
			(0.08)	(0.35)	(0.25)				
	LLANL	Loan loss allowance to noncurrent loans			-0.000	-0.000**	-0.000*	-0.000*	-0.000
					(0.11)	(0.05)	(0.08)	(0.06)	(0.22)
capitalisation	RWATLS	Risk weighted assets ratio	0.000	-0.007	0.003	-0.138	-0.180	-0.146	-0.100
			(0.89)	(0.91)	(0.95)	(0.23)	(0.14)	(0.21)	(0.29)
	TDTA	Total deposits/total asset			0.121	-0.510***	-0.434***	-0.109***	-0.882**
					(0.29)	(0.00)	(0.01)	(0.00)	(0.02)
	VLTL	Volatile liability to total liability				0.166*	0.206**	0.327***	
						(0.10)	(0.03)	(0.00)	

Table 7.17 (Cont'd)

	Dependent Variable: NPB_DUM		**Model (1)**	**Model (2)**	**Model (3)**	**Model (4)**	**Model (5)**	**Model (6)**	**Model (7)**
Description	**Capitalisation measure**	**RWATLS**	**Pre-crisis (2002:1to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**
	Variable	**Variable description**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**
			p-value	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**
CR mgt and derivatives	CEQTDTA	Commodity & equity derivatives to total assets			0.532***	0.122			
					(0.01)	(0.34)			
	SUBTT1C	Subordinated debt to Tier 1 risk adj cap				0.552***	0.585***		
						(0.00)	(0.00)		
	LSTTS	Loan sales to total assets					0.421**	0.462**	0.483***
							(0.03)	(0.02)	(0.01)
Credit risk	CILEAST	C&I loans/earning assets	0.145	0.392**	0.123	0.383**			
			(0.15)	(0.03)	(0.42)	(0.05)			
	NCOLS	Net charge-offs to loans				-0.379	-0.339	-0.234	-0.328
						(0.35)	(0.37)	(0.52)	(0.37)
Interest rate risk	ITDR_DUM	Dummy/use of interest rate derivatives	0.397***	0.755	0.166	0.241	0.271***	0.312***	0.270
			(0.00)	(0.88)	(0.95)	(0.98)	(0.00)	(0.00)	(0.99)

Table 7.17 (Cont'd)

Description	Capitalisation measure	RWATLS	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
		Dependent Variable: NPB_DUM	**Pre-crisis (2002:to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**
	Variable	**Variable description**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**
Liquidity	LR1	Highly liquid assets/Total liab	0.040***	0.127***	0.909***				
			(0.01)	(0.00)	(0.00)				
	NLLDS	Net loans and leases to deposits				-0.047***	-0.044***	-0.085***	-0.061**
						(0.00)	(0.00)	(0.01)	(0.02)
	TLTAS	Total loans to total assets						0.778*	0.410
								(0.07)	(0.29)
Loan portfolio	LSRETLNS	Loans secured by real estate loans to total loans	-0.162***	-0.153*	-0.398***	-0.167*	-0.222***	-0.302***	-0.333***
			(0.00)	(0.06)	(0.00)	(0.07)	(0.00)	(0.00)	(0.00)
	AGLTLN	Agricultural loans/total loans	-0.004	-0.011	0.000***	0.014*	0.015*	0.023***	0.022***
			(0.47)	(0.20)	(0.00)	(0.09)	(0.06)	(0.00)	(0.00)
	TFLTTLN	Total foreign loans to total loans							0.001*
									(0.06)

Table 7.17 (Cont'd)

Description	Capitalisation measure	RWATLS	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
	Dependent Variable: NPB_DUM								
			Pre-crisis (2002:to 2007:3)	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**	**Base Year (2006:4 to 2007:3)**
	Variable	**Variable description**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**
Macroeconomic context	FFR	Federal funds rate	0.117***	0.851	0.684	0.967	0.699	0.680	0.709
			(0.00)	(0.43)	(0.42)	(0.31)	(0.46)	(0.45)	(0.42)
Profitability	ROE	Return on equity	0.002	-0.009	0.000	0.014			
			(0.70)	(0.48)	(0.94)	(0.28)			
	ERT	Efficiency ratio					0.002	-0.002	0.006
							(0.77)	(0.79)	(0.35)
Size/Reputation	LASSET	Natural log of total assets	0.112***	0.116***					
			(0.00)	(0.00)					
		Constant	-24.87	-102.26	-172.43	-24.84	-26.46	-26.04	-23.01
			(0.00)	(0.84)	(0.95)	(0.98)	(0.96)	(0.95)	(0.99)
		N	27174	5311	5311	5311	5311	5311	5311

p-values in parentheses: * p<0.10; ** p<0.05; *** p<0.01

Table 7.18: Summary (Panel B: Pre-Crisis)

Models	Description	Dependent variable	Capitalisation measure	Differences	Key Results
1	2002:1 to 2007:3-Pre-crisis	NPB_DUM	RWATLS not significant at any level	Ten explanatory variables tested. Five significant variables at 1% level	Banks with more capital, larger and with less liquidity volatility likely to buy protection. Banks with real estate secured loans likely to buy protection
2	2006:4 to 2007:3-Base year	NPB_DUM	RWATLS not significant at any level	Same explanatory variables in model 1.Two significant variables at 1% level	Banks with low capital base likely to buy protection
3	2006:4 to 2007:3-Base year	NPB_DUM	RWATLS not significant at any level	Twelve explanatory variables tested. Four significant variables at 1% level	Banks with larger agricultural loans likely to buy protection
4	2006:4 to 2007:3-Base year	NPB_DUM	RWATLS not significant at any level	Fifteen explanatory variables tested. Three significant variables at 1% level	Banks with use of other types of derivatives are more likely to buy protection
5	2006:4 to 2007:3-Base year	NPB_DUM	RWATLS not significant at any level	Fourteen explanatory variables tested. Five significant variables at 1% level	Banks with liquidity problems likely to buy protection
6	2006:4 to 2007:3-Base year	NPB_DUM	RWATLS not significant at any level	Fourteen explanatory variables tested. Four significant variables at 1% level	Banks with volatile deposit base likely to buy protection
7	2006:4 to 2007:3-Base year	NPB_DUM	RWATLS not significant at any level	Fourteen explanatory variables tested. Three significant variables at 1% level	Banks who sell and securitise loans are more likely to buy protection

7.7 Results and Discussion: Panels A and B (Pre-Crisis)

We run and report seven random effects logistic regression for the pre-crisis period (Quarter 1, 2002 to Quarter 3, 2007) on the determinants of bank use to mitigate risk with credit derivatives as well as the pre-crisis period twelve months base year (Quarter 4, 2006 to Quarter 3, 2007).We report the estimates of the models in Panels A and B. The dependent variable of the models (NPB_DUM) is the probability of being a net protection buyer.

The random effects regressions are estimated using quarterly indicator explanatory variables. The model reports the coefficient as well as the p-value of each explanatory variable. The coefficient explains the amount of change in the logit for a change of one unit in the independent variable. The backbone of the proxy to test for capitalisation in Panel A is total equity capital/Tier 1 risk adjusted capital (TEQT1AC) while this is relaxed for another proxy in Panel B for risk weighted asset ratio (RWATLS).

$$NPB_{DUMit} = S_0 + S_1 CLPNCS_{it} + S_2 TEQT1AC_{it} + S_3 CILEAST_{it} + S_4 ITDR\_DUM_{it} + S_5 LR1_{it} + S_6 LSRETLNS_{it} + S_7 AGLTLN_{it} + S_8 FFR_{it} + S_9 ROE_{it} + S_{10} LASSET_{it} + \varepsilon_{it} \qquad 7.2a$$

Panel A, Model (1), pre-crisis period (Quarter 1, 2002 to Quarter 3, 2007) incorporates ten variables. This leaves room for improvement in subsequent regressions in the Panel that will incorporate more variables. The results show that the explanatory variable for capitalisation (TEQT1AC) is statistically significant at the 1% level and has a relatively high (coefficient is -0.155) suggesting that the total equity capital to Tier 1 risk adjusted capital have a negative impact as a determinant of bank use of credit derivatives to buy protection. The dummy variable for the use of interest derivatives (ITDR_DUM) is significant at the 1% level with a relatively high and positive coefficient at the 0.576 level suggesting that the use of interest rate derivatives to lock in the volatility of interest rates impacts on the decision to use credit derivatives. Much higher is the impact of the LASSET variable, which is also significant at the 1% level. The coefficient for LASSET is 0.253 confirming that bank size, reputation and total assets gives more incentive to a bank's management to use credit derivatives to buy protection so as to achieve higher levels of loanable funds and therefore profitability. An important finding of the regression is that the free funds rate (FFR) which mirrors the macro-economic operational context is significant at the 1% level and is positive. Its magnitude is high with a 0.311 coefficient; this confirms that low interest rate impacted on the use of credit derivatives by banks within and across country framework. The regression results for the commercial and industrial loans to earning assets (CILEAST) ratio is significant at the 5% level with a -0.278 coefficient reflecting credit risk. The variable for the return on equity (ROE) is significant at the 5% level and has a positive impact on the determinant of bank use of credit derivatives with a 0.014 coefficient. The CLPNCS, LR1, LSRETLNS and AGLTLN variables do not have any explanatory power as they all insignificant.

$$NPB_{DUMit} = S_0 + S_1 CLPNCS_{it} + S_2 TEQT1AC_{it} + S_3 CILEAST_{it} + S_4 ITDR\_DUM_{it} + S_5 LR1_{it} + S_6 LSRETLNS_{it} + S_7 AGLTLN_{it} + S_8 FFR_{it} + S_9 ROE_{it} + S_{10} LASSET_{it} + \varepsilon_{it} \qquad 7.2b$$

Panel A, Model (2) for the pre-crisis period, twelve months base year (Quarter 4, 2006 to Quarter 3, 2007) has ten variables; it ran estimates for the same variables in the pre-crisis period (Quarter 1, 2002 to Quarter 3, 2007). The LASSET variable retains its significantly positive impact as in Model (1) at the same level. On the other hand, although ITDR_DUM and FFR retain their positive coefficients, they lost their significance. The return on assets (ROE) variable becomes insignificant and also losses its positive sign, the highly liquid assets to total liability (LR1) variable becomes significant at 1% level with a coefficient of 0.112 suggesting that a bank is more likely to buy protection if it has liquidity issues. In the same vein, CILEAST retains its significance but has a positive coefficient of 0.360.The loans secured by real estate loans to total asset (LSRETLNS) ratio becomes significant at 10% level with a coefficient of -0.142. Although the capitalisation variable (TEQT1AC) retains its negative sign, its significance reduces to 10% level. The coefficients of CLPNCS and AGLTLN are negative but their impact on protection buying is not significant.

$$NPB_{DUMit} = S_0 + S_1 CLPNCS_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 TDTA_{it} + S_5 CEQTDTA_{it} + S_6 CILEAST_{it} + S_7 ITDR\_DUM_{it} + S_8 LR1_{it} + S_9 LSRETLNS_{it} + S_{10} AGLTLN_{it} + S_{11} FFR_{it} + S_{12} ROE_{it} + \varepsilon_{it} \qquad 7.2c$$

Panel A, Model (3) for the pre-crisis period, twelve months base year, from Quarter 4, 2006 to Quarter 3, 2007, has twelve variables, it incorporates loan allowance to non-current loans (LLANL) as a measure for asset quality, total deposit to total assets (TDTA) as a capitalisation measure while commodity and equity derivatives to total assets (CEQTDTA) mirrors credit management and derivatives. LASSET losses its place in the model as a variable for bank size. The variable CEQTDTA has a significant and positive impact on bank protection procurement as it is significant at the 1% level with a co-efficient of 0.547.The variable LR1 retains its positive significance at the 1% level but with a relatively small magnitude (0.925) in comparison to Model (2). The LSRETLNS and AGLTLN variables are both statistically significant at the 1% level although the coefficient of AGLTLN has a positive impact at 0.021 in comparison to Model (2) while LSRETLNS retains its negative impact at -0.410 suggesting that banks with exposure to agricultural loans and those secured by real estate are likely to seek payment protection to mitigate risk. The variable TEQT1AC and CILEAST loose their significance but with positive coefficients of 0.121 and 0.120 respectively. As with Model (2), ITDR_DUM is not statistically significant though the magnitude of its coefficient decreases slightly to 0.566. Model (1) and Model (2) yields similar results for CLPNCS in Model (3). It is statistically insignificant. The incorporation of LLANL and TDTA has no significant impact on the model. They are both statistically insignificant.

$$\begin{aligned} NPB_{DUM_{it}} = {} & S_0 + S_1 NCLTASST_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 TDTA_{it} + S_5 VLTL_{it} + \\ & S_6 CEQTDTA_{it} + S_7 SUBTT1C_{it} + S_8 CILEAST_{it} + S_9 NCOLSit + S_{10} ITDR\_DUM_{it} + \\ & S_{11} NLLDS_{it} + S_{12} LSRETLNS_{it} + S_{13} AGLTLN_{it} + S_{14} FFR_{it} + S_{15} ROE_{it} + \varepsilon_{it} \end{aligned} \quad 7.2d$$

The work proceeds to Panel A, Model (4), pre-crisis period, twelve months base year, from Quarter 4, 2006 to Quarter 3, 2007 with fifteen variables. The model detaches variables CLPNCS and LR1 and incorporates non-performing loans/total assets (NCLTASST) to measure asset quality, volatile liability to total liability (VLTL) as a capitalisation measure, subordinated debt to tier 1 risk adjusted capital (SUBTT1C) as a credit management and derivatives measure, net charge-offs to loans (NCOLS) to measure credit risk and net loans and leases to deposits (NLDDS) to measure liquidity. In terms of liquidity, variable NLDDS has a significant but negative impact on protection procurement with a coefficient of -0.042. The variable SUBTT1C becomes significant at 1% level with a magnitude of 0.531. The interest rate risk variable (ITDR_DUM) is significant at 1% with a positive impact on bank protection appetite as its coefficient is 0.271, an improvement over the results in Model (2) and Model (3). Total deposits to total assets (TDTA) have a significantly negative impact on protection use through credit derivatives, an improvement over the results in Model (3).In terms of credit risk measure, CILEAST is statistically significant at 5% level with a magnitude of 0.407.On the contrary, the incorporation of NCOLS has no impact on the model. It is not significant with a coefficient of -0.354.In comparison to Model (3), the significance of LSRETLNS and AGLTLN decreases to 0.10% though they still maintain their respective coefficient signs. Though TEQT1AC is not significant as with the result in Model (3), the integration of VLTL is significantly positive at 0.10% level with a coefficient of 0.168. Likewise, LLANL impacts at 0.10% level negatively, an improvement over the Model (3) result. The assimilation of NCLTASST is not statistically noteworthy though the coefficient is positive at 0.27. Of note is CEQTDTA, it lost its significance when juxtaposed against the result of Model (3) though it has a positive coefficient of 0.143. As with Model (2) and Model (3), FFR and ROE all have a positive coefficient but none of them is significant.

$$\begin{aligned} NPB_{DUM_{it}} &= S_0 + S_1 NCLTASST_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 TDTA_{it} + S_5 VLTL_{it} + \\ & S_6 SUBTT1C_{it} + S_7 LSTTS_{it} + S_8 NCOLS_{it} + S_9 ITDR\_DUM_{it} + S_{10} NLLDS_{it} + \\ & S_{11} LSRETLNS_{it} + S_{12} AGLTLN_{it} + S_{13} FFR_{it} + S_{14} ERT_{it} + \varepsilon_{it} \end{aligned} \quad 7.2e$$

The work progresses to the Panel A, Model (5), for the pre-crisis period, twelve months base year, from Quarter 4, 2006 to Quarter 3, 2007 with fourteen variables. The model do away with CEQDATA, CILEAST and ROE and features loan sales to total assets (LSTTS) as a credit management and derivatives measure as well as efficiency ratio (ERT), a profitability measure. The coefficient of the SUBTT1C variable remains significant at the 1% level and retains its sign but its magnitude is slightly increased in comparison with the result in Model 4 from 0.531 to 0.559. The liquidity measure NLLDS coefficient also remains significant at the 1% level and retains its sign but its scale is slightly reduced in comparison with the result in Model 4 from -0.042 to -0.038. Another interesting result from the model is that LSRETLNS yields similar results to Model (3) with a significant level at 1% though with a reduced coefficient from -0.410 to -0.200. The coefficient of TDTA retains its negative sign but loses its significance in comparison with the benchmark in Model (4). On the other hand, VLTL retains its positive sign but increases its significance in comparison with the level in Model (4).The incorporation of LSTTS have an effect on protection policy of banks with its significance at 5% level with a coefficient of 0.409, banks that sell loans are more likely to use credit derivatives. The agricultural loans to total loans (AGLTLN) retains its significance at the 10% level and its sign positive with what obtained in Model (4) though its scale increased marginally from 0.013 to 0.015.The coefficients of NCLTASST,TEQT1AC and ITDR_DUM,FFR and ERT are positive but their impact on protection buying is not significant. On the other hand, the impact on protection buying is not significant with respect to NCOLS but its coefficient is negative.

$$\begin{aligned} NPB_{DUM_{it}} &= S_0 + S_1 NCLTASST_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 TDTA_{it} + S_5 VLTL_{it} + \\ & S_6 LSTTS_{it} + S_7 NCOLS_{it} + S_8 ITDR\_DUM_{it} + S_9 NLLDS_{it} + S_{10} TLTAS_{it} + \\ & S_{11} LSRETLNS_{it} + S_{12} AGLTLN_{it} + S_{13} FFR_{it} + S_{14} ERT_{it} + \varepsilon_{it} \end{aligned} \tag{7.2f}$$

The work continues to Panel A, Model (6) pre-crisis period, twelve months base year, from Quarter 4, 2006 to Quarter 3, 2007 with fourteen variables. The model relaxes SUBTT1C and introduces total loans to total assets (TLTAS) as a liquidity measure. In terms of the asset quality variables, LLANL has significant and negative impact on bank protection buying and selling as it is significant at the 10% level with a coefficient of -0.001. The NCLTASST variable remains insignificant; the magnitude of the coefficient is negative at -0.923.In relation to the capitalisation variables, the TDTA retains its significance as with Model (5) at the improved level of 1% with reduced magnitude (its coefficient is -0.108). The VLTL also retains its significance but at a higher level this time (1%) and its positive impact on protection procurement is increased as its coefficient increases to 0.327.The TEQT1AC variable on the other hand is not significant though its coefficient has a positive sign (0.306). Coming to terms with the credit management/derivatives and credit risk variables, the LSTTS variable retains its significance at the same level in comparison to Model (5) and its positive impact on protection procurement is increased slightly as its coefficient increases from 0.409 to 0.438. The NCOLS remains insignificant though with reduced negative coefficient from -0.324 to -0.262 in comparison to Model (5). The interest rate risk variable, ITDR_DUM, keep hold of its insignificance though its positive coefficient improves to 0.300 from 0.256 in Model (5). The liquidity variables have a significant impact on banks decisions to sell protection. The variable NLLDS maintains its significance at 1% level though with an increased negative coefficient of -0.083. The liquidity variable of total loans to total assets (TLTAS) is significant at the 5% level and has a relatively strong positive impact on bank protection policy as its coefficient is around 0.82. As for the loan portfolio variables, the LSRETLNS preserves its significance at the 1% level and has a negative impact on protection selling to mitigate risks with a -0.299 coefficient while the coefficient of AGLTLN is 0.022 and significant at the 1% level. The federal funds rate variable (FFR) becomes insignificant although its coefficient retains its positive sign and the efficiency ratio (ERT) variable holds on to its insignificance though the coefficient loses its positive sign.

$$NPB_{DUM_{it}} = S_0 + S_1 NCLTASST_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 TDTA_{it} + S_5 LSTTS_{it} + S_6 NCOLSit + S_7 ITDR\_DUM_{it} + S_8 NLLDS_{it} + S_9 TLTAS_{it} + S_{10} LSRETLNS_{it} + S_{11} AGLTLN_{it} + S_{12} TFLTTLN_{it} + S_{13} FFR_{it} + S_{14} ERT_{it} + \varepsilon_{it} \quad 7.2g$$

Finally, the work progresses to Panel A, Model (7), pre-crisis period, twelve months base year, from Quarter 4, 2006 to Quarter 3, 2007 with fourteen variables. The model detaches the proxy for volatile liability to total liability (VLTL) and adds the proxy for total foreign loans to total loans (TFLTTLN) as a measure for loan portfolio. The three variables mirroring the loan portfolio impacts significantly on the model. The TFLTTLN variable is significant at 10% level with a positive coefficient of 0.001 signifying that active players in the credit derivative market originate foreign loans.The coefficient of the AGLTLN variable remains significant at the 1% level and retains its sign but its magnitude is reduced marginally in comparison with the benchmark of Model (6). Likewise, the coefficient of the LSRETLNS variable maintains its significance at the 1% level and preserves its sign but its magnitude has sustained its increases as with Model (5) and Model (6). In terms of liquidity, the NLLDS variable retains its significance but at a lower level this time (5%) and its negative impact on protection is reduced significantly as its coefficient falls from -0.059.The variable TLTAS loses its significance though retains its positive sign with diminished coefficient to 0.469. In relation to credit management and derivatives, the LSTTS variable retains its significance but at a higher level (1%) and its positive impact on protection is increased slightly as its coefficient increases from 0.471. The capitalisation variables throw up an interesting finding. The TDTA retains its significance at the 1% level with increased magnitude (its coefficient is -0.899). Conversely, TEQT1AC is consistently insignificant across Model (3) to Model (7). All the other variables, to wit, NCLTASST, LLANL, NCOLS, ITDR_DUM, FFR and ERT save their (in)significance.

The work summarises the results from the seven random effects logistic regression for the pre-crisis period (Quarter 1, 2002 to Quarter 3, 2007) as well as the pre-crisis period, twelve months base year (Quarter 4, 2006 to Quarter 3, 2007) on the determinants of bank use to mitigate risk with credit derivatives. The LSRETLNS variable is significant at the 1% level in Model (3), and Models (5) to (7) generally with negative signs while the AGLTLN variable retains its significance in Models (3), (6) and (7) at the 1% level with positive impact giving additional support to the tentative conclusion that the loan portfolio variables have more significant and although negative impact on bank protection decision. As a capitalisation measure, TDTA preserves its significant scale at the 1% level in Models (4), (6) and (7) while keeping its negative sign. The TEQT1AC and VLTL are both significant at the 1% level in Models (1) and Model (6) respectively with positive consequence. In terms of liquidity, the NLLDS maintain its significance at the 1% level in Models (3) to (5) with the same sign. The LR1 variable retains its significantly positive impact on bank protection in Models (2) and (3). In terms of the interest rate risk variable, ITDR_DUM has a positive coefficient and statistically significant in Models (1) and (4). As for credit management and derivatives, the variable SUBTT1C retains its positive sign and statistically significant in Models (4) and (5). Also, the variable LSTTS is significant at the 1% level with a positive sign in Model (7) while CEQTDTA is only significant in Model (3) with a positive impact. Turning to the size/reputation measure, the natural log of the total assets (LASSET) has a positive influence on the bank protection behavior; it is significant at the 1% level in Models (1) and (2). In terms of the macroeconomic variable (FFR), it has a positive coefficient and significant at the 1% level in Model (1).

$$\begin{aligned} NPB_{DUMit} = {} & S_0 + S_1 RWATLS_{it} + S_2 NCLTASST_{it} + S_3 CLPNCS_{it} + S_4 LLANL_{it} + S_5 TDTA_{it} + \\ & S_6 VLTL_{it} + S_7 CEQTDTA_{it} + S_8 SUBTT1C_{it} + S_9 LSTTS_{it} + S_{10} CILEAST_{it} + \\ & S_{11} NCOLS_{it} + S_{12} ITDR\_DUM_{it} + S_{13} LR1_{it} + S_{14} NLLDS_{it} + S_{15} TLTAS_{it} + \\ & S_{16} LSRETLNS_{it} + S_{17} AGLTLN_{it} + S_{18} TFLTTLN_{it} + S_{19} FFR_{it} + S_{20} ROE_{it} + \\ & S_{21} ERT_{it} + S_{22} LASSET_{it} + \varepsilon_{it} \end{aligned} \qquad 7.3$$

The work moves to Panel B. The results from the seven random effects logistic regression for the pre-crisis period (Quarter 1, 2002 to Quarter 3, 2007) as well as the pre-crisis period, twelve months base year (Quarter 4, 2006 to Quarter 3, 2007) uses risk weighted asset ratio (RWATLS) as the core proxy to test for capitalisation rather than total equity capital/Tier 1 risk adjusted capital (TEQT1AC) used in Panel A. The RWATLS proxy was not statistically significant in all the models tested whereas TEQT1AC was statistically significant at 1% level in Panel A,Model (1). With the exception of the variable LR1 and LSRETLNS, Panel A has largely similar results to Panel B but in some instances, proxies that are statistically significant in Panel B are not significant in Panel A. In all, the conclusions from the statistical results are similar.

Table 7.19: Random effects logistic regression estimates of the determinants of using credit derivatives (Panel C: Crisis period)

	Dependent Variable: NPB_DUM		Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Description	Capitalisation measure	TEQT1AC	CrisisPeriod (2007:4 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)
	Variable	Variable description	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value
Asset quality	NCLTASST	Non-performing loans/total assets				0.152	0.121	0.190	0.403
						(0.84)	(0.87)	(0.97)	(0.54)
	CLPNCS	Credit loss provision to net charge-offs	-0.597	-0.007	-0.009				
			(0.94)	(0.76)	(0.76)				
	LLANL	Loan loss allowance to noncurrent loans			-0.006***	-0.004**	-0.004**	-0.004***	-0.002**
					(0.00)	(0.02)	(0.02)	(0.01)	(0.04)
capitalisation	TEQT1AC	Total equity capital /Tier 1 risk adj capital	-0.234	-0.123	0.101***	0.604**	0.604**	0.871***	0.758***
			(0.44)	(0.73)	(0.00)	(0.03)	(0.04)	(0.00)	(0.00)
	TDTA	Total deposits/total asset			0.106	-0.203	-0.258*	0.156	-0.276
					(0.30)	(0.19)	(0.07)	(0.93)	(0.84)
	VLTL	Volatile liability to total liability				0.257***	0.314***	0.378***	
						(0.01)	(0.00)	(0.00)	

Table 7.19 (Cont'd)

	Dependent Variable: NPB_DUM		Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Description	Capitalisation measure	TEQT1AC	CrisisPeriod (2007:4 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)
	Variable	Variable description	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef
			p-value	p-value	p-value	p-value	p-value	p-value	p-value
CR mgt and derivatives	CEQTDTA	Commodity & equity derivatives to total assets			0.877***	0.170			
					(0.00)	(0.32)			
	SUBTT1C	Subordinated debt to Tier 1 risk adj cap				0.844***	0.881***		
						(0.00)	(0.00)		
	LSTTS	Loan sales to total assets					0.382	0.391	0.219
							(0.28)	(0.23)	(0.51)
Credit risk	CILEAST	C&I loans/earning assets	-0.100	-0.194	-0.202	-0.447			
			(0.94)	(0.92)	(0.16)	(0.82)			
	NCOLS	Net charge-offs to loans				-0.094	-0.064	-0.001	-0.036
						(0.40)	(0.55)	(0.98)	(0.66)
Interest rate risk	ITDR_DUM	Dummy/use of interest rate derivatives	0.284***	0.241***	0.413***	0.454***	0.474***	0.534***	0.521***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Table 7.19 (Cont'd)

Description	Capitalisation measure / Variable	TEQT1AC / Variable description	Model (1) Crisis-Period (2007:4 to 2009:2) Co-ef p-value	Model (2) Base Year (2008:3 to 2009:2) Co-ef p-value	Model (3) Base Year (2008:3 to 2009:2) Co-ef p-value	Model (4) Base Year (2008:3 to 2009:2) Co-ef p-value	Model (5) Base Year (2008:3 to 2009:2) Co-ef p-value	Model (6) Base Year (2008:3 to 2009:2) Co-ef p-value	Model (7) Base Year (2008:3 to 2009:2) Co-ef p-value
Dependent Variable: NPB_DUM									
Liquidity	LR1	Highly liquid assets/Total liab	0.321***	0.114***	-0.176				
			(0.01)	(0.00)	(0.59)				
	NLLDS	Net loans and leases to deposits				-0.042***	-0.047***	-0.013	-0.003
						(0.00)	(0.00)	(0.28)	(0.61)
	TLTAS	Total loans to total assets						-0.441**	-0.550***
								(0.03)	(0.00)
Loan portfolio	LSRETLNS	Loans secured by real estate loans to total loans	-0.783	-0.356	-0.444***	-0.795	-0.273	-0.141**	-0.159**
			(0.21)	(0.63)	(0.00)	(0.39)	(0.74)	(0.05)	(0.02)
	AGLTLN	Agricultural loans/total loans	-0.744	-0.001	0.001***	0.001**	0.001*	0.002***	0.002***
			(0.24)	(0.38)	(0.01)	(0.05)	(0.06)	(0.00)	(0.00)
	TFLTTLN	Total foreign loans to total loans							0.000
									(0.29)

Table 7.19 (Cont'd)

Dependent Variable: NPB_DUM			Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Description	Capitalisation measure	TEQT1AC	CrisisPeriod (2007:4 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)
	Variable	Variable description	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef
			p-value	p-value	p-value	p-value	p-value	p-value	p-value
Macroeconomic context	FFR	Federal funds rate	0.019	0.111	0.023	0.196	0.205	0.153	0.142
			(0.79)	(0.55)	(0.88)	(0.26)	(0.24)	(0.35)	(0.38)
Profitability	ROE	Return on equity	-0.002	-0.004	0.000	-0.001			
			(0.56)	(0.99)	(0.84)	(0.65)			
	ERT	Efficiency ratio					-0.004**	-0.004***	-0.004**
							(0.03)	(0.01)	(0.03)
Size/Reputation	LASSET	Natural log of total assets	0.118***	0.132***					
			(0.00)	(0.00)					
		Constant	-24.52	-27.54	-5.974	-3.995	-3.739	-5.547	-4.318
			(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
		N	9750	5659	5659	5659	5659	5659	5659

Table 7.20: Summary of Panel C

Models	Description	Dependent variable	Capitalisation measure	Differences	Key Results
1	2007:4 to 2009:2-Crisis-Period	NPB_DUM	TEQT1AC not significant at any level	Ten explanatory variables tested. Three significant variables at 1% level	Variables relating to bank capital, interest rate volatility, bank size determined use of Credit derivatives
2	2008:3 to 2009:2-Base year	NPB_DUM	TEQT1AC not significant at any level	Same explanatory variables in model 1.Three significant variables at 1% level	Banks with large asset size, use interest rate derivatives and with highly liquid assets to total liabilities are more likely to use credit derivatives
3	2008:3 to 2009:2-Base year	NPB_DUM	TEQT1AC significant at 1% level	Twelve explanatory variables tested. Six significant variables at 1% level	Banks with variables relating to credit risks, use of other types of derivatives, interest rate risks, exposure to agricultural and real estate loans are more likely to use credit derivatives
4	2008:3 to 2009:2-Base year	NPB_DUM	TEQT1AC significant at 5% level	Fifteen explanatory variables tested. Four significant variables at 1% level	Banks with variables relating to liquidity and subordinated debt, use interest rate derivatives while those exposed to agricultural loans are more likely to use credit derivatives
5	2008:3 to 2009:2-Base year	NPB_DUM	TEQT1AC significant at 5% level	Fourteen explanatory variables tested. Four significant variables at 1% level	Banks with liquidity problems, credit risks, use interest rate derivatives are more likely to buy protection
6	2008:3 to 2009:2-Base year	NPB_DUM	TEQT1AC significant at 1% level	Fourteen explanatory variables tested. Six significant variables at 1% level	Banks with credit risks, volatile deposit base and low efficiency ratio are likely to buy protection
7	2008:3 to 2009:2-Base year	NPB_DUM	TEQT1AC significant at 1% level	Fourteen explanatory variables tested. Four significant variables at 1% level	Banks with low efficiency ratio, originate agricultural loans, use interest rate derivatives are more likely to buy protection

Table 7.21: Random effects logistic regression estimates of the determinants of using credit derivatives (Panel D:Crisis Period)

Dependent Variable: NPB_DUM			Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Description	Capitalisation measure	RWATLS	CrisisPeriod (2007:4 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)
	Variable	Variable description	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef
			p-value	p-value	p-value	p-value	p-value	p-value	p-value
Asset quality	NCLTASST	Non-performing loans/total assets				0.236	0.268	0.172	0.499
						(0.74)	(0.72)	(0.78)	(0.42)
	CLPNCS	Credit loss provision to net charge-offs	- 0.000	-0.006	-0.009				
			(0.98)	(0.80)	(0.70)				
	LLANL	Loan loss allowance to noncurrent loans			-0.004***	-0.004**	-0.004**	-0.003***	-0.002**
					(0.00)	(0.02)	(0.02)	(0.01)	(0.05)
capitalisation	RWATLS	Risk weighted assets ratio	0.032	0.061	0.079**	-0.007	-0.011	0.010	0.016
			(0.40)	(0.17)	(0.02)	(0.89)	(0.84)	(0.81)	(0.69)
	TDTA	Total deposits/total asset			0.451	-0.338***	-0.363***	-0.186	-0.179
					(0.64)	(0.01)	(0.00)	(0.31)	(0.27)
	VLTL	Volatile liability to total liability				0.219**	0.272***	0.347***	
						(0.03)	(0.00)	(0.00)	

Table 7.21 (Cont'd)

	Dependent Variable: NPB_DUM		Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Description	**Capitalisation measure**	**RWATLS**	**CrisisPeriod (2007:4 to 2009:2)**	**Base Year (2008:3 to 2009:2)**	**Base Year (2008:3 to 2009:2)**	**Base Year (2008:3 to 2009:2)**	**Base Year (2008:3 to 2009:2)**	**Base Year (2008:3 to 2009:2)**	**Base Year (2008:3 to 2009:2)**
	Variable	**Variable description**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**
			p-value	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**
CR mgmt. and derivatives	CEQTDTA	Commodity & equity derivatives to total assets			0.830***	0.148			
					(0.00)	(0.38)			
	SUBTT1C	Subordinated debt to Tier 1 risk adj cap				0.863***	0.900***		
						(0.00)	(0.00)		
	LSTTS	Loan sales to total assets					0.347	0.345	0.210
							(0.33)	(0.28)	(0.52)
CR mgmt. and derivatives	CEQTDTA	Commodity & equity derivatives to total assets			0.830***	0.148			
					(0.00)	(0.38)			
	SUBTT1C	Subordinated debt to Tier 1 risk adj cap				0.863***	0.900***		
						(0.00)	(0.00)		
	LSTTS	Loan sales to total assets					0.347	0.345	0.210
							(0.33)	(0.28)	(0.52)

Table 7.21 (Cont'd)

Description	Capitalisation measure	RWATLS	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
		Dependent Variable: NPB_DUM	CrisisPeriod (2007:4 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)	Base Year (2008:3 to 2009:2)
	Variable	Variable description	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value
Credit risk	CILEAST	C&I loans/earning assets	0.121	0.322	-0.849	0.422			
			(0.93)	(0.86)	(0.53)	(0.82)			
	NCOLS	Net charge-offs to loans				-0.100	-0.078	0.000	-0.035
						(0.37)	(0.47)	(0.99)	(0.65)
Interest rate risk	ITDR_DUM	Dummy/use of interest rate derivatives	0.275***	0.235***	0.363***	0.412***	0.432***	0.465***	0.4433***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Liquidity	LR1	Highly liquid assets/Total liab	0.317***	0.115***	0.109				
			(0.01)	(0.00)	(0.72)				
	NLLDS	Net loans and leases to deposits				-0.046***	-0.048***	-0.0241*	-0.011
						(0.00)	(0.00)	(0.08)	(0.31)
	TLTAS	Total loans to total assets						-0.250	-0.404**
								(0.24)	(0.02)

Table 7.21 (Cont'd)

Description	Capitalisation measure	RWATLS	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
		Dependent Variable: NPB_DUM	**CrisisPeriod (2007:4 to 2009:2)**	**Base Year (2008:3 to 2009:2)**	**Base Year (2008:3 to 2009:2)**	**Base Year (2008:3 to 2009:2)**	**Base Year (2008:3 to 2009:2)**	**Base Year (2008:3 to 2009:2)**	**Base Year (2008:3 to 2009:2)**
	Variable	**Variable description**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**
Loan portfolio	LSRETLNS	Loans secured by real estate loans to total loans	-0.835	-0.250	-0.372***	-0.389	-0.128	-0.154**	-0.156**
			(0.17)	(0.74)	(0.00)	(0.66)	(0.87)	(0.02)	(0.02)
	AGLTLN	Agricultural loans/total loans	-0.000	-0.000	0.002***	0.001**	0.000**	0.002***	0.002***
			(0.28)	(0.42)	(0.00)	(0.03)	(0.04)	(0.00)	(0.00)
	TFLTTLN	Total foreign loans to total loans							0.000
									(0.25)
Macroeconomic context	FFR	Federal funds rate	0.009	0.095	0.075	0.231	0.241	0.192	0.180
			(0.89)	(0.61)	(0.62)	(0.17)	(0.16)	(0.23)	(0.25)
Profitability	ROE	Return on equity	-0.002	-0.00	-0.00	-0.002			
			(0.51)	(0.97)	(0.95)	(0.62)			
	ERT	Efficiency ratio					-0.004**	-0.004**	-0.003*
							(0.05)	(0.02)	(0.07)

Table 7.21 (Cont'd)

Description	Capitalisation measure / Variable	RWATLS / Variable description	Model (1) CrisisPeriod (2007:4 to 2009:2)	Model (2) Base Year (2008:3 to 2009:2)	Model (3) Base Year (2008:3 to 2009:2)	Model (4) Base Year (2008:3 to 2009:2)	Model (5) Base Year (2008:3 to 2009:2)	Model (6) Base Year (2008:3 to 2009:2)	Model (7) Base Year (2008:3 to 2009:2)
Dependent Variable: NPB_DUM			Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value	Co-ef p-value
Size/Reputation	LASSET	Natural log of total assets	0.115***	0.129***					
			(0.00)	(0.00)					
	Constant		-24.23	-27.45	-4.882	-1.896	-1.751	-2.599	-1.865
			(0.00)	(0.00)	(0.00)	(0.11)	(0.14)	(0.07)	(0.14)
	N		9750	5659	5659	5659	5659	5659	5659

Table 7.22: Summary (Panel D: Crisis Period)

Models	Description	Dependent variable	Capitalisation measure	Differences	Key Results
1	2007:4 to 2009:2-Crisis-Period	NPB_DUM	RWATLS not significant at any level	Ten explanatory variables tested. Three significant variables at 1% level	Variables relating to interest rate volatility, bank size and liquidity determined use of Credit derivatives
2	2008:3 to 2009:2-Base year	NPB_DUM	RWATLS not significant at any level	Same explanatory variables in model 1.Three significant variables at 1% level	interest rate volatility, bank size, liquidity determined use of Credit derivatives
3	2008:3 to 2009:2-Base year	NPB_DUM	RWATLS significant at 5% level	Twelve explanatory variables tested. Five significant variables at 1% level	Banks with credit risks, use of other types of derivatives, interest rate risks, exposure to agricultural loans and real estate loans are more likely to use credit derivatives
4	2008:3 to 2009:2-Base year	NPB_DUM	RWATLS not significant at any level	Fifteen explanatory variables tested. Four significant variables at 1% level	Banks with variables relating to credit risk, liquidity, volatile liabilities and subordinated debt are more likely to use credit derivatives
5	2008:3 to 2009:2-Base year	NPB_DUM	RWATLS not significant at any level	Fourteen explanatory variables tested. Five significant variables at 1% level	Banks with liquidity problems, low efficiency ratio, sell and securitise loans more likely to buy protection
6	2008:3 to 2009:2-Base year	NPB_DUM	RWATLS not significant at any level	Fourteen explanatory variables tested. Four significant variables at 1% level	Banks with volatile deposit base, use other types of derivatives and exposure to agricultural loans likely to buy protection
7	2008:3 to 2009:2-Base year	NPB_DUM	RWATLS not significant at any level	Fourteen explanatory variables tested. Two significant variables at 1% level	Banks who originate agricultural loans and use interest rate derivatives are likely to buy protection

7.8 Results and Discussion: Panels C and D (Crisis Period)

With the advent of the last financial crisis in 2007, many financial institutions and economies were thrown into turmoil. While some survived, there were thousands of failed financial institutions especially in the US banking market. This was largely blamed on the faulty operating models used by banks, subprime lending and the misuse of credit derivatives by banks. We proceed by reporting the random effects logistic regression for the financial crisis period/recession (Quarter 4, 2007 to Quarter 2, 2009) to test the determinants of bank use to mitigate risk with credit derivatives. We report the estimates and p-values of the models in Panels C and D. The regressions for financial crisis as well as for the recession, twelve months base year (Quarter 3, 2008 to Quarter 2, 2009) are also estimated. As with Panel A, the dependent variable of model C is (NPB_DUM), the probability of being a net protection buyer to mitigate risks.

$$\begin{aligned} NPB_{DUM_{it}} &= S_0 + S_1 CLPNCS_{it} + S_2 TEQT1AC_{it} + S_3 CILEAST_{it} + S_4 ITDR\_DUM_{it} + S_5 LR1_{it} \\ &+ S_6 LSRETLNS_{it} + S_7 AGLTLN_{it} + S_8 FFR_{it} + S_9 ROE_{it} + S_{10} LASSET_{it} + \varepsilon_{it} \qquad 7.4 \end{aligned}$$

Panel C, Model (1), for the crisis period/recession (Quarter 4, 2007 to Quarter 2, 2009) incorporates ten variables. This leaves room for improvement in subsequent regressions in the Panel that will integrate more variables. The results show that the explanatory variable for capitalisation (TEQT1AC) is statistically insignificant with a negative impact. The variable (ITDR_DUM) for the use of interest derivatives is significant at the 1% level with positive coefficient at the 0.284 level. This suggests interest rate derivatives use to fix the variability of interest rates had a direct effect on the decision to use credit derivatives. The coefficient for bank size and reputation (LASSET) is positive significant at the 1% with a relatively smaller magnitude (0.118). Much higher is the impact of the liquidity (LR1) variable, which is also significant at the 1% level with a coefficient of 0.321.The coefficients for the other variables, CLPNCS, CILEAST, LSRETLNS, AGLTLN and ROE are negative but their impact on protection selling is not significant. Although the coefficient of FFR is positive, its effect is insignificant.

$$NPB_{DUM_{it}} = S_0 + S_1 CLPNCS_{it} + S_2 TEQT1AC_{it} + S_3 CILEAST_{it} + S_4 ITDR\_DUM_{it} + S_5 LR1_{it} + S_6 LSRETLNS_{it} + S_7 AGLTLN_{it} + S_8 FFR_{it} + S_9 ROE_{it} + S_{10} LASSET_{it} + \varepsilon_{it} \qquad 7.4b$$

Panel C, Model (2), for the crisis period, twelve months base year (Quarter 3, 2008 to Quarter 2, 2009) features ten variables as with the crisis period/recession period (Quarter 4, 2007 to Quarter 2, 2009). The benchmark Model (1) yields similar results with Model (2). The ITDR-DUM, LR1, and LASSET are all statistically significant at 1% level with positive coefficients 0.241, 0.114 and 0.132 respectively.A bank is more likely to buy protection if it uses interest rate derivatives, experience liquidity challenges and has a large asset base.The TEQT1AC, CLPNCS, CILEAST, LSRETLNS, AGLTLN, ROE, FFR variables do not have any explanatory power as they are all insignificant.

$$NPB_{DUM_{it}} = S_0 + S_1 CLPNCS_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 TDTA_{it} + S_5 CEQDATA_{it} + S_6 CILEAST_{it} + S_7 ITDR\_DUM_{it} + S_8 LR1_{it} + S_9 LSRETLNS_{it} + S_{10} AGLTLN_{it} + \mathrm{S}_{11}\mathrm{FFR}_{\mathrm{it}} + \mathrm{S}_{12}\mathrm{ROE}_{\mathrm{it}} + \varepsilon_{\mathrm{it}} \qquad 7.4c$$

Panel C, Model (3), for the crisis period, twelve months base year (Quarter 3, 2008 to Quarter 2, 2009) features twelve variables. The model incorporates the proxy for loan allowance to noncurrent loans (LLANL) to replace credit loss provision to net charge-off (CLPNCS) . The total deposit to total assets (TDTA) is featured as a capitalisation measure as well as commodity and equity derivatives to total assets (CEQTDTA) as a proxy for credit management and derivatives. The model also relaxes the natural log of total assets (LASSET). In terms of the asset quality variable, the LLANL is negatively impactful at the 1% significance level with -0.006 coefficient. In relation to the capitalisation variable, the TEQT1AC becomes significantly positive and impact on protection selling; an improvement over the results in Model (1) and Model (2). The commodity and equity derivatives to total assets variable reflecting credit management and derivatives is significant at the 1% level and impacts on bank protection procurement as its coefficient is around 0.87.The interest rate risk variable retains its significance at the 1% level and positively impacts on bank use of credit derivatives to mitigate risk with a coefficient of 0.413.Both the LSRETLNS and AGLTLN variables become significant at 1%. While LSRETLNS retains its negative sign and magnitude (the coefficient is -0.444), AGLTLN has a positive but low magnitude at 0.001 coefficient. The variable TEQT1AC has a significant and positive impact on bank protection policy as it is significant at the 1% level with a coefficient of 0.101.The highly liquid assets to total liability (LR1) becomes insignificant and its coefficient also loses its positive sign. The coefficients of the CLPNCS and CILEAST variables are negative, none of them is significant. The TDTA, FFR and ROE variables become insignificant with positive coefficients.

$$\begin{aligned} NPB_{DUM_{it}} = {} & S_0 + S_1 NCLTASST_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 TDTA_{it} + S_5 VLTL_{it} + \\ & S_6 CEQTDTA_{it} + S_7 SUBTT1C_{it} + S_8 CILEAST_{it} + S_9 NCOLS_{it} + S_{10} ITDR\_DUM_{it} + \\ & S_{11} NLLDS_{it} + S_{12} LSRETLNS_{it} + S_{13} AGLTLN_{it} + S_{14} FFR_{it} + S_{15} ROE_{it} + \varepsilon_{\text{it}} \end{aligned} \qquad 7.4d$$

The work progresses to Panel C, Model (4), for the crisis period, twelve months base year (Quarter 3, 2008 to Quarter 2, 2009). It integrates fifteen variables. The model do away with CLPNCS and LR1 and feature non-performing loans/total assets (NCLTASST) as a measure of asset quality, volatile liability to total liability (VLTL) as a capitalisation measure, subordinated debt to tier 1 risk adjusted capital (SUBTT1C) as a credit management and derivatives measure, net charge-offs to loans (NCOLS) to measure credit risk and net loans and leases to deposits (NLDDS) to measure liquidity. From the results, LLANL retains its significance but at a lower level this time (5%) and its negative impact on protection procurement is reduced slightly as its coefficient falls from -0.006 in Model (3) to -0.004. In the same manner, TEQT1AC retains its significance level at (5%) but its positive impact on protection procurement increases significantly as its coefficient moves from 0.101 in Model (3) to 0.604. The coefficient for VLTL is positive significant at the 1% level with a magnitude of 0.257. The SUBTT1C variable becomes significant at the 1% level, albeit with a large magnitude (0.844). The ITDR_DUM retains its significance at the 1% level with slightly increased magnitude (its coefficient is 0.454). In terms of liquidity, the NLLDS variable becomes significant at the 1% level, albeit with a small magnitude. The explanatory variable AGLTLN becomes significant at the 5% level with a relatively small and positive coefficient at the 0.001 level. The NCLTASST, TDTA, CEQTDTA, CILEAST, NCOLS, LSRETLNS, FFR and ROE do not have any explanatory power as they are all insignificant.

$$\begin{aligned} NPB_{DUM_{it}} = {} & S_0 + S_1 NCLTASST_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 TDTA_{it} + S_5 VLTL_{it} + \\ & S_6 SUBTT1C_{it} + S_7 LSTTS_{it} + S_8 NCOLS_{it} + S_9 ITDR\_DUM_{it} + S_{10} NLLDS_{it} + \\ & S_{11} LSRETLNS_{it} + S_{12} AGLTLN_{it} + S_{13} FFR_{it} + S_{14} ERT_{it} + \varepsilon_{\text{it}} \end{aligned} \qquad 7.4e$$

The work proceeds to Panel C, Model (5), for the crisis period, twelve months base year (Quarter 3, 2008 to Quarter 2, 2009), and assimilating fourteen variables. The model detaches CEQDATA and CILEAST and fits in loan sales to total assets (LSTTS) as a proxy for credit management and derivatives in addition to efficiency ratio (ERT) as a proxy for profitability. The variable VLTL retains its significance at the 1% level and the relatively high positive impact it has on bank protection policy (coefficient is 0.314). On the other hand, the coefficient of TDTA becomes significant at 5% level with a negative sign in comparison with the benchmark Model 4. The TEQT1AC keep hold of its significance at 5% and its positive scale (0.604). Remarkably similar with the result of TEQT1AC is the result for the impact of loan loss allowance to non-current loans on bank protection as the proxy variable LLANL retains its significance (5% level), its negative sign but also its small magnitude (-0.004). The subordinated debt to tier 1 risk adjusted capital (SUBTT1C) variable has a strong and positive impact on bank protection as it is significant at the 1% level and its coefficient is 0.844.The loan secured by real estate loans to total loans (LSRETLNS) is insignificant and its coefficient has a negative sign, a result that is deteriorating with the impact in the Model (3). Although AGLTLN retains its positive impact, its significance nosedived to the 10% level in comparison to Model (3). Similar to the Model (4) results, the ITDR_DUM and NLLDS are both significant in Model (5) at the 1% level with a 0.474 and -0.047 coefficient respectively. The profitability variable reflecting the efficiency ratio (ERT) is significant at the 5% level although with a negative impact on bank protection policy. The NCLTASST, LSTTS, NCOLS and FFR do not have any explanatory power as they are not significant.

$$\begin{aligned} NPB_{DUM_{it}} = {} & S_0 + S_1 NCLTASST_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 TDTA_{it} + S_5 VLTL_{it} + \\ & S_6 LSTTS_{it} + S_7 NCOLS_{it} + S_8 ITDR\_DUM_{it} + S_9 NLLDS_{it} + S_{10} TLTAS_{it} + \\ & S_{11} LSRETLNS_{it} + S_{12} AGLTLN_{it} + S_{13} FFR_{it} + S_{14} ERT_{it} + \varepsilon_{\mathrm{it}} \end{aligned} \tag{7.4f}$$

The work continues to Panel C, Model (6), for the crisis period, twelve months base year (Quarter 3, 2008 to Quarter 2, 2009) wherefore it integrates fourteen variables. The model downgrades variable (SUBTT1C) and introduces total loans to total assets (TLTAS) as a liquidity measure. The profitability variable (ERT) retains its significance but at a higher level this time (1%) and its negative impact on bank protection is sustained. In the same vein, the loan portfolio variable (AGLTLN) preserve its bank protection policy but at a higher level (1%) even while keeping its positive degree. Interestingly, the LSRETLNS now becomes significant at the 5% level with a reduced negative scale at -0.141, an improvement over the results in Model (4) and (5).In terms of the liquidity variable (TLTAS) which measures total loans to total assets, it is significant at the 5% level with a negative coefficient (-0.441). Conversely, NLLDS losses its significance though it still hold on to its negative impact (-0.013). The interest rate variable (ITDR_DUM) sustains its significance but with a higher magnitude (its coefficient is 0.534). The TEQT1AC variable retains its significance but at a higher level this time (1%) and its positive impact on protection policy increased significantly as its coefficient rises from 0.604 in Model (5) to 0.871. Likewise, VLTL saves its significance at the 1% level though its scale is positive, rising to 0.378 from 0.314 in Model (5). The impact of loan loss allowance to noncurrent loans on bank protection policy as the proxy variable LLANL retains its significance albeit at a higher (1% level), its negative sign but also its magnitude (-0.004). The coefficients for the variables NCLTASST, TDTA, LSTTS and FFR are positive but their impact on bank protection is not significant. Likewise, the coefficient of the variable NCOLS is negative but its impact on bank protection is insignificant.

$$\begin{aligned} NPB_{DUM_{it}} = {} & S_0 + S_1 NCLTASST_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 TDTA_{it} + S_5 LSTTS_{it} + \\ & S_6 NCOLS_{it} + S_7 ITDR\_DUM_{it} + S_8 NLLDS_{it} + S_9 TLTAS_{it} + S_{10} LSRETLNS_{it} + \\ & S_{11} AGLTLN_{it} + S_{12} TFLTTLN_{it} + S_{13} FFR_{it} + S_{14} ERT_{it} + \varepsilon_{it} \end{aligned} \tag{7.4g}$$

The work advances to Panel C, Model (7), for the crisis period, twelve months base year (Quarter 3, 2008 to Quarter 2, 2009) wherefore it incorporates fourteen variables. We relax VLTL and add the proxy for total foreign loans to total loans (TFLTTLN) as a measure for loan portfolio. Efficiency ratio (ERT) has a significantly negative impact on bank protection with the same magnitude as in Model (6) though at 5% significant level. The results for the model (6) for the total loans to total assets (TLTAS) are slightly different from the model (7). The variable becomes significant at 1% although the coefficient retains its negative sign. The AGLTLN retains its significance at the 1% level with similar magnitude (its coefficient is 0.002). The LLANL variable retains its significance but at a lower level this time (5%) and its negative impact on bank protection is reduced marginally as its coefficient falls from -0.004. The result for the impact of capitalisation on bank protection as the proxy variable TEQT1AC retains its significance (1% level), its positive sign though its magnitude reduces to 0.758. The results show that ITDR_DUM is still significant at the 1% level with the same sign and a magnitude of 0.521 slightly lower than in the standard Model (6).The NCLTASST, TDTA, LSTTS, NCOLS, NLLDS, TFLTTLN and FFR variables do not have any explanatory power as they are all insignificant.

