A Multifactor Model of Investment Trust Discounts. A Comparative Study of UK Investment Trusts and US Closed-End Funds.

by

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Abstract

A closed-end fund, known as an investment trust in the UK and closed-end fund in the US, is a collective investment company that invests in shares of other companies. This study attempts to describe and explain the persistence of the excess discount return on UK investment trusts and US closed-end funds. The ability to identify which factors best capture return variation is central to applications of multifactor pricing models. So the main purpose of this thesis is the application of a multifactor risk model that will explain the existence of the excess discount return. Hence, the title of the thesis: "A Multifactor Model of Investment Trust Discounts. A Comparative Study of UK Investment Trusts and US Closed-End Funds".

First, the time-series properties of the closed-end funds' net asset values (NAVs) and discounts are investigated. In terms of normality, we find that the UK and US excess NAV returns and discounts are approximately normally distributed. In addition, through Augmented Dickey-Fuller tests, we find that the UK and US discounts are non-stationary, but the excess discount returns and the excess NAV returns are stationary. In terms of multicollinearity, we find that the independent variables included in our models are not closely correlated, so we do not have problems in using them in the regression models in Chapters 7 and 8. Finally, there are no significant differences in the discount during the month of January and other months.

In Chapter 7, we study the importance of management performance in terms of excess NAV returns and discount persistence. We use three approaches: Fama and French's (1993) three-factor model, an extended Fama and French model which incorporates a

market timing variable, and a performance persistence model used by Carhart (1997) and Dimson and Minio-Kozerski (2001).

On average, the six-factor model developed in the thesis can explain 67% of the variation in the excess discount return in the UK market by taking into consideration the market effect, size, the book-to-market effect, momentum, sentiment and expenses. In contrast, Fama and French's (1993) three-factor and Carhart's (1997) four-factor models explain only 42% of the variation of the excess discount return. Similarly, the six-factor model can explain 66% of the variation in the excess discount return in the US market by taking into consideration the same six independent variables. In contrast, Fama and French's (1993) three-factor model explains 59% of the excess discount return variation and Carhart's (1997) four-factor model explains 65% of the variation.

Keyword: investment trusts, closed-end funds, discount, multifactor model, performance persistence.

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Chapter 1

Introduction

1.1 Background, motivation and aims for the study

An investment trust is a company that invests in the shares of other companies. The first investment trust was launched by Foreign and Colonial in 1868. Since then the UK investment trust industry has grown considerably. The sector has grown from a market capitalisation of £5.8 billion in 1980 to £61.9 billion in 2005. Like other listed companies, investment trusts issue shares that are publicly traded on the London Stock Exchange (LSE). Investment trusts pool investors' money and employ professional fund managers to invest in the shares of a wider range of companies than most people could practically invest in themselves. In this way, even people with small amounts of money can gain exposure to a diversified and professionally run portfolio of shares and spread the risk of stock market investment. According to the Association of Investment Trust Companies (AITC), there were 263 conventional trusts with total assets of £55.6 billion in 2005 in the UK.

On the other hand, a closed-end fund in the US is a publicly traded investment company in the stock market registered under the Securities Exchange Companies Act of 1940. The market value of the shares of a closed-end fund is determined by market demand. Like mutual funds, closed-end funds may be purchased through brokers, or retirement plan accounts. A closed-end fund has a board of directors elected by the shareholders. The board appoints an investment advisor or portfolio manager. Specifically, according to the Closed-End Fund Association (CEFA), there were more than 500 closed-end funds invested in a variety of sectors in 2005 in the US. In addition, the total market capitalisation of all closed-end funds was approximately $135 billion in 2003. The largest category of closed-end funds in terms of assets under management is municipal bond funds which occupy around 42% of total assets. There were 286 municipal funds ($57 billion) out of a universe of 571 closed-end funds with almost $135 billion under management. These funds invest in bonds issued by state and local government and agencies. This category is out of the scope of our research as we focus on equity funds. Thus, other categories by sector breakdown are International Equity which occupies 6%, Equity Income 14% and Domestic Equity 11%.

Investment trusts or closed-end funds have several benefits for investors. According to AITC, they allow investors to pool their money, to spread their risk, to use a professional manager's expertise and allow investors to invest small amounts. In more detail, when you purchase shares in an investment trust you invest your money with all the other investors' money, providing potential economies of scale. Each investment trust owns shares in a range of companies so this spreads your risk. Each investment trust uses professional fund manager expertise. A key role of an investment trust's independent board of directors is to make sure that the fund's internal expenses are not high.

Furthermore, investment trusts or closed-end funds are known for the discount problem that arises within a few months. Specifically, closed-end fund shares are issued at up to a 10 per cent premium to net asset value (NAV). This premium represents the underwriting fees and start-up costs. Within a matter of months, the shares normally trade at a discount, which persists and fluctuates. Upon termination of the fund, the share price rises and the discount disappears.

This study focuses on the world's largest markets for investment trusts, the UK and US stock markets. It reviews the literature and draws a comparison between the behaviour of the discount in the US and the UK markets. Many theories suggest reasons for the existence of the discount, but since none solve all parts of the problem, researchers have found it necessary to focus on models of investor irrationality.

Moreover, the large amounts of effort invested to conduct research on these models have created additional pressures for researchers to discuss, develop and test these theories. The empirical research in this thesis has two main objectives. The first one is to investigate managerial performance persistence in the UK investment trust market and the US closed-end fund market. The second objective is to test, modify and extend Fama and French's (1993) three-factor model to explain the excess discount return in the UK investment trust market and the US closed-end fund market.

1.2 Contribution of the thesis

This thesis is primarily concerned with one of the main problems in finance, the existence and persistence of the discount on closed-end funds. The fact that the discount is non-stationary, but stationary at its first difference, and the models that we deal with are concerned with returns, motivates us to try to explain the excess discount return. Unique data sets for both the UK and US markets are collected from Datastream, Wiesenberger and other databases which allow us to explore the factors that affect the monthly changes in the discount.

Our sample of funds avoids survivorship bias for the UK market as it contains both defunct and surviving funds (but data on defunct funds were not available for the US market). Survivorship may be expected to bias the discount and performance measures upwards especially when we get averages for the whole sector or for industries within specific sectors (see Grinblatt and Titman, 1988, Brown, Goetzmann, Ibbotson and Ross,1992, Brown and Goetzmann, 1995 and Malkiel, 1995).

This thesis will give valuable information to investors, practitioners and academics. In more detail, the world of investment opportunities has changed dramatically. Investors are faced with a wide variety of fund styles (such as value, growth, small capitalisation, balanced, income, global, etc) which makes it difficult for them to choose the best one. In addition, the persistence of the discount in most closed-end funds or investment trusts and the poor performance benchmarks make the choice even more difficult.

On the other hand, professionals working within the investment trust sector and academics in finance face the continuous challenge of which methodology and factors to use that will minimize the error to explain the existence and persistence of the discount to NAV. Since every statistic has shortcomings, prudent risk management calls for the use of more than one statistic in portfolio risk analysis. So as well as the mean, median and standard deviation which give complementary information about the shape of the distribution, we also need statistics to help us capture the interaction between multivariable risk factors. This is the first study that compares so many approaches from a statistical and econometric point of view and is based on two markets, the UK and US.

Practitioners face the problem that the discount on closed-end funds cannot be explained solely by the beta, or tendency to move with the market as a whole. Multifactor extensions of the Capital Asset Pricing Model (CAPM) will facilitate the description, performance, and explanation of these anomalies. Multifactor models focus on additional risk factors as well as movements in the market as a whole.

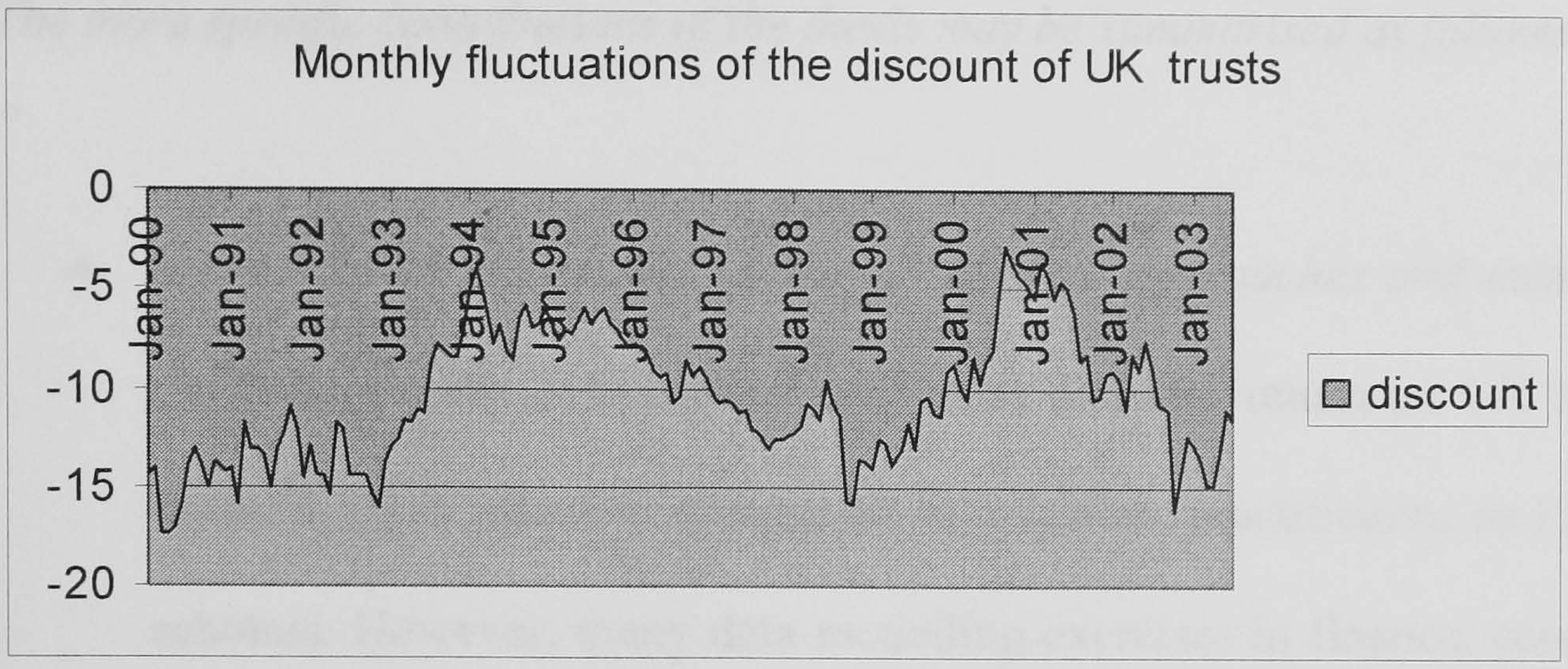
According to Weiss (1989), shares in US funds are issued at a premium to NAV of up to 10 per cent, while UK funds are issued at a premium amounting to at least 5 per cent. This premium represents the underwriting fees and start-up costs. Within a matter of months, the shares trade at a discount. Weiss (1989) found that within 24 weeks of trading, equity funds in the US trade at an average discount of 10 per cent. Levis and Thomas (1995) find that after 200 trading days equity funds in the UK fall in value by 5 per cent. Upon termination of the fund, share prices rise and discounts disappear (Brauer, 1984, and Brickley and Schallheim, 1985). This phenomenon seems to contradict the well-known Efficient Market Hypothesis in terms of semi-strong and strong efficiency as the persistence of the discount implies that publicly available information is not incorporated into the price of shares. Closed-end funds provide apparent evidence of market inefficiency and violations of standard asset pricing models.