The work summaises the results from the random effects logistic regression for the financial crisis period/recession (Quarter 4, 2007 to Quarter 2, 2009) as well as for the recession, twelve months base year (Quarter 3, 2008 to Quarter 2, 2009) on the determinants of bank use to mitigate risks with credit derivatives. The LLANL is significant at the 1% level in Model (3) and (6) with negative signs. As for capitalisation measures, TEQT1AC retains its significance in Models (3), (6) and (7) at the 1% level while keeping its positive sign.Though VLTL keeps its positive sign, it was statistically significant all through in Models (4) to (6) at the 1% level. In terms of profitability, ERT was significant at the 1% level only in Model (6) with a negative sign. We move to the results of the total assets size, LASSET was significant with a positive sign at the 1% level in Models (1) and (2). For the credit management and derivatives variables, Model (3) finds CEQTDTA significant at the 1% level while SUBTT1C is significant in Models (4) and (5) at the 1% level, both with a positive sign. Interestingly, the interest rate variable, ITDR_DUM retains its positive sign all through Models (1) to (7) at 1% significance level.In terms of liquidity,LR1 is significant at the 1% level in Models (1) and (2) with a positive sign. Models (4) and (5) finds NLLDS significant at the 1% level with a negative sign while TLTAS becomes significant only in Model (7) with a negative sign.As for the loan portfolio variables, AGLTLN is significant at the 1% level in Models (3),(6) and (7) while LSRETLNS was only significant in Model (3) with a negative sign at the 1% level.

$$
\begin{aligned}
NPB_{DUMit} = {} & S_0 + S_1 RWATLS_{it} + S_2 NCLTASST_{it} + S_3 CLPNCS_{it} + S_4 LLANL_{it} + S_5 TDTA_{it} + \\
& S_6 VLTL_{it} + S_7 CEQTDTA_{it} + S_8 SUBTT1C_{it} + S_9 LSTTS_{it} + S_{10} CILEAST_{it} + \\
& \mathrm{S}_{11} NCOLS_{\mathrm{it}} + \mathrm{S}_{12} ITDR\_DUM_{\mathrm{it}} + \mathrm{S}_{13} LR1_{\mathrm{it}} + \mathrm{S}_{14} NLLDS_{\mathrm{it}} + \mathrm{S}_{15} TLTAS_{\mathrm{it}} + \\
& \mathrm{S}_{16} LSRETLNS_{\mathrm{it}} + \mathrm{S}_{17} AGLTLN_{\mathrm{it}} + \mathrm{S}_{18} TFLTTLN_{\mathrm{it}} + \mathrm{S}_{19} FFR_{\mathrm{it}} + \mathrm{S}_{20} ROE_{\mathrm{it}} + \\
& \mathrm{S}_{21} ERT_{it} + S_{22} LASSET_{it} + \varepsilon_{it} \qquad 7.4\mathrm{h}
\end{aligned}
$$

The work proceeds to Panel D. The results from the seven random effects logistic regression for the crisis period (Quarter 4, 2007 to Quarter 2, 2009) as well as the crisis period, twelve months base year (Quarter 3, 2008 to Quarter 2, 2009) uses risk weighted asset ratio (RWATLS) as the core proxy to test for capitalisation rather than total equity capital/Tier 1 risk adjusted capital (TEQT1AC) used in Panel C.The RWATLS proxy was only statistically significant in model (3) at the 5% level whereas TEQT1AC was statistically significant at 1% level in Model (3),(6) and (7). An interesting finding is the variable ITDR_DUM. It is statistically significant at the 1% level in all the models in both Panels.

With the exception of the variable TDTA, ERT and TLTAS, Panel C has largely similar results to Panel D but in some instances, proxies that are statistically significant in Panel D are not significant in Panel C. In all, the conclusions from the statistical results are similar.

Table 7.23: Random effects logistic regression estimates of the determinants of using credit derivatives (Panel E: Post-Crisis)

	Dependent Variable: NPB_DUM		Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Description	Capitalisation measure	TEQT1AC	Postcrisis (2009:3to 2011:4)	BaseYear (2011: to 2011:4)	Base Year (2011:1 to 2011:4)	Base Year (2011:1 to 2011:4)	Base Year (2011:1 to 2011:4)	Base Year (2011:1 to 2011:4)	Base Year (2011:1to 2011:4)
	Variable	Variable description	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef
			p-value	p-value	p-value	p-value	p-value	p-value	p-value
Asset quality	NCLTASST	Non-performing loans/total assets	-0.710	-0.438	-0.552	-0.169			
			(0.32)	(0.68)	(0.55)	(0.85)			
	CLPNCS	Credit loss provision to net charge-offs				-0.000*	-0.000**	-0.000**	-0.000*
						(0.06)	(0.05)	(0.03)	(0.07)
	LLANL	Loan loss allowance to noncurrent loans	-0.002*	-0.002	-0.005**	-0.005**	-0.003*		
			(0.09)	(0.23)	(0.03)	(0.02)	(0.08)		
Capitalisation	TEQT1AC	Total equity capital /Tier 1 risk adj capital	0.156	-0.065	0.207***	0.190***	0.166***	0.185***	0.074
			(0.71)	(0.91)	(0.00)	(0.00)	(0.00)	(0.00)	(0.91)
	TDTA	Total deposits/total asset					-0.131	-0.365	0.507**
							(0.61)	(0.19)	(0.03)
	VLTL	Volatile liability to total liability	0.266	0.303	0.574***	0.515***			
			(0.80)	(0.85)	(0.00)	(0.00)			
CR mgt and derivatives	CEQTDTA	Commodity & equity derivatives to total assets						-0.107**	-0.595***
								(0.04)	(0.00)
	SUBTT1C	Subordinated debt to Tier 1 risk adj cap					0.769***	0.113***	
							(0.00)	(0.00)	
	LSTTS	Loan sales to total assets	0.458**	0.312	0.879***				
			(0.03)	(0.25)	(0.00)				

Table 7.23 (Cont'd)

Description	Capitalisation measure / Variable	Dependent Variable: NPB_DUM / TEQT1AC / Variable description	Model (1) Postcrisis (2009:3to 2011:4) Co-ef p-value	Model (2) BaseYear (2011:1 to 2011:4) Co-ef p-value	Model (3) Base Year (2011:1 to 2011:4) Co-ef p-value	Model (4) Base Year (2011:1 to 2011:4) Co-ef p-value	Model (5) BaseYear (2011:1to 2011:4) Co-ef p-value	Model (6) Base Year (2011:1 to 2011:4) Co-ef p-value	Model (7) Base Year (2011:1 to 2011:4) Co-ef p-value
Credit risk	CILEAST	C&I loans/earning assets				-0.313	-0.488**	-0.747***	-0.541*
						(0.15)	(0.05)	(0.01)	(0.09)
	NCOLS	Net charge-offs to loans	-0.185**	-0.315*	0.047	-0.007			
			(0.04)	(0.07)	(0.69)	(0.95)			
Interest rate risk	ITDR_DUM	Dummy/use of interest rate derivatives	0.631	0.768	0.270	0.220	0.192	0.198	0.192
			(0.82)	(0.85)	(0.97)	(0.95)	(0.96)	(0.95)	(0.97)
Liquidity	LR1	Highly liquid assets/Total liab	-0.635	-0.382	-0.182***	-0.213***	-0.224***	-0.287***	-0.129*
			(0.21)	(0.59)	(0.00)	(0.00)	(0.00)	(0.00)	(0.10)
	NLLDS	Net loans and leases to to deposits			-0.064***	-0.064***	-0.069***	-0.09***	
					(0.00)	(0.00)	(0.00)	(0.00)	
	TLTAS	Total loans to total assets	-0.501***	-0.401**					-0.819***
			(0.00)	(0.04)					(0.00)
Loan portfolio	LSRETLNS	Loans secured by real estate loans to total loans	-0.371	-0.342	-0.222***	-0.325***	-0.255***	-0.153	0.217
			(0.62)	(0.73)	(0.00)	(0.00)	(0.00)	(0.11)	(0.83)
	AGLTLN	Agricultural loans/total loans			0.002***	0.002***	0.001***	0.001***	0.000
					(0.00)	(0.00)	(0.00)	(0.00)	(0.70)
	TFLTTLN	Total foreign loans to total loans	0.000	0.000				0.000	
			(0.54)	(0.49)				(0.62)	

Table 7.23 (Cont'd)

Description	Capitalisation measure	TEQT1AC	Model (1) Postcrisis (2009:3to 2011:4)	Model (2) BaseYear (2011:1 to 2011:4)	Model (3) Base Year (2011:1 to 2011:4)	Model (4) Base Year (2011:1 to 2011:4)	Model (5) BaseYear (2011:1 to 2011:4)	Model (6) Base Year (2011:1 to 2011:4)	Model (7) Base Year (2011:1 to 2011:4)
	Dependent Variable: NPB_DUM								
	Variable	**Variable description**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**	**Co-ef p-value**
Macroeconomic context	FFR	Federal funds rate	0.115	0.143	-0.050	-0.567	-0.122	-0.152	0.696
			(0.63)	(0.79)	(0.99)	(0.90)	(0.80)	(0.77)	(0.90)
Profitability	ROE	Return on equity	-0.006***	-0.007***	-0.001	-0.000	-0.000	-0.000	- 0.000
			(0.00)	(0.01)	(0.49)	(0.45)	(0.46)	(0.43)	(0.48)
	ERT	Efficiency ratio	0.007***	0.009***	0.001				
			(0.00)	(0.01)	(0.62)				
Size/Reputation	LASSET	Natural log of total assets	0.936***	0.9749***					0.122***
			(0.00)	(0.00)					(0.00)
		Constant	-78.08	-93.07	-26.12	-19.25	-14.84	-12.86	-40.11
			(0.77)	(0.81)	(0.97)	(0.95)	(0.97)	(0.96)	(0.93)
		No of observations	13712	5432	5432	5432	5432	5432	5432

Table 7.24: Summary (Panel E: Post-Crisis)

Models	Description	Dependent variable	Capitalisation measure	Differences	Key Results
1	2009:3 to 2011:4-Post-Crisis	NPB_DUM	TEQT1AC not significant at any level	Fifteen explanatory variables tested. Four significant variables at 1% level	Variables relating to bank capital, credit management, liquidity, Profitability, bank size determined use of Credit derivatives
2	2011:1 to 2011:4-Base year	NPB_DUM	TEQT1AC not significant at any level	Same explanatory variables in model 1.Three significant variables at 1% level	Credit risks,liquidity,profitability and bank size determined use of Credit derivatives by banks
3	2011:1 to 2011:4-Base year	NPB_DUM	TEQT1AC significant at 1% level	Fourteen explanatory variables tested. Seven significant variables at 1% level	Banks with variables relating to capitalisation and liquidity issues as well as exposure to agricultural and mortgage secured loans are more likely to use credit derivatives
4	2011:1 to 2011:4-Base year	NPB_DUM	TEQT1AC significant at 1% level	Fourteen explanatory variables tested. Six significant variables at 1% level	Banks with volatile liabilities, liquidity issues and exposure to agricultural and mortgage secured loans are more likely to use credit derivatives
5	2011:1 to 2011:4-Base year	NPB_DUM	TEQT1AC significant at 1% level	Thirteen explanatory variables tested. Six significant variables at 1% level	Banks with credit management problems, credit risks, liquidity issues as well exposure to real estate secured loans, more likely to buy protection
6	2011:1 to 2011:4-Base year	NPB_DUM	TEQT1AC significant at 1% level	Fourteen explanatory variables tested. Six significant variables at 1% level	Banks with credit risks, liquidity issues, poor asset quality, exposure to agricultural loans, more likely to buy protection
7	2011:1 to 2011:4-Base year	NPB_DUM	TEQT1AC not significant at any level	Thirteen explanatory variables tested. Three significant variables at 1% level	Banks with capitalisation issues, credit management and liquidity problems, more likely to buy protection

Table 7.25: Random effects logistic regression estimates of the determinants of using credit derivatives (Panel F: Post-Crisis)

			PANEL F (Post-crisis)						
Dependent Variable: NPB_DUM			**Model (1)**	**Model (2)**	**Model (3)**	**Model (4)**	**Model (5)**	**Model (6)**	**Model (7)**
Description	**Capitalisation measure**	**RWATLS**	**Post-crisis (2009:3 to 2011:4)**	**Base Year (2011:1 to 2011:4)**	**Base Year (2011:1 to 2011:4)**	**Base Year (2011:1 to 2011:4)**	**Base Year (2011:1 to 2011:4)**	**Base Year (2011:1 to 2011:4)**	**Base Year (2011:1 to 2011:4)**
	Variable	**Variable description**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**
			p-value	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**
Asset quality	NCLTASST	Non-performing loans/total assets	-0.734	-0.942		-0.679			
			(0.31)	(0.41)		(0.49)			
	CLPNCS	Credit loss provision to net charge-offs					-0.000	-0.000	-0.000
							(0.19)	(0.24)	(0.53)
	LLANL	Loan loss allowance to noncurrent loans	-0.002	-0.003	-0.003	-0.004*	-0.003		
			(0.13)	(0.20)	(0.18)	(0.09)	(0.22)		
Capitalisation	RWATLS	Risk weighted assets ratio	0.000***	0.101***	0.727***	0.814***	0.461***	0.568***	0.592***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	TDTA	Total deposits/total asset	-0.151	0.405	0.988***	0.124***			
			(0.42)	(0.26)	(0.00)	(0.00)			
	VLTL	Volatile liability to total liability				0.173	0.123	0.120	0.144
						(0.43)	(0.52)	(0.54)	(0.42)

Table 7.25 (Cont'd)

Description	Capitalisation measure	RWATLS	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Dependent Variable: NPB_DUM									
			Post-crisis (2009:3 to 2011:4)	Base Year (2011:1 to 2011:4)	Base Year (2011:1 to 2011:4)	Base Year (2011:1 to 2011:4)	Base Year (2011:1 to 2011:4)	Base Year (2011:1 to 2011:4)	Base Year (2011:1 to 2011:4)
	Variable	Variable description	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef
			p-value	p-value	p-value	p-value	p-value	p-value	p-value
CR mgt and derivatives	CEQTDTA	Commodity & equity derivatives to total assets	-0.434***	-0.799***			-0.654***	-0.708***	-0.533***
			(0.00)	(0.03)			(0.00)	(0.00)	(0.01)
	SUBTT1C	Subordinated debt to Tier 1 risk adj cap			0.103			0.258	0.230
					(0.62)			(0.21)	(0.25)
	LSTTS	Loan sales to total assets	0.602***	0.827***	0.726***	0.838***			
			(0.01)	(0.00)	(0.01)	(0.00)			
Credit risk	CILEAST	C&I loans/earning assets				-0.731***	-0.337	-0.430	-0.679**
						(0.01)	(0.25)	(0.15)	(0.02)
	NCOLS	Net charge-offs to loans	-0.115	-0.236	-0.169				
			(0.22)	(0.16)	(0.27)				
Interest rate risk	ITDR_DUM	Dummy/use of interest rate derivatives	0.140***	0.190***	0.136***	0.152***	0.866***	0.106***	0.111***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Table 7.25 (Cont'd)

		Dependent Variable: NPB_DUM	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Description	Capitalisation measure	RWATLS	Post-crisis (2009:3 to 2011:4)	BaseYear (2011: to 2011:4)	Base Year (2011:1 to 2011:4)	Base Year (2011:1 to 2011:4)	Base Year (2011:1 to 2011:4)	Base Year (2011:1 to 2011:4)	Base Year (2011:1 to 2011:4)
	Variable	Variable description	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef	Co-ef
			p-value	p-value	p-value	p-value	p-value	p-value	p-value
Liquidity	LR1	Highly liquid assets/Total liab	-0.626	-0.117	-0.386	0.376	-0.129	-0.158***	0.555
			(0.21)	(0.17)	(0.64)	(0.66)	(0.11)	(0.05)	(0.22)
	NLLDS	Net loans and leases to deposits	-0.046***	-0.038**					
			(0.00)	(0.02)					
	TLTAS	Total loans to total assets			-0.294	0.905	-0.724***	-0.803***	
					(0.19)	(0.72)	(0.00)	(0.00)	
Loan portfolio	LSRETLNS	Loans secured by real estate loans to total loans			0.070	-0.976	0.912	0.167*	0.890
					(0.94)	(0.38)	(0.39)	(0.09)	(0.34)
	AGLTLN	Agricultural loans/total loans					0.000	0.000	0.000
							(0.58)	(0.54)	(0.70)
	TFLTTLN	Total foreign loans to total loans	0.000	0.000	0.000	0.000			
			(0.42)	(0.50)	(0.36)	(0.55)			
Macroeconomic context	FFR	Federal funds rate	0.120	0.289	0.210	0.211	-0.848	-0.190	-0.192
			(0.63)	(0.61)	(0.69)	(0.69)	(0.88)	(0.74)	(0.73)

Table 7.25 (Cont'd)

Dependent Variable: NPB_DUM			Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
Description	**Capitalisation measure**	**RWATLS**	**Post-crisis (2009:3 to 2011:4)**	**Base Year (2011:1 to 2011:4)**	**Base Year (2011:1 to 2011:4)**	**Base Year (2011:1 to 2011:4)**	**Base Year (2011:1 to 2011:4)**	**Base Year (2011:1 to 2011:4)**	**Base Year (2011:1 to 2011:4)**
	Variable	**Variable description**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**	**Co-ef**
			p-value	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**
Profitability	ROE	Return on equity	-0.005***	-0.006**				-0.000	-0.001
			(0.00)	(0.03)				(0.43)	(0.35)
	ERT	Efficiency ratio	0.006***	0.008**	0.002				
			(0.00)	(0.03)	(0.29)				
Size/Reputation	LASSET	Natural log of total assets	0.114***	0.120***	0.998***	0.109***	0.107***	0.103***	0.111***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
		Constant	-156.66***	-191.11	-136.70	-153.16***	-86.75**	-106.86**	-111.24**
			(0.00)	(0.75)	(0.64)	(0.01)	(0.05)	(0.03)	(0.04)
		N	13712	5432	5432	5432	5432	5432	5432

Table 7.26: Summary (Panel F: Post-Crisis)

Models	Description	Dependent variable	Capitalisation measure	Differences	Key Results
1	2009:3 to 2011:4-Post-Crisis	NPB_DUM	RWATLS significant at 1% level	Fifteen explanatory variables tested. Eight significant variables at 1% level	Use of other types of derivatives, loan sales, liquidity issues, profitability and asset size determined use of Credit derivatives
2	2011:1 to 2011:4-Base year	NPB_DUM	RWATLS significant at 1% level	Same explanatory variables in model 1.Five significant variables at 1% level	Use of other types of derivatives, loan sales, profitability and asset size determined use of Credit derivatives
3	2011:1 to 2011:4-Base year	NPB_DUM	RWATLS significant at 1% level	Fourteen explanatory variables tested. Five significant variables at 1% level	Banks that used other types of derivatives, with capitalisation issues, loan sales more likely to use credit derivatives
4	2011:1 to 2011:4-Base year	NPB_DUM	RWATLS significant at 1% level	Fourteen explanatory variables tested. Five significant variables at 1% level	Use of other types of derivatives, credit risk, loan sales, more likely to use credit derivatives
5	2011:1 to 2011:4-Base year	NPB_DUM	RWATLS significant at 1% level	Thirteen explanatory variables tested. Four significant variables at 1% level	Banks with large asset base, liquidity issues, use other types of derivatives more likely to buy protection
6	2011:1 to 2011:4-Base year	NPB_DUM	RWATLS significant at 1% level	Fourteen explanatory variables tested. Six significant variables at 1% level	Banks with large asset base, liquidity issues, use other types of derivatives more likely to buy protection
7	2011:1 to 2011:4-Base year	NPB_DUM	RWATLS significant at 1% level	Thirteen explanatory variables tested. Four significant variables at 1% level	Banks with large asset size, face interest rate and credit risk, and use other types of derivatives are likely to buy protection

7.9 Results and Discussion: Panels E and F (Post-Crisis)

The US National Bureau of Economic Research (NBER) announced that the Great Recession ended as of the second quarter of 2009. Effectively, the post-crisis started at the beginning of the third quarter of 2009. We now proceed by reporting the random effects logistic regression for the post-crisis period (Quarter 3, 2009 to Quarter 4, 2011) to test the determinants of bank use to mitigate risk with credit derivatives. We report the estimates and p-values of the models in Panels E and F. The regressions for the post crisis twelve months base year (Quarter 1, 2011 to Quarter 4, 2011) are also estimated. As with Panel C, the dependent variable of model E is (NPB_DUM), the probability of being a net protection buyer to mitigate risks.

$$\begin{aligned} NPB_{DUM_{it}} = {} & S_0 + S_1 NCLTASST_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 LSTTS_{it} + S_5 NCOLS_{it} + \\ & S_6 ITDR\_DUM_{it} + S_7 LR1_{it} + S_8 TLTAS_{it} + S_9 LSRETLNS_{it} + S_{10} TFLTTLN_{it} + \\ & S_{11} FFR_{it} + S_{12} ROE_{it} + S_{13} ERT_{it} + S_{14} LASSET_{it} + \varepsilon_{\mathrm{it}} \end{aligned} \tag{7.5a}$$

Panel E, Model (1), post-crisis period (Quarter 3, 2009 to Quarter 4, 2011) incorporates fifteen variables. This leaves room for more variables in subsequent regressions in the Panel that will fit in more variables. In terms of bank size and total assets, the LASSET variable is significant at the 1% level with a high magnitude suggesting that size impacts on bank protection policy. The profitability variables yield similar results. The ERT and ROE variables are both statistically significant at the 1% level although their coefficients are low at 0.007 and -0.006 respectively. The results for the liquidity variable TLTAS though, significant at the 1% level, has a negative impact on bank protection policy. The credit risk variable (NCOLS) is significant at the 5% level and has a negative impact on bank protection policy as its coefficient is around -0.185.The credit management and derivatives reflecting the loan sales to total assets (LSTTS) variable is significant at the 5% level, it has a positive impact on bank protection as its coefficient is around 0.458.Asset quality is reflected with the results from loan loss allowance to noncurrent loans (LLANL) variable with 10% significance level and a low impact of -0.002. The coefficients of the TEQT1AC, VLTL, ITDR_DUM, TFLTTLN, FFR, are positive but none of them is significant. In the same vein, the coefficients of NLCTASST, LR1 and LSRETLNS are negative but they are insignificant.

$$NPB_{DUM_{it}} = S_0 + S_1 NCLTASST_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 VLTL_{it} + S_5 LSTTS_{it} + S_6 NCOLS_{it} + S_7 ITDR\_DUM_{it} + S_8 LR1_{it} + S_9 TLTAS_{it} + S_{10} LSRETLNS_{it} + S_{11} TFLTTLN_{it} + S_{12} FFR_{it} + S_{13} ROE_{it} + S_{14} ERT_{it} + S_{15} LASSET_{it} + \varepsilon_{it} \quad 7.5b$$

The work moves to Panel E, Model (2) for the post-crisis period, twelve months base year (Quarter 1, 2011 to Quarter 4, 2011) has fifteen variables; it ran estimates for the same variables in the post-crisis period (Quarter 1, 2011 to Quarter 4, 2011). The LASSET retains its significance at the 1% level, albeit with a high magnitude in comparison to Model (1) (its coefficient is 0.974).The ERT variable retains its significance at 1% significance and its positive impact on bank protection is increased slightly as its coefficient is 0.009. The results show that ROE is still significant at the 1% level with the same sign and almost similar magnitude. The liquidity measure (TLTAS) is still significant though at a lower level (5%) has an impact of -0.401 on bank protection policy. The same result goes for the credit risk variable (NCOLS), it is still significant at a lower level of 10% with a coefficient of -0.325. The loan sales to total assets variable losses its significance but retains its positive sign. The loan loss allowance to noncurrent loans retains its sign but loses its significance. The Asset quality variables NCLTASST and LLANL are insignificant although their coefficient retain their negative sign. The coefficients of the VLTL, LSTTS, ITDR_DUM, TFLTTLN and FFR, are positive but none of them is significant. The results also show that the coefficients of TEQT1AC, LR1 and LSRETLNS are negative but they are insignificant.

$$NPB_{DUM_{it}} = S_0 + S_1 NCLTASST_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 VLTL_{it} + S_5 LSTTS_{it} + S_6 NCOLS_{it} + S_7 ITDR\_DUM_{it} + S_8 LR1_{it} + S_9 NLLDS_{it} + S_{10} LSRETLNS_{it} + S_{11} AGLTLN_{it} + S_{12} FFR_{it} + S_{13} ROE_{it} + S_{14} ERT_{it} + \varepsilon_{it} \quad 7.5c$$

Panel E, Model (3), for the post-crisis period, twelve months base year (Quarter 1, 2011 to Quarter 4, 2011) features fourteen variables. The model integrates net loans and leases to deposits (NLLDS) and agricultural loans to total loans (AGLTLN) while it relaxes variables TLTAS, TFLTTLN and LASSET. The LLANL variable becomes significant at the 5% level, with a small magnitude of -0.005 in comparison with the results in model (2). In terms of the capitalisation measure, TEQT1AC and VLTL shift statistically significant at 1% with coefficients of 0.207 and 0.574 respectively in comparison with the results in model (1) and (2). The variable LSTTS evolve into 1% significance level with an impact of 0.879 on bank protection. In terms of liquidity, the variable LR1 shifts to 1% significance level though with a negative sign (coefficient is -0.182). The integration of the NLLDS variable into the model is significant at 1% with a scale of -0.064. With respect to loan portfolio measures, the incorporation of the variable AGLTLN is also significant at 1% level with a degree of 0.002 on bank protection policy. The variable LSRETLNS becomes significant at 1% level with a magnitude of -0.222 on bank protection. The NCOLS, ITDR_DUM, ERT variables are insignificant in the model but their coefficients have a positive sign. On the other hand, the NCLTASST, FFR and ROE variables are not significant though they have negative signs.

$$\begin{aligned} NPB_{DUM_{it}} = {} & S_0 + S_1 NCLTASST_{it} + S_2 CLPNCS_{it} + S_3 LLANL_{it} + S_4 TEQT1AC_{it} + S_5 VLTL_{it} + \\ & S_6 CILEAST_{it} + S_7 NCOLS_{it} + S_8 ITDR\_DUM_{it} + S_9 LR1_{it} + S_{10} NLLDS_{it} + \\ & S_{11} LSRETLNS_{it} + S_{12} AGLTLN_{it} + S_{13} FFR_{it} + S_{14} ROE_{it} + \varepsilon_{it} \end{aligned} \qquad 7.5d$$

The work moves on to Panel E, Model (4), for the post-crisis period, twelve months base year (Quarter 1, 2011 to Quarter 4, 2011) features fourteen variables. The regression detaches (LSTTS) and (ERT) and fits in credit loss provision to net charge-offs (CLPNCS) and commercial/industrial loans to earning assets (CILEAST). With respect to the liquidity measures, similar to the results in Model (3), the NLLDS variable is significant in Model (4) at the 1% level with identical coefficient. Also, LR1 retains its significance at 1% significance though with an enhanced magnitude of -0.213 on bank protection policy. As for the loan portfolio measures, the results of the AGLTLN remains unchanged with the result in model (3) while LSRETLNS retains its significance at the 1% level with an increased coefficient of -0.325. In terms of capitalisation, VLTL is significant at the 1% level and has a positive impact on protection with a 0.515 coefficient while the coefficient of TEQT1AC is 0.190 and significant at the 1% level. Similar to the model (3) results, the LLANL variable is significant in Model (4) at the 5% level with a -0.005 coefficient. The credit loss provision to net charge-offs (CLPNCS) becomes significant at the 10% level. The coefficients for the other variables, NCLTASST, CILEAST, NCOLS, FFR and ROE are negative but their impact on protection buying is not significant. Although the coefficient of ITDR_DUM is positive, its effect is insignificant.

$$\begin{aligned} NPB_{DUM_{it}} = {} & S_0 + S_1 CLPNCS_{it} + S_2 LLANL_{it} + S_3 TEQT1AC_{it} + S_4 SUBTT1C_{it} + S_5 CILEAST_{it} + \\ & S_6 ITDR\_DUM_{it} + S_7 LR1_{it} + S_8 NLLDS_{it} + S_9 LSRETLNS_{it} + S_{10} AGLTLN_{it} + \\ & S_{11} FFR_{it} + S_{12} ROE_{it} + \varepsilon_{it} \quad \text{v} \end{aligned} \qquad 7.5e$$

The work moves on to Panel E, Model (5), for the post-crisis period, twelve months base year (Quarter 1, 2011 to Quarter 4, 2011) incorporates thirteen variables. The model relaxes NCLTASST, VLTL and NCOLS while it fits in total deposits to total assets (TDTA) and subordinated debt to tier 1 risk adjusted capital (SUBTT1C). Regarding liquidity, the LR1 variable though significant at the 1% level, it has a negative impact on bank protection as in the other models (3 and 4). The NLLDS retains its significance following from Models (3 and 4) with a slightly increased magnitude of -0.069. With respect to loan portfolio measures, AGLTLN and LSRETLNS retain their significance at 1% level though retain their negative and positive signs respectively. The credit risk measure (CILEAST) becomes significant at 5% significance level with a magnitude of -0.488.The introduction of SUBTT1C variable impacts positively on bank protection with a magnitude of 0.769 and 1% significance level. The capitalisation measure (TEQT1AC) continues to be significant at 1% as with models (3 and 4) with a scale of 0.166. The asset quality measure, (LLANL) retains its significance but at a lower level this time (10%) and its negative impact on bank protection is reduced as its coefficient falls from -0.005.The CLPNCS variable retains its significance though at a lower level (5%). The variables TDTA, ITDR-DUM, FFR and ROE are insignificant in the model.

$$\begin{aligned} NPB_{DUM_{it}} = {} & S_0 + S_1 CLPNCS_{it} + S_2 TEQT1AC_{it} + S_3 TDTA_{it} + S_4 CEQTDTA_{it} + S_5 SUBTT1C_{it} \\ & S_6 CILEAST_{it} + S_7 ITDR\_DUM_{it} + S_8 LR1_{it} + S_9 NLLDS_{it} + S_{10} LSRETLNS_{it} + \\ & S_{11} FFR_{it} + S_{12} ROE_{it} + \varepsilon_{\mathrm{it}} \end{aligned} \tag{7.5f}$$

The work proceeds to Panel E, Model (6), for the post-crisis period, twelve months base year (Quarter 1, 2011 to Quarter 4, 2011) incorporates fourteen variables. The model relaxes LLANL while it integrates commodity and equity derivatives to total loans (CEQTDTA) and total foreign loans total loans (TFLTTLN) variables. The asset quality measure (CLPNCS) retains its significance at 5% level with the same magnitude in comparison to model (5). TEQT1AC, the capitalisation measure, continues to be significant at 1% level with a scale of 0.185 on bank protection. In terms of the credit management and derivatives measure, SUBTT1C retains its significant at 1% level with a magnitude of 0.113 while CEQTDTA is significant at 5% and a scale of -0.107 on bank protection. The credit risk variable, CILEAST is significant at a higher level (1%) and a higher impact of -0.747. With respect to liquidity, the variables LR1 and NLLDS retain their significance at the 1% level and the negative impact they have on bank protection. The coefficients are -0.287 and -

0.09 respectively. The result of the loan portfolio measure (AGLTLN) is retained in comparison with model (5). The variables TDTA, ITDR-DUM, LSRETLNS, TFLTTLN, FFR, and ROE are not significant in the model though they retain their respective signs as with model (5).

$$NPB_{DUM_{it}} = S_0 + S_1 CLPNCS_{it} + S_2 TEQT1AC_{it} + S_3 TDTA_{it} + S_4 CEQTDTA_{it} + S_5 CILEAST_{it} + S_6 ITDR\_DUM_{it} + S_7 LR1_{it} + S_8 TLTAS_{it} + S_9 LSRETLNS_{it} + S_{10} AGLTLN_{it} + S_{11} FFR_{it} + S_{12} ROE_{it} + S_{13} LASSETit + \varepsilon_{\mathrm{it}} \qquad 7.5g$$

The work proceeds to Panel E, Model (7), for the post-crisis period, twelve months base year (Quarter 1, 2011 to Quarter 4, 2011) incorporates thirteen variables. The model will do away with SUBTT1C, TFLTTLN and NLLDS. It incorporates total loans to total assets (TLTAS) and the total assets (LASSET). The commodity and equity derivatives to total loans (CEQTDTA) reflecting credit management and derivatives is statistically significant at 1% , a higher level in comparison to model (6) with an impact of -0.595 on bank protection. The total deposit to total assets (TDTA) becomes significant at 5% level with a scale of 0.507. The credit risk measure, reflecting commercial/industrial loans to earning assets (CILEAST) variable reduces in significance to 10% level in comparison to model (6) with a diminished scale to -0.541 on bank protection. In terms of asset quality, CLPNCS reduces in significance to 10% level though maintaining its negative sign. The total assets variable (LASSET) is significant at 1% level with a magnitude of 0.122 on bank protection. In respect of liquidity, the LR1 variable retains its significance but at a lower level this time (10%) and its negative impact on bank protection is reduced as its coefficient falls from -0.287. The coefficients for the other variables, TEQT1AC, ITDR_DUM, LSRETLNS, AGLTLN and FFR are positive but their impact on protection buying is not significant. Although the coefficient of ROE is negative, its effect is insignificant.

The work summarises the results from the seven random effects logistic regression for the post-crisis period (Quarter 3, 2009 to Quarter 4, 2011) as well as the post crisis period, twelve months base year (Quarter 1, 2011 to Quarter 4, 2011) on the determinants of bank use to mitigate risk with credit derivatives.The LASSET variable is significant in Models (1),(2) and (7) at the 1% significant level with a positive sign all through.In terms of profitability, both ROE and ERT were significant in Models (1) and (2) at the 1% level reflecting a positive sign. For the loan portfolio variables, LSRETLNS is at the 1% significant level in Models (3) to (5) with a positive sign while AGLTLN, though has a negative sign, is significant in Models (3) to (6) at the 1% level. In terms of liquidity,TLTAS is only significant at the 1% level in Model (1) with a positive sign.Curiously, both LR1 and NLLDS were significant in Models (3) to (6) all through with a negative sign at the 1% level.The credit risk variable, CILEAST is only significant at the 1% level in Model (6) with a negative sign. Reviewing the credit management and derivatives variables, CEQTDTA and LSTTS are only significant at the 1% level in Model (3) and Model (6) with a positive and negative sign respectively. The SUBTT1C is positive in Models (5) and (6) with a positive sign at the 1% significant level.In terms of capitalisation,TDTA is only significant in Model (7) with a positive sign.The VLTL variable is significant in Models (3) and (4) with a positive sign at the 1% level. In models (3) to (6),TEQT1AC was significant with a positive sign at the 1% level.

$$\begin{aligned} NPB_{DUMit} = {} & S_0 + S_1 RWATLS_{it} + S_2 NCLTASST_{it} + S_3 CLPNCS_{it} + S_4 LLANL_{it} + S_5 TDTA_{it} + \\ & S_6 VLTL_{it} + S_7 CEQTDTA_{it} + S_8 SUBTT1C_{it} + S_9 LSTTS_{it} + S_{10} CILEAST_{it} + \\ & S_{11} NCOLS_{it} + S_{12} ITDR\_DUM_{it} + S_{13} LR1_{it} + S_{14} NLLDS_{it} + S_{15} TLTAS_{it} + \\ & S_{16} LSRETLNS_{it} + S_{17} AGLTLN_{it} + S_{18} TFLTTLN_{it} + S_{19} FFR_{it} + S_{20} ROE_{it} + \\ & S_{21} ERT_{it} + S_{22} LASSET_{it} + \varepsilon_{it} \end{aligned} \qquad 7.6$$

The work continues to Panel F. The results from the seven random effects logistic regression for the post-crisis period (Quarter 3, 2009 to Quarter 4, 2011) as well as the post-crisis period, twelve months base year (Quarter 1, 2011 to Quarter 4, 2011) uses risk weighted asset ratio (RWATLS) as the core proxy to test for capitalisation rather than total equity capital/Tier 1 risk adjusted capital (TEQT1AC) used in Panel E. The RWATLS proxy was statistically significant in all models at the 1% level whereas TEQT1AC was statistically significant at 1% level in Panel E, Models (3) to (6). Again, an interesting finding is the variable ITDR_DUM; it is statistically significant at the 1% level in all the models in Panel E. With the exception of the variables TDTA, VLTL, SUBTT1AC, LSRETLNS and AGLTLN. Panel E has largely similar results to Panel F but in some instances, proxies that are statistically significant in Panel F are not significant in Panel E.

7.10 Results and Discussion: Summary of Panels A, C and E

From the analysis, Panel A spanned the pre-crisis period, Panel C looked at the crisis-period while Panel E reviewed the post-crisis period. With seven models each for the period under consideration, the main capitalisation measure in the empirical models was variable TEQT1AC.

In Panel A, TEQT1AC was statistically significant at 1% level in Models (1) with a magnitude of -0.155 on bank protection. In Panel C, it was statistically significant at 1% level in Model (3), (6) and (7) with a scale of 0.101, 0.604 and 0.758 respectively on bank protection. In Panel E, TEQT1AC was statistically significant in Models (3) to (6) at the 1% level with a magnitude of 0.207, 0.190, 0.166, and 0.185 respectively on bank protection policy.

7.11 Results and Discussion: Summary of Panels B, D and F

From the analysis, Panel B reviewed the pre-crisis period, Panel D looked at the crisis-period while Panel F spanned the post-crisis period. With seven models each for the period under consideration, the main capitalisation measure in the empirical models was variable RWATLS. In all, seven models were used for our investigation following the pattern of Panels A, C and E.

Surprisingly, it was not statistically significant in Panel B for the period under investigation. In Panel D however, it was statistically significant at 5% level in Model (3) with a magnitude of 0.079 on bank protection. The results in Panel F look much better in comparison to Panels B and D. It was statistically significant in Models (1) to (7) with a magnitude of 0.001, 0.101, 0.727, 0.814, 0.461, 0.568, and 0.592 respectively on bank protection.

7.12 Conclusions

This chapter attempted to investigate and test the determinants of US banks' use of credit derivatives to mitigate risk for the pre-crisis, crisis period and the post crisis period of the Great Depression by using random effects logistic regression and alternative models to the models of Minton et al. (2009).

The result was mixed. The analysis shows that during the pre-crisis period, US banks preferred to trade more in credit derivatives in comparison to pure risk management which exposed them to more risk though they made huge returns from these activities. Conversely, during the crisis period, the banks changed their strategy in the use of the instruments to hedge their risks and reorganise their portfolios in view of the fall out from the credit crisis though there were limited trading activities. It is noted that the market reforms and the regulations put in place in respect of trade settlement influenced the performance during the post-crisis period in which banks returned to their trading rather than hedging to improve their bottom line.

CHAPTER EIGHT

IMPACT AND EFFECTIVENESS OF CREDIT DERIVATIVES ON PORTFOLIO PERSISTENCE, RISK AND RETURN

8.1 Introduction

Having explored the role of credit derivatives and the determinants of banks use of the instruments to mitigate risks before and after the credit crisis in chapter 7, with evidence that banks use the instruments largely as investments and to manage their portfolio rather hedge their risk, we will make an attempt in this chapter to extend Minton et al. (2009) to explain the impact and effectiveness of credit derivatives on portfolio persistence, risk and return during the period under review. We look at three broad issues. First, we look at portfolio risk management, portfolio average absolute deviation, market risk, credit risk, firm leverage, macro-economic context and loan portfolio. Second, we look at portfolio liquidity and profitability. Third, we explain the sensitivity analysis by introducing variables such as ownership, firm size and reputation etc.

Norden et al. (2011) examined loan pricing and the impact of credit derivatives use by banks on their bottom line, performance under different discipline, the overall risk of their portfolio and the financial crisis of 2007 to 2009. They attempted some extension of Minton et al. (2009) model by including derivatives trading (defined as trade of other derivatives and there effect on the lending process) and crisis times (dummy, defined as the lending volume of commercial and industrial loans by banks) as explanatory variables for the use of credit derivative to manage risk by active banks compared to passive banks during the crisis.

It is noted they did not include any statistical analysis or test for multiculliniarity, cointegration and stationarity of their explanatory variables. The total sample used covered 77 banks with a total of 2,638 syndicated credit investigation and credit derivative use from 1997 to 2009. However, for the credit derivative use and the bank lending models, the data used spanned four years from 2006 to 2010. Credit derivatives reporting started in 1997 but their use only became widespread in the earliest part of the last decade. The results of the two models estimated only attempted to explain the charge-offs on commercial and industrial loans in relation to credit derivatives and comparison of the lending volume of active and passive banks before and during the crisis.

This chapter presents, in comparison, an excellent study of six hypotheses and other factors to explain bank portfolio risk and return, to wit: leverage, asset quality, capitalisation, credit management of derivatives, credit risk, liquidity risk, market risk, profitability, risk management and sensitivity analysis. Furthermore, we carry out a detailed examination of the portfolio risk/returns and explanatory variables as well as the time series and econometric properties of the data used for the study. The result of our models suggests that there is evidence that selling credit derivatives affects bank RAR hence portfolio performance and that there is evidence that selling credit derivatives affect return of assets and portfolio performance.

8.2 Minton, Stulz and Williamson (2009) model

Minton et al. (2009) show in their study that the use of credit derivatives by banks to hedge loans is limited in explaining the determinants of their use by banks. Relying on the prior research on hedging theories, in chronological order, Acharya and Johnson (2007), Dahiya et al. (2003), Diamond and Rajan (2000), Duffee and Zhou (2001), Fama (1985), Geczy et al. (1997), Graham and Rogers (2002), Gorton and Pennachi (1995), James (1988), Marsh (2006), Mian (1996), Morrison (2005), Nance et al. (1993), Schrand and Unal (1998), Smith and Stulz (1985), and Stulz (2004), they constructed their probit models which is limited to explain why banks use credit derivatives to hedge loans. There was no attempt on the impact and effectiveness of credit derivatives on bank portfolio persistence, risk and return.

8.3 Econometric Specification and Approaches

We report discrete results with Arellano-Bond dynamic panel data Generalised Method of Moments (GMM). In total we extend the explanatory variables to thirty five. Again, we expect some of the variables not to be statistically significant with the depth of data captured and seasonality. For consistency, we use a panel of US banks extending the sample over a period of 10 years from 2002 to 2011. This is split into three phases as captured in chapter 5. The measurement and definition of the variables are specific. In total, we estimated 18 Arellano-Bond dynamic panel data Generalised Method of Moments (GMM) models in this chapter. By extension, we investigate the impact of credit derivatives on bank portfolio persistence, risk and return. We also investigate the sensitivity analysis by introducing additional variables such as ownership, firm size and reputation with 3 additional models to

Table 8.1: Description of selected explanatory variables

The models have four dependent variables and thirty one explanatory variables. We use quarterly data from January 2002 to December 2011

Description	Variables	Variable description	Expected impact on Dependent variables	Theoretical rationale	This Chapter	Data Characteristics	Data Sources
	NCOLS	Net charge-offs to loans				ratio	US FDIC
Dependent Variables	ROA	Return on assets				ratio	US FDIC
	RAR	Risk adjusted return (ROA/Di)				ratio	US FDIC
	Di	Average absolute deviation				ratio	US FDIC
Leverage	RORO	ROE/ROA (Financial)				ratio	US FDIC
	CCLGR	Core capital ratio (Operational)				ratio	US FDIC
Asset quality	NCLTASST	Non-performing loans/total assets				ratio	US FDIC
	TEQT1AC	Total equity capital /Tier 1 risk adj capital				ratio	US FDIC
Capitalisation	RWATLS	Risk weighted assets ratio				ratio	US FDIC
	TDTA	Total deposits/total asset				ratio	US FDIC
	VLTL	Volatile liability to total liability				ratio	US FDIC
CR mgmt. and derivatives	SUBTT1C	Subordinated debt to Tier 1 risk adj cap				ratio	US FDIC
	LSTTS	Loan sales to total assets				ratio	US FDIC
Credit risk	CILEAST	C&I loans/earning assets				ratio	US FDIC
Interest rate risk	ITDR_DUM	Dummy/use of interest rate derivatives				ratio	US FDIC
	NLLDS	Net loans and leases to deposits				ratio	US FDIC
	TLTAS	Total loans to total assets				ratio	US FDIC
Liquidity	CDAR	Total credit derivatives to assets ratio				ratio	US FDIC
	MBSTAS	Mortgage-backed securities/Total assets				ratio	US FDIC
	ABSTATS	Asset backed securities/Total assets				ratio	US FDIC

Table 8.1 (Continued)

Description	Variables	Variable description	Expected impact on Dependent variables	Theoretical rationale	This Chapter	Data Characteristics	Data Sources
	LSRETLNS	Loans secured by real estate loans to total loans				ratio	US FDIC
	AGLTLN	Agricultural loans/total loans				ratio	US FDIC
Loan portfolio	IBTLTLS	Interbank loans to total loans				ratio	US FDIC
	RESLTL	restructured loans to total loans				ratio	US FDIC
	CDLT	construction and development loans to total loans				ratio	US FDIC
Macroeconomics context	FFR	Federal funds rate				ratio	US FDIC
Market risk	STASST	Stocks to total asset				ratio	US FDIC
	ERT	Efficiency ratio				ratio	US FDIC
	NOPIAS	Net operating income to assets				ratio	US FDIC
Profitability	REAEY	Retained earnings to average equity				ratio	US FDIC
	ECNCS	Earnings coverage of net charge-offs				ratio	US FDIC
	PROA	Pre-tax return on assets				ratio	US FDIC
Risk Management	TDAR	Total derivatives to total assets				ratio	US FDIC
Sensitivity analysis	OWN_DUM	Dummy Var(stock=1;non-stock=0)				ratio	US FDIC
Size/Reputation	LASSET	Natural log of total assets				ratio	US FDIC

explain the structure of banks that use credit derivatives as an investment strategy to manage their portfolios.

8.4 Diagnostic Analysis

As explained in chapter 7 and before proceeding with the empirical model, it is necessary to note potential data-related problems. Our data was sourced from the US FDIC and the OCC. The importance of the diagnostic analysis is to ascertain the authenticity of the data and resulting models. Next, we continue with the descriptive statistics.

8.4.1 Descriptive statistics

Tables 8.2 to 8.5 show the descriptive statistics of the explanatory variables used in our models. As stated in chapter 5, we run our regressions with Stata software. We proceed with these tests to help us in exploring and examining the data before performing some statistical tests, the statistical analysis and data interpretation.

Interpretations of Tables 8.2 to 8.5

As in chapter 7, the mean is calculated by adding all the values in the particular variable and thereafter divide the sum by the total number of observations (N) in that variable field. The mean is the arithmetic average across the distribution of the data set. For example, in Table 8.2, the calculated mean for the explanatory variable NCOLS, ROA and RAR are 0.35, 1.28 and 78,246.57, respectively.

The standard deviation is the square root of the variance. It measures the spread of observations about the mean. It explains how widely the values in a data set are spread around the mean. In effect, it is the root mean square deviation of values from the arithmetic mean. The larger the standard deviation, the more spread out the observations are. For example, in Table 8.2, the standard deviation for the variable NCOLS is 1.37%, while ROA is 2.06%.

The calculated descriptive statistics has laid the groundwork for more complex statistical analysis and identified further areas of research. It has distinctively summarised and organised the ten year data in a straight forward process, translating the variables and results into the mean, standard deviation etc.

Table 8.2: Descriptive statistic of independent variables (Pre-Crisis)

Variable		Mean	Std. Dev.	Min	Max	Observations
ncols	overall	0.329822	1.305936	-8.871137	57.94011	N = 27174
	between		1.229533	-1.774227	24.64059	n = 1770
	within		0.786589	-19.71523	36.58995	T-bar = 15.3525
roa	overall	1.258954	2.042679	-132.957	83.75612	N = 27174
	between		2.911117	-107.9378	23.52823	n = 1770
	within		1.457283	-119.5793	76.45446	T-bar = 15.3525
rar	overall	77095.31	125088.7	-8141965	5129021	N = 27174
	between		178269.7	-6609847	1440811	n = 1770
	within		89240.45	-7322746	4681885	T-bar = 15.3525
di	overall	5.24E-05	0.0060889	-0.059471	1	N = 27174
	between		0.0118852	-0.004175	0.5000084	n = 1770
	within		0.0043195	-0.499939	0.500044	T-bar = 15.3525
roro	overall	25.54511	685.7218	-105850.5	29532.57	N = 27174
	between		2518.696	-105850.5	2458.333	n = 1770
	within		215.6262	-2430.819	27647.74	T-bar = 15.3525
cclgr	overall	9.669891	9.359176	-44.50306	916.937	N = 27174
	between		6.34762	-44.50306	164.6018	n = 1770
	within		7.757345	-145.2103	762.005	T-bar = 15.3525
ncltasst	overall	0.005346	0.0088138	0	0.2477289	N = 27174
	between		0.0077488	0	0.1781789	n = 1770
	within		0.0042838	-0.056647	0.0900314	T-bar = 15.3525
teqt1ac	overall	1.158266	0.4220074	0	16.64141	N = 27174
	between		0.4224418	0	8.086221	n = 1770
	within		0.2272185	-3.963831	9.713452	T-bar = 15.3525
rwatls	overall	5.085845	381.1794	0	47774.43	N = 27174
	between		736.6752	0	30986.94	n = 1770
	within		197.8682	-26141.58	16792.58	T-bar = 15.3525
tdta	overall	0.73655	0.1543321	0	0.9573724	N = 27174
	between		0.1484728	0.0000304	0.932451	n = 1770
	within		0.0483573	0.0071496	1.504812	T-bar = 15.3525
vltl	overall	0.281331	0.1797682	0	0.9957933	N = 27174
	between		0.1665927	0	0.9850141	n = 1770
	within		0.0675224	-0.519383	1.060776	T-bar = 15.3525
subtt1c	overall	0.003268	0.0153335	0	1	N = 27174
	between		0.0105709	0	0.2087586	n = 1770
	within		0.0105669	-0.20549	0.95979	T-bar = 15.3525

Table 8.2: Cont'd

Variable		Mean	Std. Dev.	Min	Max	Observations
lstts	overall	0.083774	12.14474	0	2002	N = 27174
	between		2.069238	0	87.04356	n = 1770
	within		11.878	-86.95978	1915.04	T-bar = 15.3525
cileast	overall	0.104626	0.2958353	0	22.06743	N = 27174
	between		0.1405572	0	3.888555	n = 1770
	within		0.2646453	-3.739671	20.28553	T-bar = 15.3525
itdr_dum	overall	0.327519	0.4693169	0	1	N = 27174
	between		0.3930066	0	1	n = 1770
	within		0.2651343	-0.629003	1.284041	T-bar = 15.3525
nllds	overall	5125.731	170238.3	0	2.12E+07	N = 27174
	between		77101.18	0	1614752	n = 1770
	within		152121	-1609554	2.02E+07	T-bar = 15.3525
tltas	overall	0.655538	0.1691799	0	0.9940725	N = 27174
	between		0.1658567	0	0.9898241	n = 1770
	within		0.0555284	-0.124279	1.518735	T-bar = 15.3525
cdar	overall	0.023649	1.742024	0	221.3553	N = 27174
	between		0.3106765	0	9.624143	n = 1770
	within		1.701274	-9.600494	211.7548	T-bar = 15.3525
mbstas	overall	0.110929	0.4576275	0	42.28936	N = 27174
	between		0.1668884	0	4.597388	n = 1770
	within		0.4301208	-4.480444	40.27594	T-bar = 15.3525
abstats	overall	0.002737	0.0286538	0	2.565922	N = 27174
	between		0.0210735	0	0.4742559	n = 1770
	within		0.022518	-0.470607	2.433611	T-bar = 15.3525
lsretlns	overall	0.717059	0.2320756	0	1.012784	N = 27174
	between		0.21995	0	1.004357	n = 1770
	within		0.0949212	-0.195923	1.630102	T-bar = 15.3525
agltln	overall	15013.14	67822.72	0	1709000	N = 27174
	between		52100.75	0	1106696	n = 1770
	within		29540.45	-1091683	990817.4	T-bar = 15.3525
ibtltls	overall	0.005335	0.0445283	0	1.007663	N = 27174
	between		0.0465941	0	0.9905601	n = 1770
	within		0.0273577	-0.902956	0.9256566	T-bar = 15.3525

Table 8.2: Cont'd

Variable		Mean	Std. Dev.	Min	Max	Observations
resltl	overall	0.001347	0.0418811	0	4.530181	N = 27174
	between		0.0320992	0	1.348019	n = 1770
	within		0.0296829	-1.346672	3.183509	T-bar = 15.3525
cdlt	overall	0.111278	0.112891	0	0.8367909	N = 27174
	between		0.1143127	0	0.7919219	n = 1770
	within		0.0522235	-0.391623	0.7240045	T-bar = 15.3525
ffr	overall	2.99217	1.697515	0.98	5.26	N = 27174
	between		1.130075	1.005	5.26	n = 1770
	within		1.518388	-0.43783	5.872697	T-bar = 15.3525
stasst	overall	5496.723	73171.65	0	1950000	N = 27174
	between		55656.82	0	1500000	n = 1770
	within		30051.84	-1196677	962018.5	T-bar = 15.3525
ert	overall	62.04744	137.7462	-3432.432	20200	N = 27174
	between		89.44186	-3432.432	922.3744	n = 1770
	within		132.0822	-858.0536	19339.67	T-bar = 15.3525
nopias	overall	1.205926	2.039102	-132.9853	83.75479	N = 27174
	between		2.680131	-96.74407	23.52351	n = 1770
	within		1.470084	-119.6149	76.3975	T-bar = 15.3525
reaey	overall	6.252966	33.07965	-3263.922	980.6625	N = 27174
	between		29.64446	-676.014	980.6625	n = 1770
	within		27.8925	-3036.518	733.7413	T-bar = 15.3525
proa	overall	1.831814	2.785313	-143.2905	139.2443	N = 27174
	between		3.041663	-95.8236	36.8287	n = 1770
	within		1.983185	-127.7919	126.7685	T-bar = 15.3525
ecncs	overall	187.6552	2174.717	-19563.28	168979	N = 27174
	between		848.9305	-2441.749	22732.49	n = 1770
	within		1959.027	-22544.84	153553.3	T-bar = 15.3525
tdar	overall	0.180954	1.969813	0	73.97672	N = 27174
	between		1.652403	0	53.06574	n = 1770
	within		0.3453768	-9.431722	21.09194	T-bar = 15.3525
own_dum	overall	0.943328	0.2312187	0	1	N = 27174
	between		0.2058871	0	1	n = 1770
	within		0.061367	-0.013194	1.856372	T-bar = 15.3525
lasset	overall	14.28277	1.232431	13.12241	20.9782	N = 27174
	between		1.153289	13.12241	20.54651	n = 1770
	within		0.2381824	11.50741	16.64963	T-bar = 15.3525

Table 8.3: Distribution Pattern (Pre-Crisis)

Distribution of T_i:	min	5%	25%	50%	75%	95%	max
	1	2	8	18	23	23	23

Frequency	Percent	Cum.	Pattern
690	38.98	38.98	11111111111111111111111
36	2.03	41.02	1111111111
35	1.98	42.99	11111111
30	1.69	44.69	11111
30	1.69	46.38	11111111111
30	1.69	48.08	111111111111111111
30	1.69	49.77	.1111111111111111111111
29	1.64	51.41	111111
28	1.58	52.99	1111111................
832	47.01	100.00	(other patterns)
1770	100.00		XXXXXXXXXXXXXXXXXXXXXXX

Source: Author generated

The distribution pattern describes the participation pattern of the banks in the panel data. This shows that 38.98% of the banks are observed every quarter.

Table 8.4: Descriptive statistics of the independent variables (Crisis Period)

Variable		Mean	Std. Dev.	Min	Max	Observations
ncols	overall	0.7852848	1.728748	-1.57813	48.77822	N = 9750
	between		1.38639	-0.6887869	19.32284	n = 1591
	within		1.059192	-18.65831	31.69322	T-bar = 6.12822
roa	overall	0.3673265	2.376857	-50.93626	52.88097	N = 9750
	between		1.861282	-18.34968	18.92751	n = 1591
	within		1.630729	-38.45694	40.05892	T-bar = 6.12822
rar	overall	22494.18	145552.9	-3119213	3238302	N = 9750
	between		113980.4	-1123689	1159075	n = 1591
	within		99861.9	-2355009	2453111	T-bar = 6.12822
di	overall	-6.10E-06	0.0026999	-0.2604624	0.0198884	N = 9750
	between		0.0010262	-0.0371876	0.0066335	n = 1591
	within		0.0024945	-0.223281	0.0373598	T-bar = 6.12822
roro	overall	-88.27157	13110.22	-1293210	12240.84	N = 9750
	between		4799.758	-191177.2	3859.621	n = 1591
	within		12066.33	-1102121	191219.6	T-bar = 6.12822
cclgr	overall	9.225193	4.32506	-23.82594	96.76331	N = 9750
	between		4.278721	-20.67965	70.9203	n = 1591
	within		1.244927	-22.95337	35.52078	T-bar = 6.12822
ncltasst	overall	0.0171825	0.0251222	0	0.3748387	N = 9750
	between		0.0232941	0	0.3194459	n = 1591
	within		0.0130386	-0.1346568	0.2271363	T-bar = 6.12822
teqt1ac	overall	1.150447	0.3887776	-0.558193	8.719506	N = 9750
	between		0.3901381	0	6.37569	n = 1591
	within		0.1533596	-0.9069398	6.228903	T-bar = 6.12822
rwatls	overall	1.148868	1.305555	0	58.68468	N = 9750
	between		1.816472	0	58.68468	n = 1591
	within		0.6164507	-24.10564	26.87247	T-bar = 6.12822
tdta	overall	0.7487698	0.1317099	0.0000128	1.008192	N = 9750
	between		0.1304089	0.0000147	0.957267	n = 1591
	within		0.0347929	0.2219475	1.21022	T-bar = 6.12822
vltl	overall	0.2631123	0.1439987	0	0.9976767	N = 9750
	between		0.1396993	0	0.9748493	n = 1591
	within		0.0400606	-0.172441	0.7576636	T-bar = 6.12822
subtt1c	overall	0.0021851	0.0072896	0	0.133875	N = 9750
	between		0.0069189	0	0.1211646	n = 1591
	within		0.0018142	-0.02373	0.0395792	T-bar = 6.12822

Table 8.4: Cont'd

Variable		Mean	Std. Dev.	Min	Max	Observations
lstts	overall	0.0070738	0.0378612	0	0.9723173	N = 9750
	between		0.0322206	0	0.5543698	n = 1591
	within		0.0189782	-0.5450211	0.4272962	T-bar = 6.12822
cileast	overall	0.1092159	0.0937152	0	1.003783	N = 9750
	between		0.0908505	0	0.9769609	n = 1591
	within		0.016024	-0.2212241	0.4774019	T-bar = 6.12822
itdr_dum	overall	0.405641	0.4910408	0	1	N = 9750
	between		0.4650911	0	1	n = 1591
	within		0.1563427	-0.4515018	1.262784	T-bar = 6.12822
nllds	overall	10787.97	222797.9	0	6839539	N = 9750
	between		206241.5	0	6373034	n = 1591
	within		49206.82	-1108406	2836513	T-bar = 6.12822
tltas	overall	0.695666	0.1554697	0	0.9937023	N = 9750
	between		0.1561413	0	0.9870577	n = 1591
	within		0.0337797	0.3538804	0.9497717	T-bar = 6.12822
cdar	overall	0.0152048	0.2759241	0	9.378828	N = 9750
	between		0.3029529	0	8.524011	n = 1591
	within		0.0333611	-1.028916	1.01435	T-bar = 6.12822
mbstas	overall	0.0935943	0.1001616	0	0.925851	N = 9750
	between		0.0966411	0	0.7441572	n = 1591
	within		0.0237398	-0.6505629	0.5533244	T-bar = 6.12822
abstats	overall	0.0017201	0.0126443	0	0.3870009	N = 9750
	between		0.013649	0	0.3836062	n = 1591
	within		0.0051804	-0.0902065	0.1640785	T-bar = 6.12822
lsretlns	overall	0.7446964	0.2192889	0	1.005829	N = 9750
	between		0.2178366	0	1.004898	n = 1591
	within		0.0207349	0.4253866	1.031993	T-bar = 6.12822
agltln	overall	22138.06	98981.12	0	2639000	N = 9750
	between		92236.66	0	2289857	n = 1591
	within		12620.83	-555719.1	371280.9	T-bar = 6.12822
ibtltls	overall	0.0046005	0.0402495	0	0.9848703	N = 9750
	between		0.0393681	0	0.6440905	n = 1591
	within		0.0165033	-0.3385437	0.6463266	T-bar = 6.12822

Table 8.4: Cont'd

Variable		Mean	Std. Dev.	Min	Max	Observations
resltl	overall	0.002664	0.009352	0	0.2119536	N = 9750
	between		0.0073493	0	0.1002564	n = 1591
	within		0.0058171	-0.0965648	0.1146421	T-bar = 6.12822
cdlt	overall	0.1454533	0.1241792	0	0.9262922	N = 9750
	between		0.126201	0	0.8935244	n = 1591
	within		0.0195475	-0.0812731	0.3132182	T-bar = 6.12822
ffr	overall	1.570418	1.417646	0.16	4.24	N = 9750
	between		0.6285356	0.16	4.24	n = 1591
	within		1.367782	-0.4745815	4.377085	T-bar = 6.12822
stasst	overall	5865.124	75676.43	0	2000000	N = 9750
	between		72693.55	0	2000000	n = 1591
	within		14419.37	-272706.3	677293.7	T-bar = 6.12822
ert	overall	74.09483	737.2882	-4587.546	72439.26	N = 9750
	between		264.4169	-643.5878	10481.02	n = 1591
	within		681.3996	-10534.32	62032.34	T-bar = 6.12822
nopias	overall	0.3890768	2.269867	-36.48277	52.88097	N = 9750
	between		1.821826	-18.34968	18.78915	n = 1591
	within		1.517613	-27.48283	40.08068	T-bar = 6.12822
reaey	overall	0.7680186	259.6379	-1396.058	25388.8	N = 9750
	between		98.44122	-205.1456	3840.05	n = 1591
	within		237.6264	-3887.825	21549.52	T-bar = 6.12822
proa	overall	0.5707717	3.025349	-50.98459	83.81181	N = 9750
	between		2.360526	-24.79682	30.29301	n = 1591
	within		2.026706	-38.471	63.43249	T-bar = 6.12822
ecncs	overall	32.61119	4074.348	-382576.5	63126.24	N = 9750
	between		1284.48	-48304.37	13552.65	n = 1591
	within		3836.643	-334239.5	104220.5	T-bar = 6.12822
tdar	overall	0.2539522	5.583029	0	362.0623	N = 9750
	between		7.583659	0	293.4333	n = 1591
	within		0.8911811	-40.34229	68.88296	T-bar = 6.12822
own_dum	overall	0.9466667	0.2247089	0	1	N = 9750
	between		0.2182416	0	1	n = 1591
	within		0.0323309	0.0895238	1.660952	T-bar = 6.12822
lasset	overall	14.22739	1.2106	13.12237	21.29349	N = 9750
	between		1.197707	13.12341	21.16615	n = 1591
	within		0.0991166	12.68953	15.56876	T-bar = 6.12822

Table 8.5: Distribution Pattern (Crisis Period)

Distribution of T_i: min	5%	25%	50%	75%	95%	max
1	2	7	7	7	7	7

Frequency	Percent	Cum.	Pattern
1200	75.42	75.42	1111111
40	2.51	77.94	111
39	2.45	80.39	...11111
39	2.45	82.84	.111111
36	2.26	85.10	11
30	1.89	86.99	...1111
27	1.70	88.69	1......
25	1.57	90.26	1
23	1.45	91.70	111....
132	8.30	100.00	(other patterns)
1591	100.00		XXXXXXX

Source:Author generated.

The distribution pattern describes the participation pattern of the banks in the panel data. This shows that 75.42% of the banks are observed every quarter.

Table 8.6: Descriptive Statistics of the Independent Variables (Post-Crisis)

Variable		Mean	Std. Dev.	Min	Max	Observations
ncols	overall	1.264311	1.83377	-6.716592	36.18771	N = 13712
	between		1.900349	-1.019984	35.6769	n = 1620
	within		0.9839954	-5.661223	31.41944	T-bar = 8.4642
roa	overall	0.3557768	1.785447	-22.85654	29.93669	N = 13712
	between		1.904449	-16.31914	11.65309	n = 1620
	within		1.0191	-20.1668	19.72256	T-bar = 8.4642
rar	overall	21786.91	109336.4	-1399679	1833250	N = 13712
	between		116623.8	-999344.1	713606.8	n = 1620
	within		62407.21	-1234966	1207762	T-bar = 8.4642
di	overall	0.0000271	0.0009604	-0.0799024	0.067712	N = 13712
	between		0.0003909	-0.0133352	0.0068191	n = 1620
	within		0.0008925	-0.0665401	0.06092	T-bar = 8.4642
roro	overall	39.92736	719.6893	-50891.67	43223.4	N = 13712
	between		727.7323	-15972.28	21295.32	n = 1620
	within		612.9655	-34879.46	36765.39	T-bar = 8.4642
cclgr	overall	9.57949	4.509934	-5.55094	157.5144	N = 13712
	between		4.755722	-5.55094	112.4951	n = 1620
	within		1.746875	-33.25583	112.4482	T-bar = 8.4642
ncltasst	overall	0.0260218	0.0294167	0	0.349074	N = 13712
	between		0.0328508	0	0.2940988	n = 1620
	within		0.0100913	-0.085984	0.2667143	T-bar = 8.4642
teqt1ac	overall	1.12886	0.6929933	-6.795789	75.39614	N = 13712
	between		1.87032	-1.588402	75.39614	n = 1620
	within		0.1022606	-5.510217	3.953006	T-bar = 8.4642
rwatls	overall	23.9245	2003.484	0	232031	N = 13712
	between		1524.021	0	61012.67	n = 1620
	within		1706.123	-60948.39	171042.3	T-bar = 8.4642
tdta	overall	0.7894574	0.1131077	0	1.028303	N = 13712
	between		0.1132639	0.0002569	0.9872725	n = 1620
	within		0.0305825	0.1141171	1.139048	T-bar = 8.4642
vltl	overall	0.1443001	0.1252139	0	0.9999074	N = 13712
	between		0.1167603	0	0.9971783	n = 1620
	within		0.0651131	-0.4344016	0.9321265	T-bar = 8.4642
subtt1c	overall	0.0016945	0.006077	0	0.1301266	N = 13712
	between		0.0066635	0	0.1301266	n = 1620
	within		0.001572	-0.0297677	0.0275087	T-bar = 8.4642

Table 8.6: Cont'd

Variable		Mean	Std. Dev.	Min	Max	Observations
lstts	overall	0.0069056	0.0309971	0	0.7021789	N = 13712
	between		0.0299084	0	0.4550628	n = 1620
	within		0.0122369	-0.1673002	0.4768287	T-bar = 8.4642
cileast	overall	0.0973255	0.0840334	0	0.9972752	N = 13712
	between		0.0826822	0	0.9902475	n = 1620
	within		0.0158949	-0.1405586	0.3276234	T-bar = 8.4642
itdr_dum	overall	0.4314469	0.4952962	0	1	N = 13712
	between		0.4727286	0	1	n = 1620
	within		0.1411006	-0.4685531	1.331447	T-bar = 8.4642
nllds	overall	5130.452	130404.4	0	5049231	N = 13712
	between		91956.98	0	2632786	n = 1620
	within		84194.6	-2627483	4000965	T-bar = 8.4642
tltas	overall	0.6401741	0.1502619	0	0.9917849	N = 13712
	between		0.1480108	0	0.9836396	n = 1620
	within		0.0392913	-0.0360376	0.9891624	T-bar = 8.4642
cdar	overall	0.0145777	0.2419581	0	8.831623	N = 13712
	between		0.2197917	0	6.03597	n = 1620
	within		0.0411106	-1.664279	2.810231	T-bar = 8.4642
mbstas	overall	0.1045687	0.1040901	0	0.8012202	N = 13712
	between		0.0993709	0	0.7413617	n = 1620
	within		0.0292029	-0.1844445	0.4194334	T-bar = 8.4642
abstats	overall	0.0014909	0.0130608	0	0.4353367	N = 13712
	between		0.0128968	0	0.4091499	n = 1620
	within		0.0049457	-0.0857107	0.2113891	T-bar = 8.4642
lsretlns	overall	0.7498194	0.2151724	0	1.103157	N = 13712
	between		0.2131723	0	1.005687	n = 1620
	within		0.0240069	-0.1036128	1.005679	T-bar = 8.4642
agltln	overall	24859	113631.7	0	3064000	N = 13712
	between		105191.2	0	2859500	n = 1620
	within		11211.98	-237641	463527	T-bar = 8.4642
ibtltls	overall	0.0040646	0.0398767	0	0.8501105	N = 13712
	between		0.0363136	0	0.8203252	n = 1620
	within		0.0101135	-0.1979036	0.3342737	T-bar = 8.4642

Table 8.6: Cont'd

Variable		Mean	Std. Dev.	Min	Max	Observations
resltl	overall	0.0103531	0.0172547	0	0.2373967	N = 13712
	between		0.0179267	0	0.2373967	n = 1620
	within		0.0082664	-0.1068574	0.0861446	T-bar = 8.4642
cdlt	overall	0.0893759	0.0773357	0	0.7211676	N = 13712
	between		0.0839732	0	0.7211676	n = 1620
	within		0.0213448	-0.1026342	0.2708496	T-bar = 8.4642
ffr	overall	0.1330331	0.041563	0.07	0.19	N = 13712
	between		0.0138759	0.07	0.19	n = 1620
	within		0.0407984	0.0470331	0.2155331	T-bar = 8.4642
stasst	overall	5594.906	58691.77	0	1500000	N = 13712
	between		52020.76	0	1350000	n = 1620
	within		16074.51	-1344405	293594.9	T-bar = 8.4642
ert	overall	68.38256	48.01289	-2305.946	1898.145	N = 13712
	between		40.53727	-685.7066	725.9136	n = 1620
	within		39.17556	-1698.114	1754.464	T-bar = 8.4642
nopias	overall	0.3228693	1.730112	-22.86243	15.04872	N = 13712
	between		1.870092	-16.07265	11.64896	n = 1620
	within		0.954448	-20.16067	9.896561	T-bar = 8.4642
reaey	overall	-1.829987	99.8109	-9151.586	3280.911	N = 13712
	between		65.25862	-1446.159	1014.663	n = 1620
	within		89.40983	-7799.269	2264.417	T-bar = 8.4642
proa	overall	0.5454689	2.171822	-24.84514	29.93669	N = 13712
	between		2.232616	-18.34421	18.37158	n = 1620
	within		1.190706	-22.55775	19.91225	T-bar = 8.4642
ecncs	overall	26.34787	548.9867	-285.5	52980.18	N = 13712
	between		202.9349	-54.17408	5606.144	n = 1620
	within		506.461	-5579.796	47400.39	T-bar = 8.4642
tdar	overall	0.5115594	12.70796	0	537.4274	N = 13712
	between		11.63707	0	462.5169	n = 1620
	within		1.279589	-81.89659	75.42202	T-bar = 8.4642
own_dum	overall	0.9468349	0.2243708	0	1	N = 13712
	between		0.2140041	0	1	n = 1620
	within		0.027579	0.1468349	1.846835	T-bar = 8.4642
lasset	overall	14.20238	1.190936	13.12244	21.32561	N = 13712
	between		1.169913	13.12291	21.25076	n = 1620
	within		0.1047176	12.39232	15.43522	T-bar = 8.4642

Table 8.7: Distribution Pattern (Post-Crisis)

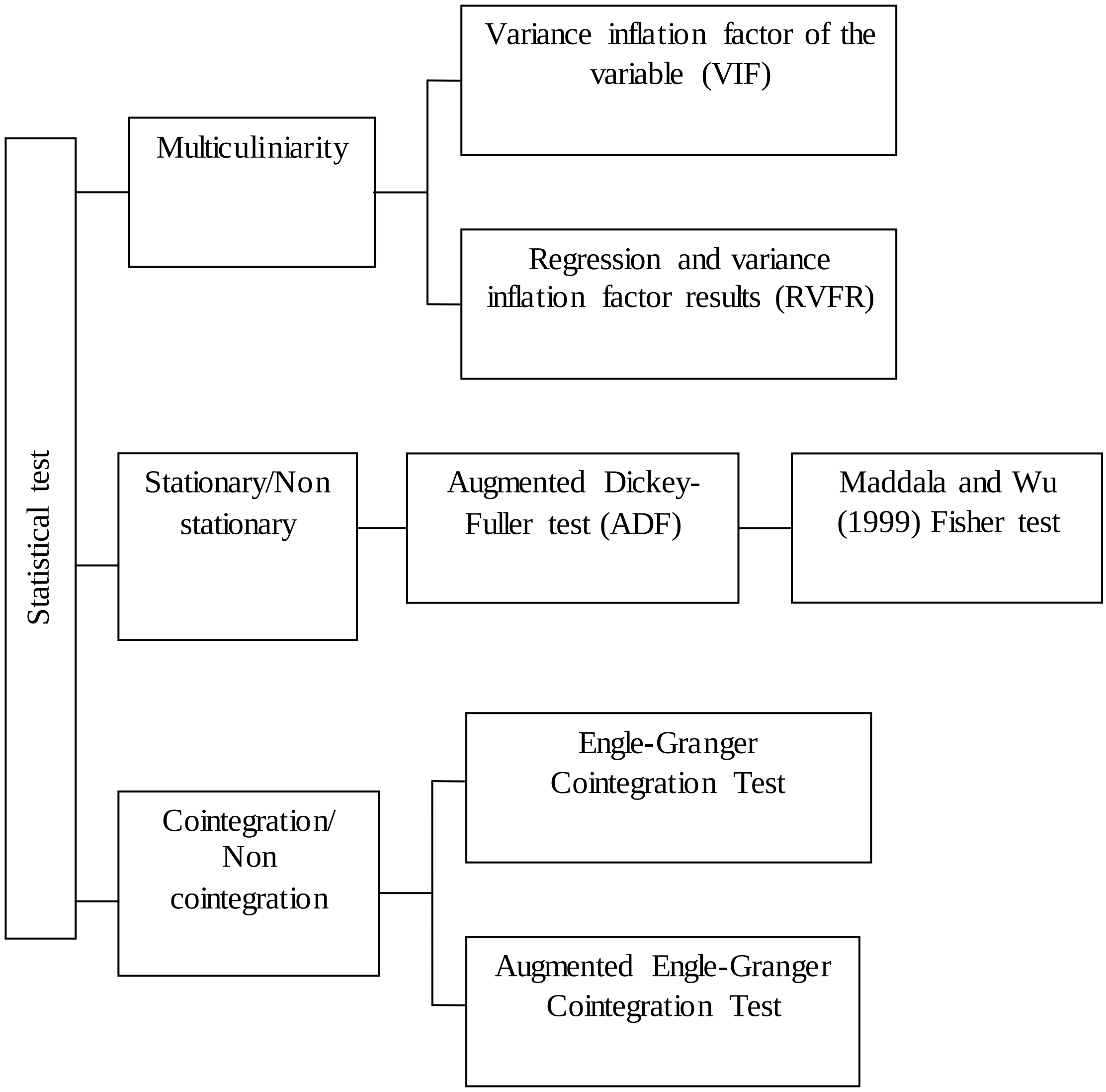
Distribution of T_i:	min	5%	25%	50%	75%	95%	max
	1	2	8	10	10	10	10

Frequency	Percent	Cum.	Pattern
1161	71.67	71.67	1111111111
42	2.59	74.26	111.......
39	2.41	76.67	1.........
26	1.60	78.27	1111......
23	1.42	79.69	11
22	1.36	81.05	11111111...
21	1.30	82.35	11........
21	1.30	83.64	11111.....
19	1.17	84.81	111111111.
246	15.19	100.00	(other patterns)
1620	100.00		XXXXXXXXXX

Source: Author generated.

The distribution pattern describes the participation pattern of the banks in the panel data. This shows that 71.67% of the banks are observed every quarter.

Figure 8.1: Statistical test flow chart



8.4.2 Test for multicolliniarity

Tables 8.8 and 8.9 show the VIF results of the model independent variables. The abbreviations have been defined above. We use quarterly data from January 2002 to December 2011.

Table 8.8: VIF Results of the Model Independent Variables

Variable	**VIF**	**1/VIF**
TDTA	1.89	0.528723
LASSET	1.69	0.591952
VLTL	1.66	0.601404
LSRETLNS	1.44	0.694965
CDLT	1.28	0.778886
CCLGR	1.23	0.810083
ITDR_DUM	1.22	0.820713
SUBTT1C	1.2	0.835422
TLTAS	1.19	0.840341
AGLTLN	1.17	0.856316
NOPIAS	1.17	0.858327
RORO	1.16	0.860923
ERT	1.13	0.882417
TEQT1AC	1.12	0.891459
OWN_DUM	1.11	0.899962
IBTLTLS	1.11	0.902052
FFR	1.1	0.905922
REAEY	1.1	0.91129
STASST	1.08	0.923954
NCLTASST	1.06	0.941423
LSTTS	1.06	0.944536
ABSTATS	1.05	0.948838
NLLDS	1.05	0.951262
CILEAST	1.04	0.957344
MBSTAS	1.04	0.959634
RWATLS	1.03	0.973525
RESLTL	1.02	0.983228
ECNCS	1.02	0.985067
CDAR	1.01	0.993113
Mean VIF	**1.19**	**0.86**

Table 8.9: Regression and VIF Results of the model independent variables

Independent Variables	Estimates	t-values	VIF
RORO	0.0000113***	-9.68	1.16
CCLGR	0.0008926***	5.73	1.23
NCLTASST	0.9375661***	34.27	1.06
TEQT1AC	0.0210463***	-4.84	1.12
RWATLS	0.0003062***	-3.86	1.03
TDTA	0.0692142***	-4.07	1.89
VLTL	0.0543342***	8.75	1.66
SUBTT1C	0.7298813***	-8.14	1.2
LSTTS	0.1755745***	5.92	1.06
CILEAST	0.0246794***	-4.45	1.04
ITDR_DUM	0.0183214***	-4.59	1.22
NLLDS	7.93E-08	0.71	1.05
TLTAS	0.0509176	0.72	1.19
CDAR	0.0049519	0.06	1.01
MBSTAS	0.0158985	-1	1.04
ABSTATS	0.2586193***	2.76	1.05
LSRETLNS	0.0408025***	-53	1.44
AGLTLN	1.28E-07***	-5.08	1.17
IBTLTLS	0.1849793***	-9.48	1.11
RESLTL	0.1706326***	39.74	1.02
CDLT	0.082275	-0.18	1.28
FFR	0.0051905***	-5.34	1.1
STASST	1.07E-07***	-3.65	1.08
ERT	0.000055***	-3.31	1.13
NOPIAS	0.0044945***	21.02	1.17
REAEY	0.0003223	-0.71	1.1
ECNCS	3.46E-06	-0.46	1.02
OWN_DUM	0.0348839***	-6.49	1.11
LASSET	0.0081067***	4.09	1.69
_cons	0.1490361***	10.91	
N	22981		
F	310.72(000)		
r2	0.28		
df_r	22951		
df_m	29		

Source: Calculated by author.

where, *, ** and *** represents t-value that is statistically significant at 0.10, 0.05 and 0.01, respectively.

Interpretations of Tables 8.8 and 8.9

In the models predicted in this chapter, the lagged dependent variables are net charge-off to loans, return on assets, risk adjusted return and average absolute deviation. As made clear in chapter 7, in theory, the ideal VIF is 1, but generally, a VIF more than 4 signify a multicullinearity problem. However, some researchers and text have suggested a limit of from 5 to 10. A multicullinarity problem exists where the VIF is high. As indicated in both tables, the mean VIF is 1.19 and 1/VIF is 0.86, none of the calculated correlation coefficients is greater than 0.2, therefore the explanatory variables are not strongly correlated. From our calculations, there is no multicollinearity problem in the data, that is, the predictor variables in our model are not correlated.

8.4.3 Stationarity and non-stationarity

The examination of the stationarity of the variables used in the models is essential giving that we are using panel data in this study. The regression results outcome may result in a statistically spurious correlation and conclusions where a data set is non-stationary. As with chapter 7, as a precondition for testing for cointegration in the panel data, we proceed to test the data if it follows a random walk, random walk with drift and trend or are stationary. To wit:

H_o :(Non Stationary) - (Unit Root) – (No Cointegration)

H_a :(Stationary) - (no Unit Root) – (Cointegration)

By interpretation, the null hypothesis is the existence of a unit root and where the variables are not co-integrated. The alternate hypothesis is the nonexistence of unit root and where the variables are co-integrated.

8.4.3.1 Unit Root test

As detailed in chapter 7, Unit root test is widely used to test for stationarity. We proceed with the augmented Dickey-Fuller test in testing for Unit root. Tables 8.10 to 8.12 shows the ADF for the data for the pre-crisis, crisis and post-crisis periods for three critical values (1, 5 and 10%).

Table 8.10: ADF test (Pre-Crisis)

Variables	MacKinnon Approximate p-value for z(t)	DF Test Statistic	Interpolated Dickey-Fuller Critical Value** 1%**	5%	10%
NCOLS	0.00	-154.46	-3.430	-2.860	-2.570
ROA	0.00	-165.46	-3.430	-2.860	-2.570
RAR	0.00	-165.46	-3.430	-2.860	-2.570
Di	0.00	-164.84	-3.430	-2.860	-2.570
RORO	0.00	-164.78	-3.430	-2.860	-2.570
CCLGR	0.00	-162.26	-3.430	-2.860	-2.570
NCLTASST	0.00	-157.50	-3.430	-2.860	-2.570
TEQT1AC	0.00	-157.06	-3.430	-2.860	-2.570
RWATLS	0.00	-164.85	-3.430	-2.860	-2.570
TDTA	0.00	-155.07	-3.430	-2.860	-2.570
VLTL	0.00	-137.00	-3.430	-2.860	-2.570
SUBTT1C	0.00	-162.54	-3.430	-2.860	-2.570
LSTTS	0.00	-164.83	-3.430	-2.860	-2.570
CILEAST	0.00	-163.74	-3.430	-2.860	-2.570
ITDR_DUM	0.00	-148.10	-3.430	-2.860	-2.570
NLLDS	0.00	-164.98	-3.430	-2.860	-2.570
TLTAS	0.00	-150.38	-3.430	-2.860	-2.570
CDAR	0.00	-164.85	-3.430	-2.860	-2.570
MBSTAS	0.00	-164.65	-3.430	-2.860	-2.570
ABSTATS	0.00	-162.17	-3.430	-2.860	-2.570
LSRETLNS	0.00	-140.26	-3.430	-2.860	-2.570
AGLTLN	0.00	-116.03	-3.430	-2.860	-2.570
IBTLTLS	0.00	152.69	-3.430	-2.860	-2.570
RESLTL	0.00	-164.91	-3.430	-2.860	-2.570
CDLT	0.00	-140.95	-3.430	-2.860	-2.570
FFR	0.00	-0.18	-3.430	-2.860	-2.570
STASST	0.00	-165.30	-3.430	-2.860	-2.570
ERT	0.00	-164.25	-3.430	-2.860	-2.570
NOPIAS	0.00	-165.59	-3.430	-2.860	-2.570
REAEY	0.00	-165.40	-3.430	-2.860	-2.570
PROA	0.00	-165.14	-3.430	-2.860	-2.570
ECNCS	0.00	-162.34	-3.430	-2.860	-2.570
TDAR	0.00	-147.36	-3.430	-2.860	-2.570
OWN_DUM	0.00	-143.23	-3.430	-2.860	-2.570
LASSET	0.00	-148.79	-3.430	-2.860	-2.570

**MacKinnon critical values for rejection of hypothesis of a unit root
Source: calculated by author
(Dependent variables: NCOLS, ROA, RAR and Di, others: independent variables)

8.11: ADF test (Crisis Period)

Variables	MacKinnon Approximate p-value for z(t)	DF Test Statistic	Interpolated Dickey-Fuller Critical Value** 1%**	5%	10%
NCOLS	0.00	-48.95	-3.430	-2.860	-2.570
ROA	0.00	-52.97	-3.430	-2.860	-2.570
RAR	0.00	-52.97	-3.430	-2.860	-2.570
Di	0.00	-98.69	-3.430	-2.860	-2.570
RORO	0.00	-95.32	-3.430	-2.860	-2.570
CCLGR	0.00	-32.95	-3.430	-2.860	-2.570
NCLTASST	0.00	-42.19	-3.430	-2.860	-2.570
TEQT1AC	0.00	-38.38	-3.430	-2.860	-2.570
RWATLS	0.00	-48.90	-3.430	-2.860	-2.570
TDTA	0.00	-32.77	-3.430	-2.860	-2.570
VLTL	0.00	-32.11	-3.430	-2.860	-2.570
SUBTT1C	0.00	-30.20	-3.430	-2.860	-2.570
LSTTS	0.00	-37.42	-3.430	-2.860	-2.570
CILEAST	0.00	-28.25	-3.430	-2.860	-2.570
ITDR_DUM	0.00	-32.50	-3.430	-2.860	-2.570
NLLDS	0.00	-29.79	-3.430	-2.860	-2.570
TLTAS	0.00	-31.02	-3.430	-2.860	-2.570
CDAR	0.00	-33.67	-3.430	-2.860	-2.570
MBSTAS	0.00	-31.15	-3.430	-2.860	-2.570
ABSTATS	0.00	-43.16	-3.430	-2.860	-2.570
LSRETLNS	0.00	-26.91	-3.430	-2.860	-2.570
AGLTLN	0.00	-21.63	-3.430	-2.860	-2.570
IBTLTLS	0.00	-33.97	-3.430	-2.860	-2.570
RESLTL	0.00	-46.27	-3.430	-2.860	-2.570
CDLT	0.00	-29.42	-3.430	-2.860	-2.570
FFR	0.00	-75.87	-3.430	-2.860	-2.570
STASST	0.00	-30.54	-3.430	-2.860	-2.570
ERT	0.00	-97.63	-3.430	-2.860	-2.570
NOPIAS	0.00	-52.00	-3.430	-2.860	-2.570
REAEY	0.00	-92.51	-3.430	-2.860	-2.570
PROA	0.00	-51.86	-3.430	-2.860	-2.570
ECNCS	0.00	-85.23	-3.430	-2.860	-2.570
TDAR	0.00	-45.77	-3.430	-2.860	-2.570
OWN_DUM	0.00	-27.52	-3.430	-2.860	-2.570
LASSET	0.00	-27.61	-3.430	-2.860	-2.570

**MacKinnon critical values for rejection of hypothesis of a unit root
Source: calculated by author
(Dependent variables: NCOLS, ROA, RAR and Di, others: independent variables

8.12: ADF test (Post-Crisis)

Variables	MacKinnon Approximate p-value for z(t)	DF Test Statistic	Interpolated Dickey-Fuller Critical Value** 1%**	5%	10%
NCOLS	0.00	-48.23	-3.430	-2.860	-2.570
ROA	0.00	-50.23	-3.430	-2.860	-2.570
RAR	0.00	-50.23	-3.430	-2.860	-2.570
Di	0.00	-117.30	-3.430	-2.860	-2.570
RORO	0.00	-120.74	-3.430	-2.860	-2.570
CCLGR	0.00	-42.81	-3.430	-2.860	-2.570
NCLTASST	0.00	-37.57	-3.430	-2.860	-2.570
TEQT1AC	0.00	-103.80	-3.430	-2.860	-2.570
RWATLS	0.00	-110.77	-3.430	-2.860	-2.570
TDTA	0.00	-33.94	-3.430	-2.860	-2.570
VLTL	0.00	-45.22	-3.430	-2.860	-2.570
SUBTT1C	0.00	-33.89	-3.430	-2.860	-2.570
LSTTS	0.00	-42.79	-3.430	-2.860	-2.570
CILEAST	0.00	-29.51	-3.430	-2.860	-2.570
ITDR_DUM	0.00	-32.04	-3.430	-2.860	-2.570
NLLDS	0.00	-42.97	-3.430	-2.860	-2.570
TLTAS	0.00	-32.74	-3.430	-2.860	-2.570
CDAR	0.00	-28.79	-3.430	-2.860	-2.570
MBSTAS	0.00	-31.42	-3.430	-2.860	-2.570
ABSTATS	0.00	-38.19	-3.430	-2.860	-2.570
LSRETLNS	0.00	-27.80	-3.430	-2.860	-2.570
AGLTLN	0.00	-21.50	-3.430	-2.860	-2.570
IBTLTLS	0.00	-24.62	-3.430	-2.860	-2.570
RESLTL	0.00	-41.42	-3.430	-2.860	-2.570
CDLT	0.00	-34.74	-3.430	-2.860	-2.570
FFR	0.00	-47.68	-3.430	-2.860	-2.570
STASST	0.00	-28.44	-3.430	-2.860	-2.570
ERT	0.00	-108.75	-3.430	-2.860	-2.570
NOPIAS	0.00	-50.17	-3.430	-2.860	-2.570
REAEY	0.00	-116.79	-3.430	-2.860	-2.570
PROA	0.00	-47.64	-3.430	-2.860	-2.570
ECNCS	0.00	-99.49	-3.430	-2.860	-2.570
TDAR	0.00	-24.08	-3.430	-2.860	-2.570
OWN_DUM	0.00	-25.96	-3.430	-2.860	-2.570
LASSET	0.00	-27.85	-3.430	-2.860	-2.570

**MacKinnon critical values for rejection of hypothesis of a unit root
Source: calculated by author
(Dependent variables: NCOLS, ROA, RAR and Di, others: independent variables)

Going by large sample size of more than 100 observations and a significance level of 1 percent, the critical value of the t-statistic from the Dickey-Fuller's tables for no intercept and no trend is -3.43. According to Tables 8.10, 8.11 and 8.12, we can reject the null hypotheses, that is, the existence of a unit root with one percent significance level. The ADF statistic is -154.46, -165.46, -165.46 and -164.84 for the dependent variables, in effect, the data is stationary

8.4.3.2: Maddala and Wu (1999) Fisher combination test-Panel Unit Root test

As we saw in chapter 7, the Fisher test by Maddala and Wu (1999) is based on combining the p-values of the test-statistic for a unit root in each cross-sectional unit. It can be performed with any unit root test on a single time-series in each cross section. Furthermore, it does not require a balanced panel like the Im-Pesaran-Shin (2003) test, so T can differ over cross sections.