In more detail, according to Figure 1 (which shows monthly fluctuations in the discount on UK investment trusts since 1990), the discount fluctuated around 15 per cent during the period 1990 to 1993. By the mid 1990s and specifically from 1994 to 1996, the monthly discount had narrowed to some 5-10 per cent, though in recent years it has reverted to around 10 to 15 per cent.

On the other hand, according to Figure 2 (which displays monthly fluctuations in the discount on US closed-end funds since 1990), the discount fluctuated around 12 to 13 per cent during the period 1990 to 1992. During the period 1992 to 1995, the discount fluctuated from 3 to 6 per cent, though in recent years it has reverted to around 10 to 14 per cent.

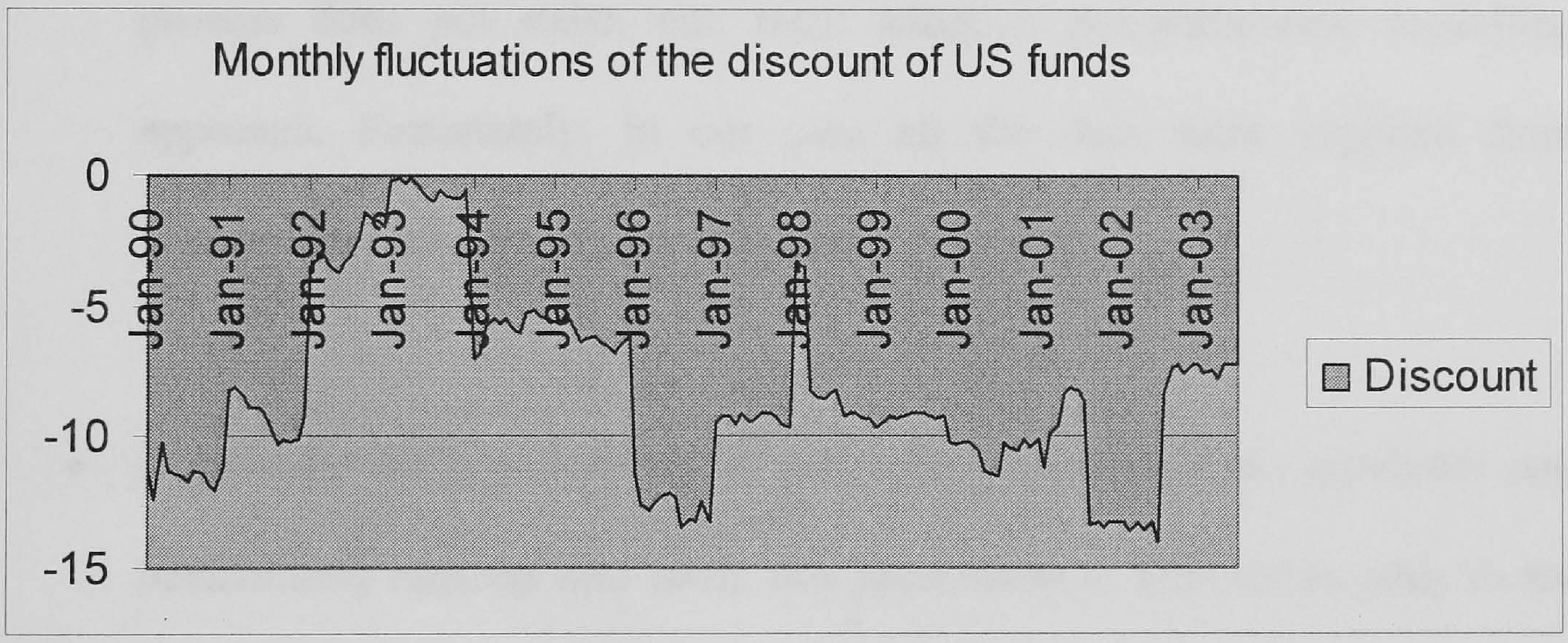
It is obvious from Figures 1 and 2 that the discount persists over a long period of time and during the last seven years it has reverted to around 10-15 per cent. This phenomenon contradicts the well known Efficient Market Hypothesis.

Figure 1



Source: calculated by the author

Figure 2



Source: calculated by the author

Several theories attempt to make sense of the closed-end fund discounts within a rational framework, but none can explain totally why this happens. A theory that explains parts of this problem is the limited rationality model of Lee, Shleifer and Thaler (1991). They suggest the existence of two kinds of investors, the rational and the irrational (noise) traders. The former make rational decisions, whereas the latter make systematic forecasting errors. Lee, Shleifer and Thaler argue that changes in the discount on closed-end funds reflect changes in investor sentiment. *The more specific contributions of the thesis may be summarised as follows:*

- *It provides an up-to-date review of different approaches and methods to the chosen topic.* It examines the excess discount return on UK and US funds. It gives valuable information to investors, practitioners, and finance scholars. However, many data modelling exercises in finance, economics and other fields are characterized by two difficulties: the absence of a complete a priori model of the data generation process and a limited quantity of data. When a complete a priori model for the data generation process does not exist, one must adopt a non-parametric modelling approach. Fortunately, in our case all the data were supplied from Datastream and Wisenberger Thomson Financial.

- *It provides an improvement of our understanding of the economic and behavioural reasons that drive this phenomenon.* This thesis adds to the existing literature some of the missing factors that could explain the existence and persistence of the excess discount return by extending the traditional three-factor model of Fama and French's (1993), along similar lines to those employed by Dimson and Minio-Kozerski (2001, 2002). The extensive search of the literature gives a clear understanding of potential weaknesses and allows us to draw some important conclusions and to confirm some hypotheses on the variables that directly or indirectly affect the discount phenomenon.

- *It provides answers to the problem of measuring the performance of managed portfolios.* This has been the subject of research for more than 20 years. Traditional measures use unconditional expected returns. However, if expected returns and risks vary over time, this may cause common time-variation in fund risk. In this way, traditional methods can show abnormal performance to an investment strategy which is not the case. We measure the manager's quality after adjusting for various anomalies documented in the finance literature. Three approaches are followed. Fama and French's (1993) three-factor model, an extended Fama and French model which incorporates a market timing variable, and Carhart's (1997) and Dimson and Minio-Kozerski (2001) performance persistence model. As we find some weak evidence of managerial persistence in these models, management performance is used later as an explanatory variable in our model designed to explain changes in the excess discount return.

1.3 Overview of the thesis

In this section we provide a brief overview of the thesis. **Chapter 1** has discussed the background, motivation and aims of the study. In addition, we have underlined the major contribution of the thesis.

In **Chapter 2**, an introduction and explanation of a closed-end fund is given. In this section we identify the different types of closed-end funds and their characteristics. In addition, we outline issues concerning capital structure, taxation and ownership.

Chapter 3 gives an in-depth explanation and analysis of the literature review of multifactor risk modelling. In particular, different economic models and theories are analysed. These include modern portfolio theory, the capital asset pricing model (CAPM), arbitrage pricing theory (APT), the three-factor model and the four-factor model. In addition, this chapter refers to the important contributions made by different researchers in the area of multifactor risk models. Empirical tests and studies conducted by various researchers are presented and their conclusions form the basis for the derivation of a better model to explain the existence and persistence of the excess discount return.

Chapter 4 is a review of the literature on closed-end fund discounts and a comparison of the behaviour of the discount in the US and UK markets. Many theories as well as empirical studies are presented for the existence of the discount, but since none solve all parts of the problem, we focus on models of investor irrationality.

In **Chapter 5,** the research design for the study is explained, which includes a framework about information acquisition, methodological and measurement issues. It describes some measurement issues relevant to the definition of the discount and to the average discount for a category. We also define measures of total returns for share prices, indexes and NAVs. The chapter also reviews the databases available for analysing the discount of the UK and US investment trust industries.

Chapter 6 analyses the time-series properties of the excess NAV and excess discount return in terms of autocorrelation, stationarity, normality and seasonality. Excess NAV returns are not autocorrelated and discounts are highly autocorrelated in their levels but not in their first differences. Augmented Dickey Fuller (ADF) tests also show that the excess NAV and excess discount return on UK investment trusts and US closed-end funds are stationary. We also find that the UK and the US excess NAV and excess discount returns are approximately normally distributed. On the other hand, in terms of seasonality there are no significant differences in the discount during the month of January and other months.