Table 8.13: Maddala and Wu (1999) Fisher Combination test- Panel Unit Root test (Pre-Crisis)

Lags	NCOLS	ROA	Di	RAR	RORO	CCLGR	NCLTASST	TEQT1AC	RWATLS
0	1.4600(0.00)	1.3600(0.00)	1.6500(0.00)	1.3600(0.00)	1.3900(0.00)	1.5100(0.00)	6347.40(0.00)	5736.02(0.00)	6118.14(0.00)
1	7812.95(0.00)	6836.68(0.00)	8640.23(0.00)	6836.68(0.00)	7007.07(0.00)	7641.68(0.00)	5525.19(0.00)	4199.29(0.00)	4785.10(0.00)
2	6265.77(0.00)	5246.21(0.00)	5522.62(0.00)	5246.21(0.00)	5496.25(0.00)	6044.04(0.00)	4016.88(0.00)	3607.57(0.00)	4902.16(0.00)
3	6182.23(0.00)	3493.45(0.00)	4245.11(0.00)	3493.45(0.00)	3698.21(0.00)	3237.48(0.00)	3331.95(0.00)	3673.25(0.00)	4269.14(0.00)

Lags	TDTA	VLTL	SUBTT1C	LSTTS	CILEAST	ITDR_DUM	NLLDS	TLTAS
0	6193.55(0.00)	4928.53(0.00)	742.66(1.00)	6915.90(0.00)	1.6200(0.00)	5147.09(0.00)	1.4200(0.00)	5215.57(0.00)
1	4602.09(0.00)	3963.45(0.00)	728.85(1.00)	4919.74(0.00)	8363.88(0.00)	2677.16(0.00)	7038.91(0.00)	4626.87(0.00)
2	3204.73(0.00)	3185.14(0.00)	738.70(1.00)	3663.97(0.01)	7032.54(0.00)	2007.08(1.00)	5263.15(0.00)	3844.74(0.00)
3	2912.99(0.00)	2813.67(0.00)	756.56(1.00)	5382.36(0.00)	2950.00(0.00)	1645.20(1.00)	2708.50(0.00)	3351.38(0.00)

Lags	CDAR	MBSTAS	ABSTATS	LSRETLNS	AGLTLN	IBTLTLS	RESLTL	CDLT
0	377.78(1.00)	1.0100(0.00)	3664.87(0.00)	1.5900(0.00)	1.1300(0.00)	3950.19(0.00)	7515.75(0.00)	1.1300(0.00)
1	254.97(1.00)	6669.59(0.00)	2131.64(1.00)	8405.06(0.00)	5913.40(0.00)	2483.27(1.00)	4488.46(0.00)	5454.50(0.00)
2	212.54(1.00)	5447.47(0.00)	1954.20(1.00)	6829.98(0.00)	4386.40(0.00)	1790.50(1.00)	3793.34(0.00)	4809.55(0.00)
3	266.21(1.00)	3955.90(0.00)	1805.10(1.00)	3168.12(0.95)	2118.17(1.00)	1512.80(1.00)	3427.26(0.00)	2510.93(1.00)

Lags	FFR	STASST	ERT	NOPIAS	REAEY	PROA	ECNCS	TDAR	OWN_DUM	LASSET
0	3785.82(0.00)	6842.44(0.00)	1.3800(0.00)	1.3600(0.00)	1.3300(0.00)	1.2700(0.00)	1.6600(0.00)	3305.58(0.36)	46.42(1.00)	5088.94(0.00)
1	2141.81(1.00)	5258.60(0.00)	7580.88(0.00)	7346.91(0.00)	8129.40(0.00)	6564.59(0.00)	8902.58(0.00)	2750.48(1.00)	64.93(1.00)	4436.36(0.00)
2	7516.50(0.00)	4398.84(0.00)	4831.50(0.00)	5275.24(0.00)	5231.58(0.00)	4859.46(0.00)	6143.03(0.00)	2583.28(1.00)	15.78(1.00)	3255.67(0.00)
3	1.5700(0.00)	3589.92(0.00)	3773.33(0.00)	3601.18(0.00)	4279.48(0.00)	3532.92(0.00)	4562.06(0.00)	2253.26(1.00)	23.93(1.00)	3852.63(0.00)

Table 8.14: Maddala and Wu (1999) Fisher Combination test- Panel Unit Root test (Crisis Period)

Lags	NCOLS	ROA	Di	RAR	RORO	CCLGR	NCLTASST	TEQT1AC	RWATLS
0	5441.16(0.00)	5192.78(0.00)	7458.81(0.00)	5192.78(0.00)	7774.70(0.00)	4577.59(0.00)	3254.55(0.00)	5359.24(0.00)	4409.93(0.00)
1	3237.22(0.00)	3977.16(0.00)	6608.58(0.00)	3977.16(0.00)	4939.68(0.00)	6245.09(0.00)	4889.64(0.00)	8877.98(0.00)	7052.28(0.00)
2	27.19(0.00)	0.00(1.00)	1.10(1.00)	0.00(1.00)	0.22(1.00)	0.00(1.00)	13.43(1.00)	5.40(1.00)	0.00(1.00)
3	0.64(0.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.32(1.00)	0.00(1.00)	0.00(1.00)

Lags	TDTA	VLTL	SUBTT1C	LSTTS	CILEAST	ITDR_DUM	NLLDS	TLTAS
0	5059.19(0.00)	5434.83(0.00)	672.66(1.00)	3243.13(0.00)	4642.30(0.00)	179.44(1.00)	3657.21(0.00)	4651.67(0.00)
1	6816.47(0.00)	7338.26(0.00)	1267.53(1.00)	4220.47(0.00)	7899.36(0.00)	83.47(1.00)	7808.14(0.00)	8241.96(0.00)
2	0.00(1.00)	0.00(1.00)	4.51(1.00)	149.11(1.01)	0.39(1.00)	31.69(1.00)	0.00(1.00)	0.00(1.00)
3	0.00(1.00)	0.00(1.00)	0.78(1.00)	14.65(1.00)	0.00(1.00)	12.42(1.00)	0.00(1.00)	0.00(1.00)

Lags	CDAR	MBSTAS	ABSTATS	LSRETLNS	AGLTLN	IBTLTLS	RESLTL	CDLT
0	210.19(1.00)	6106.71(0.00)	715.65(1.00)	5296.72(0.00)	4034.40(0.00)	1217.30(1.00)	2833.42(0.82)	4245.36(0.00)
1	91.79(1.00)	6840.25(0.00)	968.00(1.00)	7694.88(0.00)	5561.36(0.00)	1031.13(1.00)	2603.99(0.97)	7211.88(0.00)
2	0.79(1.00)	3.32(1.00)	32.78(1.00)	0.26(1.00)	9.20(1.00)	121.70(1.00)	294.61(1.00)	0.30(1.00)
3	0.94(1.00)	0.43(1.00)	20.29(1.00)	0.00(1.00)	1.01(1.00)	5.82(1.00)	30.08(1.00)	0.05(1.00)

Lags	FFR	STASST	ERT	NOPIAS	REAEY	PROA	ECNCS	TDAR	OWN_DUM	LASSET
0	3868.60(0.00)	4845.45(0.00)	6731.37(0.00)	5207.66(0.00)	7095.15(0.00)	5037.97(0.00)	1.6700(0.00)	2592.14(1.00)	3.11(1.00)	5676.28(0.00)
1	810.79(1.00)	5327.08(0.00)	3963.75(0.00)	3468.33(0.00)	4939.00(0.00)	3811(0.00)	1.1300(0.00)	3302.15(0.00)	1.45(1.00)	6048.64(0.00)
2	0.00(1.00)	12.32(0.00)	1.12(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	21.27(1.00)	31.79(1.00)	1.02(1.00)	0.00(1.00)
3	0.00(1.00)	0.87(0.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	4.48(1.00)	8.91(1.00)	0.26(1.00)	0.00(1.00)

Table 8.15: Maddala and Wu (1999) Fisher Combination test- Panel Unit Root test (Post-Crisis)

Lags	NCOLS	ROA	Di	RAR	RORO	CCLGR	NCLTASST	TEQT1AC	RWATLS
0	4450.50(0.00)	5258.73(0.00)	9249.63(0.00)	5258.73(0.00)	6934.85(0.00)	6323.23(0.00)	5575.46(0.00)	6810.32(0.00)	5695.03(0.00)
1	8417.60(0.00)	1.4200(0.00)	1.4500(0.00)	1.4200(0.00)	1.2100(0.00)	4849.41(0.00)	4213.07(0.00)	6530.23(0.00)	4580.58(0.00)
2	3974.51(0.00)	3962.03(0.00)	5778.69(0.00)	3962.03(0.00)	4683.61(0.00)	3609.19(0.00)	4786.26(0.00)	4757.88(0.00)	4970.04(0.00)
3	1.0400(0.00)	1.1800(0.00)	1.2900(0.00)	1.18000.00)	1.1400(0.00)	8088.16(0.00)	9239.60(0.00)	8301.58(0.00)	7057.58(0.00)

Lags	TDTA	VLTL	SUBTT1C	LSTTS	CILEAST	ITDR_DUM	NLLDS	TLTAS
0	7503.18(0.00)	6715.17(0.00)	312.93(1.00)	3691.74(0.00)	5054.18(0.00)	311.24(1.00)	5985.73(0.00)	4702.34(0.00)
1	5241.24(0.00)	4.5700(0.00)	421.75(1.00)	4336.48(0.00)	4846.32(0.00)	210.54(1.00)	4546.70(0.00)	4725.50(0.00)
2	4918.04(0.00)	5137.93(0.00)	241.94(1.00)	3728.77(0.00)	3835.49(0.00)	94.82(1.00)	3608.27(0.00)	3827.58(0.00)
3	8302.02(0.00)	1.0600(0.00)	799.96(1.00)	7015.47(0.00)	7646.68(0.00)	32.81(1.00)	8472.00(0.00)	7021.52(0.00)

Lags	CDAR	MBSTAS	ABSTATS	LSRETLNS	AGLTLN	IBTLTLS	RESLTL	CDLT
0	213.93(1.00)	4156.80(0.00)	1177.69(1.00)	4653.99(0.00)	2952.64(0.61)	915.21(1.00)	5400.35(0.00)	5801.57(0.00)
1	215.71(1.00)	4487.99(0.00)	960.60(1.00)	4495.00(0.00)	3134.06(0.00)	710.83(1.00)	4385.02(0.00)	4874.95(0.00)
2	116.88(1.00)	3987.56(0.00)	655.54(1.00)	3582.87(0.00)	3676.01(0.00)	631.32(1.00)	2906.64(0.00)	5142.77(0.00)
3	331.04(1.00)	6336.13(0.00)	1188.52(1.00)	7227.53(0.00)	5192.50(0.00)	977.77(1.00)	8181.06(0.00)	7744.43(0.00)

Lags	FFR	STASST	ERT	NOPIAS	REAEY	PROA	ECNCS	TDAR	OWN_DUM	LASSET
0	1033.25(1.00)	4442.07(0.00)	4758.73(0.00)	5083.88(0.00)	5914.58(0.00)	5099.34(0.00)	7631.08(0.00)	3061.79(0.13)	8.31(1.00)	4896.59(0.00)
1	3204.55(0.00)	3707.89(0.00)	1.0800(0.00)	1.2800(0.00)	1.4400(0.00)	1.4200(0.00)	9012.27(0.00)	2947.83(0.06)	1.16(1.00)	4642.15(0.00)
2	2077.71(1.00)	3169.84(0.00)	3884.49(0.00)	3789.67(0.00)	5054.72(0.00)	3667.84(0.00)	6490.76(0.00)	2324.67(1.00)	1.39(1.00)	3710.77(0.00)
3	3268.37(0.00)	6552.90(0.00)	1.0100(0.00)	1.1600(0.00)	1.0400(0.00)	1.3100(0.00)	9458.98(0.00)	5055.68(0.00)	0.45(1.00)	7705.05(0.00)

As explained in Chapter 7, the Maddala and Wu (1999) combination Fisher test reports the Fisher statistic and associated p-value and as with the Pesaran (2007) test, the null hypothesis for both tests is that all series are nonstationary. Lags indicate the lag augmentation in the Dickey Fuller regression deployed. The Dickey Fuller regression is augmented with a constant. The results from the two Tables 8.13, 8.14 and 8.15 produced important and meaningful test statistics, which allowed rejecting the unit root hypotheses at 5%. In effect, the test showed that the panel data was confirmed to be stationary.

8.4.4 Test for cointegration

On the strength that the panel data was confirmed to be stationary, we proceed to test our data for cointegration, more so, our panel data spans up to ten years. By definition, where two or more time series have nonstationary properties, but a linear combination of them is stationary, then they are classified as cointegrated (Kennedy 1992). Empirically, the earliest test used for cointegration is the Engle-Granger cointegration Test. Other first generation tests used are the Kao (1999), Pedroni (1999,2000 and 2004) and McCoskey and Kao (1998) tests. The second generation cointegration tests formulated currently are Westerlund (2007) and Gengenbach et al. (2006, 2009). We continue with the Augmented Engle-Granger Cointegration test.

Table 8.16 (a): AEG test (Pre-Crisis)

Sample (n)	Variables	p-value>(t) Significance level for rejection of the null hypothesis (no Cointegration)	Cointegration t test (Lag length (3)) Dependent variable: NCOLS			
			AR(0)	AR(1)	AR(2)	AR(3)
27174	ROA	0.00	-77.08	-55.3	-48.7	-44.25
27174	RAR	0.00	-77.08	-55.3	-48.7	-44.25
27174	Di	0.00	-74.44	-53.69	-47.21	-42.83
27174	RORO	0.00	-74.39	-53.67	-47.2	-42.82
27174	CCLGR	0.00	-75.93	-54.58	-47.78	-43.26
27174	NCLTASST	0.00	-77.16	-55.27	-48.27	-43.39
27174	TEQT1AC	0.00	-74.44	-53.68	-47.2	-42.82
27174	RWATLS	0.00	-74.44	-53.69	-47.21	-42.83
27174	TDTA	0.00	-75.63	-54.63	-48	-43.49
27174	VLTL	0.00	-75.28	-54.29	-47.64	-43.2
27174	SUBTT1C	0.00	-74.49	-53.72	-47.24	-42.86
27174	LSTTS	0.00	-74.44	-53.69	-47.21	-42.83
27174	CILEAST	0.00	-74.56	-53.77	-47.26	-42.85
27174	ITDR_DUM	0.00	-74.47	-53.71	-47.23	-42.84
27174	NLLDS	0.00	-74.45	-53.7	-47.22	-42.84
27174	TLTAS	0.00	-74.45	-53.69	-47.21	-42.83
27174	CDAR	0.00	-74.44	-53.69	-47.21	-42.83
27174	MBSTAS	0.00	-74.49	-53.72	-47.23	-42.85
27174	ABSTATS	0.00	-74.69	-53.84	-47.29	-42.87
27174	LSRETLNS	0.00	-78.02	-56.16	-48.64	-44.14
27174	AGLTLN	0.00	-74.44	-53.69	-47.21	-42.83
27174	IBTLTLS	0.00	-74.47	-53.72	-47.23	-42.85
27174	RESLTL	0.00	-73.67	-53.2	-47.67	-42.83
27174	CDLT	0.00	-74.83	-53.95	-47.33	-42.9
27174	FFR	0.00	-74.66	-53.81	-47.22	-42.76
27174	STASST	0.00	-74.48	-53.72	-47.23	-42.85
27174	ERT	0.00	-74.44	-53.68	-47.21	-42.84
27174	NOPIAS	0.00	-76.76	-55.08	-48.53	-44.18
27174	REAEY	0.00	-74.5	-53.81	-47.33	-42.94
27174	PROA	0.00	-77.22	-55.53	-48.75	-44.13
27174	ECNCS	0.00	-74.47	-53.72	-47.24	-42.84
27174	TDAR	0.00	-74.46	-53.71	-47.22	-42.84
27174	OWN_DUM	0.00	-74.58	-53.8	-47.31	-42.92
27174	LASSET	0.00	-74.84	-53.96	-47.44	-43.02

Table 8.16 (b): AEG test (Crisis Period)

Sample (n)	Variables	p-value>(t) Significance level for rejection of the null hypothesis (no Cointegration)	Cointegration t test (Lag length (3)) Dependent variable: NCOLS			
			AR(0)	AR(1)	AR(2)	AR(3)
9750	ROA	0.00	-98.52	-65.69	-54.31	-47.36
9750	RAR	0.00	-98.52	-65.69	-54.31	-47.36
9750	Di	0.00	-95.85	-64.2	-52.19	-44.85
9750	RORO	0.00	-95.84	-64.19	-52.19	-44.86
9750	CCLGR	0.00	-95.71	-64.12	-52.12	-44.77
9750	NCLTASST	0.00	-98.58	-68.05	-55.31	-47.7
9750	TEQT1AC	0.00	-95.86	-64.21	-52.19	-44.86
9750	RWATLS	0.00	-95.97	-64.23	-52.19	-44.87
9750	TDTA	0.00	-95.5	-63.77	-51.79	-44.47
9750	VLTL	0.00	-96.19	-64.29	-52.22	-44.91
9750	SUBTT1C	0.00	-95.99	-64.24	-52.22	-44.75
9750	LSTTS	0.00	-95.81	-64.13	-52.13	-44.79
9750	CILEAST	0.00	-96.02	-64.39	-52.31	-44.89
9750	ITDR_DUM	0.00	-95.9	-64.19	-52.17	-44.83
9750	NLLDS	0.00	-95.85	-64.2	-52.19	-44.86
9750	TLTAS	0.00	-95.85	-64.3	-52.25	-44.91
9750	CDAR	0.00	-95.84	-64.18	-52.18	-44.84
9750	MBSTAS	0.00	-95.89	-64.45	-52.29	-44.94
9750	ABSTATS	0.00	-95.45	-64.11	-51.99	-44.73
9750	LSRETLNS	0.00	-95.14	-63.59	-51.64	-44.15
9750	AGLTLN	0.00	-95.87	-64.2	-52.18	-44.84
9750	IBTLTLS	0.00	-95.85	-64.2	-52.19	-44.86
9750	RESLTL	0.00	-97.24	-65.56	-53.97	-46.38
9750	CDLT	0.00	-96.16	-64.35	-52.2	-44.91
9750	FFR	0.00	-98.71	-66.98	-55.14	-47.96
9750	STASST	0.00	-95.96	-64.21	-52.18	-44.87
9750	ERT	0.00	-95.85	-64.2	-52.19	-44.86
9750	NOPIAS	0.00	-98.37	-65.74	-54.6	-47.62
9750	REAEY	0.00	-95.85	-64.21	-52.23	-44.88
9750	PROA	0.00	-98.37	-65.52	-54.1	-47.14
9750	ECNCS	0.00	-95.85	-64.2	-52.19	-44.86
9750	TDAR	0.00	-95.85	-64.2	-52.19	-44.86
9750	OWN_DUM	0.00	-96.27	-64.61	-52.56	-45.16
9750	LASSET	0.00	-95.75	-63.76	-51.59	-44.08

Table 8.16 (c): AEG test (post-Crisis)

Sample (n)	Variables	p-value>(t) Significance level for rejection of the null hypothesis(no Cointegration)	Cointegration t test (Lag length (3)) Dependent variable: NCOLS			
			AR(0)	AR(1)	AR(2)	AR(3)
13712	ROA	0.00	-114.01	-76.26	-63.1	-54.2
13712	RAR	0.00	-114.01	-76.26	-63.1	-54.2
13712	Di	0.00	-110.84	-74.46	-61.61	-53.26
13712	RORO	0.00	-110.88	-74.61	-61.68	-53.25
13712	CCLGR	0.00	-111.15	-74.79	-61.91	-53.4
13712	NCLTASST	0.00	-115.12	-77.25	-62.88	-54.79
13712	TEQT1AC	0.00	-110.85	-74.48	-61.63	-53.27
13712	RWATLS	0.00	-110.83	-74.46	-61.61	-53.26
13712	TDTA	0.00	-110.47	-74.2	-61.47	-53.29
13712	VLTL	0.00	-111.47	-74.94	-62.17	-53.88
13712	SUBTT1C	0.00	-111.21	-74.73	-61.93	-53.32
13712	LSTTS	0.00	-110.79	-74.48	-61.66	-53.31
13712	CILEAST	0.00	-111.07	-74.71	-61.72	-53.42
13712	ITDR_DUM	0.00	-110.76	-74.42	-61.46	-53.12
13712	NLLDS	0.00	-110.82	-74.46	-61.62	-53.25
13712	TLTAS	0.00	-110.72	-75	-61.92	-53.8
13712	CDAR	0.00	-110.9	-74.44	-61.58	-53.23
13712	MBSTAS	0.00	-110.96	-74.72	-61.61	-53.44
13712	ABSTATS	0.00	-110.53	-74.42	-61.41	-53.19
13712	LSRETLNS	0.00	-111.02	-74.42	-61.42	-53.21
13712	AGLTLN	0.00	-110.87	-74.48	-61.61	-53.25
13712	IBTLTLS	0.00	-110.93	-74.55	-61.69	-53.32
13712	RESLTL	0.00	-112.17	-74.49	-61.63	-53.11
13712	CDLT	0.00	-113.84	-76.84	-63.46	-55.21
13712	FFR	0.00	-111.18	-74.79	-61.97	-53.63
13712	STASST	0.00	-110.99	-74.44	-61.6	-53.2
13712	ERT	0.00	-111.13	-74.66	-61.75	-53.4
13712	NOPIAS	0.00	-114.16	-76.29	-63.07	-54.22
13712	REAEY	0.00	-110.9	-74.66	-61.73	-53.29
13712	PROA	0.00	-113.34	-75.92	-62.92	-53.85
13712	ECNCS	0.00	-110.89	-74.49	-61.64	-53.28
13712	TDAR	0.00	-110.73	-74.45	-61.61	-53.26
13712	OWN_DUM	0.00	-111.49	-75.36	-62.37	-53.84
13712	LASSET	0.00	-110.15	-73.96	-61.08	-52.41

Interpretations of Tables 8.16 (a, b and c)

The output in Tables 8.16(a), 8.16(b) and 8.16(c) is from the cointegration regression. The p-values are less than 0.05 and therefore we can reject H_0 that the residuals are I(1).The residuals x_t are therefore I(0) and are stationary. Therefore, the explanatory variables in the model are cointegrated.

Summary of the entire test

In all, the diagnostic tests estimated are multicullinearity, stationarity and cointegration. They are calculated to double-check the importance and stability of the models and how they have enabled the study to continue with the estimation of the empirical models with the guarantee that the relationships and contributions of each of the explanatory variable will not lead to hollow interpretations. We are certain and positive that there are no strong linear relationships between the explanatory variables, no unit root issues and that the model variables are cointegrated.

8.4.5 Correlation analysis

The strength and direction of the linear relationship between two explanatory variables is measured by correlations. The threshold for explanatory variables included in our models is less than 0.3, thus variables that are highly correlated with each other are not included. Empirically, a variable correlated with itself will always have a correlation of 1.

Table 8.17(a): Correlation matrix of the independent variables

	RORO	CCLGR	NCLTASST	TEQT1AC	RWATLS	TDTA	VLTL	SUBTT1C	LSTTS
RORO	1								
CCLGR	0.0499	1							
NCLTASST	0.0153	0.0384	1						
TEQT1AC	0.0075	0.0197	-0.0296	1					
RWATLS	-0.0016	0.0541	-0.0121	-0.0025	1				
TDTA	0.0101	-0.1827	-0.0556	-0.1312	-0.062	1			
VLTL	0.0097	0.0486	0.0794	-0.0783	0.0018	-0.5638	1		
SUBTT1C	0.0036	0.0391	0.0182	0.0669	0.0815	-0.2203	0.0846	1	
LSTTS	0.0063	0.0587	0.0506	-0.0109	-0.005	-0.1079	0.07	0.0788	1
CILEAST	0.0065	-0.0079	0.0202	0.0137	-0.0059	-0.0062	-0.008	0.0339	0.0095
ITDR_DUM	0.0063	-0.0371	0.0048	0.0965	-0.0049	-0.0971	-0.0048	0.182	0.1548
NLLDS	-0.0722	0.0064	-0.0038	0.0005	-0.0012	-0.1707	0.0669	0.0032	-0.0047
TLTAS	0.0079	-0.0501	0.1347	-0.1332	-0.0986	0.0327	0.0823	-0.0334	0.0758
CDAR	-0.0002	-0.0003	-0.0036	-0.0028	-0.0004	-0.0318	0.0249	0.007	-0.0005
MBSTAS	-0.001	-0.0088	-0.0337	-0.0063	0.002	-0.0366	0.0311	-0.0125	-0.0206
ABSTATS	0.0034	0.0118	-0.0071	-0.0036	0.003	-0.0634	0.0228	0.0474	0.0285
LSRETLNS	-0.0408	-0.1551	-0.1019	-0.1058	-0.0628	0.2302	-0.0978	-0.2432	-0.0611
AGLTLN	-0.0004	-0.034	0.0152	0.0716	-0.0043	-0.012	-0.0298	0.1264	0.0435
IBTLTLS	0.0157	0.1383	0.0095	0.0863	-0.001	-0.1324	0.0022	0.159	0.0108
RESLTL	0.0011	0.0094	0.0604	0.0005	0.0284	-0.0161	0.0192	0.0263	-0.0056
CDLT	0.0003	-0.0567	0.0136	-0.0178	-0.0186	0.1813	-0.0235	-0.0755	-0.0031
FFR	0.0065	0.0017	-0.0759	-0.0024	-0.0088	0.0454	0.0743	-0.0325	-0.0416
STASST	-0.0003	0.0084	0.0424	-0.0075	-0.0003	-0.046	0.0679	0.0613	0.0127
ERT	0.002	0.3009	0.0049	0.0012	-0.0009	0.0178	-0.0076	-0.0036	-0.0049
NOPIAS	0.2423	0.1085	0.0876	-0.0597	0.0038	-0.0934	0.0388	0.0394	0.0616
REAEY	-0.269	-0.021	-0.0366	-0.0497	-0.0062	0.0294	0.0291	-0.0154	-0.0425
ECNCS	0.0002	0.0028	-0.0281	-0.0101	-0.0008	-0.0222	0.0199	-0.0061	-0.0057
OWN_DUM	0.0322	-0.0582	0.0662	0.0781	0.007	-0.0739	0.1133	0.0689	0.0482
LASSET	0.004	-0.0177	0.0225	0.1728	0	-0.3494	0.2536	0.3246	0.1144

Table 8.17(b): Correlation matrix of the independent variables

	CILEAST	ITDR_DUM	NLLDS	TLTAS	CDAR	MBSTAS	ABSTATS	LSRETLNS	AGLTLN
CILEAST	1								
ITDR_DUM	0.0397	1							
NLLDS	-0.0112	-0.0218	1						
TLTAS	0.0521	-0.0364	0.0362	1					
CDAR	-0.0024	0.0176	0.0745	-0.0007	1				
MBSTAS	-0.0132	-0.0048	0.0248	-0.1307	-0.0023	1			
ABSTATS	0.0278	0.0753	0.0083	-0.0959	0	0.137	1		
LSRETLNS	-0.1623	-0.189	-0.0021	0.1201	0.0016	0.0217	-0.1095	1	
AGLTLN	0.0872	0.1489	-0.0073	0.0241	0.0058	-0.0087	0.0033	-0.0762	1
IBTLTLS	0.0162	0.0549	0.0292	-0.0722	0.0041	-0.0132	0.0687	-0.2263	0.0311
RESLTL	-0.0071	-0.016	-0.0012	-0.0614	-0.0004	-0.0035	-0.0028	0.0242	-0.006
CDLT	-0.0016	0.0161	-0.0355	0.23	-0.011	-0.0342	-0.0485	0.2817	-0.0187
FFR	-0.0027	0.0434	0.002	0.1301	0.0105	-0.0199	-0.0132	0.095	0.0346
STASST	0.0138	0.0867	-0.0026	-0.0674	0.0052	-0.0047	0.0845	-0.1073	-0.0099
ERT	-0.0092	-0.0048	-0.0091	-0.0175	-0.0028	0.0034	-0.0031	-0.0188	-0.0076
NOPIAS	0.0338	0.003	-0.0255	0.0736	-0.0015	-0.0212	0.0346	-0.1671	0.0159
REAEY	0.0044	0.0012	0.0077	0.0349	-0.0038	-0.0023	-0.0204	0.0507	-0.0082
ECNCS	-0.0165	-0.0198	0.0037	-0.0344	0.0004	0.0069	0.0076	0.0562	-0.0138
OWN_DUM	0.0624	0.0849	0.0067	0.0442	0.0029	-0.0041	0.0209	-0.1995	0.0534
LASSET	0.0139	0.3451	0.0443	-0.0971	0.023	0.0176	0.1087	-0.2502	0.3244

Table 8.17(c): Correlation matrix of the independent variables

	IBTLTLS	RESLTL	CDLT	FFR	STASST	ERT	NOPIAS	REAEY	ECNCS
IBTLTLS	1								
RESLTL	-0.0033	1							
CDLT	-0.0758	0.0476	1						
FFR	-0.029	-0.019	0.2413	1					
STASST	0.098	0.0001	-0.0503	-0.0086	1				
ERT	-0.0054	0.0049	-0.0172	-0.0186	-0.0034	1			
NOPIAS	-0.0106	-0.007	0.0202	0.0121	-0.0032	-0.1001	1		
REAEY	-0.0154	-0.004	0.0506	0.0109	0.0109	-0.0181	-0.0108	1	
ECNCS	-0.0067	-0.002	-0.0244	0.0255	0.0012	-0.0128	0.0157	0.0006	1
OWN_DUM	0.0272	0.0046	0.111	0.002	0.0183	-0.0109	0.0621	-0.0139	-0.0245
LASSET	0.102	-0.008	-0.1698	-0.0158	0.2188	-0.0111	0.0369	-0.0201	0.0537

Table 8.17(d): Correlation matrix of the independent variables

	OWN_DUM	LASSET
OWN_DUM	1	
LASSET	0.1184	1

Findings of the matrix

Tables 8.17(a) to 8.17(d) are the product from the correlation matrix for the explanatory variables. The matrix indicates the association, strength and direction of the relationship between explanatory variables used in the empirical models. From the matrix, the highest figure was 1 while the lowest was -0.5638. For example, the correlation between AGLTLN and AGLTLN is 1. By interpretation, the correlation between any variable and itself is always 1. The correlation between AGLTLN and ITDR_DUM is 0.1489. It is positive. Indicating that as AGLTLN increases so does ITDR_DUM. The correlation between FFR and CILEAT is -0.0027. It is negative. This indicates that as FFR decreases, CILEAT increase.

8.5 Hypothesis Testing and Discussion using the Arellano-Bond Dynamic Panel Data Generalised Method of Moments (GMM) from 2002 To 2011

8.5.1 Testing Hypotheses 1

Hypothesis 1 is outlined below.

H_{01}: There is a definite correlation between selling of credit derivatives (bank is guarantor) and bank portfolio performance (Risk adjusted return on assets).

H_{a1}: There is an indefinite correlation between selling credit derivatives (bank is guarantor) and bank portfolio performance (Risk adjusted return on assets).

The null hypothesis is the definite correlation between selling credit derivatives and the risk adjusted return on bank portfolio performance. The alternate hypothesis is the indefinite correlation between selling credit derivatives and the risk adjusted return on bank portfolio performance.

The model for testing hypotheses 1 is stated below:

$$\begin{aligned} RAR_{it} = \alpha + S_1 RAR_{i(t-1)} + S_2 RORO_{it} + S_3 CCLGR_{it} + S_4 NCLTASST_{it} + S_5 TEQT1AC_{it} + \\ S_6 RWATLS_{it} + S_7 SUBTT1C_{it} + S_8 NLLDS_{it} + S_9 CDAR_{it} + S_{10} MBSTAS_{it} + \\ S_{11} ABSTATS_{it} + S_{12} LSRETLNS_{it} + S_{13} FFR_{it} + S_{14} ERT_{it} + S_{15} NOPIAS_{it} + \\ S_{16} REAEY_{it} + S_{17} TDAR_{it} + S_{18} LASSET_{it} + \mu_{it} \end{aligned} \tag{8.1}$$

The Stata dynamic panel data Generalised Method of Moments (GMM) estimation return the results from credit derivatives sellers as detailed below in Table 8.18 for the pre-crisis, crisis period and post-crisis period.The result for the lagged risk adjusted rate of return (RAR-1) prior to the financial crisis is not statistically significant though it has a positive impact. This becomes significant at the 5% level during the financial crisis and the post crisis period with coefficients of 0.027 and 0.018 respectively. In terms of leverage, the financial leverage variable, (RORO) is significant at the 1% level across the three periods with a coefficient of 0.229, -0.621 and 0.103 respectively. Conversely, the core capital ratio (CCLGR) reflecting operating leverage have a negative impact across the three phases but insignificant. The non-performing loans to total assets variable (NLCTASST) reflecting asset quality is not significant prior and during the financial crisis though has positive impact but becomes significant at the 5% level after the crisis with a coefficient of 0.265.

In terms of the capitalisation variables, TEQT1AC is insignificant across the three periods while RWATLS impacted significantly at the 1% level with a positive coefficient of 0.111 before the crisis but insignificant during and after the crisis period. The pre-crisis result in terms of the credit management and derivatives show that the SUBTT1C variable is insignificant though it has a positive sign. It becomes significant during the financial crisis at the 5% level with a coefficient of 0.444. It looses the significance during the post crisis period although with a negative impact (coefficient is -0.242). On the other hand, NLLDS is significant at the 1% level before the financial crisis. The biggest components of bank assets are loans, leases and deposits base, which is a pointer to profit efficiency. However, it loses its significance during the crisis and the post crisis period although retains its positive coefficients.

Concerning the liquidity variables, total credit derivatives to assets ratio (CDAR) is insignificant pre crisis. The coefficient during the crisis is negative significant at the 1% scale with a magnitude of -0.950. The scale reduces to -0.701 though still significant at the 1% post crisis. The mortgage-backed securities to total assets variable (MBSTAS) is positively correlated and strongly significant at 1% level before the crisis with a magnitude of 0.204. However, it loses its significance and sign during the crisis and post crisis phase. We move to the results of the federal funds rate (FFR), it is insignificant before the financial crisis though with a positive sign. It becomes significant with a 1% level during the crisis period (coefficient is 0.236) sign posting a favourable interest rate regime; however, it loses its significance post crisis albeit with a negative sign. In terms of the liquidity variables, the coefficient of the efficiency ratio (ERT) is positive and negative respectively before and during the crisis but its impact is not significant. It becomes significant at the 5% level during the post crisis phase with a scale of 0.153.The net operating income to assets (NOPIAS) have a significantly positive impact of 0.544, 0.400 and 0.547 respectively during the three periods at the 1% level. This is a pointer that selling protection was a hugely profitable business for the banks. The retained earnings to average equity (REAEY) is insignificant during the pre-crisis phase though has a positive sign. It becomes significant (1% level) during the crisis period with a positive scale of 0.215.It retains its significance at the same level during the post crisis period though the coefficient reduces to 0.115 in comparison to the crisis period.

In terms of the risk management variable, the total derivative to total assets (TDAR) is insignificant before and during the crisis period though retains a positive sign for both phases. This is incompatible to my hypotheses. However, it becomes significant with a magnitude of 0.199 during the post crisis period (1% level) wherefore banks also use other forms of derivatives to improve portfolio performance. This is same to my hypotheses. All the other variables (ABSTATS and LASSET) retain their insignificance across the three periods.

Table 8.18: Dynamic Panel Data Generalised Method of Moments (GMM) Estimation for Credit Derivatives Sellers (2002 To 2011)

Description Dependent Variable	Acronym RAR	Explanatory Variables Risk adjusted return	Pre-crisis Co-ef p-value	Crisis Co-ef p-value	Post-crisis Co-ef p-value
Constant	Const	Constant	25042.120	-183724.4	-110129.1
			(0.46)	(0.22)	(0.22)
Lagged Dependent Variable	RAR (-1)	Lagged Risk adjusted return	0.012	0.027**	0.018**
			(0.14)	(0.08)	(0.02)
Leverage	RORO	ROE/ROA (Financial Leverage)	0.229***	-0.621***	0.103***
			(0.00)	(0.00)	(0.00)
	CCLGR	Core capital ratio (Operational Leverage)	-0.025	-0.398	-0.967
			(0.36)	(0.77)	(0.34)
Asset quality	NCLTASST	Nonperforming loans/total assets	0.976	0.102	0.265**
			(0.21)	(0.57)	(0.03)
Capitalisation	TEQT1AC	Total equity capital /Tier 1 risk adj capital	0.958	0.573	-0.486
			(0.23)	(0.59)	(0.56)
	RWATLS	Risk weighted assets ratio	0.111***	0.995	-0.337
			(0.00)	(0.17)	(0.51)
CR mgt and derivatives	SUBTT1C	Subordinated debt to Tier 1 risk adj cap	0.997	0.444**	-0.242
			(0.88)	(0.09)	(0.11)
	NLLDS	Net loans and leases to deposits	0.000***	0.161	0.244
			(0.00)	(0.84)	(0.69)
Liquidity	CDAR	Total credit derivatives to assets ratio	-0.492	-0.950***	-0.701***
			(0.55)	(0.01)	(0.01)
	MBSTAS	Mortgage-backed securities/Total assets	0.204***	-0.611	-0.296
			(0.01)	(0.16)	(0.31)

Table 8.18: Cont'd

Description Dependent Variable	Acronym RAR	Explanatory Variables Risk adjusted return	Pre-crisis Co-ef p-value	Crisis Co-ef p-value	Post-crisis Co-ef p-value
Macroeconomics context	ABSTATS	Asset backed securities/Total assets	0.918	-0.852	-0.749
			(0.64)	(0.25)	(0.64)
	FFR	Federal funds rate	0.595	0.236***	-0.116
			(0.85)	(0.01)	(0.27)
Profitability	ERT	Efficiency ratio	0.169	-0.233	0.153**
			(0.39)	(0.65)	(0.08)
	NOPIAS	Net operating income to assets	0.544***	0.400***	0.547***
			(0.00)	(0.00)	(0.00)
	REAEY	Retained earnings to average equity	0.311	0.215***	0.115***
			(0.35)	(0.00)	(0.00)
Risk Management	TDAR	Total derivatives to total assets	0.114	0.374	0.199***
			(0.28)	(0.11)	(0.00)
Size/Reputation	LASSET	Natural log of total assets	-0.231	0.111	0.676
			(0.19)	(0.18)	(0.22)
N			355	148	267
Wald test			16203.0 (0.00)	30124.0 (0.00)	16487.0(0.00)

*represents p-values significant at 10% level, ** represent p-values significant at 5% level and *** represent p-values significant at 1% level.

Source: author generated

From the analysis of the results, there is some evidence, though not overwhelming, that selling credit derivatives is correlated with and affects bank portfolio performance. Therefore, we can reject the hypotheses that selling protection is correlated with the risk-adjusted return of bank portfolios and therefore affects bank portfolio performance.

8.5.2 Testing hypothesis 2

The equation in hypothesis 1 is similar to Hypotheses 2 but we do away with CDAR and LASSET and introduce ITDR_DUM, AGLTLN and ROA to the equation.

Hypothesis 2 is outlined below.

H_{02}: There is a definite correlation between buying of credit derivatives (bank is beneficiary) and bank portfolio performance (Risk adjusted return on assets).

H_{a2}: There is an indefinite correlation between buying credit derivatives (bank is beneficiary) and bank portfolio performance (Risk adjusted return on assets).

The null hypothesis is the definite correlation between buying credit derivatives and the risk adjusted return on bank portfolio performance. The alternate hypothesis is the indefinite correlation between buying credit derivatives and the risk adjusted return on bank portfolio performance.

The model for testing hypotheses 2 is stated below:

$$\begin{aligned} RAR_{it} = {} & \alpha + S_1 RAR_{i(t-1)} + S_2 RORO_{it} + S_3 CCLGR_{it} + S_4 NCLTASST_{it} + S_5 TEQT1AC_{it} + \\ & S_6 RWATLS_{it} + S_7 SUBTT1C_{it} + S_8 ITDR\_DUM_{it} + S_9 NLLDS_{it} + S_{10} MBSTAS_{it} + \\ & S_{11} ABSTATS_{it} + S_{12} LSRETLNS_{it} + S_{13} AGLTLN_{it} + S_{14} FFR_{it} + S_{15} ROA_{it} + \\ & S_{16} ERT_{it} + S_{17} NOPIAS_{it} + S_{18} REAEY_{it} + S_{19} TDAR_{it} + \mu_{it} \end{aligned} \qquad 8.2$$

The dynamic panel data Generalised Method of Moments (GMM) estimation results for the credit derivatives buyers is detailed below in Table 8.19 for the pre-crisis, crisis period and post-crisis period. The result for the lagged risk adjusted rate of return (RAR-1) pre-crisis is insignificant though it has a positive impact. This becomes significant at the 10% level during the financial crisis with a very low coefficient. It loses its significance during the post crisis period albeit with a positive sign. The results from the risk management variable (TDAR), is statistically insignificant pre crisis with a negative sign. This becomes significant during the crisis period (1% level) with a very low impact. It loses its significance post crisis though with a positive magnitude suggesting that banks bought credit derivatives for risk management purposes during the credit crisis while it was used for speculative purposes before the crisis; it also confirms the continued speculation after the crisis.

Another interesting result from the profitability variables explains the high volatility in earnings for the period under consideration for bank portfolios. For example, the return on assets (ROA) has a significant and positive impact on bank portfolio performance as it is significant at the 1% level with a coefficient of 0.162 in all periods sign posting the effect of low interest rates. The net operating income (NOPIAS) is insignificant pre crisis albeit with a negative sign. It becomes significant during the crisis period at the 1% level with a very low magnitude of 0.002. It hangs on to its significance during the post crisis period at the 5% level with the same positive impact. Likewise, the retained earnings to average equity variable (REAEY) is not significant before the crisis. However, it becomes significant (1% level) during the crisis period with a very low negative scale. It retains its significance post crisis at the 10% level with a very low positive magnitude suggesting that users of credit derivatives have modest retained earnings to average equity volatility. Curiously though, the efficiency ratio variable (ERT) is insignificant in all periods.

The results from the liquidity variables give additional support to the tentative conclusion that the variable (ABSTATS) has a significant but negative impact on bank portfolio performance as it is significant at the 1% level with a coefficient of -0.264. However, it loses its significance during and after the crisis period. The net loans and leases to deposits variable (NLLDS) is significant at the 5% level with a very low coefficient. It loses its significance during the crisis and during the post crisis period. The mortgage backed securities to total loans variable (MBSTAS) is not statistically significant pre crisis. It regains its significance (10% level) with a scale of -0.023 during the crisis but loses its significance during the post crisis period with a negative sign.

In terms of credit management and derivatives, the subordinated debt to Tier 1 risk adjusted capital variable (SUBTT1C) becomes significant at the 1% level with a negative coefficient at the -0.759 level. It loses its significance during the crisis and post crisis period with a magnitude of 0.182 and -0.093 respectively. With regard to the capitalisation measures, total equity capital to Tier 1 risk adjusted capital (TEQT1AC) is not significant during the three phases. However, risk weighted assets ratio (RWATLS) becomes significant at the 1% level, albeit with a small magnitude during the pre-crisis which it lost all the while the crisis period lasted but regains during the post crisis period at the 1% level with a positive but relatively low coefficient. The non-performing loans to total assets (NCLTASST) reflecting asset quality is not significant during the pre-crisis phase and the duration of the crisis. It becomes significant at the 5% level with a coefficient of -0.207 at the time of the post crisis phase.

We move to the results of the leverage variables. The operational leverage (CCLGR) is significant at the 5% level with a low positive magnitude before the crisis suggesting that banks with high operational leverage use credit derivatives. The significance falls away at the full length of the crisis and post crisis period with a negative sign. On the other hand, the financial leverage variable (RORO) is significant at the full length before the crisis phase though with a very low positive coefficient. The significance gave way throughout the time of the crisis period with a negative sign. It regains its significance (1% level) at the time of the post crisis phase with a coefficient of -0.057. All the other variables (ITDR_DUM, LSRETLNS, AGLTLN and FFR,) retain their insignificance across the three periods.

Table 8.19: Dynamic Panel Data Generalised Method of Moments (GMM) Estimation for Credit Derivatives Buyers (2002 To 2011)

Description Dependent Variable	Acronym RAR	Explanatory Variables Risk adjusted return	Pre-crisis Co-ef p-value	Crisis Co-ef p-value	Post-crisis Co-ef p-value
Constant	Const	Constant	-0.010 (0.74)	-0.001 (0.83)	0.014 (0.27)
Lagged Dependent Variable	RAR (-1)	Lagged Risk adjusted return	0.000 (0.32)	0.000* (0.10)	0.000 (0.90)
	RORO	ROE/ROA (Financial Leverage)	0.000*** (0.00)	-0.000 (0.13)	-0.057*** (0.00)
Leverage	CCLGR	Core capital ratio (Operational Leverage)	0.000** (0.05)	-0.187 (0.37)	-0.000 (0.17)
Asset quality	NCLTASST	Non-performing loans/total assets	-0.321 (0.54)	0.045 (0.39)	-0.207** (0.03)
	TEQT1AC	Total equity capital /Tier 1 risk adj capital	-0.000 (0.96)	0.001 (0.40)	-0.002 (0.68)
Capitalisation	RWATLS	Risk weighted assets ratio	0.019*** (0.00)	-0.000 (0.65)	0.000*** (0.01)
CR mgt and derivatives	SUBTT1C	Subordinated debt to Tier 1 risk adj cap	-0.759*** (0.00)	0.182 (0.12)	-0.093 (0.21)
Interest rate risk	ITDR_DUM	Dummy/use of interest rate derivatives	0.019 (0.35)	0.004 (0.21)	
	NLLDS	Net loans and leases to deposits	0.000** (0.03)	-0.008 (0.82)	0.051 (0.56)
	MBSTAS	Mortgage-backed securities/Total assets	-0.000 (0.99)	-0.023* (0.10)	-0.002 (0.85)
Liquidity	ABSTATS	Asset backed securities/Total assets	-0.264*** (0.00)	-0.005 (0.77)	0.007 (0.89)
	LSRETLNS	Loans secured by real estate to total loans	0.002 (0.83)	-0.011 (0.23)	-0.004 (0.73)
Loan portfolio	AGLTLN	Agricultural loans/total loans	0.000 (0.11)	0.005 (0.31)	0.006 (0.2)

Table 8.19: Cont'd

Description	Acronym	Explanatory Variables	Pre-crisis	Crisis	Post-crisis
Dependent Variable	**RAR**	**Risk adjusted return**	**Co-ef**	**Co-ef**	**Co-ef**
			p-value	**p-value**	**p-value**
Macroeconomics context	FFR	Federal funds rate	-0.001	0.000	0.010
			(0.39)	(0.50)	(0.12)
			0.612***	0.612***	0.612***
	ROA	Return on assets	(0.00)	(0.00)	(0.00)
			-0.000	0.000	-0.006
	ERT	Efficiency ratio	(0.71)	(0.45)	(0.15)
			-0.016	0.002***	0.002**
	NOPIAS	Net operating income to assets	(0.21)	(0.00)	(0.06)
			-0.000	-0.000***	0.000*
Profitability	REAEY	Retained earnings to average equity	(0.19)	(0.00)	(0.10)
			-0.000	-0.000***	0.000
Risk Management	TDAR	Total derivatives to total assets	(0.63)	(0.01)	(0.34)
N			421	166	225
Wald test			825.00(0.00)	855.00(0.00)	113.00(0.00)

*represents p-values significant at 10% level, ** represent p-values significant at 5% level and *** represent p-values significant at 1% level.

Source: author generated

From the analysis of the model, there is some evidence that buying credit derivatives is correlated with and affects bank portfolio performance though not overwhelming. Therefore we cannot reject the hypotheses that buying protection is correlated with the risk-adjusted return of bank portfolios and therefore affects bank portfolio performance.

8.5.3 Testing hypothesis 3

The third hypothesis is outlined below. It tests the effects and relationship of credit derivatives on the average absolute deviation of bank portfolio performance.

H_{03}: The relationship between net credit derivatives outstanding and the average absolute deviation of bank portfolio performance (p) does not differ before start of the credit crisis in 2007 and after the credit crisis of 2007.

H_{a3}: The relationship between net credit derivatives outstanding and the average absolute deviation of bank portfolio performance (p) look well positional after the credit crisis in 2007 than before the credit crisis in 2007.

The null hypothesis is the relationship between net credit derivatives outstanding and the average absolute deviation of bank portfolio performance before start of the credit crisis in 2007 and after the credit crisis of 2007.The alternate hypothesis is the relationship between net credit derivatives outstanding and the average absolute deviation of bank portfolio performance look well positional after the credit crisis in 2007 than before the credit crisis in 2007.

The equation for testing hypotheses 3 is stated below:

$$\begin{aligned} Di_{it} = {} & \alpha + S_1 Di_{i(t-1)} + S_2 CCLGR_{it} + S_3 NCLTASST_{it} + S_4 TEQT1AC_{it} + S_5 RWATLS_{it} + \\ & S_6 SUBTT1C_{it} + S_7 NLLDS_{it} + S_8 TLTAS_{it} + S_9 CDAR_{it} + S_{10} MBSTAS_{it} + \\ & S_{11} ABSTATS_{it} + S_{12} LSRETLNS_{it} + S_{13} AGLTLN_{it} + S_{14} FFR_{it} + S_{15} ERT_{it} + \\ & S_{16} NOPIAS_{it} + S_{17} REAEY_{it} + S_{18} PROA_{it} + S_{19} TDAR_{it} + S_{20} LASSET_{it} + \mu_{it} \end{aligned} \qquad 8.3$$

The Arellano-Bond dynamic panel data Generalised Method of Moments (GMM) estimation results for the effects and relationship of credit derivatives on the average absolute deviation of bank portfolio performance is detailed below in Table 8.20 for the pre-crisis, crisis period and post-crisis period. The result for the lagged average absolute deviation D*i* (-1) pre-crisis is statistically significant (1% level) with a coefficient of -0.016. This becomes insignificant during the financial crisis with a very low coefficient and a negative sign. Further, it retains its insignificance during the post crisis period albeit with a positive sign. We move to the results of the capitalisation measures. The total equity capital to Tier 1 risk adjusted capital (TEQT1AC) is significant at the 5% level with a very low magnitude. Its significance wears out at the full length of the crisis and the post crisis phases with a negative sign. On the other hand, the risk weighted assets ratio (RWATLS) is insignificant all through the three phases. With regard to credit management and derivatives, SUBBT1C is significant (10% level) with a low magnitude before the crisis. It loses its significance subsequently all the while through the crisis and post crisis phase with a negative sign.

In terms of liquidity, total loan to total assets (TLTAS) variable is insignificant prior to the financial crisis though it has a positive sign. It shifts to 1% significance level in the midst of the crisis period with a magnitude of 0.005. It becomes insignificant in the whole time of the post crisis with a negative sign. Total credit derivative to assets ratio (CDAR) is insignificant before the crisis though it has positive sign suggesting that there is no evidence that purchasing credit derivatives affect the volatility of bank portfolio returns for the periods. It retains its insignificance during the crisis and after the crisis with a negative sign suggesting that when there is a financial crisis or economic recession, banks are more likely to experience swings in their return on assets than where there is economic prosperity.

We progress to the results of the loan portfolio. The agricultural loan to total loans (AGLTLN) is statistically significant at the 1% level with a very low magnitude. It loses its significance during and after the crisis period.The total derivatives to total assets (TDAR) reflecting risk management is not significant at the full length of the period under review although with a positive sign suggesting that banks with derivatives activities as a tool for risk management are not likely to have wild swings in the volatility of their return on assets.

Table 8.20: The Arellano-Bond Dynamic Panel Data Generalised Method of Moments (GMM) Estimation for Net Protection Buyers (2002 To 2011)

Description Dependent Variable	Acronym Di	Explanatory Variables Average absolute deviation	Pre-crisis Co-ef p-value	Crisis Co-ef p-value	Post-crisis Co-ef p-value
Constant	Const	Constant	-0.000 (0.79)	-0.014 (0.19)	0.000 (0.95)
Lagged Dependent Variable	Di (-1)	Lagged Average absolute deviation	-0.016*** (0.00)	-0.000 (0.99)	0.003 (0.85)
Leverage	CCLGR	Core capital ratio (Operational Leverage)	0.000 (0.27)	0.000 (0.13)	0.001 (0.91)
Asset quality	NCLTASST	Non-performing loans/total assets	-0.000 (0.92)	0.005 (0.27)	-0.000 (0.72)
Capitalisation	TEQT1AC	Total equity capital /Tier 1 risk adj capital	-0.000** (0.02)	-0.000 (0.31)	-0.000 (0.67)
	RWATLS	Risk weighted assets ratio (Panel C&D)	-0.004 (0.99)	-0.000 (0.80)	0.000 (0.93)
CR mgt and derivatives	SUBTT1C	Subordinated debt to Tier 1 risk adj cap	-0.001* (0.10)	-.000 (0.99)	-0.002 (0.85)
	NLLDS	Net loans and leases to deposits	0.006 (0.78)	-0.000 (0.84)	0.002 (0.99)
	TLTAS	Total loans/total assets	0.000 (0.52)	0.005*** (0.00)	-0.000 (0.32)
Liquidity	CDAR	Total credit derivatives to assets ratio	0.000 (0.97)	-0.000 (0.91)	-0.000 (0.91)
	MBSTAS	Mortgage-backed securities/Total assets	-0.002 (0.74)	0.001 (0.62)	0.000 (0.82)
	ABSTATS	Asset backed securities/Total assets	-0.003 (0.98)	0.000 (0.96)	-0.001 (0.72)
Loan portfolio	LSRETLNS	Loans secured by real estate loans to total loans	-0.000 (0.54)	0.003 (0.24)	-0.000 (0.55)
	AGLTLN	Agricultural loans/total loans	0.000*** (0.00)	-0.000 (0.97)	0.001 (0.45)
Macroeconomics context	FFR	Federal funds rate	0.004 (0.29)	0.000 (0.16)	0.000 (0.59)
Profitability	ERT	Efficiency ratio	-0.000 (0.66)	0.007 (0.89)	-0.000 (0.91)

Table 8.20: Cont'd

Description	Acronym	Explanatory Variables	Pre-crisis	Crisis	Post-crisis
Dependent Variable	**Di**	**Average absolute deviation**	**Co-ef**	**Co-ef**	**Co-ef**
			p-value	**p-value**	**p-value**
	NOPIAS	Net operating income to assets	0.001 (0.90)	0.000 (0.77)	0.002 (0.95)
	REAEY	Retained earnings to average equity	0.000 (0.99)	-0.000 (0.73)	0.008 (0.95)
	PROA	Pre-tax return on assets	-0.001 (0.80)	-0.000 (0.46)	0.006 (0.86)
Risk Management	TDAR	Total derivatives to total assets	0.002 (0.91)	0.001 (0.96)	0.000 (0.98)
Size/Reputation	LASSET	Natural log of total assets	0.000 (0.77)	0.000 (0.46)	0.000 (0.86)
N			23522	6603	10460
Wald test			118.29(0.00)	18.64(0.54)	3.33(1.00)

*represents p-values significant at 10% level, ** represent p-values significant at 5% level and *** represent p-values significant at 1% level.

Source: author generated.

The result of the model suggests that banks were more inclined to use credit derivatives to speculate rather than to hedge their portfolio risk exposure before and after the crisis. Thus the evidence that the relationship of credit derivatives outstanding and bank portfolio performance differs before 2007 and after 2007 is not overwhelming and on that basis we cannot reject null hypothesis.

8.5.4 Testing hypothesis 4

Hypothesis 4 as outlined below tests the constructive effects of credit derivatives on bank portfolio returns on asset.

H_{o4}: There is a constructive correlation between selling credit derivatives (bank is guarantor) and the return on asset (ROA) of bank portfolio.

H_{a4}: There is no constructive correlation between selling credit derivatives (bank is guarantor) and the return on asset (ROA) of bank portfolio.

The null hypothesis is that there is a constructive correlation between selling credit derivatives and bank portfolio returns. The alternate hypothesis that there is no constructive correlation between selling credit derivatives and the return on asset of the bank portfolio.

The equation for testing hypotheses 4 is stated below:

$$\begin{aligned} ROA_{it} = \alpha &+ S_1 ROA_{i(t-1)} + S_2 RORO_{it} + S_3 CCLGR_{it} + S_4 NCLTASST_{it} + S_5 TDTA_{it} + \\ &S_6 VLTL_{it} + S_7 RWATLS_{it} + S_8 CDAR_{it} + S_9 MBSTAS_{it} + S_{10} ABSTATS_{it} + \\ &S_{11} STASST_{it} + S_{12} LSRETLNS_{it} + S_{13} RESLTL_{it} + S_{14} AGLTLN_{it} + S_{15} CILEAST_{it} + \\ &S_{16} FFR_{it} + S_{17} NOPIAS_{it} + S_{18} PROA_{it} + S_{19} ECNCS_{it} + S_{20} TDAR_{it} + S_{21} LASSET_{it} + \mu_{it} \end{aligned} \quad 8.4$$

The Arellano-Bond dynamic panel data Generalised Method of Moments (GMM) estimation results for the constructive correlation between selling credit derivatives (when the bank is guarantor) and the return on asset (ROA) of bank portfolio is detailed below in Table 8.21 for the pre-crisis, crisis period and post-crisis period. The result for the lagged return on assets (ROA (-1)) pre-crisis is insignificant with a very low scale. The insignificance continues during the crisis phase though with a negative sign. This becomes statistically significant in the whole time of the post crisis phase with a magnitude of -0.015.

We proceed to the results of the leverage variables. The financial leverage variable (RORO) is not significant throughout the pre crisis and crisis period though it has a positive and negative sign respectively. It becomes significant throughout the time of the post crisis period at the 1% level with an impact of -0.001. Conversely, the operational leverage variable (CCLGR) is significant (1% level) with a very low positive magnitude throughout the pre-crisis period. It retains its significance albeit at the 10% level with a coefficient of -0.005. However, it loses its significance at the time of the post crisis although with a negative sign. The results suggest that many active banks in the market had high operational leverage before the crisis which the regulators did not detect early enough. The non-performing loans to total assets (NCLTASST) reflecting the asset quality is insignificant at the pre crisis level with a positive sign. It becomes significant at the 1% level with a scale of 0.799 during the crisis period but looses its significance completely during the post crisis phase suggesting that an early warning signal was building up which many protection sellers failed to pick up early enough before the credit crisis period.

For the capitalisation measures, total deposits to total assets (TDTA) is statistically significant at the 1% level with a coefficient of -0.226 in the course of the pre crisis phase but looses its significance during and after the crisis although with a positive sign suggesting that there was a deposit run on banks during the early quarters of the credit meltdown which was nipped in the bud by numerous government interventions. In terms of liquidity, the mortgage-backed securities to total assets (MBSTAS) is significant at the 5% level with a magnitude of 0.246.It loses its significance during the crisis and after the crisis with negative signs respectively. The same scenario goes for the asset backed securities to total assets (ABSTATS) variable. It is positive significant with a scale of 0.551 pre-crisis. The significance gives way throughout the duration of the crisis and post crisis with a coefficient of -0.338 and -0.950 respectively.

With regard to the loan portfolio variables, the restructured loan to total loans (RESLTL) is significant (1% level) before the crisis with a magnitude of -0.365.The significance is dispossessed in the course of the crisis and post crisis phases (with coefficients of -0.210 and -0.865). In the same vein, agricultural loans to total loans (AGLTLN) is positive significant at the 1% level before the crisis with a very low coefficient. The significance falls away in the whole time of the crisis and post crisis phases though with a negative sign.We progress to the profitability measures. The net operating income to assets (NOPIAS) variable though, is significant at the 1% level at the pre-crisis phase, it has a relatively strong positive impact of 0.637 as in all the other periods (coefficients of 0.764 and 0.619). The pre-tax return on assets (PROA) have a significantly (1% level) positive impact with almost the same magnitude as in the crisis and post crisis period. The results show that the federal funds rate (FFR) reflecting the macroeconomic context is significant at 5% level with a magnitude of -0.009 at the pre-crisis period. Further, the significance pales away during and after the crisis though with a positive magnitude. Juxtaposed against the lagged ROA, net operating income to assets (NOPIAS) and Pre-tax return on assets (PROA), this confirms that there is a clear relationship between bank profitability and the interest rate regime.

The earnings coverage of net charge offs (ECNCS) becomes insignificant at the pre-crisis and crisis period although its coefficient retains its positive and negative sign respectively. It becomes significant at the 1% level with a very low coefficient of 0.004 in the whole time of the post crisis period which meant banks had to make more of their earnings available to cover provisions and write off bad debts, over rated securities and downgraded bonds. This confirms that debt defaults is strongly correlated during a credit meltdown in which sellers of credit derivatives would record more volatility in their returns on investments while banks who bought protection by hedging credit risk with credit derivatives would also suffer wild volatility in their returns on investments due to asset write-down. This further explains why the commercial and industrial loan to earning assets (CILEAST) variable reflecting credit risks becomes significant at the 10% level with a magnitude of -0.098. The significance falls away in the duration of the crisis and post crisis phases. There was massive downgrade of assets from the books of derivatives sellers which affected their returns on asset.

The total derivative to total assets (TDAR) variable reflecting risk management is significant at the 1% level with a coefficient of 0.005 before the crisis. It becomes insignificant in the succeeding periods although its coefficient retains its positive sign suggesting that sellers of protection were more concerned in using the instruments to hedge their risks. The coefficients of the natural log of total assets (LASSET) which mirrors bank size are negative and positive respectively but none of them is significant before and during the crisis. It becomes significant at the 1% level with a degree of 0.228 at the time of the post crisis period. When juxtaposed against the profitability variables, sellers pursued the twin objective of asset growth and profitability after the crisis while their objective was largely on profitability before the crisis. All the other variables (VLTL, RWATLS, CDAR, STASST and LSRETLNS) retain their insignificance across the three periods.

From our analysis, we can reject the null hypotheses that selling credit hypotheses does affect return of assets and portfolio performance. The results show that where the information asymmetry between sellers and buyers of credit protection holds, banks with positions as sellers of protection will buy securities that are well priced and in some cases overpriced. However, where moral hazard holds in a market, the probability of default of the underlying exposure by bank customers will trigger a ratings downgrade that would affect pricing of the credit derivatives and subsequently the returns on the portfolio of the sellers.

Table 8.21: The Arellano-Bond Dynamic Panel Data Generalised Method of Moments (GMM) Estimation for Net Protection Sellers (2002 To 2011)

Description	Acronym	Explanatory Variables	Pre-crisis	Crisis	Post-crisis
Dependent Variable	**ROA**	**Return on assets**	**Co-ef**	**Co-ef**	**Co-ef**
			p-value	**p-value**	**p-value**
Constant	Const	Constant	0.739	-1.673	-4.058***
			(0.11)	(0.52)	(0.00)
Lagged Dependent Variable	ROA (-1)	Lagged Return on assets	0.000	-0.002	-0.015**
			(0.99)	(0.84)	(0.07)
Leverage	RORO	ROE/ROA (Financial Leverage)	0.000	-0.000	-0.001***
			(0.92)	(0.13)	(0.00)
	CCLGR	Core capital ratio (Operational Leverage)	0.001***	-0.035*	-0.012
			(0.00)	(0.09)	(0.43)
Asset quality	NCLTASST	Non-performing loans/total assets	0.151	0.799***	-0.078
			(0.15)	(0.01)	(0.96)
Capitalisation	TDTA	Total deposits/total asset	-0.226***	0.030	0.049
			(0.00)	(0.92)	(0.79)
	VLTL	Volatile liability to total liability	0.063	0.296	0.271
			(0.49)	(0.39)	(0.17)
	RWATLS	Risk weighted assets ratio	0.021	-0.064	0.004
			(0.63)	(0.60)	(0.45)
Liquidity	CDAR	Total credit derivatives to asset ratio	-0.016	-0.043	0.051
			(0.17)	(0.50)	(0.20)
	MBSTAS	Mortgage-backed securities/Total assets	0.246**	-0.639	-0.571
			(0.02)	(0.39)	(0.18)
	ABSTATS	Asset backed securities/Total assets	0.551**	-0.338	-0.950
			(0.06)	(0.80)	(0.68)
Market risk	STASST	Stocks to total stocks	0.000	0.000	0.002
			(0.23)	(0.13)	(0.13)
Loan portfolio	LSRETLNS	Loans secured by real estate to total loans	0.0272	-0.150	0.066
			(0.20)	(0.81)	(0.82)
	RESLTL	Restructured loans to total loans	-0.365***	-0.210	-0.865
			(0.00)	(0.80)	(0.75)
	AGLTLN	Agricultural loan/total loan	0.000***	-0.000	-0.000
			(0.00)	(0.45)	(0.22)
Credit risk	CILEAST	C&I loans/earning assets	-0.098*	0.299	0.353
			(0.09)	(0.68)	(0.53)

Table 8.21: Cont'd

Description Dependent Variable	Acronym ROA	Explanatory Variables Return on assets	Pre-crisis Co-ef p-value	Crisis Co-ef p-value	Post-crisis Co-ef p-value
Macroeconomics context	FFR	Federal funds rate	-0.009**	0.014	0.040
			(0.03)	(0.35)	(0.80)
	NOPIAS	Net operating income to assets	0 .637***	0.764***	0.619***
			(0.00)	(0.00)	(0.00)
Profitability	PROA	Pre-tax return on assets	0.238***	0.205***	0.273***
			(0.00)	(0.00)	(0.00)
	ECNCS	Earnings coverage of net charge-offs	0.005	-0.001	0.004***
			(0.70)	(0.35)	(0.00)
Risk Management	TDAR	Total derivatives to total assets	0.005***	0.003	0.000
			(0.00)	(0.46)	(0.95)
Size/Reputation	LASSET	Natural log of total assets	-0.039	0.108	0.228***
			(0.12)	(0.44)	(0.00)
N			355	148	267
Wald test			22133.79(0.00)	29169.55(0.00)	21200.61(0.00)

*represents p-values significant at 10% level, ** represent p-values significant at 5% level and *** represent p-values significant at 1% level.

Source: author generated

8.5.5 Testing hypothesis 5

As outlined below, hypothesis 5 tests the constructive effects of purchasing credit derivatives on bank portfolio returns on asset.

H_{05}: There is an effective correlation between purchasing of credit derivatives (bank is beneficiary) and the return on asset (ROA) of bank portfolio.

H_{a5}: There is an ineffective correlation between purchasing of credit derivatives (bank is beneficiary) and the return on asset (ROA) of bank portfolio.

The null hypothesis is that there is an ineffective correlation between purchasing credit derivatives and bank portfolio returns. The alternate hypothesis that there is an ineffective correlation between purchasing credit derivatives and the return on asset of the bank portfolio.

The equation for testing hypotheses 5 is stated below:

$$\begin{aligned} ROA_{it} = \alpha + S_1 ROA_{i(t-1)} + S_2 RWATLS_{it} + S_3 VLTL_{it} + S_4 LSTTS_{it} + S_5 CDAR_{it} + \\ S_6 MBSTAS_{it} + S_7 ABSTATS_{it} + S_8 IBTLTLS_{it} + S_9 LSRETLNS_{it} + S_{10} STASST_{it} + \\ S_{11} FFR_{it} + S_{12} ERT_{it} + S_{13} NOPIAS_{it} + S_{14} REAEY_{it} + S_{15} PROA_{it} + S_{16} ECNCS_{it} + \\ S_{17} TDAR_{it} + \mu_{it} \end{aligned} \quad 8.5$$

The Arellano-Bond dynamic panel data Generalised Method of Moments (GMM) estimation results for effective correlation between purchasing of credit derivatives (bank is beneficiary) and the return on asset (ROA) of bank portfolio is detailed below in Table 8.22 for the pre-crisis, crisis period and post-crisis period. The result for the lagged return on assets (ROA (-1)) before the crisis is significant (1% level) with a coefficient of 0.013. It retains its significance during the crisis and post crisis period with a magnitude of -0.0826 and 0.025 respectively. In terms of capitalisation, the risk weighted asset ratio (RWATLS) is negative insignificant before the crisis phase. It becomes significant during the crisis at the 1% level with a magnitude of 0.084.It loses its significance post crisis with a very low coefficient. The volatile liability to total liability (VLTL) variable is statistically significant (1% level) with an impact of 0.116 pre-crisis but loses its significance at the time of the crisis period. It regains its significance at the same scale with an impact of 0.229 post crisis. The variables controlling the activities of credit derivatives were mixed. Loan sale to total assets (LSTTS) is significant (1% level) pre crisis with a scale of -0.643. It loses its significance during and after the crisis with a negative sign.

The total credit derivative to asset ratio (CDAR) is statistically insignificant pre crisis with a positive but very low magnitude. It remained insignificant during and after the crisis with a scale of -0.180 and 0.047 respectively. The mortgage-backed securities to total assets (MBSTAS) is insignificant pre crisis and during the crisis. It becomes significant (1% level) post crisis with a magnitude of -0.523.In the same vein, asset backed securities to total assets (ABSTATS) is insignificant before and during the crisis. However, it is significant (5% level) with a scale of -0.113 post crisis.

With regard to the bank's loan portfolio, interbank loan to total loans (IBTLTLS) has a magnitude of -0.200 and significant at the 1% level. Much higher is the impact during the crisis period which is also significant at the 1% level but loses its significance post crisis with a negative sign suggesting that protection buyers were very active in the money market to finance their operations. The result of the loans secured by real estate to total loans

(LSRETLNS) is significant at the 1% level with a coefficient of 0.197 pre crisis. It retains its significance through the duration of the crisis with a relatively strong impact of 0.828.The significance is sustained post crisis with a coefficient of -0.329.The coefficient of federal funds rate variable (FFR) which mirrors the macro economic context is -0.011 and -0.013 before and during the crisis with 1% significance levels suggesting that the low interest rate regime encouraged speculation with the instruments while the very low interest rate was needed to help the recession. It sustains the significance post crisis with a magnitude of 0.230.

Looking at the profitability variables, although (NOPIAS) is significant at the 1% level it has a relatively strong positive impact on protection buying as in all the periods under consideration. The pre-tax return on assets (PROA) is also significant in all periods with coefficients of 0.268, 0.556 and 0.400 respectively. On the other hand, the retained earnings to average equity (REAEY) variable is significant pre and during the crisis with very low coefficients. It maintains its significance post crisis though at 10% level with a low magnitude as with other periods. The efficiency ratio variable (ERT) is insignificant pre crisis with a negative sign. It becomes significant through the duration of the crisis at 1% significance level with a low magnitude. It loses its significance post crisis with a positive sign. In terms of risk management, total derivatives to total assets (TDAR) is significant at 1% level with a magnitude of 0.031 pre-crisis but loses its significance during and after the crisis though with a positive sign.

The findings we gleaned from the analysis suggest that we can reject the null hypotheses that purchasing credit derivatives does have an effective correlation on return of assets and portfolio performance.

Table 8.22: The Arellano-Bond Dynamic Panel Data Generalised Method of Moments (GMM) Estimators in Stata Summarises the Results from the Protection Buyers

Description	**Acronym**	**Explanatory Variables**	**Pre-crisis**	**Crisis**	**Post-crisis**
Dependent Variable	**ROA**	**Return on assets**	**Co-ef**	**Co-ef**	**Co-ef**
			p-value	**p-value**	**p-value**
Constant	Const	Constant	-0.139***	-0.717***	0.184**
			(0.00)	(0.00)	(0.02)
Lagged Dependent Variable	ROA (-1)	Lagged Return on assets	0.013***	-0.0826***	0.025***
			(0.00)	(0.00)	(0.00)
Capitalisation	RWATLS	Risk weighted assets ratio	-0.000	0.0849***	0.000
			(0.61)	(0.00)	(0.41)
	VLTL	Volatile liability to total liability	0.116***	-0.013	0.229***
			(0.00)	(0.90)	(0.00)
CR mgt and derivatives	LSTTS	Loan sales to total assets	-0.643***	-0.115	-0.051
			(0.00)	(0.65)	(0.74)
Liquidity	CDAR	Total credit derivatives to asset ratio	0.001	-0.180	0.047
			(0.21)	(0.23)	(0.45)
	MBSTAS	Mortgage-backed securities/Total assets	0.001	-0.313	-0.523***
			(0.78)	(0.12)	(0.00)
	ABSTATS	Asset backed securities/Total assets	-0.041	0.108	-0.113**
			(0.57)	(0.20)	(0.02)
	IBTLTLS	Interbank loans/total loans	-0.200***	0.424***	-0.141
			(0.00)	(0.00)	(0.51)
Loan portfolio	LSRETLNS	Loans secured by real estate loans to total loans	0.197***	0.828***	-0.329***
			(0.00)	(0.00)	(0.00)
Market risk	STASST	Stocks to total stocks	0.000	0.000	-0.000
			(0.64)	(0.97)	(0.24)
Macroeconomics context	FFR	Federal funds rate	-0.011***	-0.013***	0.230***
			(0.00)	(0.01)	(0.00)
Profitability	ERT	Efficiency ratio	-0.000	-0.000***	0.000
			(0.29)	(0.01)	(0.35)
	NOPIAS	Net operating income to assets	0.620***	0.347***	0.558***
			(0.00)	(0.00)	(0.00)
	REAEY	Retained earnings to average equity	0.000***	-0.000***	0.000*
			(0.00)	(0.00)	(0.09)
	PROA	Pre-tax return on assets	0.268***	0.556***	0.400***
			(0.00)	(0.00)	(0.00)

Table 8.22: Cont'd

Description Dependent Variable	Acronym	Explanatory Variables	Pre-crisis	Crisis	Post-crisis
	ROA	Return on assets	Co-ef	Co-ef	Co-ef
			p-value	p-value	p-value
Risk Management	TDAR	Total derivatives to total assets	0.031***	0.002	0.000
			(0.00)	(0.47)	(0.72)
N			23522	6603	10460
Wald test			818875.47(0.00)	155492.32(0.00)	271593.41(0.00)

*represents p-values significant at 10% level, ** represent p-values significant at 5% level and *** represent p-values significant at 1% level.

8.5.6 Testing Hypothesis 6

Hypothesis 6 tests the constructive correlation of bank net charge-offs and credit derivatives outstanding.

H_{o6}: There is zero correlation between bank net charge-off to loans and credit derivatives outstanding.

H_{a6}: There is a constructive correlation between bank net charge-off to loans and credit derivatives outstanding.

The null hypothesis is that there is zero correlation between bank net charge-off to loans and credit derivatives outstanding. The alternate hypothesis is that there is a constructive correlation between bank net charge-off to loans and credit derivatives outstanding.

The equation for testing hypothesis 6 is stated below:

$$\begin{aligned} NCOLS_{it} = {} & \alpha + S_1 NCOLS_{i(t-1)} + S_1 NCOLS_{i(t-2)_{it}} + S_2 RORO_{it} + S_3 CCLGR_{it} + S_4 NCLTASST_{it} + \\ & S_5 TDTA_{it} + S_6 VLTL_{it} + S_7 ITDR\_DUM_{it} + S_8 NLLDS_{it} + S_9 TLTAS_{it} + S_{10} MBSTASit + \\ & S_{11} ABSTATS_{it} + S_{12} STASST_{it} + S_{13} LSRETLNS_{it} + S_{14} AGLTLN_{it} + S_{15} FFR_{it} + S_{16} NOPIAS_{it} + \\ & S_{17} REAEY_{it} + S_{18} PROA_{it} + S_{19} ECNCS_{it} + S_{20} TDAR_{it} + S_{21} LASSET_{it} + \mu_{it} \end{aligned} \tag{8.6}$$

The result for the lagged net charge-off to loans (NCOLS (-1)) is insignificant pre crisis with a negative sign. It becomes significant (1% level) all the while of the crisis and the duration post crisis with a coefficient of 0.439 and 0.249 respectively. The lagged net charge-off to loans (NCOLS (-2)) is insignificant before the crisis with a negative sign as with (NCOLS (-1)) for the same period. It sustains its insignificance for the crisis and post crisis phase with a positive magnitude. As for the leverage measures, the operational leverage variable (CCLGR) has a coefficient of -0.016 and 0.0846 respectively during the pre-crisis and crisis period and significantly (1% level) impact on bank net charge-offs to loans and credit derivatives. It becomes insignificant after the crisis with a magnitude of -0.091.

It is not surprising that the non-performing loan to total loans (NCLTASST) variable becomes significant at the 1% level with a high magnitude of 0.701 before the crisis. It retains its significance at the 1% level with a reduced magnitude (its coefficients are 0.433 and 0.220) during and after the crisis. Curiously, the volatile liability to total liability is insignificant for the whole period under review although it has a positive magnitude. In terms of liquidity, the net loans and leases to deposits (NLLDS) is positive significant (1% level) with a magnitude of 0.005 pre-crisis. It lost its significance throughout the crisis and post crisis with a scale of -0.003 and 0.013 respectively. Total loans to total assets (TLTAS) is significant at 5% level pre crisis but loses its significance with a magnitude of -0.512 and 0.066 respectively during and after the crisis. The MBSTAS and ABSTATS variables do not have any explanatory power as they are both insignificant.

Owing to the structure of banks loan portfolios, loans secured by real estate to total loans (LSRETLNS) has an impact of -0.470 with a significance of 1% pre crisis but loses it during the crisis albeit with a positive sign. It regains its significance post crisis at the 10% level and a scale of 0.203.The agricultural loans to total loans variable (AGLTLN) is significant (5% level) with a very low negative impact before the crisis. However, it loses its significance during and after the crisis with a negative sign. The results from the model show that the federal funds rate (FFR) is significant at 5% level with a magnitude of -0.089.The significance falls away during the crisis with a negative impact. It becomes strong again post crisis with a magnitude of 0.278 at the 1% significant level owing to the generous interest rates regime.

In terms of bank's total assets and size, LASSET is insignificant with a scale of -0.240 pre-crisis. It sustains its insignificance during the crisis with a magnitude of 0.088. It becomes significant (1% level) post crisis with a scale of 0.137. The profitability variables exhibited an interesting mix. The net operating income to assets (NOPIAS) is significant post crisis at the 5% level with an impact of 0.378. It is insignificant pre crisis and during the duration of the crisis though with a negative sign. The retained earnings to average equity

(REAEY) variable pre crisis is insignificant with a very low scale. It remains insignificant during the crisis albeit with a negative sign. It becomes significant post crisis with a magnitude of -0.031 at the 1% significant level. The pre-tax return on assets (PROA) variable is insignificant pre crisis and during the crisis with a scale of 0.053 and 0.025 respectively. It regains its significance (1% level) post crisis with a magnitude of -0.432. As for the earnings coverage of net charge-offs (ECNCS), it is insignificant pre crisis and all the while of the crisis with a positive sign. It becomes significant at the 5% level with a very low magnitude.

The Arellano-Bond dynamic panel data Generalised Method of Moments (GMM) estimation results for the constructive correlation of bank net charge-offs to loans and credit derivatives outstanding is detailed below in Table 8.23 for the pre-crisis, crisis period and post-crisis period.

Table 8.23: The Arellano-Bond Dynamic Panel Data Generalised Method of Moments (GMM) Estimators in Stata Summarises the Results from the Protection Buyers

Description	Acronym	Explanatory Variables	Pre-crisis	Crisis	Post-crisis
Dependent Variable	NCOLS	Net charge-offs to loans	Co-ef	Co-ef	Co-ef
			p-value	p-value	p-value
Constant	Const	Constant	3.393	-1.762	-27.085***
			(0.45)	(0.89)	(0.00)
Lagged Dependent Variable	NCOLS (-1)	Lagged Net charge-offs to loans	-0.073	0.439***	0.249***
			(0.11)	(0.01)	(0.00)
	NCOLS (-2)	Lagged Net charge-offs to loans	-0.022	0.060	0.033
			(0.61)	(0.62)	(0.54)
Leverage	RORO	ROE/ROA (Financial Leverage)	-0.000	-0.000	-0.002
			(0.19)	(0.52)	(0.22)
	CCLGR	Core capital (Operational Leverage)	-0.016***	0.0846***	-0.091
			(0.00)	(0.01)	(0.15)
Asset quality	NCLTASST	Non-performing loans/total assets	0.701***	0.433***	0.220***
			(0.00)	(0.00)	(0.01)
Capitalisation	TDTA	Total deposits/total asset	0.204	-0.681	0.312
			(0.80)	(0.81)	(0.15)
	VLTL	Volatile liability to total liability	0.819	0.705	0.654
			(0.24)	(0.55)	(0.60)
Interest rate risk	ITDR_DUM	Dummy/use of interest rate derivatives	0.359	-0.087	
			(0.33)	(0.84)	
Liquidity	NLLDS	Net loans and leases to deposits	0.005***	-0.003	0.013
			(0.00)	(0.84)	(0.27)
	TLTAS	Total loans/total assets	0.016**	-0.512	0.066
			(0.03)	(0.85)	(0.97)
	MBSTAS	Mortgage-backed securities/Total assets	0.854	-0.166	0.195
			(0.42)	(0.37)	(0.23)
	ABSTATS	Asset backed securities/Total assets	0.140	-0.184	-0.133
			(0.41)	(0.60)	(0.86)
Market risk	STASST	Stocks to total stocks	-0.000	-0.003	0.000
			(0.29)	(0.13)	(0.63)
Loan portfolio	LSRETLNS	Loans secured by real estate to total loans	-0.470***	0.156	0.203*
			(0.00)	(0.50)	(0.09)
	AGLTLN	Agricultural loans/total loans	-0.000**	-0.000	-0.001
			(0.07)	(0.77)	(0.13)

Table 8.23: Cont'd

Description Dependent Variable	Acronym NCOLS	Explanatory Variables Net charge-offs to loans	Pre-crisis Co-ef p-value	Crisis Co-ef p-value	Post-crisis Co-ef p-value
Macroeconomics context	FFR	Federal funds rate	-0.0895**	-0.032	0.278***
			(0.05)	(0.62)	(0.00)
Profitability	NOPIAS	Net operating income to assets	-0.028	-0.012	0.378**
			(0.81)	(0.86)	(0.05)
	REAEY	Retained earnings to average equity	0.000	-0.010	-0.031***
			(0.78)	(0.34)	(0.01)
	PROA	Pre-tax return on assets	0.053	0.025	-0.432***
			(0.47)	(0.81)	(0.00)
	ECNCS	Earnings coverage of net charge-offs	0.001	0.000	-0.001**
			(0.83)	(0.71)	(0.03)
Risk Management	TDAR	Total derivatives to total assets	-0.008	0.027	-0.003
			(0.54)	(0.48)	(0.46)
Size/Reputation	LASSET	Natural log of total assets	-0.240	0.088	0.137***
			(0.35)	(0.90)	(0.00)
N			422	157	280
Wald test			370.03(0.00)	114.27(0.00)	333.96(0.00)

*represents p-values significant at 10% level, ** represent p-values significant at 5% level and *** represent p-values significant at 1% level.

We cannot reject the null hypotheses that there is zero correlation between bank net-charge-offs to loans and credit derivatives outstanding. In other words, there is a correlation between net-charge-offs and credit derivatives outstanding.

Table 8.24: Summary of empirical results (variables)

Description	Variables	Variable description	RAR	RAR	Di	ROA	ROA	NCOLS	Review of literature
	NCOLS(-1), NCOLS(-2)	Lagged Net charge-offs to loans						0.01,0.01	
Dependent Variables	ROA (-1)	Lagged Return on assets				0.07	0.01,0.01,0.01		
	RAR(-1)	Lagged Risk adjusted return (ROA/Di)	0.08,0.02	0.10					
	Di (-1)	Lagged Average absolute deviation			0.01,				
Leverage	RORO	ROE/ROA (Financial)	0.01,0.01,0.01	0.01,0.01		0.01			
	CCLGR	Core capital ratio (Operational)		0.05		0.01,0.09		0.01,0.01	
Asset quality	NCLTASST	Non-performing loans/total assets	0.03	0.03		0.01		0.01,0.01,0.01	
	TEQT1AC	Total equity capital /Tier 1 risk adj capital			0.02				
capitalisation	RWATLS	Risk weighted assets ratio	0.01	0.01,0.01			0.01,		
	TDTA	Total deposits/total asset				0.01			
	VLTL	Volatile liability to total liability					0.01,0.01		
CR management and derivatives	SUBTT1C	Subordinated debt to Tier 1 risk adj cap	0.09	0.01	0.10				
	LSTTS	Loan sales to total assets					0.01		
	CILEAST	C&I loans/earning assets				0.09			
Interest rate risk	ITDR_DUM	Dummy/use of interest rate derivatives		0.01					
	NLLDS	Net loans and leases to deposits	0.01,	0.03				0.01	
	TLTAS	Total loans to total assets			0.01			0.05	
Liquidity	CDAR	Total credit derivatives to assets ratio	0.01,0.01						
	MBSTAS	Mortgage-backed securities/Total assets	0.01	0.10		0.02	0.01		
	ABSTATS	Asset backed securities/Total assets		0.01		0.06	0.02		

Table 8.24: Cont'd

Description	Variables	Variable description	RAR	RAR	Di	ROA	ROA	NCOLS	Review of literature
	LSRETLNS	Loans secured by real estate loans to total loans				0.01	0.01,0.01,0.01	0.01,0.10	
	AGLTLN	Agricultural loans/total loans				0.01		0.05	
Loan portfolio	IBTLTLS	Interbank loans to total loans					0.01,0.01		
	RESLTL	restructured loans to total loans				0.01			
	CDLT	construction and development loans to total loans							
Macroeconomics context	FFR	Federal funds rate	0.01	0.01,0.01,0.01		0.03	0.01,0.01,0.01	0.05,0.01	
Market risk	STASST	Stocks to total asset							
	ERT	Efficiency ratio	0.08	0.01			0.01		
	NOPIAS	Net operating income to assets	0.01,0.01.0.01	0.01,0.06		0.01,0.01,0.01	0.01,0.01,0.01	0.05	
Profitability	REAEY	Retained earnings to average equity	0.01,0.01	0.01,0.10			0.01,0.01,0.09	0.01	
	ECNCS	Earnings coverage of net charge-offs				0.01		0.03	
	ROA	Return on assets		0.01,0.01,0.01					
	PROA	Pre-tax return on assets				0.01,0.01,0.01	0.01,0.01,0.01	0.01,	
Risk Management	TDAR	Total derivatives to total assets	0.01,	0.01		0.01,0.01	0.01	0.01	
Sensitivity analysis	OWN_DUM	Dummy Var(stock=1;non-stock=0)							
Size/Reputation	LASSET	Natural log of total assets				0.01		0.01	

Table 8.25: Summary of empirical results (hypotheses)

Description					Results			
H	**Hypotheses**	**Dependent Variable**	**Independent variables**	**Data Type**	**Estimate**	**sig**	**Decision**	**Conclusion**
H1	There is definite (negative) correlation between dealing in CD and RAR of banks	RAR	RAR(-1),CDAR, MBSTAS,RORO,NOPIAS	Sellers (Guarantor) and non-users	0.027; 0.400	0.02; 0.01	Reject null hypothesis	There is evidence that selling credit derivatives affects bank RAR hence portfolio performance
H2	There is definite (positive) correlation between purchasing CD and RAR of banks	RAR	RAR(-1), ABSTATS,MBSTAS, NOPIAS	Buyers (Beneficiary) and non-users	0.00; 0.002	0.10; 0.01	We cannot Reject null hypothesis	The evidence that buying protection is correlated with bank RAR and therefore bank performance is not overwhelming
H3	The relationship between outstanding CD and performance of bank portfolios(p) does not differ before 2007 and after 2007	Di	Di(-1), ERT,REAEY,NOPIAS	Net protection buyers	-0..016; -0.211	0.01; 0.01	We cannot Reject null hypothesis	The evidence that the relationship of CD outstanding and bank portfolio performance differs before 2007 and after 2007 is not overwhelming

Table 8.25: Cont'd

Description					Results			
H	**Hypotheses**	**Dependent Variable**	**Independent variables**	**Data Type**	**Estimates**	**sig**	**Decision (Accept /Reject)**	**Conclusion**
H4	Dealing in CD does not affect (negative) the return of bank portfolios	ROA	ROA(1),CDAR, NOPIAS,PROA,ECNCS	Sellers (Guarantors)	-0.015; 0.619	0.07; 0.01	Reject null hypothesis	There is evidence that selling credit derivatives affect return of assets and portfolio performance
H5	Purchasing CD does affects (positive) the return of bank portfolios	ROA	ROA(1), CDAR,NOPIAS,PROA, ECNCS	Net protection buyers	-0.082; 0.347	0.01; 0.01	Reject null hypothesis	There is evidence that purchasing credit derivatives does have effective correlation on ROA and portfolio performance
H6	The notional amount of outstanding CD is not correlated to the bank's net charge-offs to loan ratio	NCOLS	NCOLS(1), NCOLS(2), ECNCS, NCLTASST, ABSTATS, MBSTAS	All users	0.439; 0.433	0.01; 0.01	Reject null hypothesis	There is evidence that the notional amount of outstanding CD is correlated to the bank's net charge-offs to loan ratio

8.6 Sensitivity Analysis

$$\begin{aligned} ROA_{it} = {} & \alpha + S_1 ROA_{i(t-1)} + S_2 RORO_{it} + S_3 CCLGR_{it} + S_4 NCLTASST_{it} + S_5 TEQT1AC_{it} + \\ & S_6 TDTA_{it} + S_7 RWATLS_{it} + S_8 VLTL_{it} + S_9 NLLDS_{it} + S_{10} SUBTT1C_{it} + \\ & S_{11} CILEAST_{it} + S_{12} CDAR_{it} + S_{13} MBSTAS_{it} + S_{14} ABSTATS_{it} + S_{15} STASST_{it} + \\ & S_{16} LSRETLNS_{it} + S_{17} AGLTLN_{it} + S_{18} FFR_{it} + S_{19} NOPIAS_{it} + S_{20} REAEY_{it} + \\ & S_{21} ECNCS_{it} + S_{22} TDAR_{it} + S_{23} LASSET_{it} + S_{24} OWN_{DUM\,it} + \mu_{it} \end{aligned} \quad 8.7$$

The result generated by the sensitivity analysis is interesting. The result for the lagged return on assets (ROA (-1)) is insignificant pre crisis with a positive sign. It becomes significant (1% level) at the full length of the crisis period with a magnitude of 0.035.It retains its significance post crisis with a scale of 0.066. The result of stock to non-stock (OWN_DUM) variable reflecting bank ownership is significant at the 5% level pre-crisis. It holds on to its significance at the duration of the crisis at the 1% level with a magnitude of 0.728 but loses its significance post crisis although with a coefficient of 0.027 suggesting that the active and dominant players in the market are publicly owned companies with shares traded on the stock exchange markets compared to privately owned banks.

In terms of leverage, the financial leverage variable (RORO) is significant at the 1% level pre crisis with a negative scale. It retains its significance during the crisis and post crisis with a positive, although very low magnitude. The operational leverage variable (CCLGR) at the time of the pre-crisis is significant at the 1% level with a scale of -0.001.The significance is sustained during the crisis with a coefficient of 0.094. The CCLGR variable remains significant at the 1% level and retains its sign but its magnitude is much reduced in comparison with the crisis period. The non-performing loans to total assets (NCLTASST) reflecting asset quality is significant (1% level) with a scale of -1.938 pre-crisis. It is significant during the crisis with a coefficient of 0.346. Post crisis, it sustains the 1% significant level with a magnitude of -0.043.

In terms of the capitalisation variables, TEQT1AC is insignificant pre-crisis with a negative sign, It becomes significant in the duration of the crisis with a magnitude of 0.263.It retains its magnitude post crisis but its magnitude is reduced to 0.120. The TDTA variable becomes significant at the 1% level with a magnitude of -0.601. It loses its significance during the crisis and afterwards, albeit with a positive sign. The RWATLS variable pre-crisis is insignificant with a scale of -0.005 but becomes significant at the 5% level during the crisis with a magnitude of 0.023.It loses its significance post crisis albeit with a positive sign. The

VLTL variable is not significant before and during the crisis with a negative and positive scale respectively but becomes significant (5% level) post crisis with a magnitude of 0.107.The subordinated debt to Tier 1 risk adjusted capital (SUBTT1C) mirrors credit management and derivatives, it is significant at the 5% level pre-crisis with a magnitude of -0.682.It preserves its significance at a higher level (1%) throughout the duration of the crisis with a magnitude of 0.115. However, it lost its significance post crisis although with a positive sign.

The commercial and industrial loans to earning assets (CILEAST) reflecting credit risks is insignificant pre and during the crisis with a negative sign. It becomes significant at the 5% level with a scale of 0.449. In terms of liquidity, the coefficients of mortgage backed securities to total assets (MBSTAS) are positive and negative before and during the crisis but not significant at any level. However, it becomes significant (1% level) post crisis with a scale of -0.607.The asset backed securities to total assets (ABSTATS) variable pre-crisis is insignificant although with a positive sign. It becomes significant (5% level) at the time of the crisis with a magnitude of -0.268.It maintains the significance (1% level) post crisis with a scale of -0.191.The loans secured by real estate to total loans (LSRETLNS) variable is significant at the 1% level pre-crisis with a coefficient of 0.169. It continued to be significant (5% level) in the duration of the crisis with a magnitude of 0.922 but loses its significance post crisis although with a positive sign. On the other hand, restructured loan to total loans (RESLTL) variable is not significant pre-crisis. It becomes significant at the time of the crisis at the 5% level with a magnitude of 0.211.It hang on to its significance on a lower pedestal (10% level) with a magnitude of -0.618.

Interestingly, the federal funds rate (FFR) is significant (1% level) throughout the duration of the three phases under investigation with a magnitude of -0.022, 0.015 and 0.507 respectively. In terms of profitability, the net operating income to assets (NOPIAS) variable pre-crisis has a coefficient of 0.974 and a significance level of 1%. It maintains its significance at the same level with a magnitude of 0.942 and 0.100 respectively during the crisis and after the crisis period. In the same token, retained earnings to average equity (REAEY) variable is significant at 5% level with a very low impact pre-crisis. It preserves its significance at the 1% level with a very low positive magnitude during the crisis and afterwards. Earnings coverage of net charge-offs (ECNCS) is significant at 1% level with an impact of -0.003 pre-crisis. It loses its significance during and after the crisis with a negative and positive scale respectively. With regard to risk management, total derivatives to total assets (TDAR) is significant (1% level) pre-crisis with a scale of 0.036.It loses its significance during the crisis and post crisis phases with a negative and positive scale respectively.

The coefficient of the LASSET variable is 0.096 and 0.251 respectively before and during the crisis at the 1% level but loses its significance post crisis although on a positive scale suggesting that the credit derivatives market was dominated by large banks with enormous asset base.

Table 8.26: Sensitivity analysis

Description	Acronym	Explanatory Variables	Pre-crisis	Crisis	Post-crisis
Dependent Variable	ROA	Return on assets	Co-ef	Co-ef	Co-ef
			p-value	p-value	p-value
Constant	Const	Constant	-0.739**	-6.455***	-0.924*
			(0.02)	(0.00)	(0.09)
Lagged Dependent Variable	ROA (-1)	Lagged Return on assets	0.002	0.035***	0.066***
			(0.10)	(0.00)	(0.00)
Leverage	RORO	ROE/ROA (Financial Leverage)	-0.000***	0.000***	0.000***
			(0.01)	(0.00)	(0.00)
	CCLGR	Core capital ratio (Operational Leverage)	-0.001***	0.094***	0.004**
			(0.00)	(0.00)	(0.04)
Asset quality	NCLTASST	Non-performing loans/total assets	-1.938***	0.346***	-0.043
			(0.00)	(0.00)	(0.89)
Capitalisation	TEQT1AC	Total equity capital /Tier 1 risk adj capital	-0.000	0.263***	0.120***
			(0.98)	(0.00)	(0.00)
	TDTA	Total deposits/total asset	-0.601***	0.231	0.110
			(0.00)	(0.31)	(0.35)
	RWATLS	Risk weighted assets ratio	-0.005	0.023**	0.002
			(0.89)	(0.04)	(0.81)
	VLTL	Volatile liability to total liability	-0.003	0.210	0.107**
			(0.94)	(0.26)	(0.04)
CR mgt and derivatives	SUBTT1C	Subordinated debt to Tier 1 risk adj cap	-0.682**	0.115***	0.325
			(0.05)	(0.00)	(0.13)
Credit risk	CILEAST	C&I loans/earning assets	-0.003	-0.300	0.449**
			(0.64)	(0.54)	(0.05)
	CDAR	Total credit derivatives to asset ratio	0.000	0.023	-0.011
			(0.80)	(0.91)	(0.88)
Liquidity	MBSTAS	Mortgage-backed securities/Total assets	0.000	-0.208	-0.607***
			(0.90)	(0.48)	(0.00)
	ABSTATS	Asset backed securities/Total assets	0.000	-0.268**	-0.191***
			(0.99)	(0.03)	(0.00)
Market risk	STASST	Stocks to total stocks	0.000	-0.000	-0.000
			(0.91)	(0.44)	(0.40)
Loan portfolio	LSRETLNS	Loans secured by real estate to total loans	0.169***	0.922**	0.210
			(0.00)	(0.02)	(0.173)

Table 8.26: Cont'd

Description	Acronym	Explanatory Variables	Pre-crisis	Crisis	Post-crisis
Dependent Variable	ROA	Return on assets	Co-ef	Co-ef	Co-ef
			p-value	p-value	p-value
Macroeconomics context	AGLTLN	Agricultural loans/total loans	-0.000 (0.53)	-0.000 (0.91)	-0.000 (0.22)
	RESLTL	Restructured loans/total loans	-0.053 (0.44)	0.211** (0.07)	-0.618* (0.10)
	FFR	Federal funds rate	-0.022*** (0.00)	0.015*** (0.07)	0.507*** (0.00)
Profitability	NOPIAS	Net operating income to assets	0.974*** (0.00)	0.942*** (0.00)	0.100*** (0.00)
	REAEY	Retained earnings to average equity	0.000** (0.02)	0.005*** (0.00)	0.000*** (0.00)
	ECNCS	Earnings coverage of net charge-offs	-0.003*** (0.00)	-0.000 (0.79)	0.001 (0.74)
Risk Management	TDAR	Total derivatives to total assets	0.036*** (0.00)	-0.003 (0.59)	0.001 (0.62)
Size/Reputation	LASSET	Natural log of total assets	0.096*** (0.00)	0.251*** (0.00)	0.030 (0.39)
Bank Ownership	OWN_DUM	Stock to non-stock	-0.148** (0.03)	0.728*** (0.00)	0.027 (0.79)
N			23522	6603	10460
Wald test			533454.79(0.00)	68270.14(0.00)	155175.63(0.00)

*represents p-values significant at 10% level, ** represent p-values significant at 5% level and *** represent p-values significant at 1% level.