Chapter 7 has four objectives. The first one is to investigate whether management performance persistence is related to anomalies documented in the finance literature, such as size or the book-to-market effect. The second objective is to test if fund managers have market timing ability or can predict the movement of the market. The third objective is to test performance and discount persistence by using the method employed by Carhart (1997) and Dimson and Minio-Kozerski (2001). The fourth objective is to assess the performance of UK 'dead' funds. The argument that NAV reflects the quality of the management has been investigated in the past but the results were mixed. However, in these studies NAV is measured as the raw return on the fund's NAV (Grinblatt and Titman,1992, Elton, Gruber, Das and Hlavka,1993, and Elton, Gruber, and Blake,1996a). Possible sources of persistence in raw return figures include differences in risk exposures, size, the book-to-market ratio and fund manager skills.

In **Chapter 8**, we attempt to extend Fama and French's (1993) three-factor model in order to explain the fluctuations of the excess discount return. Based on the Fama and French model, we first take into account market risk, small firm risk, and book-to-market risk. An attempt is made to explain at least part of the movements in the discount by introducing additional factors. In particular, we investigate the importance of managerial performance, noise-trader sentiment theory (by taking into consideration retail flows and an investor sentiment index) and expenses.

In **Chapter 9**, opportunities for future research are discussed and the conclusion of the study is presented.

Chapter 2

Background of the industry

2.1 Introduction to investment trusts

This chapter provides an overview of the closed-end fund industry. We outline the differences and similarities between closed-end and open-end funds. In addition, different categories of UK investment trusts and US closed-end funds are described and used later in the research.

Investment trusts are closed-end limited companies quoted on the London and US Stock Exchanges. Investment trusts can be tailored to the investor's individual needs as they cover a diverse range of sectors and countries, allowing investors to choose the level of risk that is required. Investors can choose from the Far East and Emerging Markets sectors, through to the more solid UK and Global Growth sectors. For example, in the Global Growth Fund, the investment trust companies objectives are to produce a total return to shareholders from capital growth. They will also have less than 80% of their assets in any one geographical area with at least 20% in UK registered companies. In contrast, in UK Growth, the investment trust companies' objective is to produce a total return to shareholders from capital and/or dividend income growth, using as a benchmark the FTSE All-Share Index. They also have at least 80% of their assets in UK registered companies.

2.2 Types of mutual funds

Mutual funds can be classified into

- Closed-end funds
- Open-end funds.

Closed-end funds are professionally managed investment companies, whose shares are listed on stock exchanges. They are bought and sold in the open market. Daily trading allows investors to purchase and sell shares of closed-end funds just like the shares of other publicly traded securities. In addition, when shares of closed-end funds trade at prices below their NAV, investors have the opportunity to enhance the return on their investment.

The key distinction between a closed-end fund and an open-end fund is their share structure: a closed-end fund has a relatively fixed share structure. So unlike mutual fund managers who must worry about constant inflows and outflows of cash, investment trust managers are responsible for a fixed share structure. This is particularly beneficial when markets are volatile because fund managers are not forced to sell securities in a falling market to meet redemptions. They are thus able to plan for the longer term and make more careful long-term investment decisions. It also makes the investment trust structure more attractive for investing in specialized areas, such as less liquid securities.

In contrast, open-end funds or unit trusts expand or decrease in size continually according to the wish of investors, which means that fund managers cannot plan ahead with the same certainty. If a number of investors decided to sell their units for various reasons at a certain point in time, the fund manager may be forced to sell some of the trust's most valuable assets. This can badly affect investment performance, especially over the long term.

In order to better understand the above two types of investment vehicles, consider their similarities and differences.

Similarities

- Both are diversified portfolios of securities.
- They may be structured in different categories of funds.
- They are professionally managed.
- Both types of funds must distribute most of the income earned or realized capital gains in a given year.

Differences

- *Limited Number of Shares.* Closed-end funds have a limited number of shares. On the contrary, the number of shares of open-end funds changes constantly as units are bought and redeemed.
- *Trading.* Because the number of shares of a closed-end fund is limited, this type of fund trades on an exchange. Open-end funds do not. Consequently, the price of a closed-end fund may trade above the fund's NAV (i.e. at a premium), or below its NAV (i.e. at a discount). If the NAV is $8, and the

price is $9, then the fund is trading at a 12.5% premium. If the price is $7.00, then the fund is trading at a 12.5 % discount.

- *Inefficient Market.* Information on closed-end funds is not always easily available. According to the Financial Services Authority (2002), a number of splits have invested a portion of their portfolios in the shares of other splits. Some have also borrowed funds from banks to leverage or to gear the fund. This creates pricing inefficiencies among closed-end funds. A split is an investment trust with more than one type of shares.
- *Higher Volatility.* Closed-end funds tend to be more volatile. The price volatility of a closed-end fund tends to be higher as its discount or premium narrows or widens.
- *Leverage.* A closed-end fund can borrow money at a lower rate than that at which it can invest its assets. The purpose of leveraging a closed-end fund's assets is to increase its performance. This additional performance will come at the expense of higher volatility. In other words, a leveraged fund should outperform a non-leveraged fund in a rising market. In contrast, it underperforms a non-leveraged fund in a declining market.

2.3 Categories of UK investment trusts according to AITC

Global Growth: These are investment trust companies whose objective is to produce a total return to shareholders from capital growth. They will also have less than 80% of their assets in any one geographical area with at least 20% in UK registered companies. This category contains some of the oldest and largest companies in the investment trust sector. In terms of seeking a trust to suit a long term buy and hold strategy, this sector is the ideal place to start for the less sophisticated investor, as the fund managers will take care of both geographic and sector allocation. Total assets of the sector were £14,953 million in 2005.

Global Growth and Income: These are investment trust companies whose objective is to produce a total return to shareholders from capital and dividend income growth. They will also have less than 80% of their assets in any one geographical area with at least 20% in UK registered companies. Total assets of the sector were £1,460 million in 2005.

Global Smaller Companies: These are investment trust companies which have less than 80% of their assets in any one geographical area with at least 20% in UK registered companies, whose policy is to invest at least 80% of their assets in smaller companies. Total assets of the sector were £318 million in 2005.

UK Growth: These are investment trust companies whose objective is to produce a total return to shareholders from capital growth and which use as a benchmark the FTSE All-Share Index. They also have at least 80% of their assets in UK companies. Total assets of the sector were £4,647 million in 2005.

UK Growth and Income: These are investment trust companies whose objective is to produce a total return to shareholders from capital or dividend income growth and which use a benchmark of FTSE All-Share Index. They also have at least 80% of their assets in UK registered companies. Total assets of the sector were £4,424 million in 2005.

UK Smaller Companies: These are investment trust companies which have at least 80% of their assets invested in the shares of smaller UK registered companies. Total assets of the sector were £3,437 million in 2005.

North America: These are investment trust companies which have at least 80% of their assets in North America. Total assets of the sector were £592 million in 2005.

North America Smaller Companies: These are investment trust companies which have at least 80% of their assets invested in the shares of North American smaller companies. Total assets of the sector were £437 million in 2005.

Far East Including Japan: These are investment trust companies which have at least 80% of their assets in Far Eastern Securities, which include a Japanese content of 20%. Total assets of the sector were £326 million in 2005.

Far East Excluding Japan: These are investment trusts which have at least 80% of their assets in Far Eastern securities, which include Japanese content of less than 20%. Total assets of the sector were £1,475 million in 2005.

Japan: These are investment trust companies with at least 80% of their assets in Japan. Total assets of the sector were £1,084 million in 2005.

Japanese Smaller Companies: These are investment trust companies which have at least 80% of their assets invested in the shares of Japanese smaller companies.

The performance of the Japanese Smaller Companies trusts has been disappointing with every company's share price declining by more than 30% in 2001. This was due to their exposure to growth stocks and in particular technology shares. Total assets of the sector were £296 million in 2005.

Country Specialist Far East: These are investment trust companies that have at least 80% of their assets in the Far East. The sector has a large number of very small and specialist trusts whose only real connection is that they concentrate on the same geographical region. Total assets of the sector were £278 million in 2005.

Europe: These are investment trusts which have at least 80% of their assets in Europe. Total assets of the sector were £2,421 million in 2005.

European Smaller Companies: These are investment trusts which at least 80% of their assets have been invested in the shares of European smaller companies. Total assets of the sector were £784 million in 2005.

Sector Specialist-Property: These are investment trusts whose policy is to invest in the shares and securities of property companies. TR Property is by far the largest trust in this small specialist sector. The share price discount in this sector is not very volatile and does not tend to move far from the 20% level. Property trusts have a place in private investors' investment portfolios providing another opportunity for asset diversification. Total assets of the sector were £3,252 million in 2005.

2.4 Categories of US closed-end funds as defined by CEFA

Equity-Income These closed-end funds seek growth and income by investing a minimum of 15% of their assets in income-producing equity securities. Total assets of the sector were $28,035 million in 2005.

Growth and Income. These closed-end funds seek more capital appreciation by investing in equities with a level or rising dividend stream. Total assets of the sector were $23,461 million in 2005.

Growth-Domestic. These closed-end funds seek long term capital appreciation by investing primarily in domestic equity securities of any market capitalization. Total assets of the sector were $10,946 million in 2005.

Global Growth These closed-end funds seek capital appreciation by investing in equity securities of companies involved in worldwide activities. They invest primarily in domestic and foreign equity securities of any market capitalization. Total assets of the sector were $3,272 million in 2005.

2.5 Structure and regulatory environment

2.5.1 Ownership

There is a difference in the ownership structure of UK investment trusts and US closed-end funds. In 1990, investment trusts were largely dominated by institutional investors. The estimate by the AITC was that the proportion of shares of investment trusts held by institutional investors was 70 to 75 per cent by 1990. In 2003, 77% of investment trust assets managed in the UK were owned by institutional investors, such as insurance, pension and investment trust companies. In 2003, individuals held 59.9 per cent of investment trusts shares. The figure is significantly higher than the 2002 figure of 37.7 per cent. In contrast, Lee et al (1991) report that US closed-end funds owned by institutional investors amounted to only 6.6 per cent (see Weiss, 1989 and Ammer, 1990). In 2003, institutional investors owned 30 per cent of all US closed-end funds and individual investors owned 70 per cent.