8.7 Conclusions

In this chapter we have attempted to extend the work of Minton et al. (2009) in order to explain the impact of credit derivatives on portfolio persistence, risk and return by US banks. The work added several factors to the risk, liquidity, profitability, leverage measures etc. On average, the Arellano-Bond dynamic panel data Generalised Method of Moments (GMM) models can explain 70% of the evidence and correlation of the use and transactions in credit derivatives by taking into consideration risk factors like market, interest rate, credit, size/reputation, core capital, asset quality, expenses etc. In contrast, the issue of the impact of these financial instruments on bank portfolio risk and return was not addressed by Minton et al. (2009).

The conclusion of this study is that credit derivatives do affect bank portfolio persistence, risk and return at the time of the pre-crisis, the duration of the crisis and post crisis period, whether in a capacity of a beneficiary or as a guarantor. According to our observation in chapter 1 and our findings in chapter 7, banks claim that, transacting in credit derivatives is for the use of managing and hedging against credit risk in their portfolio but our findings does not support this assertion.

Table 8.27: Derivatives Notional by Type

Details	4Q2007 (%)	4Q2011 (%)	4Q2012 (%)
Interest rates	78.9	81.2	80.2
Foreign exchange rate	10.1	11	12.4
Commodity	0.6	0.7	0.6
Equity	1.5	0.7	0.9
Credit derivatives	8.8	6.4	5.9

Source: OCC

Table 8.27 details the notional amount outstanding by type among US banks. The notional amount is the face value that is used to calculate settlements made on derivative products for example, credit default swaps. The notional amount does not change hands among counterparties; it is not the contract amount at risk in a transaction. It is a fact that the derivatives notional amount outstanding among banks grew very rapidly in the early years of last decade and up to the beginning of the credit crisis, the total percentage of credit derivatives has not exceeded 10% so far. Variation in notional amount are pointers to general volume of business activity among counterparties, they are also pointers to revenue generation and operational risks concentration.

However, based on the ripple effect in the heat of the credit crisis, it is not impossible to lose a sizeable chunk of the notional amount of a derivatives transaction if the bets do not go as planned, especially if the bet is connected to other bets, as this can trigger losses by other counterparties occurring at the same time. Banks in most cases rarely inform investors how much of the notional amount they would forgo when things go wrong

In effect, the notional amount is not an effective and actual reflection of the inherent market and credit risks in these transactions. For example Table 8.28 indicates that the composition and maturities of the underlying reference assets before the credit crisis were up to 75% before their gradual reduction post crisis. In the same vein, the US annual banks trading revenues from derivatives transactions from 2006 to 2012 (Table 8.29) which was first reported in 2007 indicates that banks revenue and losses from credit derivatives impacted significantly on their portfolio even though the notional amount attributable to these securities are less than 10%. For example, the notional amount for credit derivatives in 2010 was 8.8%, and the revenue contributed to the pool was quite significant at 20%. Again the notional amount for credit derivatives in 2011 was 6.4%, and the revenue contributed to the pool was also significant at 20%. Conversely, the notional amount for 2012 was 5.9% but there was a loss of 246% in comparison to what was recorded in 2011. It is on record that many banks made a lot of profit from credit derivatives before the outbreak of the credit crisis.

Going by our objective to investigate the impact of credit derivatives on bank portfolio pre and post the credit crisis, the result of our analysis suggest that credit derivatives impact it directly. Thus we reject hypotheses 4 and 5 as dealing in credit derivatives both as a seller and buyer of credit protection has a bearing on portfolio returns. In the same, we reject hypotheses 6 as there is evidence that the notional amount of outstanding credit derivatives is correlated to the bank's net charge-offs to loan ratio.

Table 8.28: Credit Derivatives Composition by Product Type

Details	4Q2007 (%)	4Q2011 (%)	4Q2012 (%)
Credit default swaps	98.47	96.7	97.1
Total return swaps	1.31	0.6	0.8
Credit options	0.1	1.1	0.9
Others	0.12	1.6	1.2

Source: OCC

Table 8.28 shows the component of credit derivative transactions in which credit default swap accounts for nearly 90% of the contracts.

Table 8.29: US annual banks trading revenues from derivatives transactions 2006 -2012 (USD $' Millions)

Products	2006	2007	2008	2009	2010	2011	2012	Total
Interest Rate	4,618	7,902	866	14,470	6,162	11,285	17,105	62,408
Foreign Exchange	7,953	6,974	11,363	5,595	9,081	5,061	5,267	51,294
Equity	4,952	2,991	(2,017)	1,061	2,051	2,802	2,044	13,884
Commodity & others	1,265	295	1,543	1,460	618	1,434	1,182	7,797
Credit	-	(12,673)	(12,590)	6	4,605	5,193	(7,642)	(23,101)
Total Trading Revenues	18,788	5,489	(835)	22,592	22,517	25,775	17,956	112,282

Source:OCC

Table 8.30: Credit Derivatives Composition by Maturity and Quality of Underlying Reference Entity

		Q42006	Q42007	Q42008	Q42009	Q42010	Q42011	Q42012
Grade	Maturity (years)	%	%	%	%	%	%	%
Investment grade	more than 1	4	4	5	8	6	9	8
Investment grade	1 to 5	47	46	42	41	40	40	44
Investment grade	less than 5	24	25	19	15	10	8	6
Sub-total (a)		75	75	66	64	56	57	58
Sub-Investment	more than 1	2	2	3	5	6	11	13
Sub-Investment	1 to 5	15	17	22	25	29	26	26
Sub-Investment	less than 5	8	6	9	8	9	6	3
Sub- total (b)		25	25	34	38	44	43	42
Total		100	100	100	100	100	100	100

Source: OCC

CHAPTER NINE

CONCLUSIONS

One of the reasons for the outbreak of the financial meltdown from 2007 to 2009 was the size of financial institutions, the concentration of the banking sector which was heightened by their risky leverage on a monumental scale. The precipitating factor was a high default rate in the subprime home mortgage sector. The world financial system was put in danger when the enormous bets made by the banks missed it badly. The resultant consolidation which was triggered by the crisis coupled with a lack of strong regulations shows the surviving bank are now even larger than before the crisis with a large chunk of the overall deposit base of the entire banking system. The banks are still very much engaged in lending activities and derivatives trading to boost their portfolios and as such exposed to credit risks on a larger scale. For example, JP Morgan made multi-billion losses in the London Whale debacle. Besides, the enactment of the Wall Street Reform and Consumer Protection Act (2009) as amended by the Dodd–Frank Wall Street Reform and Consumer Protection Act of 2010 (Murdock 2011) and Restoring American Financial Stability Act of 2010 (Dodd 2010) to reduce the chance of reoccurrence, the introduction of the Basel III capital and liquidity standards which increased capital ratios, limits on leverage, narrow definition of capital (to exclude subordinated debt), limit counter-party risk, and new liquidity amongst others which also has also been faulted on the premise that it doesn't address the problem of faulty risk-weightings. As such, another financial crisis and shock may be catastrophic if proper safeguards are not put in place as some of the regulations (Basel III among others) have indeed led to excessive lending to risky governments by some large banks. Therefore, this research has investigated the determinants of bank use of credit derivatives to mitigate risks and the impact of these financial instruments on bank portfolio persistence, risk and return of US banks with $500 million in total assets as a bench mark. Previous researches have looked at hedging theories and hedging bank loan portfolio with credit derivatives.

9.1 Limitations of the Research

In this research, we measure the risk of return on assets as absolute average deviation/standard deviation of return of assets of the preceding 40 quarters. The return on assets is for one quarter (short term), while the standard deviation is for 40 quarters (long term). Data for daily, weekly or monthly was not available to compute the standard deviation of return on assets, this limitation was by-passed by estimating the standard deviation of return on assets and using a larger data set than using a limited number of Bank holding companies.

Another limitation of the study was the lost data where banks did not have a long history of operations over the 40 quarters. As explained in chapter 6, the data set is unbalanced. The data set would have been more substantial if the data set was balanced. However, this has not affected the validity of the estimation of the standard deviation of the return on assets.

9.2 Opportunities for Expected and Prospective Research

The selected study is very broad and there are several sub-fields in which future studies could be channelled. We now outline some of the sub-fields for future research.

(i) Analysis of credit derivatives into type, maturity, and category of the underlying assets

The first of opportunity for future research is to analyse and test credit derivatives by maturity and category of underlying assets. Due to limited data, this research does not take into account maturity of credit derivatives and different types of the underlying assets. With the availability of data, future research can analyse issues on credit derivatives and their maturity, protection of the underlying assets, why some banks use certain types of financial instrument, the processes and how they impact on bank portfolios. This research will be imperative for financial regulators in appreciating the condition for using specific credit derivatives instruments and their contributions to bank portfolio performance.

(ii) Bank asset concentration hierarchy and credit derivatives

US banks are classified into ten types based on their asset concentration hierarchy. Future studies can investigate the effects of credit derivatives using these parameters. Finding the relationship between credit derivatives and bank asset concentration hierarchy and how this relationship affects bank portfolio performance would be an interesting research.

(iii) Impact of credit derivatives on small/savings banks portfolios

With the introduction of regulatory measures and market discipline into the credit derivatives market, the reduction in cost of using the financial products in the future is appealing to some small players, thus their activities would be of interest for research and investigation on the impact of credit derivatives on their performances and portfolios.

(iv) International comparison between US banks and European banks

The major credit derivatives centres are New York and London. An interesting area would be a research making international comparison between European banks and US banks. As explained in chapter 5, this study is focussed on US banks due to availability of data, limited data preludes us from extending a comparison with European banks. A comparison with European banks would border on issues covering location advantages and disadvantages, legal, business environment, relationship between credit derivatives and bank portfolio performance etc.

(v) The use of credit derivatives and bank stock market performance

This research tested the effects of market risk on the effects of credit derivatives on bank risk on asset using the proxy of stocks to total assets but not directly test the effects of using credit derivatives on bank stock market performance. There is a chance of future studies to analyse the effects of using credit derivatives on bank stock price and to gauge the market's understanding of whether or not the financial instrument increases overall risk.

(vi) Credit derivatives and measures of bank portfolio performance

In Chapter 5, this research work defined bank portfolio performance as the risk-adjusted return on securities used in investment management, which is also suggested by modern portfolio theory. Further research could use several measures of bank performance developing in credit derivatives use. This is because bank portfolios are different from investment portfolios. Possible choices to risk adjusted return on assets might happen in different studies and investigations. Possible choices of bank performance can be investigated to discover which of the measures are strongly correlated with the use of credit derivatives.

(vii) Credit derivatives, moral hazard and information asymmetry

Another opportunity for further study is the exploration of moral hazard problem and information asymmetry problem. Protection sellers need profits to take of the risk exposures they obtained from protection buyers. Where information asymmetry and moral hazard have adverse effects to financial assets and products, the actual payoffs will be more than anticipated payoffs, these results in the economic value potentially turning positive, paltry and inconsequential. This can better be investigated when more robust data on pricing and payoffs become available.

(viii) Out of sample study

Arising from the methods and models used in this study, future research can proceed to perform an out-of-sample study to examine whether the suggested models can forecast the independent variables and therefore the banks to be prepared in advance.

(ix) Use of larger and balanced data set

To compute the absolute average deviation/standard deviation of return of assets, and for a longer duration of time than 40 quarters, balanced data for daily, weekly or monthly would need to be sourced and collated. This would address the issue of lost data where banks did not have a long history of operations over the 40 quarters.

9.3 Closing Comments

Credit derivatives are known as a new process of spreading out and re-circulating credit risk made in their asset books or market portfolios to other stakeholders in the market. We have appreciated that they also allow financial institutions to have a way in to credits and structures not accessible in the traditional cash trading floor, more so as it makes more funds available to make more loans for their customers.

The key aims of the pragmatic studies submitted in this research are:

(i) To explore and scrutinise the determinants of the mitigation of risk with credit derivatives in US banks using random effects logistic models.

(ii) To use Arellano-Bond dynamic panel data Generalised Method of Moments (GMM) models to investigate the impact of credit derivatives on bank portfolio persistence, risk and return and if banks can achieve a superior risk adjusted return and increase the value of assets in their portfolios for the period from 2002 through 2011.

To these objectives, the main goal of chapter 7 was to extend the probit models of Minton et al. (2009) in order to explain the determinants of why banks use credit derivatives to mitigate risks as well as a risk management tool. By using random effects logistic models, we came to the decision based on facts that for the US banks, the results are mixed and therefore executive effectiveness and manner of functioning is an element that needs more research. Specifically, before the crisis period, the work found evidence that US banks used credit derivatives more for trading than for hedging thus expanding their level of risk taking. Our finding for this period is consistent with Ashraf et al. (2007) and Minton et al. (2009) who documented some use of credit derivatives by US banks. The results for the crisis period are mixed. The work found little evidence of risk taking, limited trading but more of hedging. He work found evidence that the appetite for risk taking and product trading in credit derivatives rather than hedging resurfaced post crisis.

The principal purpose of chapter 8 was to extend the model of Minton et al. (2009) in order to explain the effect, success and value of credit derivatives on bank portfolio persistence and risk adjusted return. On average, the six models were able to explain the variation in the US bank portfolio performance by taking into consideration the macroeconomic and market effect, size and total assets, interest rate effect, leverage, profitability, liquidity, credit risk management, asset quality, sentiment, momentum, etc.

In contrast, the Minton et al. (2009) probit models were not designed to investigate bank portfolio persistence and risk adjusted return. Pre crisis generally, banks with outstanding credit derivatives interest position significantly outperformed banks with little or none. However, the disproportionate trading in the securities made some banks to wind down. During the crisis period, the returns and asset valuation of most banks portfolios with positions in credit derivatives suffered huge losses due to the financial crisis and economic downturn. Some bank portfolios returned to profitability and rise in valuation due to reforms in the credit derivatives market. The post crisis period saw improvements in returns and valuation due to the result of the market reforms in the credit derivatives market. However, the year ended 2012 was a bad year for some banks with positions in credit derivatives.

This research work has been an endeavour to find out how using credit derivatives impact the portfolio US banks. The results propose that banks should be permitted to continue to transact in credit derivatives though the results are mixed. There is evidence that selling credit derivatives affects bank RAR hence portfolio performance and return of assets. The evidence that effectiveness is impaired or that there is a surge in risks is not overwhelming.

Furthermore, credit derivatives provide protection which hitherto enabled banks to offer loans to subprime borrowers with low credit score or that might not meet the requirements for facilities at smaller banks which was a practice that contributed to the credit crisis of 2007 through

2009, tighter regulations being put in place should discourage the contravention of banking best practices in the future.

Given that the introduction of these products have changed the face of the banking industry, the regulators should watch and scrutinise the income pattern of banks using these products for the solidity, strength and steadiness of the banks, financial markets and the economy as a whole.

The proxies, NCOLS (Net charge-offs to loans), LSRETLNS (Loans secured by real estate loans to total loans), NCLTASST (Non-performing loans/total assets) CLPNCS (Credit loss provision to net charge-offs) though an essential price of banking business, should be monitored strictly by the bank and the Federal Reserve.

REFERENCES

Abbassi, P. and Linzert, T., 2012. The effectiveness of monetary policy in steering money market rates during the financial crisis. *Journal of Macroeconomics*, 34 (4), 945-954.

Acharya, T. and Johnson, T., 2007. Insider Trading in Credit Derivatives. *Journal of financial Economics*, 84(1), 110-141.

Acharya, V. and Naqvi, H., 2012. The seeds of a crisis: A theory of bank liquidity and risk taking over the business cycle. *Journal of Financial Economics*, 106(2), 349-366.

Adelson, M. 2013. The Deeper causes of the financial crisis: Mortgages alone cannot explain it. *Journal of Portfolio Management*. 39 (3), 16-31.

Association for Financial Markets in Europe (AFME), 2012.Securitisation quarterly data reports, 2012. Available from: www.afme.eu (Accessed 8 June 2013.)

Ahn, S.C. and Schmidt, P., 1995. Efficient estimation of models for dynamic panel data. *Journal of Econometrics*, 68, 5-27.

Akerlof, G., 1970. The market for "lemons": quality uncertainty and the market mechanism. *The Quarterly Journal of Economics*, 84(3), 488-500.

Akhigbe, A. and Whyte, A.M., 2004. The Gramm-Leach-Bliley Act of 1999: risk implications for the financial services industry. *Journal of Financial Research*, 27(3),435-446.

Akhigbe, A. and Madura, J., 2005. Motivation and performance of seasoned offerings by closed end funds.*Financial Review*, 36(3).101-122.

Alexander, C., 2009. *Market Risk Analysis, Value at Risk Models* (Vol. 4). John Wiley and Sons.

Al Mamun, A., Hassan, M.K., Karels, G.V., and Maroney, N., 2005. Financial Services Modernization Act of 1999: Market assessment of winners and losers in the insurance industry. *Journal of Insurance Issues* 28(1), 103-128.

Allayannis, G. and Ofek, E., 2001. Exchange rate exposure, hedging and the use of foreign currency derivatives. *Journal of international Money and finance*, 20, 273-296.

Allayannis, G. and Weston, J.P., 2001. The use of foreign currency derivatives and firm market value. *Review of financial studies*, 14 (1), 243-276.

Allen, F. and Carletti, E., 2006. Credit risk transfer and contagion. *Journal of Monetary Economics*, 53(1), 89-111.

Altman, E.I. and Duen, L.K., 1992. Rating drift in high yield bonds. *The Journal of Fixed Income*, 1(4), 15-20.

Altman, E., Hadelmann, R. and Narayanan, P., 1977. ZETA analysis: a new model to identify bankruptcy risk of corporations. *Journal of Banking and Finance*. June, 470-492.

Altman, E.I., 1968. Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance*, 23(4), 589–609.

Altman, E.I. 1987. The anatomy of the high yield bond market. *Financial Analysts Journal*, 43(4), 12-25.

Altman, E.I. 1996. Financial ratios, discriminant analysis and the prediction of corporate recoveries on defaulted bonds. *Financial analyst Journal*, 52(6), 57-63.

Altman, E.I., 2002. Managing credit risk: A challenge for the new millennium. Economic Notes, 31(2), 201-214.

Anderson, T.W. and Hsiao, C., 1981. Estimation of dynamic models with error components. *Journal of the American Statistical Association*, 76, 598-606.

Anderson, T.W. and Hsiao, C., 1982. Formulation and estimation of dynamic models using panel data. *Journal of Econometrics*, 18, 47-82.

Andrade, G. and Kaplan, S.N., 1998. How costly is financial (Not Economic) distress? Evidence from highly leveraged transactions that became distressed. *The Journal of Finance*, 53(5), 1443-1493.

Angelidis, T; Thomaidis, N., Vassiliadis, V. and Dounias, G., 2009. Active portfolio management with cardinality constraints: An application of particle swarm optimization. *New Mathematics and Natural Computation*, 3, 1-21.

Angelidis, T., Degiannakis, S. and Filis, G., 2015. US stock market regimes and oil price shocks. *Global Finance Journal*, 28, 132–146.

Angelini, P., Clerc, L., Cúrdia,V., Gambacorta, L., Gerali, A., Locarno, A., Motto, R., Roeger, W., Van den Heuvel, S and Vlček, J., 2015. Basel III: Long-term impact on economic performance and fluctuations. *Manchester School*, 83(2), 217-251.

Anjan V. T., 2015. The Financial crisis of 2007–2009: Why did It happen and what did we learn? *Review of Corporate Finance Studies*, 4(2), 204-216.

Appignanesi, L., 2005. *Simone de Beauvoir*. Haus Publishing.

Aranello, M., 1989. A note on the Anderson-Hsiao estimator for panel data. *Economics Letters*, 31, 337-341.

Arellano, M. and Bond, S., 1991. Some test of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, 58, 277-297.

Arellano, M. and Bover, O., 1995. Another look at the instrumental variables estimation of error-component models. *Journal of Econometrics,* 68, 29-51.

Arentsen, E., Mauer, D.C., Rosenlund, B., Zhang, H.H. and Zhao, F., 2015. Subprime mortgage defaults and credit default swaps. *Journal of Finance,* 70(2), 689-731.

Arnold, G., 2002. *Corporate Financial Management*. 2nd edition. Financial Times/Prentice Hall, Harlow, England.

Aronson, R., 1980. *Jean-Paul Sartre* Philosophy in the World.

Ashenfelter, O. and Solon, G., 1982. *Longitudinal labour market data: Sources, uses, and limitations* (No. 535). Princeton University, Department of Economics, Industrial Relations Section.

Asher, J., 1998. Credit derivatives: a red hot growth area. *American Bankers Association (ABA) Banking Journal*, 90(8), 33-34.

Ashraf, D., Altunbas, Y. and Goddard, J., 2007. Who transfers credit risks? Determinants of the use of credit derivatives by large US banks. *European Journal of Finance*, 13(5), 483-500.

Asness, C.S., Liew, J.M. and Stevens, R.L., 1997. Parallels between the cross-sectional predictability of stock and country returns. *The Journal of Portfolio Management*, 23(3), 79-87.

Asquith, P.D., Mullins Jr .W. and Eric D.W., 1989. Original issue high yield bonds: ageing analyses of defaults, exchanges, and calls. *The Journal of Finance,* 44 (4), 923-952.

Asquith, P., Gertner, R. and Scharfstein, D., 1994. Anatomy of financial distress: an examination of junk-bond issuers. *Quarterly Journal of Economics,* 109, 625 - 658.

Association of Chartered Certified Accountants. 2009. *Business Taxation study text*. ACCA. London.

Athanasoglou, P.P., Brissimis, S.N. and Delis, M.D., 2008. Bank-specific, industry-specific and macroeconomic determinants of bank profitability. *Journal of international financial Markets, Institutions and Money,* 18(2), 121-136.

Atkinson, T., Luttrell. D. and Rosenblum, H., 2013. How bad was it? The costs and consequences of the 2007 to 2009 financial crisis. *Federal Reserve Bank of Dallas, Staff Paper*, No. 20.

Auerbach, A.J. and Slemrod, J., 1997. The economic effects of the Tax Reform Act of 1986. *Journal of Economic Literature*, 35(2), 589-632.

Ayadi, R. and Behr, P., 2009. On the necessity to regulate credit derivatives markets. *Journal of Banking Regulation,* 10,179-201.

Babbel, D.F., Merrill, C. and Panning, W., 1997. Default risk and the effective duration of bonds, *Financial Analysts Journal,* 53(1), 35-44.

Baltagi, B.H., 2001. *Econometric analysis of panel data*. 2nd edition. John Wiley and Sons, Limited, England.

Baltigi, B.H., Uwe, B. and Katja, W., 2010. A dynamic Spatial Panel Data approach to the German wave curve, *Economic Modelling*, 29(1), 12-21.

Baltigi, B., Chihwa, K. and Sanggon, N., 2011. Test of hypothesis in panel data models when the regressor and disturbances are possibly non-stationary. *Advances in Statistical Analysis*, 95(4). 329-350.

Bank for International Settlement (BIS). 1987. Proposals for International Convergence of capital measurement and standards - consultative document. Available from: www.bis.org (Accessed 30 April 2015).

Bank for International Settlement (BIS). 2004. Basel II: International Convergence of Capital Measurement and Capital Standards: a Revised Framework. Available from: www.bis.org (Accessed 30 April 2015).

Bank for International Settlement (BIS). 2011. Basel III: A global regulatory framework for more resilient banks and banking systems. Available from: www.bis.org (Accessed 30 May 2015).

Bank for International Settlement (BIS). 2013. Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools, Available from: www.bis.org (Accessed 30 May 2015).

Bank for International Settlement (BIS). 2014. Basel III: the net stable funding ratio, Available from: www.bis.org (Accessed 30 May 2015).

Bank for international Settlement (BIS). 2016. Statistical release, OTC derivatives Statistics (1999, 2000, 2007, 2009, 2011, 2013, 2016). Available from: www.bis.org (Accessed 30 December 2016).

Banks, E. Glantz, M. and Siegel, P., 2007. *Credit Derivatives: Techniques to manage credit risk for financial professionals*, The McGraw-Hill Companies, New York.

Banz, R., 1981. The relationship between return and market value of common stocks. *Journal of Financial Economics*, 9, 3-18.

Bauer, W. and Ryser, M., 2004. Risk management strategies for banks. *Journal of Banking and Finance*, 28(2), 331-352.

Barrell, R., Hurst, I. and Kirby, S., 2008. Financial crisis, regulation and growth. *National Institute Economic Review*, 20(1), 56-65.

Bartram, S.M., Brown, G.W. and Fehle, F.R., 2003. The effects of derivatives on firm risk and value, J*ournal of Financial and Quantitative Analysis*, 46(4), 967-999.

Bauer, W. and Ryser, M., 2004. Risk management strategies for banks. *Journal of Banking and*

Finance, 28(2), 331-352.

Basel Committee on Banking Supervision. 1994. *Risk Management Guidelines for Derivatives,* BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 1995a. *Public Disclosure of the Trading and Derivatives Activities of Banks and Securities firms,* BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 1995b. *Basel Capital Accord: Treatment of Potential Exposure for Off-Balance –Sheet Items,* BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 1995c. *An Internal Model-Based Approach to Market Risk Capital Requirements,* BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 1996. *Amendment to the Capital Accord to Incorporate Market Risks,* BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 1998a. *Operational Risk Management*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 1998b. *Enhancing Bank Transparency*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 1999a. *Performance of Model-Based Capital Charges for Market Risk*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 1999b. *Credit Risk Modelling: Current Practices and Applications,* BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 1999c. *Recommendations for public disclosure of Trading and Derivatives Activities of Banks and Securities Firms*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 1999d. *A New Capital Adequacy Framework*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 1999e. *Banks' Interactions with Highly Leveraged Institutions*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 1999f. *Capital Requirements and Bank Behaviour: The Impact of the Basel Accord,* Working Paper, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 1999g. *Credit Risk Modelling: Current Practices and Applications*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2000a. *Best Practices for Credit Risk Disclosure,* BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2000b. *Overview of the Amendment to the Capital*

Accord to Incorporate Markets Risks, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2000c. *Treatment of Potential Exposure for Off-Balance Sheet Items,* BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2000d. *Sound Practices for Managing liquidity in Banking Organisations,* BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2000e. The relationship between Banking Supervisors and Banks' External auditors, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2000f. *Report to the G7 Finance Ministers and Central Bank Governors on International Accounting Standards,* BIS, Basel, Switzerland, April.

Basel Committee on Banking Supervision. 2000g. *Operational Risk*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2000h. *Best Practices for Credit Risk Disclosure*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2000i. *Principles for the Management of Credit Risk*, BIS, Basel, Switzerland, September.

Basel Committee on Banking Supervision. 2001a. *The New Basel Accord*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2001b. *Principles for the Management and Supervision of Interest Rate Risk*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2001c. *Regulatory Treatment of Operational Risk*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2001d. *Sound Practices for the Management and Supervision of Operational Risk,* BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2001e. *The Standardized Approach to Credit Risk*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2001f. *The Internal Ratings-Based Approach*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2001g. *Risk Concentration Principles*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2001h. *Industry Views on Credit Risk Mitigation*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2001i. *The New Basel Accord: An Explanatory Note*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2001j. *Asset Securitisation*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2004. *Loan-Portfolio Quality and the Diffusion of Technological Innovation*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2010a. *Basel III*, BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2010b. *Results of the Comprehensive Quantitative Impact Study,* BIS, Basel, Switzerland.

Basel Committee on Banking Supervision. 2014. *Progress report on implementation of the Basel Regulatory Framework in adopting Basel II, Basel 2.5 and Basel III as of March 2014,* BIS, Basel, Switzerland.

Basurto, M.A.S., Jones, B., Lindner, P. and Blankenheim, J., 2013. *Securitization: Lessons learned and the road ahead.* International Monetary Fund. (No. 13-255).

British Bankers Association. 1998. *Credit derivatives report 1996-2002*. London. British Bankers.

Beatty, A., 1999. Assessing the use of derivatives as part of a risk-management strategy. *Journal of Accounting and Economics*, 26, 353-357.

Becketti, S., 1993. Are derivatives too risky for banks? *Economic review-Federal Reserve Bank of Kansas City,* 78(3), 37-42.

Bedendo, M. and Bruno, B., 2012. Credit risk transfer in US commercial banks: What changed during the 2007–2009 crisis? *Journal of Banking and Finance,* 36(12), 3260-3273.

Behr, P., Reinhard, H.S and Ru X., 2010. Market structure, capital regulation and bank risk taking. *Journal of Financial Services Research* 37(2-3), 131-158.

Behr, P., Annekathrin, E. and Andre, G., 2011. How do lending relationships affect access to credit and loan conditions in micro lending? *Journal of Banking and Finance* 35(8), 2169-2178.

Ben-Ameur, H., Brigo, B. and Errais, E., 2009. A dynamic programming approach for pricing CDS and CDS options. *Quantitative Finance*, 9(6), 717-726.

Benmelech, E., Dlugosz, J. and Ivashina, V., 2012. Securitization without adverse selection: The case of CLOs. *Journal of Financial Economics*, 106(1), 91-113.

Berger, A.N., 2003. The economic effects of technological progress: Evidence from the banking industry. *Journal of Money, credit, and Banking*, 35(2), 141-176.

Berger, A., Klapper, L. and Turk-Ariss, R., 2009. Bank competition and financial stability. *Journal of Financial Services Research,* 35 (2), 99-118.

Berger, A.N., 1995. The relationship between capital earnings in banking. *Journal of Money, Credit and Banking*, 27(2), 432-456.

Berger, A.N., Kashyap, A.K. and Scalise, J.M., 1995. The transformation of the U.S. Banking industry: What a long, strange trip it's been. *Brookings Papers on Economic Activity*, (2), 55-218.

Berger, A.N., Bonime, S.D., Goldberg, L.G. and White, L.J., 2004. The dynamics of market entry: the effects of mergers and acquisitions on entry in the banking industry. *Journal of Business,* 77(4), 797-834.

Berger, A.N., Frame, W.S. and Miller, N.H., 2005. Credit scoring and the availability, price, and risk of small business credit. *Journal of Money, Credit and Banking*, 37(2), 191-222.

Berger, A.N and Roman, R.A., 2015. Did TARP banks get competitive advantages? *Journal of Financial and Quantitative Analysis*, 50 (6), 1199-1236.

Berkman, H. and Bradbury, M.E., 1996. Empirical evidence on the corporate use of derivatives. *Financial Management*, 25(2), 5-13.

Bernanke, B.S., 1983. Non-monetary effects of the financial crisis in the propagation of the great depression. *American Economic Review*, 73 (3), 257.

Bernanke, B. S., 2009. The Federal Reserve's Balance Sheet, speech at the Federal Reserve Bank of Richmond 2009 Credit Markets Symposium, Charlotte, North Carolina. Available at: http://www.federalreserve.gov (Accessed May 11 2014).

Berndt, E.R., 1991. *The practice of econometrics: classic and contemporary*. Addison-Wesley Publishing Company, England.

Bhansali, V., Gingrich, R. and Longstaff, F.A., 2008. Systemic credit risk: what is the market telling us? *NBER UCLA papers*, California.

Bicksler, J.L., 2009. Classical libertarianism: The economic perspectives of Milton Friedman including his likely views on the 'proper' role of government in the subprime mortgage debacle. International, *Journal of Disclosure and Governance*. 6(1), 21-39.

Bierman Jr., H. and Jerome, E.H., 1975. An analytic model of bond risk differentials. *Journal of Financial and Quantitative Analysis*, 10(5), 757-773.

Bierwag, G.O. and George, G.K., 1988. Durations of non-default-free securities. *Financial Analysts Journal*, 44(4), 39-46.

Bhar, R., Malliaris, A.G. and Malliaris, M., 2015. The impact of large-scale asset purchases on the S&P 500 index, long-term interest rates and unemployment., *Applied Economics*, 47(55), 6010-6018.

Black, F., Michael, C. and Scholes, M., 1972. The capital asset pricing model: Some empirical tests. *Journal of Capital Markets*, 79-121.

Black, F., 1972. Capital market equilibrium with restricted borrowing. *Journal of Business,* 45(3), 444-455.

Black, F. and Cox, J.C., 1976. Valuing corporate securities: some effects of bond indenture provisions. *Journal of Finance,* 31(2), 351-367.

Black, F., 1993. Beta and return. *Journal of Portfolio management*, 20, 8-18.

Black, T.R., 1999. *Doing quantitative research in social sciences: an integrated approach,* SAGE, London.

Blasko, M. and Sinkey Jr., J.F., 2006. Bank asset structure, real-estate lending and risk taking. *The quarterly review of economics and finance*, 46(1), 53-81.

Blau, B.M., Hein, S.E and Whitby, R.J., 2016. The Financial impact of the lender-of-last-resort borrowing from the Federal Reserve during the financial crisis. *Journal of Financial Research*, 39 (2), 179-206.

Blumberg, B.F., 2001. Cooperation contracts between embedded firms. *Organization studies,* 22(5), 825-852.

Blume, M.E., Lim, F. and MacKinlay, A.C., 1998. The declining credit quality of US corporate debt: Myth or reality?. *The journal of finance*, 53(4), 1389-1413.

Blundell, R.S., Bond, M. and Schiantarelli, F., 1992. Investment and Tobin's: evidence from company panel data. *Journal of Econometrics,* 51, 233-257.

Blundell, R. and Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. *Journal of econometrics*, 87(1), 115-143.

Blundell-Wignall, A. and Atkinson, P., 2010. Thinking beyond Basel III. *OECD Journal: Financial Market Trends,* 2010(1), 9-33.

Bodnar, G.M., Hayt, G.S., Marston, R.C. and Smithson, C.W., 1995. Wharton survey of derivatives usage by US nonfinancial firms. *Financial Management*, 25(4), 113-133.

Bodnar, G.M., Hayt, G.S., Marston, R.C. and Smithson, C.W., 1998. Wharton survey of financial risk management by US non-financial firms. *Financial Management*, 27(4), 70-91.

Bongaerts, D., DeJong, F. and Driessen, J., 2011. Derivative pricing with liquidity risk: Theory and evidence from the credit default swap market. *Journal of Finance,* 66 (1), 203-240.

Bowman, D., Cai, F., Davies, S. and Kamin, S., 2011. Quantitative easing and bank lending: evidence from Japan. *Board of Governors of the Federal Reserve System*.

Boyd, J.H. and Heitz, A., 2016. The social costs and benefits of too-big-to-fail banks: A "bounding" exercise. *Journal of Banking and Finance*, 68, 251-265.

Brendea, G., 2013.The Impact of the recent financial crisis on the capital structure choices of the Romanian listed firms. *Review of Economic Studies and Research*, 6(2), 15-26.

Brewer, E.III., Jackson Jr., W.E. and Moser, J.T., 1996. Alligators in the swamp: the impact of derivatives on the financial performance of depository institutions. *Journal of money, credit and banking*, 28(3), 482-497.

Brewer, E. III., Minton, B.A and Moser, J.T., 2000. Interest-rate derivatives and bank lending. *Journal of Banking and Finance*, 24, 353-379.

Brewer, E.III., Jackson, W.E.III and Moser, J.T., 2001. The value of using interest rate derivatives to manage risk at U.S banking organisations. *Economic Perspectives*, 25(3), 49-66.

Brewer, E.III., Minton, B.A and Moser, J.T., 2001. Interest rate derivatives and bank lending. Journal *of banking and finance*, 24(3), 353-379.

Brigham, F. and Weston, F.J., 1992. *Essentials of Managerial Finance*. Thompson learning. 2nd edition. USA.

Brigo, D. and Kyriakos, C. 2009. Counterparty risk for credit default swaps: Impact of spread volatility and default correlation. *International Journal of Theoretical and Applied Finance*, 12(7), 1007-1026.

British Bankers Association. 1998. *Credit derivatives report 1997-1998*. London. British Bankers.

British Bankers Association. 2000. *Credit derivatives report 1999-2000*. London. British Bankers.

British Bankers Association. 2002. *Credit derivatives report 2001-2002*. London. British Bankers.

British Bankers Association. 2004. *Credit derivatives report 2003-2004*. London. British Bankers.

British Bankers Association. 2006. *Credit derivatives report 2005-2006*. London British Bankers.

British Bankers Association. 2008. *Credit derivatives report 2007-2008*. London. British Bankers.

British Bankers Association. 2010. *Credit derivatives report 2009-2010*. London. British Bankers.

British Bankers Association, 2012. *Credit derivatives report 2011-2012.*London. British Bankers.

Breitung, J. and Pesaran, M.H., 2008. *Unit roots and cointegration in panels*. In The econometrics of panel data (279-322). Springer Berlin Heidelberg.

Broadstock, D.C. and Filis, G., 2014. Oil price shocks and stock market returns: New evidence from the United States and China. *Journal of International Financial Markets, Institutions and Money*, 33, 417-433.

Broll, U., Schweimayer, G. and Welzel, P., 2004. Managing credit risk with credit and macro derivatives. *Schmalenbach Business Review*, 56(4), 360-378.

Brown, G., 2001. Managing foreign exchange risk with derivatives. *Journal of Financial Economics*, 60, 401-448.

Brownbridge, M., 2015. How relevant are the Basel capital reforms for sub-Saharan Africa? *Journal of Risk, Management in Financial Institutions*, 8(2), 153-162.

Bryman, A., 2004. *Social research methods*. Oxford University press, Oxford.

Bucher-Koenen, T and Ziegelmeyer, M., 2014. Once burned, twice shy? Financial literacy and wealth losses during the financial crisis. *Review of Finance*, 18 (6), 2215-2246.

Buchholz, M., 2015. *How effective is macro-prudential policy during financial downturns? Evidence from caps on banks' leverage* (No. wp2015-7). Bank of Estonia.

Burmeister, E. and McElroy, M. 1988. Joint estimation of factor sensitivities and risk premia for the arbitrage pricing theory. *Journal of Finance*, 43(3), 721-733.

Burns, R.B. 2000. *Introduction to research methods*. SAGE, London.

Cacciatore, M., Ghironi, F. and Stebunovs, V., 2015. The domestic and international effects of interstate US banking. *Journal of International Economics*, 95(2), 171-187.

Calice, G., Christos, I. and Julian, W., 2012. Credit derivatives and the default risk of large complex financial institutions. *Journal of Financial Services Research*, 42(1-2), 85-107.

Calomiris, C.W and Khan, U., 2015. An assessment of TARP assistance to financial institutions. *Journal of Economic Perspectives*, 29 (2), 53-80.

Canlin, L. and Min, W., 2014. *Term Structure Modelling with Supply Factors and the Federal Reserve's Large Scale Asset Purchase Programs*. Working Papers -- U.S. Federal Reserve Board's Finance and Economic Discussion Series.1-33.

Carhart, M., 1997. On persistence in mutual fund performance. *The Journal of Finance*, 52(1), 57-82.

Caristrom, C.T. and Samolyk, K.A., 1995. Loan sales as response to market-based capital constraints. *Journal of Banking and Finance*, 19(3-4), 627-646.

Carpenter, S., Demiralp, S. and Eisenschmidt, J., 2014. The effectiveness of non-standard monetary policy in addressing liquidity risk during the financial crisis: The experiences of the

Federal Reserve and the European Central Bank. *Journal of Economic Dynamics and Control,* 43, 107-129.

Carter, D.A. and Sinkey Jr., J.F., 1998. The use of interest rate derivatives by end-users: the case of large community banks. *Journal of Financial Services Research*, 14(1), 17-34.

Carter, D.A. and McNutly, J.E., 2005. Deregulation, technological change, and the business-lending performance of large and small banks. *Journal of Banking and Finance*. 29(5), 1113-1130.

Carty, L.V. and Jerome, S.F., 1994. Measuring changes in corporate credit quality. *The Journal of Fixed Income*, (4)1, 27-41.

Cebenoyan, A.C. and Strahan, P.E., 2004. Risk management, capital structure and lending at banks. *Journal of Banking and Finance*, 28(1), 19-43.

Cecchetti, S.G., 2008. *Crisis and responses: the Federal Reserve and the financial crisis of 2007-2008* (No. w14134). National Bureau of Economic Research.

Cecchetti, S.G., 2008b. *Monetary policy and the financial crisis of 2007-2008: Advances in credit risk modeling.* IMF Working Paper.

Cerasi, V. and Daltung, S., 2000. The optimal size of a bank: Costs and benefits of diversification. *European Economic Review*, 44(9), pp.1701-1726.
Chamberlain, G., 1980. Analysis of covariance with qualitative data. *Review of Economic Studies*, 47, 225-238.

Cevik, E.İ., Korkmaz, T. and Atukeren, E., 2012. Business confidence and stock returns in the USA: a time-varying Markov regime-switching model. *Applied Financial Economics*.22 (4), 299-312.

Chamberlain, G., 1980. Analysis of Covariance with Qualitative Data. *Review of Economic Studies*, 47, 225-238.

Chan, L.K.C., Jegadeesh, N. and Lakonishok, J., 1996. Momentum strategies. *Journal of Finance*, 51(5), 1681-1713.

Chance, D.M., 1999. Research trends in derivatives and risk management since Black-Scholes. *The Journal of Portfolio Management,* 35-46.

Chance, D.M. 2001. *An introduction to derivatives and risk management*. 5th edition. Harcourt College Publishers, London.

Charest, G. 1978. Split information, stock returns and market efficiency. *Journal of Financial Economics*, 6, 265-296.

Chaudhry, M.K., Christie-David, R., Koch, T.W. and Reichart, A.K. 2000. The risk of foreign currency contingency claims at US commercial banks. *Journal of Banking and Finance*, 24(9), 1399-1417.

Chaudron, R.F., 2008. *How to capture securitisation and structured debt instruments*. Background issue paper 4,133.

Chen, N.F., Roll, R.W. and Ross, S.A., 1986. Economic forces and the stock market: testing the APT and the alternative asset pricing theories, *Journal of Business*, 59, 383-403.

Chen, K.C.W., Chen, Z. and Wei, K.C.J., 2011. Agency costs of free cash flow and the effect of shareholder rights on the implied cost of equity capital. *Journal of Financial and Quantitative Analysis*, 46, 171–207.

Chiang, Y. and Lin, H., 2005. The use of foreign currency derivatives and foreign-denominated debts to reduce exposure to exchange rate fluctuations. *International Journal of Management*, 22(4), 589-604.

Chien-Chiang, L., Meng-Fen, H. and Hua-Wei, D., 2012. How does foreign bank ownership in the banking sector affect domestic bank behaviour? A dynamic panel analysis, *Bulletin of Economic Research*. 64, 86-108.

Chien-Chiang, L., Meng-Fen, H., 2013. The impact of bank capital on profitability and risk in Asian banking. *Journal of International Money and Finance*. 32,251-281.

Chodorow-Reich, G., Feiveson, L ., Liscow, Z. and Woolston, G., 2012. Does state fiscal relief during recessions increase employment? Evidence from the American Recovery and Reinvestment Act. *American Economic Journal: Economic Policy*, 4(3),118–45.

Choi, J.J. and Elyasiani, E., 1997. Derivative exposure and the interest rate and exchange rate risks of US banks. *Journal of Financial Research*, 12(2-3), 267-286.

Chowdhry, B. and Howe, J.T.B., 1999. Corporate risk management for multinational corporations: financial and operational hedging policies. *European Finance Review*, 2, 229-246.

Chartered Institute of management accountants (CIMA) 2009. *Advance Taxation study text*. CIMA, London.

Chatziantoniou, I., Filis, G. and Floros, C., 2016. Asset prices regime-switching and the role of inflation targeting monetary policy. *Global Finance Journal*. (In press)

Clark, E., Zenaidi, A. and Trabelsi, M.G., 2008. Capital market integration, currency crises, and exchange rate regimes 1990–2002. *International Journal of Finance and Economics*, 13(3), 280-306.

Clough, P. and Nutbrown, C., 2012. *A student's guide to methodology*. Sage Publications, London.

Cociug, V. and Dogotari, V., 2014. Financial innovations and prudential regulation-impact of new rules of Basel III. *Financial Studies*, 18(4), 8-18.

Cohen, D. and Crabtree, B. 2008. Robert Wood Johnson, qualitative research guidelines project. Available from: http://www.qualres.org/ [Accessed 18 December 2012].

Coles, J.L., Daniel, N.D. and Naveen, L., 2007. Managerial incentives and risk-taking. *Journal of Financial Economics*, 79(2), 431-468.

Colquitt, L.L. and Hayt, R.E., 1997. An empirical analysis of the nature and cost of fraudulent life insurance claims. *Journal of Insurance Regulation*, 15(4), 451-479.

Cornett, M.M., McNutt, J.J., Strahan, P.E. and Tehranian, H., 2011. Liquidity risk management and credit supply in the financial crisis. *Journal of Financial Economics*, 101(2), 297-312.

Covas, F. B., Rump, B. and Zakrajsek, E., 2014. Stress-testing US bank holding companies: A dynamic panel quantile regression approach. *International Journal of Forecasting*. 30(3), 691-713.

Covitz, D., Liang, N. and Suarez, G.A., 2013. The Evolution of a Financial Crisis: Collapse of the Asset-Backed Commercial Paper Market. *The Journal of Finance*, 68(3), 815-848.

Crane, D.B. and Bodie, Z., 1996. Form Follows Function: The Transformation of Banking, *The magazine, Harvard Business School Review*. Available from: www.hbr.org/1996/03/ [Accessed 4 July 2013].

Crawford, C., 2011. The repeal of the Glass-Steagall Act and the current financial crisis. *Journal of Business and Economics Research*, 9(1), 127-137

Credit Suisse Financial Products. 1997. Credit Risk, Credit Suisse Banking Corporation. Available from: http://www.credit-suisse.com [Accessed 14 August 2013].

Creswell, J., 2009. *Research design: qualitative, quantitative, and mixed methods approach*. Thousand Oaks, California, Sage publications.

Crouch, R., Kaplan, R.M., King, T.H. and Riezler, S., 2002. A comparison of evaluation metrics for a broad-coverage stochastic parser. In Proceedings of the LREC Beyond PARSEVAL workshop (67-74).

Dagher, J.C. and Arnold, N., 2015. Growth opportunities, strategic savings, and the dot-com boom and bust, *Economic Inquiry*. 53(4), 1850-1871.

Dahiya, S., Puri, M. and Saunders, A., 2003. Bank borrowers and loan sales: new evidence on the uniqueness of bank loans. *Journal of Business*, 76, 563–582.

Dai, J. and Lapointe, S., 2011. Discerning the impact of derivatives on asset risk: the case of Canadian banks. *Financial markets, institutions and instruments*, 19(5), 405-433.