2.5.2 Saving schemes and personal equity plans in the UK and the US

Investment trusts saving schemes were introduced in the UK in 1984 as a method of buying investment trust shares without having to go through a stockbroker. Small private investors can use them to invest a regular amount each month or to invest a lump sum. Most investment shares are available through these schemes which are generally run by the management companies of the relevant investment trusts. The advantages of investing through savings scheme are flexibility, low minimum investment, low costs, simple administration and variety. Specifically, savers can invest monthly or make a lump sum investment or a combination of both. With minimum monthly payments starting from £30 in some schemes and lump sums or occasional top-ups from £250, investors can start to build their investments up from a low initial base. On the other hand, by pooling all the investors' money, the manager is able to negotiate a discount on the dealing costs.

Personal equity plans (PEPs) were introduced in the UK in 1986 to increase the interest of private investors to invest in shares of investment trusts. The main feature of PEPs was that all dividend income and capital gains were entirely free of tax. The maximum amount that could be invested in a general PEP was £6,000 in each tax year.

However, PEPs, were replaced by Individual Savings Accounts (ISAs) in April 1999. Exemption from income and capital tax is similar to PEPs but investors have more choices. Specifically, ISAs can include one or more components such as cash (bank and building society savings accounts, National Savings), life assurance (investment type life insurance policy), stocks and shares (investment trusts, unit trusts, shares, bonds and so on). There are strict rules regarding the maximum amount allowed for each component and the overall amount you can invest in any one tax year. Until April 2006 you can pay an overall total of £7000 into ISAs each tax year. According to AITC, the benefits of investing within an ISA are the following:

- Investors do not pay tax on any interest or dividends they receive from the investments within the ISA
- ISAs can save time on administering investments since any money invested in an ISA does not have to be declared in self-assessment tax returns.
- For higher rate taxpayers, dividends received from investments held within an ISA are not liable to the additional 25% tax levied on the net amount of dividends received from other investments.

On the other hand, there are no PEP or ISA plans for the US market. Most investors place their order with the assistance of a securities broker, or financial advisor, who transmits instructions to the exchange on which the closed-end fund trades. The broker also may offer guidance on how the fund fits into investors' overall planning. The most common sectors that we will cover in this thesis are growth funds which provide capital appreciation over the medium to long-term and equity income funds which aim to provide both growth and regular income.

2.5.3 Capital structure

As discussed previously, closed-end funds are characterized by a fixed capitalization. This structure makes it easier for the investment manager to make long-term commitments. Thus, according to the structure of investment trusts, they are divided into conventional and split capital investment trusts. Conventional investment trusts have just one class of share. On the other hand, Split capital investment trusts is the name given to investment trusts that offer two or more classes of shares, which can be used by investors to meet specific investment goals. At least one of the share classes is likely to have a limited life (usually between five and ten years), so there will be a fixed wind-up date when the company is terminated and the assets split between the various categories of shareholder. The main types of shares, as described below, are zero dividend preference shares, income shares, ordinary income shares and capital shares.

- Zero dividend preference shares have a target redemption value that will be paid to investors on wind-up. This redemption value is not guaranteed and investors may make less of a profit than expected or even lose part or all of their money. Zero dividend means that there is no income but also no income tax to pay so the profit is taxed as a capital gain and the investor can therefore offset this against the capital gains tax exemption, which is £8,200 for the 2004/05 tax year.

- Income shares pay dividends after any interest or borrowing costs. There is no target level of return at redemption, as the rate will depend on investment performance.
- Ordinary income shares are similar to income shares but also offer the prospect of capital growth. On wind-up, these shares are usually ranked last in the trust's repayment order, so if the trust has made big profits, ordinary income shareholders will do very well (but the reverse is also true).
- With capital shares, the value depends on how much money is left after any borrowings are repaid and the zeros and income shares have been redeemed, so these shares are considered high risk.

In this thesis, we focus only on conventional trusts that have just one class of shares, namely ordinary income shares or capital shares.

2.5.4 Taxation

Under the US tax system, closed-end funds are required to distribute to shareholders 90 per cent of realized capital gains in a given year to qualify for exemption from corporation tax. The dividend income is taxed as ordinary income and the capital gain is taxed at the capital gains rate. In more detail, closed-end funds pay out their earnings to shareholders in two ways:

- Fixed income closed-end funds typically pay out income dividends monthly or quarterly, while equity funds pay out income dividends quarterly, semi-annually or annually. Income dividends generally are taxable to shareholders as ordinary income.
- Capital gains distributions pass through to shareholders the "realized" capital gains of the fund, net of realized capital losses. Most closed-end funds make capital gains distributions once each year, toward the end of the calendar year. The portion of a capital gains distribution is taxed to shareholders at a maximum federal income tax rate of 15%, under current law.

In contrast, UK investment trusts are not allowed to distribute capital gains, but must retain them for reinvestment. Capital gains tax on investment trusts was removed completely in 1980. Therefore, closed-end fund managers can turn over their portfolios without incurring any capital gains tax liability. Each individual has an annual exempt amount and the first £7,700 in the 2004/05 tax year of total gains is tax-free.

On the other hand, UK investment trusts cannot retain more than 15 per cent of dividends received. Each individual has a personal allowance and if all income falls within this, no income tax is payable. The allowance for the year 2004/05 is

£4,615. This increases to £6,100 for those aged 65-74 and £6,370 for those aged 75 and over. After deducting the personal allowance, the next band of income, regardless of its source, is taxed at the lower rate of 10%. In 2004/05, the first £1,920 above the personal allowance qualifies for this lower rate. However, the rate payable for a higher rate taxpayer is 32.5% on the total of the dividend. What this means in practice is that a higher rate taxpayer has to pay 25% of the dividend received.

2.6 Conclusion

This chapter provides an overview of the closed-end fund industry and outlines the differences and similarities between closed-end and open-end funds. The main similarities are that they are professionally managed and are structured in different categories of funds. On the other hand, the main differences are trading, limited number of shares, higher volatility and leverage. We also mentioned the different categories that will be used later for further statistical analysis. Finally, we briefly explained the structure and regulatory environment in both the UK and the US.

Chapter 3

Single and multifactor risk models - A review of the literature

3.1 Introduction

One of the key issues facing an individual is how to allocate wealth among alternative assets. Risk measurement was first developed by Bernoulli (1738) who mentioned risk in relation to decision making. In other words, it is not sensible to talk about investment returns without talking about risk because investment decisions involve a trade-off between the two. Investors must constantly be aware of the risk they are taking, know what it can do to their investment decisions and be prepared for the consequences.

There are many ways that risk can be defined and measured. Broadly, these definitions have concentrated on two types of risk: (1) specific risk, which is the riskiness of an asset held in relation to other assets, and (2) market risk, which is an asset's risk in relation to the market. No investment will be made unless the expected rate of return is high enough to compensate the investor for taking extra risks. In general, it is believed that the higher the perceived risk associated with an investment opportunity, the higher should be its expected return to persuade an investor to accept the investment opportunity. General theories of portfolio selection and asset pricing were formulated by Markowitz's (1959) theory of portfolio optimisation, which showed how risk and return must be related in optimal portfolio construction.

Tobin (1958), Treynor (1961) and Sharpe (1963) argued that since we would expect all investors to make this trade-off between risk and return, then high risk assets must compensate investors by offering higher returns. This gave rise to the capital asset pricing model, which has been the cornerstone of asset pricing.

The CAPM provides a description of why average returns on some stock portfolios are higher than others. But the average returns of many investment opportunities cannot be explained by the CAPM beta alone and multifactor models have been derived to cover this problem. Similarly, the average returns on closed-end funds or investment trusts can be explained in part by the CAPM, but there are other factors that also need to be considered such as growth, style and size.

In this chapter, we review multifactor asset pricing models. The excess discount on closed-end funds or investment trusts cannot be explained solely from their share price or their NAV. Multifactor models tend to measure the degree of variability between the discount and share price or NAV with additional risk factors in addition to movements in the market as a whole. Their distinguishing feature is that expected asset returns are determined by a linear combination of their covariances with variables representing the risk factors.

In this thesis, we use the same factors that explain the excess return in CAPM-based multifactor models to explain the excess discount return for the following reasons.

The excess discount return (defined as the monthly change in the discount, less the risk-free rate) is used because changes in the discount can be interpreted as returns. Another explanation is that we use the excess discount return to verify arbitrage activity above the risk free rate. On the other hand, we want to test if firm-specific attributes such as the size effect, the book-to-market ratio and momentum are the causes of the fluctuations of the discount. These anomalies, documented in the finance literature, are influences on fund performance, which in turn helps to determine the discount or premium. Thus, there is a direct relationship between the discount and firm-specific factors. Since the market return cannot solely explain the fluctuations of the excess discount return (see chapter 8), we use multifactor risk models that include firm-specific attributes in addition to expenses and a measure of investor sentiment as explanatory variables.

The discussion in this chapter attempts to shed light on recent studies that include the empirical factors advocated by Fama and French's (1993) three-factor model and Carhart's (1997) four-factor model. The following section of this chapter covers modern portfolio theory and the efficient frontier, the CAPM, empirical tests and critiques of CAPM, arbitrage pricing theory, and multifactor asset pricing models and their critiques.

3.2 Modern Portfolio Theory

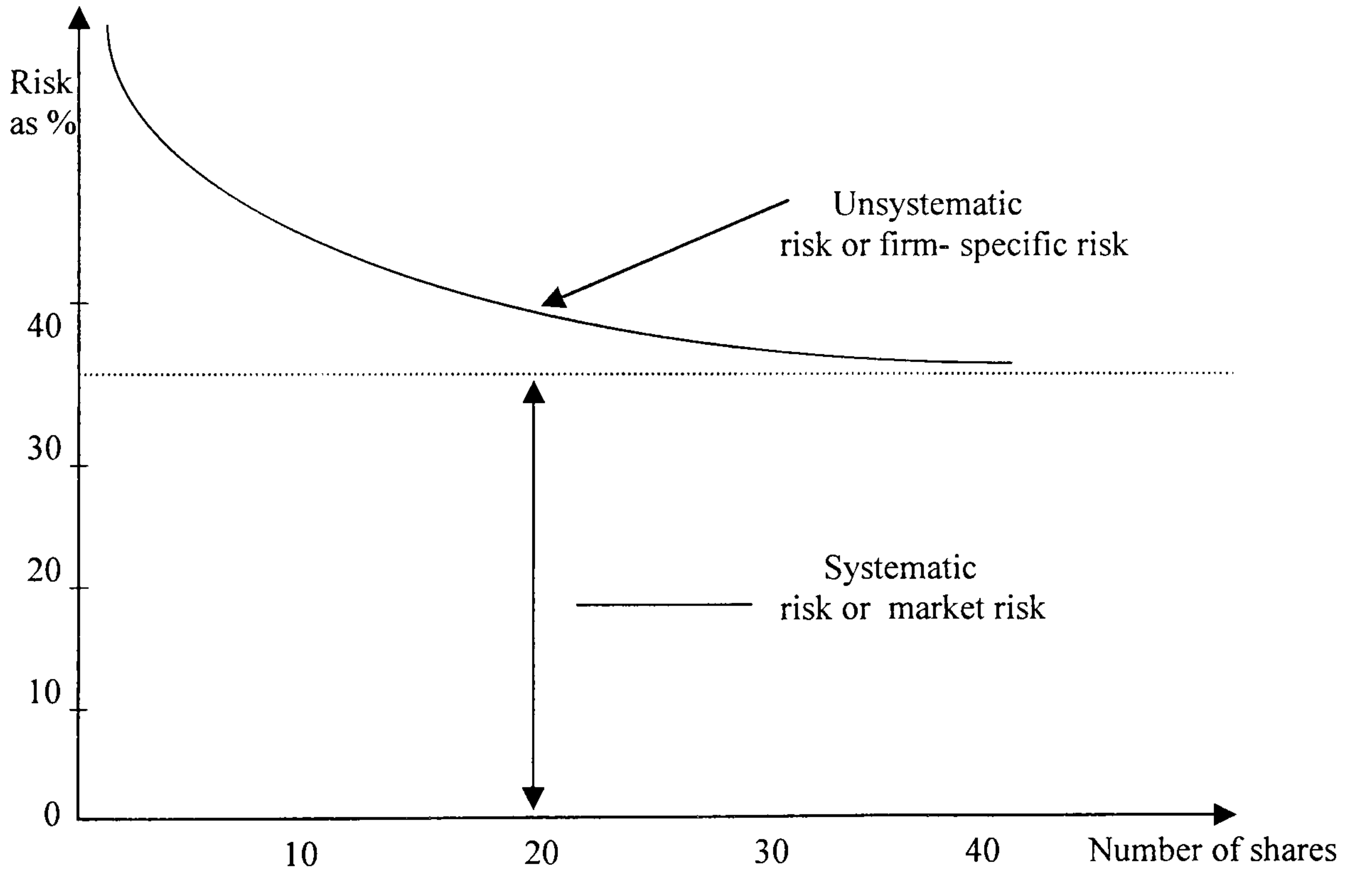
In economics in general, and investment analysis in particular, the standard assumption is that investors are rational. Rational investors prefer certainty to uncertainty. It is easy to say that investors dislike risk, but more precisely, we should say that investors are risk averse, namely that they want to reduce their risk through a diversified balanced portfolio. This leads us to modern portfolio theory, which was developed by Markowitz (1959). According to Markowitz, a good portfolio is more than a long list of good stocks and bonds. It is a way to provide the investor with protection and opportunities with respect to a wide range of contingencies. He argued that for any given level of risk, the rational investor would select the maximum expected return, and for any given level of expected return, the rational investor would select the minimum risk. By measuring risk, Markowitz laid down the cornerstones of modern portfolio theory (Freear, 1980).

Furthermore, according to modern portfolio theory, an investor faces two types of risk, market risk and firm-specific risk. Market risk cannot be eliminated by diversification because it is associated with economic or market factors that systematically affect all or most firms (Weston, Besley and Brigham 1996). These factors can be inflation, recession, high interest rates, etc. and are non-diversifiable.

On the other hand, firm-specific risk is the part of a security's risk associated with random outcomes generated by events or behaviours specific to the firm (Cuthbertson, 1996). These risks can be caused by factors such as strikes, successful and unsuccessful management, and failure to advertise the product properly. This type of risk, however, can be eliminated through diversification. Thus, an investor cannot avoid market risk because it derives from the uncertainties of the whole economy. In contrast, firm-specific risk, which is related to a particular company or project, can be avoided by investing in several different kinds of shares (Franks and Broyles, 1979, Pilbeam, 1998, Rutterford, 1993)

In addition, an investor can diversify more than half of the total risks that he/she would bear by investing in different shares. Thus, a portfolio of shares can "average out" the firm-specific risks of the different shares. This is illustrated in Figure 3.

Figure 3: Market and firm-specific risk



Source : Solnik (1974), pp 48-54

According to Figure 3, Solnik (1974) finds that risk can only be eliminated in a reasonably well diversified portfolio, which is one containing up to 20 stocks (Copland and Weston, 1992). As the number of shares becomes very larg, the investor cannot diversify the risk anymore and he/she faces the market risk.

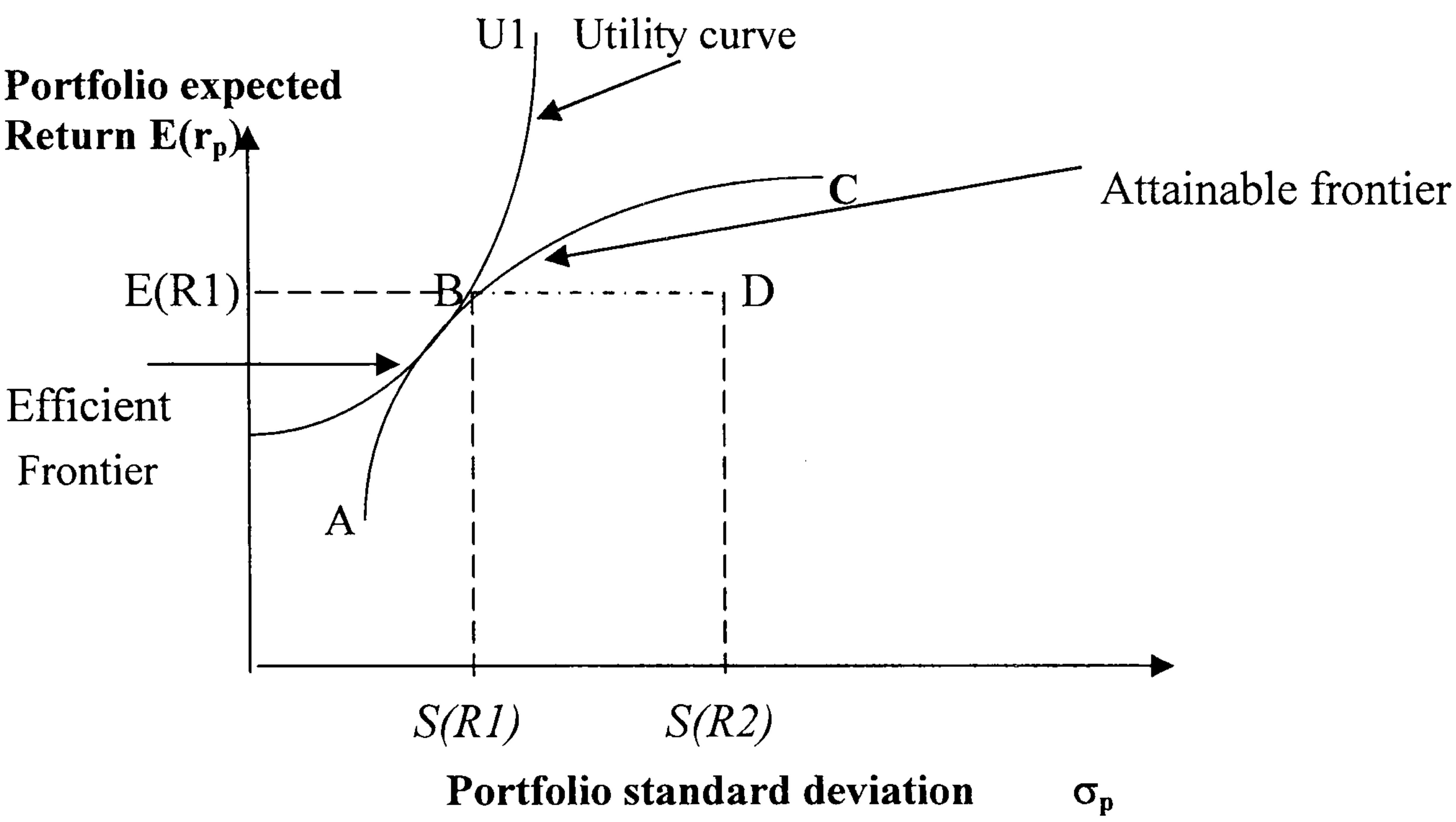
Finally, Markowitz (1952) demonstrated that the covariance between securities in a portfolio is the most important element in determining the overall risk of the portfolio. *Ceteris paribus*, the lower the covariance between the securities in the portfolio, the lower the standard deviation of the portfolio. It is thus important in selecting an asset for diversification purposes to establish the covariance of the asset with all other assets in the portfolio.

Portfolio theory is concerned with the allocation of an individual's wealth among the various available assets. Therefore, the selection of a portfolio among those represented by the efficient frontier will depend upon the individual's utility function. Knowledge of the preference of the investor is normally required before we can choose between portfolios. Portfolio theory, therefore, makes several reasonable assumptions about preferences between risk and return.