Daily Mail (UK). 2014. *UBS looses UK case against Leipzig's KWL, judge rebuke both sides*.

Available from: www.dailymail.co.uk/wires/reuters (Accessed on July 2, 2015).

Danielason, J., Jorgensen, B.N. and deVries, C.G., 2002. Incentives for effective risk management. *Journal of Banking and Finance*, 26(7), 1407-1425.

Darren, M., 2009. Credit risk management and mitigation. *Journal of Securities Operations and Custody*, 2(2), 134-140.

Das, S.R., 1995. Credit risk derivatives. *The Journal of Derivatives*, 7-23.

Das, S., 1997. *Risk management and financial derivatives: a guide to the mathematics*. MacMillan Press Limited, London.

Das, S., 1998. *Credit Derivatives: Trading and Management of Credit and Default Risk*. John Wiley and Sons, Singapore.

Davis, J.L., Fama, E.F. and French, K.R., 2000. Characteristics, covariances, and average returns: 1929 to 1997. *The Journal of Finance*, 55(1), 389-406.

Davidson, P., 2008. Is the current financial distress caused by the subprime mortgage crisis a Minsky moment? Or is it the result of attempting to securitize illiquid non-commercial mortgage loans? *Journal of Post Keynesian Economics*, 30(4), 669-676.

Delianedis, G. and Geske, R.L., 2003. *Credit risk and risk neutral default probabilities: information about rating migrations and defaults.* In EFA 2003 annual conference paper (No. 962).

Devlin, H., Roberts, M., Okaya, A. and Xiong, Y.M., 2006. Our lives were healthier before: focus groups with African American, American Indian, Hispanic/Latino, and among people with diabetes. *Health promotion practice*, 7(1), pp.47-55.

DeYoung, R., Hunter, W.C. and Udell, G.F., 2004. The past, present, and probable future for community banks. *Journal of Financial Services Research*, 25(2-3), 85-133.

DeYoung, R., 2005. The performance of Internet-based business models: evidence from the banking industry. *Journal of Business*, 78(3), 893–947.

DeYoung, R., 2007. Safety, soundness, and the evolution of the US banking industry. *Economic review*, 92(1-2), 41-66.

DeYoung, R., Lang, W.W. and Nolle, D.L., 2007. How the Internet affects output and performance at community banks. *Journal of Banking and Finance,* 31(4), 1033-1060.

Dhrymes, P.J., Friend, I. and Gultekin, N.B., 1984. A critical re-examination of the empirical evidence on the arbitrage pricing theory. *Journal of Finance*, 39(2), 323-346.

Diamond, D.W., 1984. Financial intermediation and delegated monitoring. *Review of Economic Studies*, 51(166), 22-39.

Diamond, D.W., 1996. Financial intermediation as delegated monitoring: a simple example. *Economic Quarterly*, 82(3), 51- 71.

Diamond, D.W. and Rajan, R.G., 2000. A theory of bank capital. *The Journal of Finance*, 55(6), 2431-2465.

Dick, A.A., 2006. Nationwide branching and its impact on market structure, quality, and bank performance. *The Journal of Business*, 79(2), 567-592.

Dickey, D.A. and Fuller, W.A., 1979. Distribution of the estimates for autoregressive time series with a unit root. *Journal of the American Statistical Association*, 74, 427-431.

Dickey, D.A. and Fuller, W.A., 1981. Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, 49(4), 1057-1072.

Dietrich, A., Hess, K. and Wanzenried, G., 2014. The good and bad news about the new liquidity rules of Basel III in Western European countries. *Journal of Banking and Finance*,44, 13-25.

Dodd, C., 2010. *Restoring American Financial Stability Act of 2010*. Reported by the Senate Committee on Banking, Housing, and Urban Affairs, April, 30.

Dodd Frank Law. 2012. Dodd–Frank Wall Street Reform and Consumer Protection Act. Available from: www.banking.senate.gov [Accessed 13 February 2014].

Dolde, W., 1993. The trajectory of corporate financial risk management. *Journal of Applied Corporate Finance*, 6, 33-41.

Dolde, W., 1995. Hedging, leverage and primitive risk. *The Journal of financial Engineering*, 4(2), 187-216.

Dong, H., 2005. *The effectiveness of credit derivatives on bank portfolio management. An empirical analysis.* Doctoral dissertation, George Washington University, Washington DC.

Deng, S.E., Elyasiani, E. and Mao, C.X., 2007. Diversification and the cost of debt of bank holding companies. *Journal of Banking and Finance*, 31(8), 2453-2473.

Dore, M.H.I and Singh, R.G., 2009. Turning points in nonlinear business cycle theories, financial crisis and the global 2007-2008 downturn. *Nonlinear Dynamics, Psychology, and Life Sciences*, 13, (4) 423-444.

Dore, H.I. and Singh, R.G., 2012. The role of credit in the 2007-2009 Great Recession. *Atlantic Economic Journal*, 40, 295-313.

Duffee, G.R. and Zhou, C. 2001. Credit derivatives in banking: useful tools for managing risk? *Journal of Monetary Economics*, 48, 25-54.

Duffie, D. and Liu, J., 2001. Floating-fixed credit spreads. *Financial Analysts Journal*, 57(3), 76-87.

Duffie, D. and Singleton, K., 1999. Modeling term structures of defaultable bonds. *Review of Financial Studies*, 2, 687-720.

Durkheim, E., 1897. *Le suicide: étude de sociologie.* F. Alcan.

Dunbar, N., 2000. *Inventing Money: The Story of Long Term Capital Management and the Legends Behind It*. Chichester and New York: Wiley.

Ederington, L.H. and Goh, J.C., 1998. Bond rating agencies and stock analysts: who knows what when*? Journal of Financial and Quantitative Analysis, 33(04), 569-585.*

Egly, P., Jackson, D. and Johnk, D., 2015. The impact of securitization and bank liquidity shocks on bank lending: Evidence from the U.S. *Banking and Finance Review*, 7(2), 55-86.

Elyasiani, E. and Wang, Y., 2012. Bank holding company diversification and production efficiency. *Applied Financial Economics*, 22(17), 1409-1428.

Erdogan, B.E., 2016. Long-term examination of bank crashes using panel logistic regression: Turkish banks failure case, *International Journal of Statistics and Probability*; 5(3), 42-48.

Erel, I., Nadauld, T. and Stulz, R.M., 2014. Why did holdings of highly rated securitization tranches differ so much across banks? *Review of Financial Studies*, 27 (2), 404-453.

Everaert, G., 2014. A panel analysis of the fisher effect with an unobserved I(1) world real interest rate. *Economic Modelling*.41, 198-210.

Fabozzi, F.J., 1993. *Bond Markets: Analysis and Strategies*. 2nd edition. Prentice Hall.

Fabozzi, F.J. and Fabozzi, T.D., 1994. *The handbook of fixed income securities*. 4th edition. Irwin.

Faff, R. and Treepongkaruna, S., 2013. A re-examination of the empirical performance of the Longstaff and Schwartz two-factor term structure model using real yield data. *Australian Journal of Management*, 38(2), 333-352.

Farka, M. and Fleissig, A.R., 2013. The impact of FOMC statements on the volatility of asset prices. *Applied Economics*, 45(10), 1287-1301.

Farnsworth, H.K., 2009. Evaluating stochastic discount factors from term structure models, *Journal of Empirical Finance*, 16 (5), 852-861.

Fama, E.F., 1971. Risk, return and equilibrium. *The Journal of Political Economy*, 79(1), 30-55.

Fama, E.F. and French, K.R., 1992. The cross section of expected stock returns. *Journal of Finance*, 47, 427-465.

Fama, E.F. and French, K.R., 1993. Common risk factors in the returns of stocks and bonds. *Journal of Financial Economics*, 33, 3-56.

Fama, E.F. and French, K.R., 2004. The capital asset pricing model: theory and evidence. *Journal of Economic Perspectives*, 18(3), 25-46.

Fama, E., 1985. What's different about banks? *Journal of Monetary Economics*, 15, 29-39.

Fama, E. and Macbeth, J., 1973. Risk, return and equilibrium: empirical tests. *Journal of Political Economy*, 81, 601-36.

Fattouh, B., Mouratidis, K. and Harris, L., 2008. South Africa's real exchange rate and the commodities boom: A Markov regime switching approach. *CSAE Conference, Economic Development in Africa*.

Federal Deposit Insurance Corporation (FDIC). 1996. Supervisory Guidance for Credit Derivatives. Available from: www.fdic.gov (Accessed 30 June 2014).

Federal Deposit Insurance Corporation (FDIC). 2014. Statistics on US depository Institutions from 2002-2013. Available from: http://www.fdic.gov (Accesses 15 June 2014).

Federal Reserve Board. 2009a. The Supervisory Capital Assessment Program: Overview of Results, May 7.

Federal Reserve Board. 2009b. The Supervisory Capital Assessment Program: Design and Implementation, April 24.

Federal Reserve Board. 2009c. FAQs - Supervisory Capital Assessment Program, December 24

Federal Reserve Survey of Consumer Finance. 2004.
Available from: www.federalreserve.gov/econresdata, (Accessed 15 January 2014).

Feldkircher, M., 2014. The determinants of vulnerability to the global financial crisis 2008 to 2009: Credit growth and other sources of risk. *Journal of International Money and Finance*, 43, 19-49.

Felsenfeld, C. and Bilali, G., 2006. Check Clearing for the 21st Century Act-A wrong turn in the road to improvement of the US payments system, *The. Neb. L. Rev*., 85,52-62.

Ferguson, T. and Johnson, R., 2009. Too big to bail: The 'Paulson Put,' presidential politics, and the global financial meltdown, Part I: From shadow banking system to shadow bailout. *International Journal of political economy*, 38(1) 3-34.

Field, A., 2013. *Discovering statistics using IBM SPSS*. 4th edition. Sage publications Ltd, Sussex.

Financial Crisis Inquiry Commission. 2011. The Financial Crisis Inquiry Report: Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United

States. Available from: fcic.law.stanford.edu (Accessed 30 July 2015).

Fisher, L., 1959. Determinants of the risk premiums on corporate bonds. *Journal of Political Economy*, 67(3), 217-37.

Flannery, M.J., 1981a. Market interest rates and commercial bank profitability: An empirical investigation. *The Journal of Finance*, 36(5), 1085-1101.

Flannery, M.J., 1983. Interest Rates and Bank Profitability: Additional Evidence: Note. *Journal of Money, Credit and Banking,* 15(3), 355-362.

Flavin, T.J and Sheenan, L., 2015. The role of U.S. subprime mortgage-backed assets in propagating the crisis: Contagion or interdependence? *North American Journal of Economics and Finance.* 34,167-186.

Fligstein, N. and Roehrkasse, A.F., 2016. The causes of fraud in the financial crisis of 2007 to 2009.*American Sociological Review*, 81(4), 617-643.

Fok, R.C.W., Carroll C. and Chiou, M.C., 1997. Determinants of corporate hedging and derivatives: a revisit. *Journal of Economics and Business,* 49, 569-585.

Fong, K., Gallagher, D.R. and NG, A., 2005. The use of derivatives by investment managers and implications for portfolio performance and risk. *International Review of Finance*, 5(1-2), 1-29.

Fons, J.S., 1994. Using default rates to model the term structure of credit risk. *Financial Analysts Journal*, 25 - 31.

Frame, W.S. and White, L.J., 2014. Technological change, financial innovation, and diffusion in banking. Available from: https://papers.ssrn.com (Accessed 17 December 2014).

Frame, W.S. and Wall, L.D., 2002. Financing housing through government-sponsored enterprises. *Economic Review-Federal Reserve Bank of Atlanta*, 87(1), 29-39.

Frame, W.S., Srinivasan, A. and Woosley, L., 2001. The effect of credit scoring on small business lending. *Journal of Money, Credit, and Banking*, 33(3), 813-825.

Francis, J. and Stephen, J., 1993. Characteristics of hedging firms: An empirical investigation. In: Schwartz, R.J. and Smith, C.W. Jr. eds. *Advanced strategies in financial risk management,* 615-635.

Frankel, A.B. and Montgomery, J.D., 1991. Financial structure: an international perspective. *J.D. Brookings Papers on Economic Activity*, 1, 257-297.

Frankfort-Nachmias, C. and Nachmias, D., 1996. *Research Methods in the social sciences*. 5th edition. St. Martin's Press, New York.

Frey, R. and McNeil, A.J., 2003. Dependent defaults in models of portfolio credit risk. *Journal* *of Risk*, 6, 59-92.

Friedman, M., 1970. Controls on interest rates paid by banks. *Journal of Money, Credit, and Banking*, 2(1), 15-32.

Friedman, J. and Shachmurove, Y., 2015. The responses of the prime rate to change in policies of the Federal Reserve. *Economic Modelling*,46, 407-411.

Froot, K.A., Scharfstein, D.S. and Stein, J.C., 1993. Risk management: coordinating corporate investment and financing policies. *Journal of Finance*, 48(5), 1629-1658.

Froot, K.A. and Stein, J.C., 1998. Risk management, capital budgeting, and capital structure policy for financial institutions: An integrated approach. *Journal of Financial Economics*, 47(1), 55-82.

Galbraith, J.W. 1988. Modelling Expectations formation with measurement errors, *Economic Journal*, 98(391), 412-428.

Galloway, T.M., Lee. W.B. and Roden, D., 1997. Banks' changing incentives and opportunities for risk taking. *Journal Of Banking And Finance*, 21(4), 509-527.

Garcia, G., Baer, H., Brewer, E., Allardice, D.R., Cargill, T.F., Dobra, J., Kaufman, G.G., Gonczy, A.M.L., Layrent, R.D. and Mote, L.R., 1983. The Garn-St Germain Depository Institutions Act of 1982. *Economic Perspectives*, (Mar), .3-31.

Gavalas, D., 2015. How do banks perform under Basel III? Tracing lending rates and loan quantity. *Journal of Economics and Business*, 81, 21-37.

Gay, G.D. and Nam, J., 1998. The underinvestment problem and corporate derivatives use. *Financial Management*, 27(4), 53-69.

Geanakoplos, J., 2009. The leverage Cycle. *Cowles Foundation Discussion Paper No. 1715*. Available from: www.cowles.econ.yale.edu [Accessed 15 March 2014].

Geanakoplos, J., 2010. *The leverage cycle*. In NBER Macroeconomics Annual 2009, 24,1-65. University of Chicago Press.

Geczy, C., Minton, B.A. and Schrand, C., 1997. Why firms use currency derivatives. *The Journal of Finance*, 52(4), 1323-1354.

Gengenbach, C., Palm, F.C. and Urbain, J.P., 2006. Panel cointegration testing in the presence of common factors. *Oxford Bulletin of Economics and Statistics*, 68, 683-719.

Gengenbach, C., Palm, F.C. and Urbain, J.P., 2009. Panel unit root tests in the presence of cross-sectional dependencies: comparison and implications for modelling.*Econometric Reviews,* 29(2), 111-145.

Gengenbach, C., Urbain, J.P., Westerlund, J., 2009. *Panel error cointegration testing with* *global stochastic trends*. Working paper Meteor RM/08/051, Maastricht University.

Gerdes, G.R. and Walton, J.K., 2002. The use of checks and other noncash payment instruments in the United States. *Federal Reserve Bulletin* 88, 360-374.

Gerdes, G.R., Walton, J.K., Liu, M.X. and Parke, D.W., 2005. Trends in the use of payment instruments in the United States. *Federal Reserve Bulletin*, 91, 180-201..

Geske, R., 1977. The valuation of corporate liabilities as compound options. *Journal of Financial and Quantitative Analysis*, 541- 552.

Getter, D.E., 2012. *US Implementation of the Basel Capital Regulatory Framework*. Congressional Research Service, Library of Congress.

Gibson, M.S., 2007. Credit derivatives and risk management. *Economic Review*, 4th quarter, 25-41.

Goldsmith-Pinkham, P. and Tanju Y., 2010. Liquidity, bank runs, and bailouts: Spill-over effects during the Northern Rock episode. *Journal of Financial Services Research*, 37(2-3), 83-98.

Gonzalez, L.O., Gil, L.I.R., Lopez, S. F. and Bua, M.M.V., 2012. Determinants of credit risk derivatives use by the European banking Industry. *Journal of Money, Investment and Banking*, (25), 36-58.

Gonzalez, L.O., Gil, L.I.R., Santomil, P.D. and Agra, S.C., 2012. *Banking risk and credit derivatives*. Available from: http://www.ssrn.com [Accessed 17 October 2013].

Gordy, M.B., 2000. A comparative anatomy of credit risk models. *Journal of Banking and Finance*, 24(1), 119-149.

Gordy, M.B., 2003. A risk-factor model foundation for ratings-based bank capital rules. Journal of financial intermediation, 12(3), 199-232.

Gormley, T. A.; Johnson, S; Changyong R., 2015. Ending "Too Big To Fail": Government promises versus investor perceptions. *Review of Finance*, 19(2), 491-518.

Gorton, G.B. and Pennachi, G.G., 1995. Bank and loan sales marketing nonmarketable assets. *Journal of Monetary Economics*, 35, 389-411.

Gorton, G., 2009. Information, Liquidity, and the (Ongoing) Panic of 2007. *American Economic Association*, 99(2), 567-72.

Goudrean, R.E. and Whitehead, D.D., 1989. Commercial bank profitability improved in 1988, *Economic Review, Federal Reserve Bank of Atlanta*, July/August.

Gouldner, A.W., 1971. *The Coming Crisis of Western*. Sociology, Heinemann, London.

Goyenko, R., Subrahmanyam, A. and Ukhov, A., 2011. Financial frictions and total factor productivity: Accounting for the real effects of financial crises. *Journal of Financial and Quantitative Analysis*, 46 (1), 111-139.

Graham, J.R. and Rogers, D.A., 2000. *Is Corporate Hedging Consistent with Value-Maximisation? An Empirical Analysis,* Working Paper, Fuqua School of Business, January 2000.

Graham, J.R. and Rogers, D.A., 2002. Do firms hedge in response to tax incentives? *The Journal of Finance,* 57(2), 815-839.

Graham, J.R. and Smith, C.W., 1999. Tax incentives to hedge. *Journal of Finance*, 54, 2241-2262.

Grazano, A.M. and Raulin, M.L., 1993. *Research methods: a process of inquiry.*2ed. HarperCollins College Publishers, NewYork.

Green, W.H. 2008. *Econometric analysis*. 7th edition. Prentice Hall.

Grigorian, D.A. and Manole, V., 2006. Determinants of commercial bank performance in transition: an application of data envelopment analysis. *Comparative Economic Studies*, 48(3), 497-522.

Groshenny, N., Julien, B. and Gomis-Porqueras, P., 2013. Monetary policy, inflation and unemployment: in defence of the Federal Reserve. *Macroeconomic Dynamics*, 17 (6), 1311-1329.

Guay, W. and Kothari, S.P., 2003. How much do firms hedge with derivatives? *Journal of Financial of Economics*, 70, 423-461.

Guay, W., 1999. The impact of derivatives on firm risk: an empirical examination of new derivatives users. *Journal of Accounting and Economics*, 26, 319-351.

Gujarati, D.N., 2003. *Basic econometrics.* 4th edition. Boston: McGraw-Hill/Irwin.

Gup, B. E., 1977. Portfolio theory—A planning tool. *Long Range Planning* 10(3), 10-13.

Hajivassilou, V.A. 1987. The external debt repayments problems of LDC's: an econometric model based on panel data. *Journal of Econometrics*, 93,309-326.

Halliwell, L.H., 1995. Mean-variance analysis and the diversification of risk, in incorporating risk factors in dynamic financial analysis. *Discussion Paper Program of the Casualty Actuarial Society*, 1-22.

Hanak, E., 2009. State infrastructure spending and the federal stimulus package. *National Tax Journal,* 573-583.

Hanck, C., 2009. For which countries did PPP hold? A multiple testing approach. *Empirical*

Economics, 37, 93–103.

Hancock, D., 1985. Bank Profitability, Interest Rates and Monetary Policy. *Journal of Money, Credit and Banking*,17(2),189-202.

Hand, J.R.M., Robert, W.H. and Richard, W.L., 1992. The effect of bond rating agency announcements on bond and stock prices. *The Journal of Finance*, 47(2), 733-752.

Hansen, L.P. and Sargent, T.J., 1991. Exact liner rational expectations models: specification and estimation. In: Hansen, L.P. and Thomas J. S., eds. *Rational Expectations Econometrics: Specification and Estimation*, West view Press, 45-76.

Hansen, L.P., 1982. Large sample properties of generalised method of moments estimators. *Econometrica*, 50,1029-1054

Hardy, M.A. and Bryman, A., 2004. *Handbook of data analysis*. London: Sage.

Harris, J. and Bergin, L., 1998. *The Management of Corporate Risk-a Framework for Directors*, The Association of Corporate Treasurers, London Social Science Research Imagination, Sage, London.

Hart, O.D. and Jaffee, D.M., 1974. On the application of portfolio theory to depository financial intermediaries. *Review of Econometric Studies* 41(1), 129-147.

Hauck Jr, W.W. and Donner, A., 1977. Wald's test as applied to hypotheses in logit analysis. *Journal of America Statistic Association*, 72, 851-853.

Haugen, R. 1995. *The new Finance: The case against efficient markets*. Prentice Hall, Englewood Cliffs, New Jersey.

Haugen, R.A., 2001. *Modern investment theory*. 5th edition. Prentice Hall International, Inc; London.

Haushalter, G.D., 2000. Financing policy, basis risk, and corporate hedging: Evidence from oil and gas producers. *The Journal of Finance*, 55(1), 107-152.

Hausman, J.A., 1978. Specification tests in econometrics. *Econometrica* 46, 1251-1271.

Hegel, G.W.F., 1830. *Encyclopedia of the philosophical sciences*, 3rd edition. Oxford University Press.

Hendrick, D., Patel, J. and Zeckhauser, R., 1993. Hot hands in mutual funds: the persistence of performance, 1974-1988. *Journal of Finance*, 48, 93-130.

Henke, S., Burghof, H.P. and Rudolph, B., 1998. Credit securitization and credit derivatives: financial instruments and the credit risk management of middle market commercial loan portfolios. *Univ.-Bibliothek Frankfurt am Main*.

Hentschel, L. and Kothari, S.P., 1997. Life insurance or lottery: Are corporations managing or taking risks with derivatives? *Available from: https://papers.ssrn.com (Accessed 18 June 2012).*

Hentschel, L. and Kothari, S.P., 2001. Are corporations reducing or taking risks with derivatives. *Journal of Financial and Quantitative Analysis*, 36(1), 93-118.

Herbst, A. F., Wu, J. S.K. and Ho, C. P., 2014. Quantitative easing in an open economy—Not a liquidity but a reserve trap. *Global Finance Journal*, 25(1)1-16.

Heyde, F. and Neyer, U., 2010. Credit default swaps and the stability of the banking sector. *International Review of Finance*, 10(1), 27-61.

Hill, R.C. Griffiths, W.E. and Lim, G.C., 2012. *Principles of econometrics, principles of econometrics*, 4th edition. Hoboken, Wiley, New Jersey.

Hirakubo, N. and Friedman, H. H., 2002. Dot-Bombs: Lessons from the Dot-Com debacle. *Journal of Internet Commerce*, 1(2), 89.

Hirtle, B.J., 1997. Derivatives, portfolio composition and bank holding company interest rate exposure. *Journal of Financial Services Research*, 12(2-3), 243-266.

Hirtle, B., 2009. Credit derivatives and bank credit supply. *Journal of Financial Intermediation*, 18(2), 125-150.

Holtz-Eakin, D.W., Newey, W. and Rosen, H.S., 1988. Estimating vector autoregressions with panel data. *Econometrica*, 56, 1371-1395.

Holtz-Eakin, D. 1988., Testing for individual effects in autoregressive models. *Journal of Econometrics*, 39, 297-307.

Homstrom, B. and Milgrom, P., 1987. Aggregation and linearity in the provision of inter-temporal incentives. *Econometrica*, 55(2), 303-328.

Hosmer, D.W. and Lemeshow, S., 1989. *Applied logistic regression*. John Wiley and Sons, Incorporation, New York.

Hosmer, D.W., Taber S, Lemeshow S., 1991. The importance of assessing the fit of logistic regression models: a case study. *American Journal of Public health*, 81(2), 1630-1635.

Houtrakker, H.S., Verleger, P.K. and Shehan, D.P., 1974. Dynamic demand analyses for gasoline and residential electricity American. *Journal of Agricultural Economics*, 56 (2), 412-418.

Howton, S.D. and Perfect, S.B., 1998. Currency and interest rate derivatives use in U.S firms. *Financial Management*, 27(4), 111-121.

Hsiao, C., 1985. Benefits and limitations of panel data. *Econometric Reviews*, 4(1), 121-174.

Hsiao, C., 2003. *Analysis of panel data*. 2nd edition, Cambridge: Cambridge University Press, Econometric Society monograph, 34.

Hsiao, C., 2005.Why Panel Data? *Singapore Economic Review*, 50(2), 1-12.

Hsiao, C., 2014. *Analysis of panel data* (No. 54). Cambridge university press.

Hughes, J. and Sharrock, W. 1997. T*he Philosophy of Social Research*. 3rd edition, Pearson, Essex.

Hughes, J., 1980. *The Philosophy of Social Research*. Longman, London.

Hughes, J., 1990. *The philosophy of social science*. London Longman.

Hull, J., Mirela P and Alan W., 2004. The relationship between credit default swap spreads, bond yields, and credit rating announcements. *Journal of Banking and Finance*, 28, 2789-2811.

Hull, J.C. 2006. *Options, Futures, and other Derivatives*. 6th edition. Prentice Hall, New Jersey.

Hull, J.C. 2009. *Options, futures, and other derivatives*. 7th edition. Prentice Hall, New Jersey.

Humphrey, D.B., 2002.US cash and card payments over 25 years. *In Conference on Innovation in Financial Services and Payments*, Federal Reserve Bank of Philadelphia.

Heyde, F. and Neyer, U., 2010. Credit default swaps and the stability of the banking sector. *International Review of Finance*, 10(1), 27-61.

Husserl, E., Findlay, J.N. and Dermot. M., 1900. *Logical investigations* Vol. 1. Routledge and Kegan Paul.

Husserl, E., 1975. *Introduction to the logical investigations: a draft of a preface to the logical investigations*, Fink E. Ed.: Martinus Nijhoff The Hague.

Hwang, J., Hankinson, M. and Brown, K. S., 2015. Racial and Spatial Targeting: Segregation and Subprime Lending within and across Metropolitan Areas. *Social Forces*, 93(3), 1081-1108.

Hwang, A.L., Patouhas, J.S., Schiela, D. and Dougherty, N., 2001. Practical issues in implementing FASB 133. *Journal of Accountancy*, 191(3), p.26.

Im, K.S., Pesaran, M.H. and Shin, Y., 2003. Testing for unit roots in Heteregenous panels. *Journal of Econometrics*, 115, 53-74.

International Monetary Fund. 2008. Global Financial Stability report (GFSR), Available from: www.imf.org/external pubs [Accessed 8 March 2010].

International Monetary Fund. 2009. Global Financial Stability report (GFSR). Available from: http://www.imf.org/external [Accessed 11 July 2010].

International Monetary Fund. 2010. Global Financial Stability report (GFSR). Available from: http://www.imf.org/external [Accessed 15 November 2011].

International Monetary Fund. 2011. Global Financial Stability report (GFSR). Available from: http://www.imf.org/external [Accessed 3 November 2012].

International Monetary Fund. 2012. Global Financial Stability report (GFSR). Available from: http://www.imf.org/external [Accessed 15 March 2014].

Im, K.S., Pesaran, M.H. and Shin, Y., 2003.Testing for Unit roots in Heterogeneous Panels, *Journal of Econometrics*, 115,53-74.

Insterford, N., 2005. Risk and hedging: do credit derivatives increase bank risk? *Journal of Banking And Finance*, 29(2) 333-345.

International Accounting Standards Board (IASB). Financial Instruments: Presentation and Recognition, IAS 32.

International Accounting Standards Board (IASB). Financial Instruments: Recognition and Measurement, IAS 39.

International Swaps and Derivatives Association (ISDA) 2014. Documentation of OTC derivatives. Available from: www.isdadocs.ord/educat. [Accessed 18 February 2014].

Intriligator, M.D., 1978. *Econometric Models, Techniques, and Applications*. Englewood Cliffs, NJ.: Prentice-Hall, Inc.; Amsterdam: North-Holland Publishing Co.

Ioannides, M. and Skinner, F.S., 1999. Hedging *Corporate Bonds, Journal of Business Finance and Accounting*, 26(7/8), 919-944.

Islam, N., 1995. Growth empirics: a panel data approach. *Quarterly Journal of Economics*, 110, 1127-1170.

Jacobs, P., 2009. Questioning pro-poor responses to the global economic slump. *Review of African Political Economy*, 36(122), 611-619

Jacobson, T, Jesper, L. and Kasper, R., 2006. Internal ratings systems, implied credit risk and the consistency of banks' risk classification policies. *Journal of Banking and Finance* 30(7), 1899-1926.

James, C., 1988. The use of loan sales and standby letters of credit by commercial banks. *Journal of Monetary Economics*, 22, 399-422.

Jarrow, R.D. and Turnbull, S., 1995. Pricing derivatives on financial securities subject to credit risks. *Journal of Finance*, 50, 53-85.

Jarrow, R.A., David, L. and Stuart, M.T., 1997. A markov model for the term structure of credit risk spreads. *The Review of Financial Studies*, 10(2), 481-523.

Jarrow, R. and Stuart, M.T., 1999. The intersection of market and credit risk. *Journal of Banking and Finance*, 24, 271-299.

Jayaratne, J. and Strahan, P.E., 1998. Entry Restrictions, Industry Evolution, and Dynamic Efficiency: Evidence From Commercial Banking 1. *The Journal of Law and Economics*, 41(1), 239-274.

Jegadeesh, N. and Titman, S., 1993. Returns to buying winners and selling losers implications for stock market efficiency. *Journal of Finance*, 48, 65-91.

Jennings, D.E, 1986. In Hosmer, D.W, and Lemeshow, S. and Sturdivant, R.X., 2013. *Applied logistic regression*. Wiley, London.

Jensen, M.C., 1986. Agency cost of free cash flows, corporate finance and takeovers. *American Economic Review*, 76, 323-329.

Jewell, J.J. and Mankin, J.A., 2011. What is your ROA? An investigation of the many formulas for calculating return on assets. *Academy of Educational Leadership Journal*, 15, 79-91.

Jin, Y. and Jorion, P., 2006. Firm value and hedging: evidence from U.S. oil and gas producers. *Journal of Finance*, 61(2), 893-919.

Jones, K.D. and Critchfield, T., 2005. Consolidation in the U.S. Banking Industry: Is the "Long, strange Trip" about to end? FDIC Banking review, 17(4), 31-61.

JP MORGAN. 1997. *Credit metrics-technical document*. 1st edition. JP Morgan, New York.

Judge, A., 2006. The determinants of foreign currency hedging by UK non-financial firms. *Multinational Finance Journal*, 10(1-2), 31-41.

Judge, A., 2006. Why and how U.K firms hedge, *European Financial Management*, 12(3), 407-441.

Judson, R.A and Owen, A.L., 1999. Estimating dynamic panel models: a guide for macroeconomists. *Economics Letters*, 65, 9-15.

Kaiser, B. and Axford, S., 2006. Principal Legal Issues of German True Sale Securitization, *Chapter 23 in Securitizations: Legal and Regulatory Issues/With Update*, ed. by Patrick D. Dolan and C. van Leer Davis.

Kao, C., 1999. Spurious regressions and residual based tests for cointegration in panel data. *Journal of Econometrics*, 90, 1-44.

Kandrac, J., 2014. Modelling the causes and manifestation of bank stress: an example from the financial crisis. *Applied Economics*. 46 (35), 4290-4301.

Kapetanios, G., Mumtaz, H., Stevens, I. and Theodoridis, K., 2012. Assessing the economy-wide effects of quantitative easing. *Economic Journal*, 22(564), 316-347.

Karras, K.N., 2009. Credit derivatives: banks' behaviour, financial stability and banking regulation. *Journal of Risk Management in Financial Institutions*, 2(2), 193-213.

Kaufold, H. and Smirlock, H., 1991. The impact of credit risk on the pricing and duration of floating-rate notes. *Journal of Banking and Finance*, 15, 43-52.

Keane, M.P. and Runkle, D.E., 1992. On the estimation of panel data models with serial correlation when instruments are not strictly exogenous. *Journal of Business and Economic Statistics*, 10, 1-9.

Keat, R. and Urry, J. 2011. *Social theory as science*. International library of sociology, Routledge revivals, Taylor and Francis, London.

Kennedy, P., 1992. *A Guide to Econometrics*, 3rd edition. Cambridge, MA: The MIT Press

Keys, B.J., Mukherjee, T., Seru, A., and Vig, V. 2009. Did securitization lead to lax screening? Evidence from subprime loans. *Journal of Monetary Economics*, 56, 700-20.

Kiff, J., Elliott, M.J.A., Kazarian, E.G., Scarlata, J.G. and Spackman, C. 2009. *Credit Derivatives: Systemic Risks and Policy Options?* (No. 9-254). International Monetary Fund.

Kijima, M. and Komoribayashi, K., 1998. A Markov chain model for valuing credit risk derivatives. *The Journal of Derivatives*, 97 - 108.

Kinateder, H., 2016. Basel II versus III: a comparative assessment of minimum capital requirements for internal model approaches. *Journal of Risk*,18(3), 25-45.

King, M.R., 2013. The Basel III Net Stable Funding Ratio and bank net interest margins. *Journal of Banking and Finance*, 37(11), 4144-4156.

Kiviet, J.F., 1995. On bias, inconsistency and efficiency of various estimators in dynamic panel data models. *Journal of Econometrics*, 68, 53-78.

Kmenta, J., 1986. *Recent developments in quantitative comparative methodology* 43 *elements of econometrics*. 2nd edition. New York: Macmillan; London: Collier Macmillan.

Kmenta, J., 1971. *Elements of econometrics*. The MacMillan Company, New York.

KMV., 1993. *Credit monitor overview*. KMV Corporation, San Francisco.

KMV., 1998. *Uses and abuses of bond default rates,* Internal Document, KMV Corporation, San Francisco.

Knopf, J.D., Nam, J. and Thornton Jr, J.H., 2002. The volatility and price sensitivities of managerial stock option portfolios and corporate hedging. *The Journal of Finance*, 57(2), 801-813.

Kohn, D., 2013. Federal Reserve Independence in the Aftermath of the Financial Crisis: Should We Be Worried? *Business Economics*.48 (2),104-107.

Kothari, V., 2006. *Securitization: the financial instrument of the future*, (Vol. 385). John Wiley and Sons.

Kothari, S.P., Shanken, J. and Sloan, R.G., 1995. Another look at the cross-section of expected stock returns. *Journal of finance*, 50, 185-224.

Koopman, S.J., Kräussl, R., Lucas, A. and Monteiro, A.B., 2009. Credit cycles and macro fundamentals. *Journal of Empirical Finance*, *16*(1), 42-54.

Kranacher, M.C., 2008. Once upon a time, in the land of subprime. *The CPA Journal*, 78(4): 80-81

Kranacher, M., 2012. What's left in the Fed's Monetary Policy toolkit? *The CPA Journal*. 82 (10), 80-80.

Krishnamurthy, A. and Vissing-Jorgensen, A., 2011. The effects of quantitative easing on interest rates: Channels and implications for policy. *Brookings Papers on Economic Activity*, 2, 215-265.

Kroszner, R.S. and Rajan R.G., 1994. Is the Glass-Steagall Act justified? A study of the US experience with universal banking before 1933, *American Economic Review*, 84(4),810-832.

Kuhn, T.S., 1962. *The structure of Scientific Revolutions*. Chicago: University of Chicago press.

Kühn, R. and Neu, P., 2003. Functional correlation approach to operational risk in banking organizations. *Physical A: Statistical Mechanics and its Applications*, 322, 650-666.

Kwan, S.H. and Eisenbeis, R.A., 1996. An analysis of inefficiencies in banking: A stochastic cost frontier approach. *Economic Review-Federal Reserve Bank of San Francisco*, 2, 16.

Kyeong-Won, K. and Hwa-Nyeon, K., 2009. Global financial crisis overview, in global financial crisis: Asian perspective, *SERI Quarterly*, 2(2). Available from: www.seriworld.org [Accessed 15 December 2012].

Laidler, D., 2015. Three revolutions in macroeconomics: their nature and influence. *European Journal of the History of Economic Thought*. 22 (1),1-25

Lando, D., 2004. *Credit risk modelling, theory and applications*. Princeton University Press.

Lastra, R.W.G., 2010. The crisis of 2007-09: nature, causes and reactions. *Journal of International Economic Law*, 13(3), 531-550.

Leamer, E.E., 2007. *Housing is the business cycle (No. w13428)*. National Bureau of Economic Research.

Lee, C.C. and Hsieh, M.F., 2013. The impact of bank capital on profitability and risk in Asian banking. *Journal of international money and finance*, 32,251-281.

Letendre, M. and Smith, G.W., 2001. Precautionary saving and portfolio allocation: DP by GMM. *Journal of Monetary Economics*, 48 (1), 197-215.

Lavoie, M., 2016. Understanding the global financial crisis: contributions of post-Keynesian economics. Studies in Political Economy: *A Socialist Review*. 97 (1), 58-75.

Fisher, L., 1959. Determinants of risk premiums on corporate bonds, *Journal of political economy*,67(3), 217-37

Lawrence, D. 1996. *Measuring and managing derivative market risk*. Thompson Business Press. UK.

Leland, H.E. 1998. Agency costs, risk management, and capital structure. *Journal of Finance*, 53, 1213-1243.

Lesaffre, E and Spiessens B., 2001. On the effect of the number of quadrature point in a logistic random-effects model: an example. *Applied Statistics*, 50:325–335.

Letizia, A., 2010. Vulnerability of risk management systems in credit spread widening scenarios. *IUP Journal of Financial Risk Management*. 7(3), 7-24.

Lewis, V., Kay, K.D., Kelso, C. and Larson, J., 2010. Was the 2008 financial crisis caused by a lack of corporate ethics? *Global Journal of Business Research*, 4(2), 77-84.

Li, B., Lingsma, H.F., Steyerberg, E.W. and Lesaffre, E., 2011. Logistic random effects regression models: a comparison of statistical packages for binary and ordinal outcomes. *BMC medical research methodology*, 11(1), 1.

Li, L., 2013. TARP funds distribution and bank loan supply. *Journal of Banking and Finance*.37 (12), 4777-4792.

Li, J. and Zinna, G., 2004. On bank Credit Risk: Systemic or Bank Specific? Evidence for the United States and United Kingdom. *Journal of Financial and Quantitative analysis*, 49(5/6), 1403-1442.

Li, X., Bandyopadhyay, D., Lipsitz, S. and Sinha, D., 2011. Likelihood methods for binary responses of present components in a cluster. *Biometrics*, 67, 629-635.

Lintner, J. 1965. Security prices, risks and maximal gains from diversification. *Journal of Finance*, 20(4), 587-614.

Litterman, R. and Thomas I., 1991. Corporate bond valuation and the term structure of credit risks. *The Journal of Portfolio Management*, 17(3),52-64.

Lockwood, L.J. and Linn, S.C. 1990. An examination of stock market return volatility during overnight and intraday periods, 1964–1989. *The Journal of Finance*, 45(2), 591-601.

Longstaff, F.A. and Rajan, A. 2008. An empirical analysis of the pricing of collaterised debt obligations. *Journal of Finance*, 63(2), 529-563.

López-Andión, C; Iglesias-Casal, A; López-Penabad, M. C; Maside-Sanfiz, J. M., 2015. The solvency of financial institutions in Spain: lessons from securitisation. *Applied Economics*,47

(44), 4741-4753.

Lorie, J.H. and Hamilton, M.T., 1973. Long range risk policy: new focus for investment counselling to pension and endowment portfolios. *Financial Analysts Journal,* 29(4), 46-50.

Lucas, D.J. and John, G.L., 1992. Changes in corporate credit quality 1970-1990. *The Journal of Fixed Income*, 1(4),7-14.

Maddala, G.S. and Wu, S.,1999. A comparative study of unit root tests with panel data and a new simple test, *Oxford Bulletin of Economics and Statistics*, 61, 631-652.

Mahieu, R. and Xu, Y., 2007. Hedging with interest rate and credit derivatives by banks. Available from: www.papers.ssrn.com (Accessed 13 June 2014).

Mallik, G., 2008. Foreign aid and economic growth: A cointegration analysis of the six poorest African countries. *Economic Analysis and Policy,* 38(2), 251-260.

Marcus, A.J. and Evren, O., 1996. Hedging corporate bond portfolios across the business cycle. *The Journal of Fixed Income*, 5(4),56-60.

Markham, A.N., 2009. How can qualitative researchers produce work that is meaningful across time, space, and culture? In: Markham, A.N. and Baym, N.K. eds. *Internet inquiry: Conversations about method*. Thousand Oaks, CA: Sage, 131-155.

Markowitz, H.M., 1952. Portfolio selection, *The Journal of Finance,* 7(1), 77-91.

Markowitz, H.M., 1959. *Portfolio Selection: Efficient Diversification of Investments*. New Haven: Yale University Press, Connecticut.

Markowitz, H.M., 1991. Foundations of portfolio theory. *The Journal of Finance,* 46(2), 469-477.

Markowitz, H., 1999. The early history of portfolio theory: 1600-1960. *Financial Analysis Journal*, 55(4), 5-16.

Marschak, J., 1938. Money and the theory of assets. *Econometrica*, 6, 311-325.

Marsh, W.I., 2006. The effect of lenders' credit risk transfer activities borrowing firms' equity returns. *Bank of Finland Research Discussion Papers*, 31, 1-33.

Marshall, W.C., 2013. The causes and consequences of the misdiagnosis of the financial crisis in the United States. *Review of Political Economy*, 25(2), 294-308.

Mathews, D.J., 2009. Ruined in a conventional way: responses to credit ratings role in credit crisis. *Northwestern Journal of international law and Business*, 29(1), 245-274.

McCartan-Quinn, D., Durkin, M. and O'Donnell, A., 2004. Exploring the application of IVR: Lessons from retail banking. *The Service Industries Journal*, 24 (3), 150-168.

McCoskey, S. and Kao, C., 1998. A residual based test of the null of cointegration in panel data. *Econometric Reviews*, 17, 57-84.

Mckinsey and Company, 1997. *Credit portfolio view – a credit portfolio risk management approach*. McKinsey and Company, Zurich.

Mcmenamin, J., 1999. *Financial management: an introduction*. London: Routledge.

McNeill, C.R., 1980. Depository Institutions Deregulation and Monetary Control Act of 1980, The. *Fed. Res. Bull.*, 66, p.444.

McPhail, J. and McPhail, L., 2014. Forecasting lifetime credit losses: Modelling considerations for complying with the new FASB and IASB current expected credit loss models. *Journal of Risk Management in Financial Institutions,* 7(4), 375-388.

Meltzer, A. H., 2013. What's Wrong With the Federal Reserve: What Would Restore Independence? *Business Economics*, 48 (2), 96-103

Merton, R.C., 1974. On the pricing of corporate debt: the risk structure of interest rates. *Journal of Finance*, 29(2), 449-470.

Mester, L.J., 1997. What's the point of credit scoring? *Federal Reserve Bank of Philadelphia Business Review,* 3-16.

Meyer, K.E., 1998. *Direct investment in economies in transition*. Aldershot: Elgar.

Mian, S.L. 1996. Evidence on corporate hedging policy. *Journal of Quantitative and Financial Analysis*, 31(3), 419-439.

Mian, A. and Amir, S., 2009. The consequences of mortgage credit expansion: Evidence from the 2007 mortgage default crisis, *Quarterly Journal of Economics,* 124, 1449–1496.

Mian, R.A. and Sufi, A., 2009. The consequences of mortgage credit expansion: Evidence from the U.S. mortgage default crisis. *Quarterly Journal of Economics,* 124(4) 1449-1496.

Mill, J.S., 1961. *Auguste Comte and Positivism* (1961), 4th ed. Kegan Paul, Trench Truener and company, London.

Michael, B.D., 2008. An historical perspective on the crisis of 2007-2008 (No. w14569). *National Bureau of Economic Research*.

Michael, S., 2013. Competition and Crisis in Mortgage Securitization, *Indiana Law Journal*, 88,213-220.

Miller, P.R., Dasher, R., Collins, R., Griffiths, P. and Brown, F., 2001. Inpatient diagnostic assessments: 1. Accuracy of structured vs. unstructured interviews. *Psychiatry research*, 105(3), 255-264.

Minton, B.A., Stulz, R. and Williamson, R., 2005. How much do banks use credit derivatives to reduce risk? NBER Working Paper No. 11579.

Minton, B., Stulz, R. and Williamson, R., 2009. How much do banks use credit derivatives to hedge loans? *Journal Of Financial Services Research*, 35(1), 1-31.

Modigliani, F. and Miller, M.H., 1958. The cost of capital, corporation finance, and the theory of investment. *American Economic Review*, 48(3), 261-297.

Modigliani, F. and Miller, M.H., 1963. Corporate income taxes and the cost of capital: a correction. *American Economic Review*, 53, 433-443.

Moenninghoff, S.C., Ongena, S. and Wieandt, A., 2015. The perennial challenge to counter Too-Big-to-Fail in banking: Empirical evidence from the new international regulation dealing with Global Systemically Important Banks. *Journal of Banking and Finance*, 61, 221-236.

Moessner, R., 2014. Effects of explicit FOMC policy-rate guidance on equities and risk measures.*Applied Economics*, 46 (18), 2139-2153.

Moessner, R., 2015. Reactions of real yields and inflation expectations to forward guidance in the United States, *Applied Economics*.47 (26), 2671-2682.

Molenberghs, G. and Verbeke, G., 2007. Likelihood ratio, score, and Wald tests in a constrained parameter space. *The American Statistician*, 61(1), 22-27.

Molenberghs, G., Verbeke, G., Demétrio, C.G. and Vieira, A.M., 2010. A family of generalized linear models for repeated measures with normal and conjugate random effects. *Statistical Science*, 25(3), 325-347.

Moody's Special Comment, 1997. *Modern Credit Risk Management and the Use of Credit Derivatives: European Banks' Brave New World (And It's Limits)*. Moody's Investors Service, New York.

Moody's Special Report, 2012(a), *Default and Loss Rates of Structured Finance Securities: 1993-2011*, Special Report (New York).

Moody's Special Report, 2012(b*), CLOs and the Simplified Supervisory Formula Approach (SSFA),* Research/White Paper (New York).

Morrison, A.D., 2005. Credit derivatives, disintermediation and investment decisions. *The Journal of Business*, 78(2), 621-647.

Moser, J.T., 1998. Credit derivatives: Just-in-time provisioning for loan losses. *Economic perspectives-Federal Reserve Bank of Chicago*, 22, 2-11.

Mossin, J., 1966. Equilibrium in a capital market. *Econometrica*, 34(4), 768-783.

Mulder, A. and Westerhuis, G., 2015. The determinants of bank internationalisation in times of financial globalisation: evidence from the world's largest banks, 1980 to 2007*, Business History*. 57(1), 121-154.

Mullineux, A., 2013. Restoring the bank lending channel of monetary transmission. *Brussels*

Economic Review-Cahiers Economiques De Bruxelles, 56(3/4).

Mullineux, A., 2014. Banking for the public good. *International Review of Financial Analysis,* 36, 87-94.

Murdock, C.W., 2011. Dodd-Frank Wall Street Reform and Consumer Protection Act: What Caused the Financial Crisis and Will Dodd-Frank Prevent Future Crises, *The. SMUL Rev*., 64, .1243-1255.

Murphy, A., 2010. The Mispricing of Credit Default Swaps: Institutional Causes and Effects, *Banking and Finance Review*, 2 (2), 105-118

Murray, M., 1978. *Heidegger and modern philosophy: critical essays.*

Naik, N.Y. and Yadav, P.K., 2003. Risk management with derivatives by dealers and market quality in government bond markets. *The Journal of Finance*, 58(5), 873-904.

Nagel, S and Singleton, K.J., 2011. Estimation and Evaluation of conditional asset pricing models. *Journal of Finance*, 66(3), 873-909

Nance, D., Smith, C. Smithson, C., 1993. On the determinants of corporate hedging. *The Journal of Finance,* XLVIII (1), 267-284.

Nashikar, A., Subrahmanyam, M.G. and Mahanti,S., 2011. Liquidity and arbitrage in the market for credit risk. *Journal of Financial and Quantitative Analysis*, 46(3), 627-656.

National Bureau of Economic Research (NBER). 2015. US business cycle expansions and contractions. Available from : www.nber.org/cycles, (Accessed on 13 May 2015).

Neal, R.S., 1996. Credit derivatives: new financial instruments for controlling credit risk. *Economic Review-Federal Reserve Bank of Kansas City*, 81(2), 15-27.

Nersisyan, Y. 2015. The repeal of the Glass-Steagall Act and the Federal Reserve's extraordinary intervention during the global financial crisis. *Journal of Post Keynesian Economics*. 37(4), 545-567.

Nguyen, H. and Faff, L., 2002. Further evidence on the corporate use of derivatives in Australia: the case of foreign currency and interest rate instruments. *Australian Journal of Management*, 28(3), 307-317.

Nickell, S., 1981. Biases in dynamic panel data models with fixed effects. *Econometrica*, 49, 1417-1426.

Nijskens, R. and Wagner, W., 2011. Credit risk transfer activities and systemic risk: How banks became less risky individually but posed greater risks to the financial system at the same time. *Journal of Banking and Finance*, 35(6), 1391-1398.

Nisha, N., 2016. Global Financial Crisis: Exploring the Special Role of U.S. Banks and

Regulations. *International Journal of Banking, Risk and Insurance*, 4 (1), 53-63.

Nolan, A.R.G., 2006. Synthetic securitisation and derivatives transactions by banks: selected regulatory issues. *The Journal of structured finance*, 12(3), 40-53.

Noh, J. 2013. BASEL III Counterparty Risk and Credit Value Adjustment: Impact of the Wrong-way Risk. *Global Economic Review*, 42(4), 346-361.

Norden, L., Buston, C.S. and Wagner, W., 2011. Banks' use of credit derivatives and the pricing of loans: What is the channel and does it persist under adverse economic conditions. *Erasmus University Rotterdam and Tilburg University Working paper.*

Norden, L., Buston, C.S. and Wagner, W., 2014. Financial innovation and bank behaviour: evidence from credit markets. *Journal of Economic Dynamics and Control*, 3, 130–145.

Office of the Comptroller of the Currency (OCC)., 1997, 2009. Risk management of Financial Derivatives, Comptroller's Handbook. Available from: www.occ.treas.gov [Accessed 16 June 2014].

Office of the Comptroller of the Currency (OCC). Report on Bank derivatives activities 2002-2016. Available from: www.occ.treas.gov [Accessed 16 October 2016].

Oehmke, M. and Zawadowski, A., 2013. The Anatomy of the CDS market. Available from: www.ssrn.com [Accessed 13 February 2014].

Oehmke, M. and Zawadowski, A., 2014. Synthetic or Real? The equilibrium effects of credit default swaps on bond markets. Working Paper, Columbia University. Available from: http://www.ssrn.com [Accessed 13 February 2014].

Ohlson, J.A., 1980. Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research*, 18(1), 109–131.

Oldfield, G.S. and Santomero, A.M., 1977. Risk management in financial institutions. *Slaon management Reviews*, 39(1), 33-45.

Opler, T. and Timan, S., 1994. Financial distress and corporate performance. *The Journal of Finance*, 49, 1015-1040.

Opler, T.C. and Titman, S., 1994. Financial distress and corporate performance. *The Journal of Finance,* 49(3), 1015-1040.

Organisation for Economic Cooperation and Development, 2011. Development cooperation report, Available from: www.oecd-ilibrary.org (Accessed 10 July 2014).

Pajarskas, V. and Jočienė, A., 2014. Subprime mortgage crisis in the United States in 2007-2008: causes and consequences (Part I). *Ekonomika / Economics* , 93 (4), 85-118.

Pajarskas, V. and Jočienė, A., 2015. Subprime mortgage crisis in the United States in 2007-

2008: causes and consequences (Part II). *Ekonomika / Economics,* 94 (1), 7-41.

Park, S., 1997. Risk-taking behaviour of banks under regulation. *Journal of Banking and Finance* 21: 491-507.

Park, S., 1998. Credit risk. *American Bankers Association. (ABA) Banking Journal* (90)8,30-33.

Parlour, C.A. and Winton, A., 2013. Laying off credit risk: Loan sales versus credit default swaps. *Journal of Financial Economics*, 107(1), 25-45.

Pedroni, P., 1999. Critical values for cointegration tests in heterogenous panels with multiple regressors, *Oxford Bulletin of Economics and Statistics,* 61, 653-678.

Pedroni, P., 2000. Fully modified OLS for heterogenous cointegrated panels. *Advances in Econometrics*, 15, 93-130.

Pedroni, P., 2004. Panel cointegration: asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric theory*, 20(03),597-625

Peek. J. and Rosengren, E.S., 1996. Derivative activities at troubled banks. Available from: www.fic.wharton.upenn.edu/fic/papers [Accessed 2 June 2013].

Peicuti, C., 2013. Securitization and the subprime mortgage crisis. *Journal of Post Keynesian Economics*, 35(3), 443-456.

Peng, C.Y., Lee, K.L. and Ingersoll, G.M., 2002. An introduction to logistic regression analysis and reporting. *Journal of Educational Research*, 96: 3-14.

Pesaran, M.H., 2007. A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics,* 22(2), 265-312.

Perraudin, W. and Taylor, A.P., 2004. On the consistency of ratings and bond market yields. *Journal of Banking and Finance, 28(11), 2769-2788.*

Petrin, A., 2001. *Quantifying the benefits of new products: The case of the minivan*. Available from: www.nber.org (Accessed 13 June 2013).

Podolski, E. J., 2012. Regulating synthetic securitisation following the global financial crisis. *Australian Economic Review*, 45 (1), 14-28.

Poole, W., 2010. Causes and consequences of the financial crisis of 2007-2009, *Harvard Journal of Law and Public Policy,* 3 (2), 421-441.

Popper, K., 1959. *The logic of scientific discovery*. Basic Books, New York.

Pratap, S. and Urrutia, C., 2012. Financial frictions and total factor productivity: Accounting for the real effects of financial crises, *Review of Economic Dynamics*. 15 (3), 336-358.

Prindl, A.R., 1976. *Foreign exchange risk*. John Wiley and Sons, London.

Provost, C., 2016. Competition and coordination in bank regulation: The financial crisis of 2007–09. *International Journal of Public Administration*. 39 (7), 540-551.

Purnanandam, A., 2007. Interest rate derivatives at commercial banks: An empirical investigation. *Journal of Monetary Economics*, 54(6), 1769-1808.

Purnanandam, A., 2008. Financial distress and corporate risk management: theory and evidence. *Journal of Financial Economics*, 87(3), 706-739.

Purnanandam, A., 2011. Originate-to-distribute model and the sub-prime mortgage crisis. *Review of Financial Studies*, 24, 1881–1915.

Pyle, D.H., 1971. On the theory of financial intermediation. *Journal of Finance*, 26(3), 737-747.

Rahe, A., 2004. Securitisation of SME Loan Portfolios in Germany and Europe, presented by KfW.

Rajan, R.G. and Ramcharan, R., 2015. Constituencies and legislation: The fight over the mcfadden act of 1927. *Management Science. Available from: pubsonline.informs.org. (Accessed 16 January 2016).*

Reilly, F.K. and Brown, K.C., 2006. *Investment analysis and portfolio management*. 8th edition. Thomson South-Western, USA.

Reinganum, M.R. 1981. Misspecifiaction of capital asset pricing model. Empirical anomalies based on earnies yields and market values. *Journal of Financial Economics*, 9(1), 19-46.

Reinhart, C.M. and Rogoff, K.S., 2008. This time is different: A panoramic view of eight centuries of financial crises. Available from: www.nber.org. (Accessed September 2012).

Reinhart, C.M. and Rogoff, K.S. 2008. Is the 2007 U.S. sub-prime financial crisis so different? An international historical comparison. *American Economic Review*, 98, 339-44.

Reinhart, C.M. and Rogoff, K.S., 2009. *This time is different: Eight centuries of financial folly.* Princeton: Princeton University Press.

Reinhart, C.M. and Rogoff, K.S., 2014. Recovery from financial crises: Evidence from 100 episodes. *American Economic Association*, 104(5), 50-55.

Reuters Business News (UK) "*Co-op Bank agrees £1.5 billion 'bail-in' rescue plan".* June 17, 2013) Available at www. uk.reuters.com/article/uk-coop-capital. (Accessed on 2 May 2015).

Rodriguez, G. and Elo, I., 2003. Intra-class correlation in random-effects models for binary data. *The Stata Journal*, 3,32–46.

Rodriguez, R.J., 1988. Default risk, yield spreads and time to maturity. *Journal of Financial and Quantitative Analysis*, 23(1), 111-117.

Roll, R., 1977. A critique of the asset pricing tests, Part 1: On part and potential testability of the theory. *Journal of Financial Economics*, 4(1), 129-136.

Roll, R. and Ross, S.A., 1980. An empirical investigation of the arbitrage pricing theory. *The Journal of Finance*, 35(5), 1073-1103.

Ross, S.A., 1976. The arbitrage theory of the capital asset pricing. *Journal of Economic Theory*, 13, 341-360.

Rötheli, T.F., 2010. Causes of the financial crisis: Risk misperception, policy mistakes, and banks' bounded rationality. *Journal of Socio-Economics*. 39 (2), 119-126.

Roy, S and Kemme, D.M., 2012. Causes of banking crises: Deregulation, credit booms and asset bubbles, then and now. *International Review of Economics and Finance*. 24, 270-294.

Rudiger, F. and Jochen, B., 2008. Pricing and hedging of portfolio credit derivatives with interacting default intensities. *International Journal of Theoretical and Applied Finance*, 11(6), 611-634.

Rule, D., 2001. The credit derivatives market: Its development and possible implications for financial stability. *Bank of England, Financial Stability Review*, 10 June, 117-140.

Ryan, B., Scapens, R.W. and Theobald, M., 1992. *Research method and methodology in finance and accounting*. Academic Press Limited, London.

Saretto, A. and Tookes, H.E. 2013. Corporate leverage, debt maturity, and credit supply: The role of credit default swaps. *Review of Financial Studies*. 26(5), 1190-1247.

Sargent, T.J., 1979. A note on maximum likelihood estimation of the rational expectations model of the term structure. *Journal of Monetary Economics*, 5(1), 133-143.

Sarno, L., Thornton, D.L. and Valente, G., 2007. The empirical failure of the expectations hypothesis of the term structure of bond yields. *Journal of Financial and Quantitative Analysis*. 42(1), 81-100.

Santomero, A .,2001. What do financial intermediaries do*? Journal of Banking and Finance*, 25, 271-294.

Saunders, M., Lewis, P. and Thornhill, A., 2007. *Research methods for business students,* 4th edition, Prentice.

Saunders, A., 1999. *Credit Risk Measurement*. Wiley, New York.

Saunders, M., Lewis, P. and Thornhill, A., 2003. *Research methods for business students*. 3rd edition. Pearson Education Limited, Essex.

Schmudde, D., 2009. Responding to subprime mess: the new regulatory landscape. *Fordham Journal of Corporate and Financial Law*, 14(4), 708-770.

Schrand, C. and Unal, H., 1998. Hedging and the coordinated risk management: evidence from the thrift conversions. *The Journal of Finance*, 53(3), 979-1013.

Schuermann, T., 2014. Stress testing banks. *International Journal of Forecasting*. 30 (3)717-728.

Schwartz, T., 1998. Estimating the term structures of corporate debt. *Review of Derivatives Research*, 2,193-230.

Securities, U.S., 2003. Exchange Commission (SEC). 2002. *Acceleration of periodic report filing dates and disclosure concerning website access to reports. September, 5.*

Sevestre, P. and Trognon, A., 1985. A note on autoregressive error component models. *Journal of Econometrics*, 28, 231-245.

Shao, Y. and Yeager, T.J., 2007. *The effects of credit derivatives on US bank risk and return, capital and lending structure.* Unpublished working paper. Available from:www. comp.uark.edu (Accessed 30 January 2012).

Sharma, S.D., 2013. Credit default swaps: Risk hedge or financial weapon of mass destruction, *Economic Affairs*, 33(3), 303-311.

Sharpe, W.F., 1963. *A simplified model for portfolio analysis*. Management Science Book.

Sharpe, W.F., 1964. Capital asset prices. A theory of market equilibrium under conditions of risks. *Journal of Finance*, 19(3), 425-442.

Sharpe, W.F., 1967. Portfolio analysis. *The Journal of Financial and Quantitative Analysis*, 2(2), 76-84.

Sharpe, W. F., 1970. *Portfolio Theory and Capital Markets*, McGraw-Hill, London.

Sheaffer, Z., Richardson, B. and Rosenblatt, Z. 1998. Early-Warning-Signals management: A lesson from the Barings crisis. *Journal of Contingencies and Crisis Management*, 6(1), 31-45.

Sherman, M., 2009. *A short history of financial deregulation in the United States*. Center for Economic and Policy Research, Washington DC. Available from: http://www.cpr.net [Accessed 15 March 2014].

Shivdasani, A. and Wang, Y., 2011. Did structured credit fuel the LBO boom? *The Journal of Finance*, 66(4), pp.1291-1328.

Silvers, J.B., 1973. An alternative to the yield spread as a measure of risk. *Journal of Finance*, 28(4), 933-955.

Sinkey, J.F. and Carter, D.A., 1997. The reaction of bank stock prices to news of derivative loses by corporate clients. *Journal of Banking and Finance*, 23(12), 1725-1743.

Sinkey, J.F.Jr., and Carter, D.A. 1999. The reaction of bank stock prices to news of derivative losses by corporate clients. *Journal of Banking and Finance*, 23(12), 1725-1743.

Sinkey, J.F. and Carter, D.A. 2000. Evidence on the financial characteristics of banks that do and do not use derivatives. *The quarterly review of economics and Finance*, 40, 431-449.

Skinner, F.S. and Diaz, A., 2003. An empirical study of credit default swaps. *The Journal of Fixed Income*, 13(1), 28-38.

Skinner, F.S., 1998. Hedging bonds subject to credit risk. *Journal of Banking and Finance*, 22(3), 321-345.

Skyrm, S.E.D., 2014. The London Whale: *Rogue risk management*. *Futures*, 43 (7), 18-21.

Slovik, P. and Cournède, B., 2011. Macroeconomic impact of Basel III, *OECD Economics Department Working Papers,* No. 844, OECD Publishing, Paris.

Smith, C.W. and Stulz, R.M., 1985. The determinants of firms hedging policies. *Journal of Financial and Quantitative Analysis*, 20(4), 391-405.

Smith, C.W., 1995. Corporate risk management: theory and practice. *Journal of Derivatives*, 2(4), 21-30.

Smithson, C., 2003. C*redit portfolio management*. Hoboken, New Jersey: John Wiley and Sons, Incorporation.

Snedecor, G.W. and Cochran, W.G., 1989. *Statistical methods*. 8th edition. Iowa State University Press, Iowa.

Sohn, S.Y and Kim, H.S., 2007. Random effects logistic regression model for default prediction of technology credit guarantee fund. *European Journal of Operational Research*, 183(1), 472-478.

Sorensen, E.H., 1980. An analysis of the relationship between underwriter spread and the pricing of municipal bonds. *Journal of Financial and Quantitative Analysis*, 15(02), 435-447.

Sorensen, E.H., 1980. Bond ratings versus market risk premiums. *The Journal of Portfolio Management*, 6(3), pp.64-69.

Spiegel, M.M., 2006. Did quantitative easing by the bank of Japan 'work'? *Federal Reserve Bank of San Francisco Economic Letter*, Number 2006-28.

Stevenson, B.G. and Fadil, M.W., 1995. Modern portfolio theory: can it work for commercial loans? *Commercial Lending Review*, 10(2), 4-12.

Stock, D., 1994. Term structure effects on default risk premia and the relationship of default - risky tax - exempt yields to risk free taxable yields -a note. *Journal of Banking and Finance*, 18, 1185-1203.

Stritzel, S., 1995. Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994: Progress toward a New Era in Financial Services Regulation, *The. Syracuse L. Rev*., 46,161-172

Strong, R.A., 2003. *Portfolio construction, management, and protection*. 3rd edition. Thomson, South- Western, Ohio.

Stulz. R., 1984. Optimal hedging policies. *Journal of Financial and Quantitative Analysis,* 19, 127-140.

Stulz, R., 1990. Managerial discretion and optimal financing policies. *Journal of Financial Economics*, 26, 3-20.

Stulz, R., 1996. Rethinking risk management. *Journal of Applied Corporate Finance*, 9(3), 8-25.

Stulz, R., 2003. Risk Management and Derivatives, South-Western Publishing

Stulz, R., 2004. Should we fear derivatives? *Journal of Economic Perspectives*, 18, 173–192.

Stulz, R., 2010. Credit default swaps and the credit crisis. *Journal of Economic Perspectives,* 24, 73-92.

Sylla, R., 1976. Forgotten men of money: private bankers in early U.S. history. *Journal of Economic History,* 173-188.

Sylla, R., 1998. U.S capital markets and the banking system, 1790-1840, Federal Reserve bank of St. Louise Review.

Szego, G.P., 1980. *Portfolio theory with application to bank asset management*. Academic Press, New York.

Taylor, J.B., 2009. The financial crisis and the policy responses: An empirical analysis of what went wrong. Available from: www.nber.org (Accessed 13 August 2013).

Temin, P., 2001. A market economy in the early Roman Empire. *Journal of Roman studies*, 91, 169-181.

Thakor, A.V., 2015. The financial crisis of 2007–2009: Why did it happen and what did we learn?. *Review of Corporate Finance Studies,* 4(2), 155-205.

The New York Times. 2012. JPMorgan Discloses $2 Billion in Trading Losses. Available from: www.dealbook.nytimes.com/2012/05/10/. (Accessed 15 July 2015).

Thornton, D.L., 1994. Financial innovation, deregulation and the ‘credit view’ of monetary policy. *Federal Reserve Bank of St. Louis Review*, 76(1), 31-49.

Thornton, D.L., 2007. Open market operations and the federal funds rate. *Federal Reserve Bank of St. Louis Review*, 89(6), 549-70.

Thornton, D.L., 2009. The fed, liquidity, and credit allocation. *Federal Reserve Bank of St.*

Louis Review, 91(1), 13-21.

Taylor, C., 1975. *Hegel.* Cambridge: Cambridge University Press.

Taylor, J. B., 2013.The Effectiveness of Central Bank Independence vs. Policy Rules. *Business Economics*, 48 (3), 155–162.

Thornton, D.L., 2010a. The relationship between the daily and policy-relevant liquidity effects. *Federal Reserve Bank of St. Louis Review*, 92(1), 73-87.

Thornton, D.L., 2010b. Monetary policy and longer-term rates: an opportunity for greater transparency. *Federal Reserve Bank of St. Louis, Economic Synopses*, 36.

Thornton, D.L., 2010c. The unusual behaviour of the federal funds rate and treasury yields: a conundrum or an instance of Goodhart's law? *Federal Reserve Bank of St. Louis Working Paper 2007-039C,* revised June 2012.

Thornton, D.L., 2011. The effectiveness of unconventional monetary policy: the term auction facility. *Federal Reserve Bank of St. Louis Review*, 93(6), 439-53.

Thornton, D.L., 2012a. Monetary policy: why money matters and interest rates don't. *Federal Reserve Bank of St. Louis Working Paper,* 2012-020A, revised July 2012.

Thornton, D.L., 2012b. Evidence on the portfolio balance channel of quantitative easing. *Federal Reserve Bank of St. Louis, Working Paper,* 2012-015A

Thornton, D.L., 2012c. The efficacy of monetary policy: a tale from two decades. *Federal Reserve Bank of St. Louis Economic Synopses*, 18.

Thorp, W.L., 1926. Business annals. New York: *National Bureau of Economic Research*.

Timan, S. and Wessels, R., 1988. The determinants of capital structure choice, *Journal of Finance*, 43(1), 1-19.

Tirtiroglu, D., Daniels, K.N. and Tirtigoglu, E., 2005. Deregulation, intensity of competition, industry evolution, and the productivity growth of U.S commercial banks. *Journal of Money, Credit and Banking,* 37 (2), 339-360.

Titman, S., Wei, K.C.J. and Xie, F., 2004. Capital investments and stock returns. *The Journal of Financial and Quantitative Analysis,* 39(4), 677-700.

Titman, S., 1992. Interest rates swaps and corporate financing choices. *The Journal of Finance*, 47(4), 1503-1516.

Tobin, J., 1958. Liquidity preference as behaviour towards risk. *Review of Economic Studies*, 26(6), 65-86.

Tole, T.M., 1981. How to maximise stationarity of beta. *Journal of Portfolio Management*, 7(2), 45-49.

Treynor, J.L., 1961. Market value, time and risk. Available from www.ssrn.com (Accessed 18 February 2012).

Tsay, R.S. and Ando, T., 2012. Bayesian panel data analysis for exploring the impact of subprime financial crisis on the US stock market. *Computational Statistics and Data Analysis*, 56(11), 3345-3365.

Tufano, P., 1996.Who manages risk? An empirical examination of risk management practices in the gold mining industry. *The Journal of Finance*, 51(4), 1097-1137.

Ur-Rehman, A and Man, W., 2015. Corporate Cash Holdings and Adjustment Behaviour in Chinese Firms: An empirical Analysis Using Generalized Method of Moments. *Australasian Accounting Business and Finance Journal,* 9 (4), 20-37.

US Department of Housing and Urban Development (HUD).2010. Available from: www.huduser.org/portal/datasets/manu.html. (Accessed 2 March, 2015).

Viorica, S.O., 2012. New approaches to monetary policy in the context of actual financial crisis.University Annals, *Series Economic Sciences*, 12(1), 1692-1696.

Vitorino, M. A., 2014. Understanding the effect of advertising on stock returns and firm value: Theory and Evidence from a Structural Model, *Management Science*, 60(1), 227-245.

Vogt, W. P., 1993. *Dictionary of statistics and methodology*. Newbury Park, CA: Sage.

Von Newmann, J. and Morgenstern, O., 1947. *Theory of games and economic behaviour*. 2nd edition. Princeton, New Jersey, U.S: Princeton University Press, 641.

Vyas, D., 2011. The timeliness of accounting write-downs by U.S. financial institutions during the financial crisis of 2007-2008, *Journal of Accounting Research*, 49 (3), 823-860.

Wade, R., 2008. The first-world debt crisis of 2007-2010 in global perspective. *Challenge*, 51(4), 23-54.

Waqar, A., Rashid, K and Jadoon, A., 2014. Board size and board independence: A quantitative study on banking industry in Pakistan, *IUP Journal of Corporate Governance*, 13 (2), 60-69.

Wagner, W., 2007. The liquidity of bank assets and banking stability, *Journal of Banking and Finance*, 31(1), 121-139.

Wakeman, L.M., 1990. *The real function of bond rating agencies: the modern theory of corporate financ*e. 2nd edition. McGraw-Hill.

Wall, L.D., Eisenbeis, R.A. and Frame, W.S., 2005. Resolving large financial intermediaries: banks versus housing enterprises. *Journal of Financial Stability*, 1(3), 386-425.

Wallace, T.D. and Hussain, A., 1969. Use of error components model for combining time series with cross-section data. *Econometrica*, 37, 55-72.

Walliman, N.S.R., 2001. Your research project: *A step-by-step guide for the first-time researcher,* London: Sage Publications Ltd.

Wang, Z., 2007. Technological innovation and market turbulence: The dot-com experience, *Review of Economic Dynamics,* 10 (1), 78-105.

Walton, P., 2004. IAS 39: Where different accounting models collide. *Accounting in Europe*, 1(1), 5-16.

Weber, M., 1948. *From Max Weber* ed. By H. H. Girth and C.W Mills London, Routledge.

Westerlund, J., 2007. Testing for error correction in panel data. *Oxford Bulletin of Economics and Statistics*, 69, 709–748.

Westerlund, J., 2008. Panel cointegration tests of the Fisher effect. *Journal of Applied Econometrics*, 23, 193-233.

Wexler, M.N., 2010. Financial edgework and the persistence of rogue traders. *Business and Society Review*, 115(1), 1-25.

Wheelock, D.C., 2010. Lessons learned? Comparing the Federal Reserve's responses to the crises of 1929-1933 and 2007-2009. *Review*, 92 (2), 89-10.

Wheelock, D.C. and Wilson, P.W., 1995. Explaining bank failures: deposit insurance, regulation, and efficiency. *The Review of Economics and Statistics*, 77(4), 689-700.

Wheelock, D.C and Wilson, P., 1995. Explaining bank failures: deposit insurance, regulation, and efficiency. *The Review of Economics and Statistics*, 77(4), 689-700.

White, H., 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, 48 (4), 817–838.

William, W.L and Julapa, J., 2010. The Mortgage and Financial Crises: The Role of Credit Risk Management and Corporate Governance, *Atlantic Economic Journal*, 38(2), 123-144.

Wilmarth, A.E., 2009. The dark side of universal banking: financial conglomerates and the origins of the subprime financial crisis. *Connecticut Law Review*, 41(4), 963-1050.

Wilmarth, A.E., 2009. The dark side of universal banking: financial conglomerates and the origins of the subprime financial crisis, *Connecticut Law Review*, 41(4).

Wind, Y., 1974. Product portfolio analysis: a new approach to the product mix decisions, in 1974 combined proceedings, Ronald C.C., eds, Chicago. *American Marketing Association*, 460-464.

Woodford, M., 2001. The Taylor rule and optimal monetary policy. *The American Economic Review*, 91(2), 232-237.

World Bank Group. 2008. Global Financial Development report. Available from: www.econ.worldbank.org [Accessed 10 August 2012].

World Bank Group. 2010. Global Financial Development report. Available from: www.econ.worldbank.org [Accessed 19 September 2012].

World Bank Group. 2011. Response to economic crisis. Available from: www.worldbankgroup.org (Accessed 30 July 2015).

World Bank Group. 2012. Global Financial Development report. Available from: http://www.econ.worldbank.org [Accessed 15 March 2014].

Wray, L.R., 2008. Lessons from the subprime meltdown, *Challenge*, 51(2), 40-68.

Wu, J., Lim, H. and Jeon, B.N., 2016. The impact of foreign banks on monetary policy transmission during the global financial crisis of 2008–2009: Evidence from Korea. *Emerging Markets Finance and Trade*, 52(7), 1574-1586.

Wysocki, P., 1996. Managerial Motives and Corporate Use of derivatives: Some Evidence, *Working paper, Simon School of Business, University of Rochester.*

Xin H., Hao, Z and Haibin Z., 2010. *Assessing the systemic risk of a heterogeneous portfolio of banks during the recent financial crisis.* BIS, Basel Working paper, Switzerland.

Xing, Y. and Yuqin, Z., 2012. The effect of credit derivatives CDO to financial market stability. *Journal of Business Economics*, 2, 67-75.

Yawitz, J.B., Kevin, J.M. and Louis, H.E., 1985. Taxes, default risk and yield spreads. *The Journal of Finance*, 40(4), 1127-1140.

Yawitz, J.B., 1977. An analytical model of interest rate differentials and different default recoveries. *Journal of Financial and Quantitative Analysis*, 481-490.

Zimmerman, T., 2007. The great subprime meltdown. *Journal of Structured Finance*, 13(3), 7-20.

Appendix

Table A1: Asset Write Down by Banks 2007-2009 ($' Billions)

	Financial Institutions	Country	Write downs	Total Write Down	Largest Write Down	Market Value (2007)	Market Value (2009)	(-)%
1	Dexia SA	BELGIUM	8	6,812	2,946	31,435	5,144	-84%
2	KBC Groep NV	BELGIUM	9	12,127	4,960	44,905	10,591	-76%
3	Bank of Montreal	CANADA	7	1,917	486	30,553	17,899	-41%
4	Bank of Nova Scotia	CANADA	7	1,586	734	43,844	32,715	-25%
5	Canadian Imperial Bank of Commerce	CANADA	10	9,400	3,363	26,442	17,119	-35%
6	National Bank of Canada	CANADA	8	1,059	564	8,824	5,930	-33%
7	Royal Bank of Canada	CANADA	8	5,413	1,111	57,121	51,644	-10%
8	BNP Paribas	FRANCE	9	19,526	3,974	98,557	37,262	-62%
9	Credit Agricole S.A	FRANCE	9	9,352	3,597	57,109	24,758	-57%
10	Natixis	FRANCE	7	8,891	2,355	22,479	5,053	-78%
11	Societe Generale	FRANCE	10	19,856	3,816	69,359	27,544	-60%
12	Commerzbank AG	GERMANY	10	5,044	1,512	24,914	6,759	-73%
13	Deutsche Bank AG	GERMANY	9	21,797	4,067	69,837	22,267	-68%
14	Hypo Real Estate Holding AG	GERMANY	9	7,281	4,579	8,428	880	-90%
15	UniCredit SpA	ITALY	4	6,413	3,165	77,261	27,428	-64%
16	ING Groep N.V.	NETHERLANDS	8	10,273	3,658	74,996	16,128	-78%
17	DBS Group Holdings Ltd	SINGAPORE	2	194	111	19,180	13,333	-30%
18	Banco Santander SA	SPAIN	9	13,167	2,643	107,543	74,194	-31%
19	UBS AG	SWITZERLAND	9	57,090	19,510	113,563	40,880	-64%
20	Alliance & Leicester Plc	UK	3	2,934	1,391	9,753	1,421	-85%
21	Barclays Plc	UK	4	37,209	12,837	90,905	18,502	-80%
22	HBOS Plc	UK	3	31,521	24,080	81,128	12,760	-84%
23	HSBC Holdings Plc	UK	4	50,074	20,354	183,766	100,353	-45%
24	Lloyds TSB Group Plc	UK	3	4,083	1,761	31,262	7,712	-75%
25	Royal Bank of Scotland Group Plc	UK	5	54,465	20,345	34,292	28,014	-18%

	Financial Institutions	Country	Write downs	Total Write Down	Largest Write Down	Market Value (2007)	Market Value (2009)	(-)%
26	Bank of America Corp	USA	10	89,305	14,530	239,758	90,007	-62%
27	BB&T Corp	USA	10	3,901	653	23,863	15,171	-36%
28	Bear Stearns Companies Inc	USA	3	3,200	1,900	17,771	-	
29	Citigroup Inc.	USA	10	120,763	19,721	273,691	36,566	-87%
30	Credit Suisse Group AG	USA	9	18,315	5,682	84,342	30,371	-64%
31	E*TRADE Financial Corp	USA	8	5,709	2,840	9,572	618	-94%
32	Fifth Third Bancorp	USA	10	8,086	2,249	22,842	4,769	-79%
33	Goldman Sachs Group Inc.	USA	8	9,100	2,275	82,824	37,312	-55%
34	Huntington Bancshares	USA	10	4,191	882	5,644	2,804	-50%
35	Indymac Bancorp (ONE WEST BANK)	USA	3	1,071	617	3,201	-	
36	JPMorgan Chase & Co.	USA	11	63,134	9,800	167,551	117,681	-30%
37	KeyCorp	USA	10	5,096	822	15,272	4,217	-72%
38	Lehman Brothers Holdings Inc.	USA	5	16,230	7,000	38,880	-	
39	Merrill Lynch & Co.	USA	5	50,357	16,729	82,050	-	
40	Marshall & llsley Corp.	USA	10	4,641	868	9,727	3,539	-64%
41	Morgan Stanley	USA	10	23,388	9,400	65,537	17,235	-74%
42	National City Corp.	USA	6	29,532	19,900	23,120	-	
43	PNC Financial Services Group	USA	9	14,332	4,848	21,754	20,970	-4%
44	Sovereign Bancorp Inc.	USA	3	1,750	1,430	12,007	-	
45	SunTrust Banks Inc	USA	10	6,470	1,018	29,907	10,460	-65%
46	U.S. Bancorp	USA	10	9,109	1,416	63,617	43,569	-32%
47	Washington Mutual Inc.	USA	7	44,547	30,871	42,998	-	
48	Wachovia Corporation	USA	6	101,887	49,762	90,049	-	
49	Wells Fargo & Company	USA	9	37,467	8,604	120,049	110,712	-8%
	Total		**366**	**1,069,065**	**361,736**	**2,963,482**	**1,152,291**	**-61%**

Sources: IMF; BIS

Table A2: Growth of US FDIC insured banks

Year	No of FDIC Insured banks	Total Assets ($ billions)	Total equity capital ($ billions)	Tier 1(core) risk-based-capital ($ billions)	Derivatives ($ billions)
1996	11,454	5,611	461	419	20,310
2000	9,904	7,462	633	556	40,772
2005	8,833	10,876	1,118	864	101,879
2010	7,658	13,318	1,511	1,160	232,111
2011	7,357	13,892	1,569	1,217	232,061
2012	7,083	14,450	1,629	1,262	224,271

Source: FDIC

Table A3: IMPORTANT UNITED STATES BANKING REGULATIONS AND RULES

No	REGULATION	PURPOSE
1	National Bank Act of 1864 (Chapter 106, 13 STAT. 99).	Established a national banking system and the chartering of national banks
2	Federal Reserve Act of 1913 (P.L. 63-43, 38 STAT. 251, 12 USC 221)	Established the Federal Reserve System as the central banking system of the U.S.
3	An Act to Amend the National Banking Laws and the Federal Reserve Act (P.L. 69-639, 44 STAT. 1224).	Also known as The McFadden Act of 1927. Prohibited interstate banking.
4	Banking Act of 1933 (P.L. 73-66, 48 STAT. 162).	Also known as the Glass-Steagall Act. Established the FDIC as a temporary agency. Separated commercial banking from investment banking, establishing them as separate lines of commerce.
5	Banking Act of 1935 (P.L. 74-305, 49 STAT. 684).	Established the FDIC as a permanent agency of the government.
6	Federal Deposit Insurance Act of 1950 (P.L. 81-797, 64 STAT. 873).	Revised and consolidated earlier FDIC legislation into one Act. Embodied the basic authority for the operation of the FDIC.
7	Bank Holding Company Act of 1956 (P.L. 84-511, 70 STAT. 133).	Required Federal Reserve Board approval for the establishment of a bank holding company. Prohibited bank holding companies headquartered in one state from acquiring a bank in another state.
8	Financial Institutions Supervisory Act of 1966 (P.L. 89-695, 80 STAT. 1028).	Expanded bank enforcement powers of the Federal banking agencies, permitting regulators to bring cease and desist orders against banks engaged in unsafe and unsound banking practices or other violations of law. Granted the Federal banking agencies authority to remove bank officers and directors for breach of fiduciary duty.

Table A3 Cont'd

No	REGULATION	PURPOSE
9	International Banking Act of 1978 (P.L. 95-369, 92 STAT.607).	Brought foreign banks within the federal regulatory framework. Required deposit insurance for branches of foreign banks engaged in retail deposit taking in the U.S.
10	Financial Institutions Regulatory and Interest Rate Control Act of 1978 (P.L. 95-630, 92 STAT. 3641).	Created the Federal Financial Institutions Examination Council. Established limits and reporting requirements for bank insider transactions.
11	Depository Institutions Deregulation and Monetary Control Act of 1980 (P.L. 96-221, 94 STAT. 132).	Established "NOW Accounts." Began the phase-out of interest rate ceilings on deposits. Established the Depository Institutions Deregulation Committee. Granted new powers to thrift institutions. Raised the deposit insurance ceiling to $100,000.
12	Garn-St Germain Depository Institutions Act of 1982 (P.L. 97-320, 96 STAT. 1469).	Expanded the powers of thrift institutions. Expanded FDIC powers to assist troubled banks through such measures as the Net Worth Certificate (NWC) program, which provided for recapitalisation of banks and thrifts that suffered from interest rate shock after deregulation of interest rates on deposits. NWCs were a temporary form of capital that the institution gradually replaced as it became profitable.
13	Competitive Equality Banking Act of 1987 (P.L. 100-86, 101 STAT. 552).	Also known as CEBA. Established new standards for expedited funds availability. Recapitalised the Federal Savings & Loan Insurance Company (FSLIC). Expanded FDIC authority for open bank assistance transactions, including bridge banks.

Table A3 Cont'd

No	REGULATION	PURPOSE
14	Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (P.L. 101-73, 103 STAT. 183).	Also known as FIRREA. FIRREA's purpose was to restore the public's confidence in the savings and loan industry. FIRREA abolished the Federal Savings & Loan Insurance Corporation (FSLIC), and the FDIC was given the responsibility of insuring the deposits of thrift institutions in its place. The FDIC insurance fund created to cover thrifts was named the Savings Association Insurance Fund (SAIF), while the fund covering banks was called the Bank Insurance Fund (BIF). FIRREA also abolished the Federal Home Loan Bank Board. Two new agencies, the Federal Housing Finance Board (FHFB) and the Office of Thrift Supervision (OTS), were created to replace it. Finally, FIRREA created the Resolution Trust Corporation (RTC) as a temporary agency of the government. The RTC was given the responsibility of managing and disposing of the assets of failed institutions. An Oversight Board was created to provide supervisory authority over the policies of the RTC, and the Resolution Funding Corporation (RFC) was created to provide funding for RTC operations.
15	Crime Control Act of 1990 (P.L. 101-647, 104 STAT. 4789).	Title XXV of the Crime Control Act, known as the Comprehensive Thrift and Bank Fraud Prosecution and Taxpayer Recovery Act of 1990, greatly expanded the authority of Federal regulators to combat financial fraud. This Act prohibited undercapitalised banks from making golden parachute and other indemnification payments to institution-affiliated parties. It also increased penalties and prison time for those convicted of bank crimes, increased the powers and authority of the FDIC to take enforcement actions against institutions operating in an unsafe or unsound manner, and gave regulators new procedural powers to recover assets improperly diverted from financial institutions.

Table A3 Cont'd

No	REGULATION	PURPOSE
16	Federal Deposit Insurance Corporation Improvement Act of 1991 (P.L. 102-242, 105 STAT. 2236).	Also known as FDICIA. FDICIA greatly increased the powers and authority of the FDIC. Major provisions recapitalised the Bank Insurance Fund and allowed the FDIC to strengthen the fund by borrowing from the Treasury. The Act mandated a least-cost resolution method and prompt resolution approach to problem and failing banks and ordered the creation of a risk-based deposit insurance assessment scheme. Brokered deposits and the solicitation of deposits were restricted, as were the non-bank activities of insured state banks. FDICIA created new supervisory and regulatory examination standards and put forth new capital requirements for banks. It also expanded prohibitions against insider activities and created new Truth in Savings provisions.
17	Housing and Community Development Act of 1992 (P.L. 102-550, 106 STAT. 3672).	Established regulatory structure for government-sponsored enterprises (GSEs), combated money laundering, and provided regulatory relief to financial institutions.
18	RTC Completion Act of 1989 (P.L. 103-204, 107 STAT. 2369).	Required the RTC to adopt a series of management reforms and to implement provisions designed to improve the agency's record in providing business opportunities to minorities and women when issuing RTC contracts or selling assets. Expands the existing affordable housing programs of the RTC and the FDIC by broadening the potential affordable housing stock of the two agencies. Increased the statute of limitations on RTC civil lawsuits from three years to five, or to the period provided in state law, whichever is longer. Provided final funding for the RTC and established a transition plan for transfer of RTC resources to the FDIC. The RTC's sunset date is set at Dec. 31, 1995, at which time the FDIC assumed its conservatorship and receivership functions.

Table A3 Cont'd

No	REGULATION	PURPOSE
19	Riegle Community Development and Regulatory Improvement Act of 1994 (P.L. 103-325, 108 STAT. 2160).	Established a Community Development Financial Institutions Fund, a wholly owned government corporation that would provide financial and technical assistance to CDFIs. Contains several provisions aimed at curbing the practice of "reverse redlining" in which non-bank lenders target low and moderate income homeowners, minorities and the elderly for home equity loans on abusive terms. Requires the Treasury Department to develop ways to substantially reduce the number of currency transactions filed by financial institutions. Contains provisions aimed at shoring up the National Flood Insurance Program.
20	Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 (P.L. 103-328, 108 STAT. 2338).	Permits adequately capitalised and managed bank holding companies to acquire banks in any state one year after enactment. Concentration limits apply and CRA evaluations by the Federal Reserve are required before acquisitions are approved. Beginning June 1, 1997, allowed interstate mergers between adequately capitalised and managed banks, subject to concentration limits, state laws and CRA evaluations. Extends the statute of limitations to permit the FDIC and RTC to revive lawsuits that had expired under state statutes of limitations.
21	Economic Growth and Regulatory Paperwork Reduction Act of 1996 (P.L. 104-208, 110 STAT. 3009).	Requires the Federal Financial Institutions Examination Council and its member agencies to review their regulations at least once every 10 years to identify any out-dated or unnecessary regulatory requirements imposed on insured depository institutions. Amended the Fair Credit Reporting Act to strengthen consumer protections relating to credit reporting agency practices. Established consumer protections for potential clients of consumer repair services. Clarified lender liability and federal agency liability issues under the Comprehensive Environmental Response, Compensation, and Liability Act. Directed FDIC to impose a special assessment on depository institutions to recapitalise the Savings Association Insurance Fund(SAIF), and aligned SAIF assessment rates.

Table A3 Cont'd

No	REGULATION	PURPOSE
22	Gramm-Leach-Bliley Act of 1999 (P.L. 106-102, 113 STAT 1338).	Repeals last vestiges of the Glass Steagall Act of 1933. Modifies portions of the Bank Holding Company Act to allow affiliations between banks and insurance underwriters. While preserving authority of states to regulate insurance, the Act prohibits state actions that have the effect of preventing bank-affiliated firms from selling insurance on an equal basis with other insurance agents. Law creates a new financial holding company under section 4 of the BHCA, authorised to engage in: underwriting and selling insurance and securities, conducting both commercial and merchant banking, investing in and developing real estate and other "complimentary activities." There are limits on the kinds of non-financial activities these new entities may engage in. Allows national banks to underwrite municipal bonds. Restricts the disclosure of non-public customer information by financial institutions. All financial institutions must provide customers the opportunity to "opt-out" of the sharing of the customers' non-public information with unaffiliated third parties. The Act imposes criminal penalties on anyone who obtains customer information from a financial institution under false pretenses. Amends the Community Reinvestment Act to prohibit financial holding companies from being formed before their insured depository institutions receive and maintain a satisfactory CRA rating. Also requires public disclosure of bank-community CRA-related agreements. Grants some regulatory relief to small institutions in the shape of reducing the frequency of their CRA examinations if they have received outstanding or satisfactory ratings. Prohibits affiliations and acquisitions between commercial firms and unitary thrift institutions. Makes significant changes in the operation of the Federal Home Loan Bank System, easing membership requirements and loosening restrictions on the use of FHLB funds.

Table A3 Cont'd

No	REGULATION	PURPOSE
23	International Money Laundering Abatement and Financial Anti-Terrorism Act of 2001* (P.L. 107-56).	Title III of the USA PATRIOT Act. Legislation designed to prevent terrorists and others from using the U.S. financial system anonymously to move funds obtained from or destined for illegal activity. It authorises and requires additional record keeping and reporting by financial institutions and greater scrutiny of accounts held for foreign banks and of private banking conducted for foreign persons. The law requires financial institutions to establish anti-money laundering programs and imposes various standards on money-transmitting businesses. It amends criminal anti-money laundering statutes and procedures for forfeitures in money laundering cases and requires further cooperation between financial institutions and government agencies in fighting money laundering.
24	Sarbanes-Oxley Act of 2002 (P.L. 107-204).	Sarbanes-Oxley established the Public Company Accounting Oversight Board to regulate public accounting firms that audit publicly traded companies. It prohibits firms that audit publicly traded companies from providing other services to the companies they audit, and it requires that CEOs and CFOs of the publicly traded companies certify their companies' annual and quarterly reports. The Act authorised the Securities and Exchange Commission (SEC) to issue rules governing audits. The law requires that insiders may no longer trade their company's securities during pension fund blackout periods. It mandates various studies including a study of the involvement of investment banks and financial advisors in the bookkeeping and recordkeeping scandals that motivated enactment of the legislation. Also included are whistle blower protections, new federal criminal laws, including a ban on alteration of documents..
25	The Check Clearing for the 21st Century Act of 2003(P.L. 108-100).	The Act directly affected insured depository institutions and their customers by providing a Federal statutory framework for electronic check processing. The Act allows an original paper check to be removed from the check collection or return process and an image of the paper check to be transmitted electronically. The Act also allows the transmitting bank to create a "substitute check" which contains the electronic picture and payment information if a receiving bank or a customer requires a paper check.

Table A3 Cont'd

No	REGULATION	PURPOSE
26	Fair and Accurate Credit Transactions Act of 2003* (P.L. 108-159).	The Fair and Accurate Credit Transactions (FACT) Act contains extensive amendments to the Fair Credit Reporting Act designed to improve the accuracy and transparency of the national credit reporting system, to prevent identity theft, and to assist victims. It contains provisions enhancing consumer rights in situations involving alleged identity theft, credit scoring, and claims of inaccurate information. It requires companies to notify consumers who receive credit on terms that are materially less favourable than the most favourable terms available to a substantial proportion of consumers of the company. The purpose of the notice is to alert consumers to the existence of negative information on their consumer report so that the consumer can check their consumer report for accuracy and correct any inaccurate information. Companies that share consumer information among affiliated companies must provide consumers notice and an opt-out for sharing of such information if the information will be used for marketing purposes.
27	The Federal Deposit Insurance Reform Act of 2005 (P.L. 109-171).	The Act required the merger of the Bank Insurance Fund and the Savings Association Insurance Fund into the Deposit Insurance Fund. The Act also increased the coverage limit for retirement accounts to $250,000 and indexed the coverage limit for retirement accounts to inflation as with the general deposit insurance coverage limit. The Act also granted the FDIC Board the discretion to price deposit insurance according to risk for all insured institutions regardless of the level of the reserve ratio. Soon after enactment, the Federal Deposit Insurance Reform Conforming Amendments Act of 2005 (P.L. 109-173)(February 15, 2006), was passed. This Act provided amendments that were necessary for the complete implementation of Federal Deposit Insurance Reform Act of 2005.
28	Financial Services Regulatory Relief Act of 2006 (P.L. 109-351).	The Act, among other things, authorised interest payments on balances held at Federal Reserve Banks, increased the flexibility of the Federal Reserve to set institution reserve ratios, extended the examination cycle for certain depository institutions, reduced the reporting requirements for financial institutions related to insider lending, and expanded enforcement and removal authority of the federal banking agencies, such as the FDIC.

Table A3 Cont'd

No	REGULATION	PURPOSE
29	The Housing and Economic Recovery Act of 2008 (P.L. 110-289).	This Act focused on housing reform and included provisions addressing foreclosure prevention, community development block grants, and housing counseling. The Act established a temporary Federal Housing Administration refinancing program, called the HOPE for Homeowners Program. In addition, the Act required the FDIC, working jointly with the other Federal banking agencies, to develop and maintain a system for registering with the Nationwide Mortgage Licensing System and Registry, residential mortgage loan originators who are employees of depository institutions and certain subsidiaries. The Act also amended the Truth in Lending Act to expand the types of home loans subject to good faith estimate disclosures.
30	Emergency Economic Stabilisation Act of 2008 (P.L. 110-343).	This Act authorised the United States Secretary of the Treasury to spend up to 700 billion dollars to purchase distressed assets, particularly mortgage-backed securities, and supply banks with cash.
31	Helping Families Save Their Homes Act of 2009 (P.L. 111-22).	This Act contains provisions intended to prevent mortgage foreclosures and enhance mortgage credit availability. With respect to the FDIC, the Act lengthened the Deposit Insurance Fund restoration plan period to 8 years, increased the FDIC's borrowing authority to $100 billion, and expanded the FDIC's assessment authority for systemic risk actions.
32	Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (P.L.111-203).	The Act implemented significant changes affecting the oversight and supervision of financial institutions and systemically important financial companies. It also provided the FDIC with new resolution powers for large financial companies, created a new agency (the Consumer Financial Protection Bureau), introduced (for nonbank financial companies) or codified (for bank holding companies) more stringent regulatory capital requirements, and set forth significant changes in the regulation of derivatives, credit ratings, corporate governance, executive compensation, and the securitisation market. A more complete summary is available here: FDIC's Role and Authorities under the Financial Reform Law

Source: Federal Deposit Insurance Corporation