- If two portfolios have the same standard deviation and different expected returns, the one with the larger expected return is preferred.
- If two portfolios have the same expected return and different standard deviations of return, the one with the smaller standard deviation is preferred.
- If one portfolio has a smaller standard deviation and a larger expected return than another, it is preferred.

In more detail, the efficient set is represented by the upper left-hand boundary of the points A and C, as shown in Figure 4.

Figure 4 : Markowitz efficient frontier



Source: Dobbins and Witt, (1983), p.31

According to Figure 4, the dashed rectangle area represents all attainable portfolios that are all the combinations of risk and expected return which may be achieved with the available securities. For example, consider the portfolios represented by points B and D. Portfolios B and D promise the same expected return E(R1) but the risk associated with B is S(R1), whereas that associated with D is S(R2). Investors therefore prefer portfolios on the efficient frontier rather than interior portfolios given the assumption of risk aversion. Obviously, point A on the frontier represents the portfolio with the least possible risk, while C represents the portfolio with the highest possible rate of return (Dobbins and Witt, 1983, p.31). In other words, the portfolio efficiency frontier consists of those portfolios with the maximum rate of return for a given level of risk, or equivalently those portfolios with the minimum level of risk for a given rate of return (Pilbeam, 1998, p.136).

In addition, the investor has to select a portfolio among all those represented by the efficient frontier according to his risk-return preference. According to Figure 4, this is shown by the utility curve. The investor therefore wishes to be on the highest possible indifference curve in order to obtain the maximum possible level of utility, and this is given by the point of tangency between an indifference curve and the efficient frontier, that is point B. This point therefore represents the optimal portfolio (Dobbins and Witt, 1983, p.32).

3.3 Capital Asset Pricing Model (CAPM)

Shortly after Treynor (1961) began his work on asset pricing, Sharpe set out to determine the relationship between the prices of assets and their risk attributes. Sharpe, Lintner and Mossin (1964) aimed to use the theory of portfolio selection to construct a market equilibrium theory of asset prices under conditions of risk.

The CAPM divides equity risk into two components:

- Specific Risk
- Systematic risk

Investors cannot diversify away about one-third of the total risk of a single security, no matter how many shares he/she holds (Myddelton, 1995). This represents the market risk to which all shares are subject. This leads us to the

Capital Asset Pricing Model (CAPM), which is basically derived from modern portfolio theory. Its foundation is based upon the fact that the portfolio is diversified, and the only variable that we have to calculate is market volatility. This model is based on the proposition that any stock's required rate of return is equal to the risk-free rate of return (e.g. the yield on treasury bills) plus a risk premium where risk reflects diversification. The equilibrium relationship between expected return and risk for individual securities is known as the security market line, and can be expressed accordingly:

$$\left(R_{i,t} - R_{f,t}\right) = \beta\left(R_{m,t} - R_{f,t}\right) \tag{1}$$

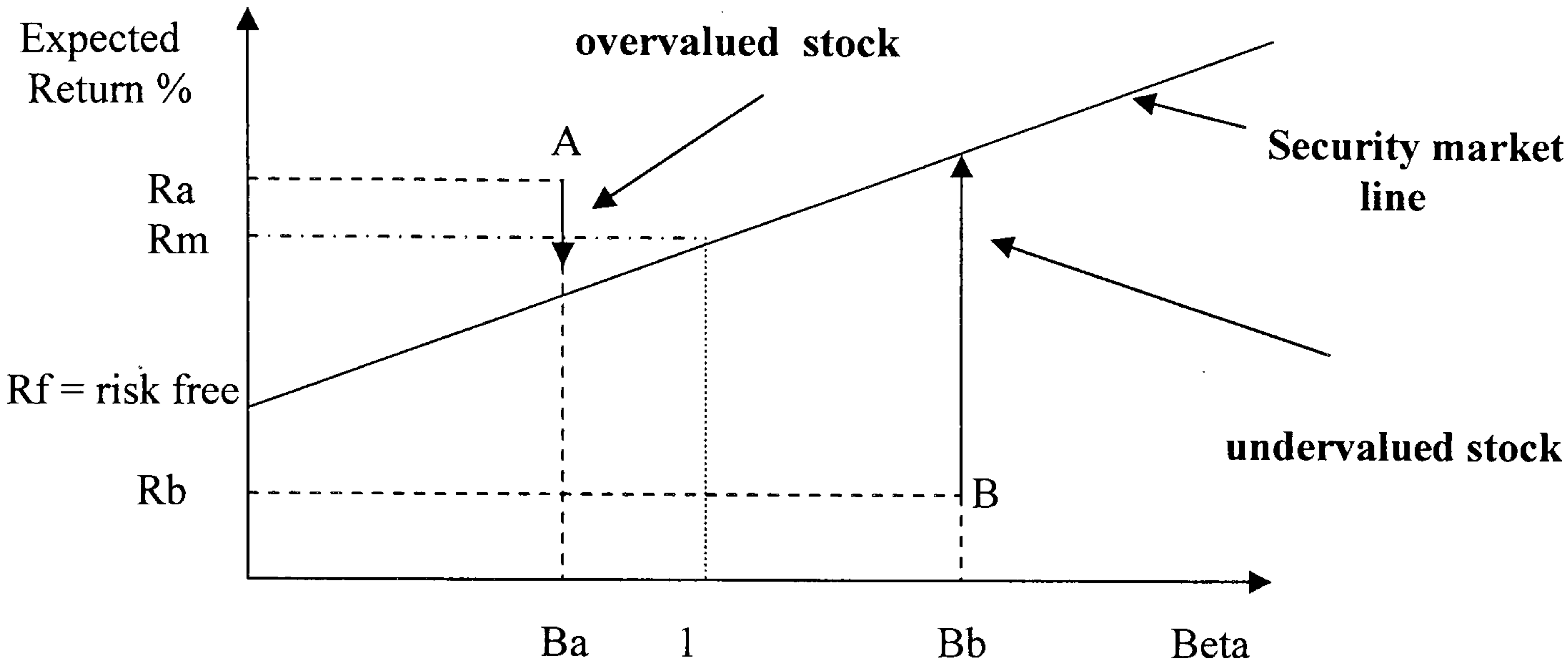
where $\left(R_{i,t} - R_{f,t}\right)$ is the excess security rate of return, defined as the security rate of return less the one-month risk-free rate of return, $\left(R_{m,t} - R_{f,t}\right)$ is the excess market return and β is the beta coefficient, which measures a stock's sensitivity to market fluctuations and is given by the following formula:

$$\beta = \frac{\mathrm{Co\ Var}_{\mathrm{i,m}}}{\mathrm{Var}_{\mathrm{m}}} \tag{2}$$

The $\mathrm{CoVar}_{i,m}$ is the covariance of returns on security i with those of the market portfolio m. The beta measures the responsiveness of a security's return to changes in the market. For example, it measures the degree to which a security's return rises or falls as the market rises or falls. In more detail, a beta of 1 means that the share is as risky as the market portfolio, whereas a beta of 0.5 implies that the share is half as risky as the market. The above security market line equation (1) is illustrated in Figure 5.

By referring to Figure 5, we can see why the CAPM is often called the equilibrium model of capital markets. If, at any given time, there were a financial asset with the combination of Return Ra and beta Ba, then this would immediately

Figure 5: Security market line



Source: Drury (1992), p 400-401

be recognised as overvalued. There would in theory be an excess demand for asset A and the price of A would increase until the expected return falls back to the security market line, thus in 'equilibrium'. The process would work in exactly the opposite direction in the case of an undervalued asset such as B. In this sense, the security market line may be interpreted as an 'equilibrium concept', enabling statements to be made as to whether a financial asset is over- or under-valued at any given time, and how prices should react to eliminate such anomalies.

3.3.1 Assumptions of the CAPM

- All investors are risk averse and aim to maximize their expected utility of wealth and therefore are interested in two features of a security, its expected return and its standard deviation.
- All investors have similar assessments of the probability distributions of returns expected from traded securities.
- There are no transaction costs entailed in trading securities.
- All securities are marketable

With regard to investment trusts, it can be said that the first assumption seems reasonable based on the utility function and efficient frontier that we discussed above. Clearly, the next three assumptions are invalid. As we will see in Chapter 5, there is a some difference in the mean and standard deviation by various categories of trusts. In addition, transaction costs are always incurred in trading securities and some categories of investment trusts hold securities that are illiquid. For example, venture and development investment trusts, private equity trusts, emerging market funds, hedge funds, and split capital trusts all hold securities that are illiquid.

3.3.2 Empirical tests of CAPM

A lot of empirical work has been conducted towards testing the CAPM's validity. Empirical studies such as those of Black, Jensen, and Scholes (1972) and Fama and McBeth (1973) support the CAPM. On the other hand, there are empirical studies such as Fama and French (1992) and Banz (1981) that challenge the model's validity.

3.3.3 The Black, Jensen, and Scholes empirical test

Black, Jensen, and Scholes (1972) were the first to conduct empirical studies on the CAPM. The objective of their test was to show that a linear, positively sloped relationship exists between the betas and the expected rate of return. They found that the data were consistent with the predictions of the CAPM, given the fact that the CAPM is an approximation to reality just like any other model.

Black, Jensen, and Scholes use all stocks of the New York Stock Exchange (NYSE) to form 10 portfolios with different historical beta estimates. They regressed average monthly excess returns on beta. By plotting the data on a scatter diagram, they were able to see that a relationship between beta and the average excess monthly return existed since most of the data could be fitted on a straight line. They used the 30-day treasury bill as the risk-free asset for these 10 portfolios. The estimated slope for the resulting regression line was 1.08 per cent instead of 1.42 per cent as predicted by the CAPM. Despite the fact that the t-statistics indicated that the slope and the intercept of their regression line were different from their theoretical values, this does not necessarily mean that the findings did not support the CAPM. As Black (1993), points out, one possible explanation for these results concerns the measurement and model specification error that arises due to the use of a proxy instead of the actual market portfolio. This error biases the regression line's estimated intercept. Overall, we can say that

Black, Jensen, and Scholes' empirical tests give no evidence of non-linearity of the estimated security market line. Thus, there is a positive relationship between betas and expected rates of return.

3.3.4 The Fama and French studies

According to the CAPM, expected returns vary across assets only because the asset's betas are different. As a result, one way to examine whether the CAPM adequately captures all important aspects of reality is to test whether other asset-specific characteristics can explain the cross-sectional differences in average returns that are related to cross-sectional differences in beta. In empirical tests of CAPM, researchers want to know if beta is the only characteristic that matters. Fama and French (1992) estimated the relationship between betas and expected rates of return for the period from July 1963 to December 1990. They grouped stocks from firms listed on the New York Stock exchange (NYSE) and NASDAQ (the National Association of Security dealers Automated Quotations) into 10 size classes and then into 10 beta classes, for a total of 100 portfolios. Their estimates indicated that, for a large collection of stocks, beta could not explain the cross-sectional variation in average returns, whereas size had substantial explanatory power.

Fama and French (1992) reached the conclusion that for some periods, the relation between average return and beta is completely flat, evidence that is against the validity of CAPM.

On the other hand, Fama and MacBeth (1973) examined the relationship between rates of return and betas for portfolios. Through their research, it was found that a relationship exists between the monthly return and beta. Although, the monthly results varied over time, the overall results supported the CAPM.

Furthermore, Tole (1981) extended the above studies that focused on the examination of relative stability and examined the standard deviation of the betas for portfolios with different sizes. He concluded that there was substantially greater stability in beta as the portfolio size increased and a direct relationship with excess returns.

3.4 Critiques of CAPM

Roll's critique of CAPM is not on the theoretical framework of the model itself but rather on the empirical tests of CAPM (Roll, 1977, p.129-136). In general, Roll's critique can be divided into two main parts. In the first part, he claims that the empirical tests conducted by Black, Jensen, and Scholes (1972) were tautological: that is, due to the design of the test, no matter how the stocks were priced during that period in relation to the real world, they would obtain the answer that they wanted. If this is true, the CAPM was never put through a real test. In the second part, he claims that since the only real prediction of CAPM is that the market portfolio is efficient, this prediction is the one that should be tested. However, the market portfolio should contain every asset that is available to the investors. It is impossible to determine whether such a portfolio exists. Even if such a portfolio does exist, it would be impossible to test the efficiency of such a portfolio. This implies that CAPM can never be tested empirically. In the empirical test conducted by Black, Jensen, and Scholes (1972), the portfolio of stocks traded on the NYSE were used as the proxy of the market portfolio. Firstly, the equity stocks traded on the NYSE does not represent all stocks that are traded in the international market. The stocks traded on the NYSE are only a fraction of those that are traded in the world market. Secondly, the market portfolio in CAPM can contain other types of assets besides equity stock. Therefore, stock represents only a fraction of all assets. For this reason, Roll claims that the market portfolio is not observable. He also claims that even if the index used by Black, Jensen, and Scholes (1972), is a good proxy of the market portfolio, the efficiency of the index will not guarantee the efficiency of the market portfolio. The reason behind this is that the index used is merely a fraction of the total assets.

In more detail, the main critique of Roll (1977) on Black, Jensen, and Scholes' (1972) empirical tests is that these tests did not directly test the CAPM's single prediction: that is, the market portfolio is on the efficient set. Instead, the tests examined the properties of the security market line constructed using an equally weighted proxy for the market. Therefore, if it is true that the market portfolio is efficient, the relationship between beta and the expected return will be a perfect positive linear slope. However, this does not mean that a positive linear relationship between beta and the expected returns will imply that the market portfolio, or for that matter the proxy, is efficient.

On the other hand, Banz (1981), in his empirical study of CAPM, wanted to check whether the size of the firms involved was able to explain the residual variation in average returns across assets that is not explained by the CAPM's beta. Banz (1981) used a procedure that is similar to the portfolio grouping procedure that Black, Jensen, and Scholes used. Banz used firms from the NYSE and he firstly assigned the assets to one of five subgroups based on their historical betas. The stocks in each of the subgroups were then assigned to five further subgroups based on the market value of the firms' equity. Thus, 25 portfolios were finally produced, and these portfolios were updated at the end of each year. From his results he found that during 1936-75, the average returns to stocks of small firms (those with low values of market equity) were substantially higher than the average returns of large firms after adjusting for risk using CAPM. Consequently, a firm's relative size seemed to be able to explain a larger fraction of cross-sectional variation in average return than the CAPM's beta could.

Even if CAPM is less than perfect, its broad approach seems to be well worth taking into account. This matches perfectly with what Levy and Sarnat (1986) have written about the value and usefulness of CAPM. In their book they ask the question: " if the CAPM is so bad... Why is it so popular in academic circles?" They provide an answer that points out that "a theory can only be replaced by a better... theory". Consequently, it can be said that CAPM can provide some insights into the risk/return trade-off relating to investments. CAPM helps us understand better the relationship between risk and expected return. Moreover, the coefficient β can be seen as a useful tool for measuring a security's riskiness or even a portfolio's riskiness.

3.5 Arbitrage Pricing Theory (APT)

An alternative model that could potentially overcome the CAPM problems while still retaining the underlying concept was the arbitrage pricing theory (APT) developed by Ross (1976). In more detail, CAPM's basis in mean variance analysis determines that it is optimal for the investor to choose investments on the basis of expected returns, standard deviations or mean-variance analysis. Furthermore CAPM considers a single factor, the market portfolio, to explain security returns, relating them to the security's beta coefficient. CAPM's failure to explain adequately differences in returns of the various assets using the beta terminology led to the development of other asset pricing models.

On the other hand, APT is a more general approach to asset pricing because it allows for the possibility that many factors can be used to explain security returns. The APT can include any number of risk factors that could determine the required return.

The logical development of APT is similar to that of CAPM: that is, that investors should get rewarded for accepting a non-diversifiable risk. Unlike CAPM, APT assumes that returns are generated by a factor model. Furthermore, although CAPM is based on strong assumptions about investors' preferences, APT makes no such assumptions. APT does not accept the idea that investors look at portfolios in terms of expected returns and standard deviations.

It is based on the law of one price: two identical items cannot sell at different prices in a perfect market. The description of equilibrium is more general than CAPM, implying that pricing can be affected by influences beyond means and variances. The assumption of investors utilizing a mean variance framework is replaced by an assumption of the process generating security returns. APT starts by stating that the returns on any stock are linearly related to a set of n systematic factors without specifying exactly what these are:

$$\left(R_{i,t} - R_{f,t}\right) = \beta_1 F_{1,t} + \beta_2 F_{2,t} + \ldots\ldots\ldots\ldots + \beta_n F_{n,t} + \varepsilon_i \qquad (3)$$

where $\left(R_{i,t} - R_{f,t}\right)$ is the excess security rate of return, defined as the security rate of return less the one-month risk-free rate of return, $\beta_{1,2....n}$ are the betas with respect to factors $F_{1,2....n}$ and ε_t is a random error or disturbance term.

Equation 3 says that the return on a security is affected separately by all the n factors. These factors might include firm-specific characteristics, such as size, and the book-to-market effect. Equation 3 contrasts with equation 1 of the CAPM in that it has several beta coefficients rather than just one. In addition, the CAPM deals with market risk while the arbitrage pricing theory does not have market risk coefficients, the whole point of the model being that market risk is unidentifiable. The proponents of the APT argue that it has several advantages over the CAPM model:

- The CAPM requires that the investors' utility function is based upon expected returns and the standard deviation of systematic risk. The APT does not require standard deviations to be used as a measure of risk.

- APT does not require an observed market index .

- It does not make assumptions about the empirical distribution of asset returns

- It does not make assumptions about individuals' utility functions

- APT can easily be extended to a multi-period framework, according to Ross (1976)

3.6 Empirical tests and critiques of APT

On the other hand, the APT has its own defects. It does not say what the relevant factors are or even how many relevant factors there are. It can be argued that although the APT gets rid of the problem of an unobservable market index, it fails to provide a solution for choosing alternative factors. In an empirical study Chen, Roll and Ross (1986) found four statistically significant macroeconomic variables to be priced in the US stock market. These included changes in inflation, the spread between the yield on short-term and long-term government bonds, risk premia and industrial production.

Burmeister and McElroy (1988) continue the attempt to differentiate between CAPM and APT. Their study differs from Chen, Roll and Ross (1986) in two ways. They modify their definition of observable factors and assume that there are three observable factors rather than one. They then use three portfolios to represent these observable factors: the return of the S&P 500 index, the return on 20 year corporate bonds and the return on 20 year government bonds. They conclude that at a 1% significance level, CAPM can be rejected and replaced by arbitrage pricing theory. The APT restrictions cannot be rejected at any significance level. Their work is the strongest evidence in favour of APT so far as a useful and successful explanation of expected return.

APT is still questioned for its superiority over CAPM even though more interrelated factors tend to explain the expected returns on investments better. A test by Dhrymes, Friend and Gultekin (1984) finds that a multifactor APT model has better explanatory power than a one factor model like CAPM. This supports the hypothesis that more than one factor generates expected returns on assets. Chen (1983) found that CAPM's anomaly of size effect in the returns is largely eliminated by APT. The above studies seem to suggest the APT is an improvement over the CAPM, particularly when the returns include some anomaly when examined by CAPM.

3.7 Fama and French's (1993) three-factor model

The model of Fama and French (1993) was constructed and implemented on various portfolios of shares to explain various anomalies in financial markets in terms of size, book/market ratio etc. This led to the three-factor model. Their model was an extension of asset-pricing tests in Fama and French (1992) in two ways.

(a) They expanded the set of asset returns to include bond returns. Their tests included US government and corporate bonds as well as stocks.

(b) They also expanded the set of independent variables used to explain returns. The size and book-to-market variables in Fama and French (1992) are directed at stocks. They added the term-structure variables that are likely to play a role in bond returns.

Fama and French (1993) tested returns through estimation based on the following model:

$$(R_{i,t} - R_{f,t}) = \alpha + \beta_1 (R_{m,t} - R_{f,t}) + \beta_2 (R_{s,t} - R_{b,t}) + \beta_3 (R_{g,t} - R_{v,t}) + \varepsilon_t \qquad (4)$$

where $(R_{i,t} - R_{f,t})$ is the excess security rate of return, defined as the security rate of return less the one-month risk-free rate of return.

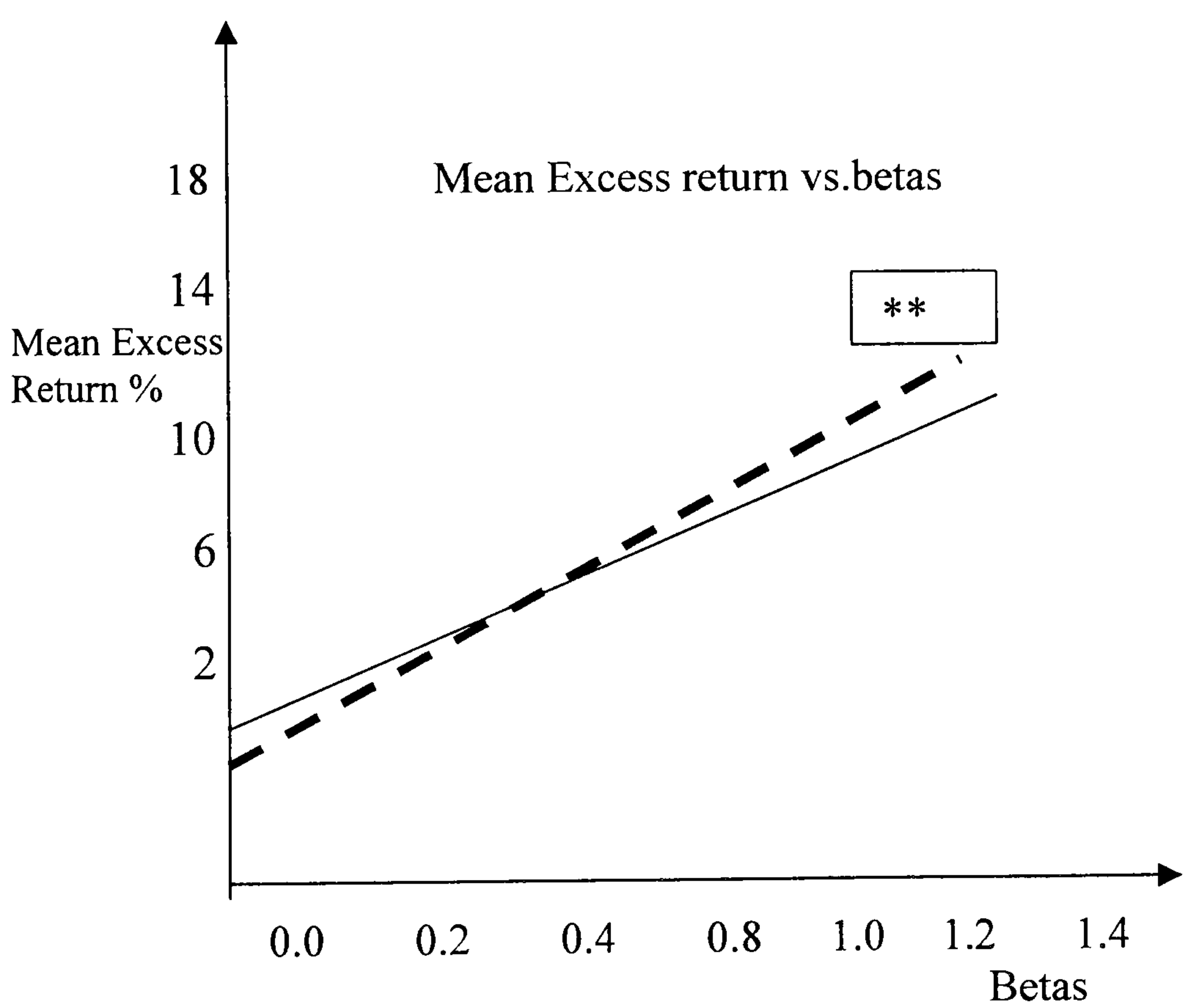
$(R_{m,t} - R_{f,t})$ is the excess market return.

$(R_{s,t} - R_{b,t})$ is the size factor (small minus big), i.e the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks.

$(R_{g,t} - R_{v,t})$ is the book-to-market factor (high minus low), i.e the difference between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to- market stocks. ε_t is the disturbance term.

The first so-called anomaly in financial markets is the size effect, according to Banz (1981). On average, stocks of small companies (measured by their market value) tend to perform better than stocks of big companies. Figure 6 captures one of the first significant failures of the CAPM. The smallest firms (the far right portfolios represented by the two stars inside the rectangle) seem to earn an average return a few per cent too high given their betas. This is the celebrated small-firm effect (Banz 1981) and this deviation was found to be statistically significant.

Figure 6 : The size effect



Source: Cochrane (1999), p.4

Another observed anomaly in financial markets is called the “value effect”. Value stocks are more risky than growth stocks. Value stocks are stocks with low valuations compared to their assets, measured by a low book-to-market ratio. Growth stocks on the other hand, have very high valuations relative to their assets, measured by a high book-to-market ratio. They tend to be stocks of companies with very high earnings growth over the previous years.

In Fama and French (1993), the observed anomalies are regarded as indications of the fact that there is not only one kind of risk. Besides the market risk, other factors like firm size and the book-to-market ratio must be taken into account.

Fama and French's (1993) conclusion that size and book-to-market equity are the most significant factors in explaining stock returns for the US had implications for the CAPM. Like the cross-section regressions of Fama and French (1992), the time series regressions say that the size and book-to-market factors can explain the differences in average returns across stocks. For bonds, the portfolios for the term structure factor capture most of the variation in the returns on their government and corporate bond portfolios. Their results implied that the CAPM was mis-specified and more emphasis should be placed on size and book-to-market equity in any new model.

Their major drawback is that not all risk factors have been identified and interpreted entirely. It is problematic to assume that investors have better information about the risks associated with stocks than researchers do.

3.8 Carhart's (1997) four-factor model

Carhart (1997) constructed his four-factor model using Fama and French's (1993) three-factor model plus an additional factor capturing Jegadeesh and Titman's

(1993) one-year momentum anomaly. Momentum can be interpreted as the ability of fund managers to outperform the market over short horizons of one to twelve months. This was motivated by the three-factor model's inability to explain cross-sectional variation in momentum-sorted portfolio returns (Fama and French 1993). Chan, Jegadeesh and Lakonishok (1996) suggest that the momentum anomaly is market inefficiency due to slow reaction to information. However, the effect is robust to time periods (Jegadeesh and Titman, 1993, Asness, Liew, and Stevens, 1996). The four-factor model is consistent with a model of market equilibrium with four risk factors. According to Carhart, it may be interpreted as a performance model where the coefficients of the various factors are used to explain the proportion of the independent variables that can explain the variations of the dependent variable.

Carhart assessed his four-factor model relative to the CAPM and three-factor model by estimating:

$$\left(R_{i,t}-R_{f,t}\right)=\alpha+\beta_1\left(R_{m,t}-R_{f,t}\right)+\beta_2\left(R_{s,t}-R_{b,t}\right)+\beta_3\left(R_{g,t}-R_{v,t}\right)+\beta_4 MOM_t+\varepsilon_t \qquad (5)$$

where $\left(R_{i,t}-R_{f,t}\right)$ is the excess security rate of return, defined as the security rate of return less the one-month risk-free rate of return.

$\left(R_{m,t}-R_{f,t}\right)$ is the excess market return.

$\left(R_{s,t}-R_{b,t}\right)$ is the size factor (small minus big), i.e the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks.

$(R_{g,t} - R_{v,t})$ is the book-to-market factor (high minus low), i.e the difference between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks.

MOM_t is the momentum factor defined by Carhart (1997) as one-year momentum in stock returns.

In more detail, according to Jegadeesh and Titman (1993), the momentum effect implies positive serial correlation of returns and appears primarily over short horizons of about one to twelve months. An economic interpretation is that the market only after some time incorporates news into asset prices. This is also called underreaction to news. An investor who knows that the asset price will only gradually adjust might want to profit from this phenomenon. He could follow the momentum strategy which implies buying stocks with a good performance in the past one to twelve months and adjusting this portfolio over time. Then on average the investor with his portfolio of past winners will earn superior returns because winners will continue to win and the losers will continue to lose.

Carhart's results suggest that ". . . persistence in mutual fund performance does not reflect superior stock-picking skill rather common factors in stock returns and persistent differences in mutual fund expenses and transactions costs. In addition, this analysis indicates that Jegadeesh and Titman's (1993) one year momentum in stock returns accounts for Hendricks, Patel, and Zeckhauser's (1993) hot hands effect in mutual fund performance. However, funds that earn higher one year returns do so not because fund managers successfully follow momentum strategies, but because some mutual funds just happen by chance to hold relatively a larger position in last year's winning stocks". (Carhart, 1997, p.57)

Fund performance and load fees are strongly and negatively related probably due to higher total transaction costs for load funds. According to Carhart, holding expense ratios constant, load funds underperform no-loads funds by approximately 80 basis points per year. There is little evidence in his study to support the existence of mutual fund manager stock-picking skill. The funds that he tested showed alphas that are insignificantly different from zero. His study expands the existing literature by controlling for survivor bias, and by documenting common factor and cost based explanations for mutual fund persistence. His database covers diversified equity funds measured monthly from January 1962 to December 1993. In an average year, his sample includes 509 funds with average total net assets of $218 million and average expenses of 1.14 per cent per year.

3.9 Empirical studies and critiques of multifactor risk models

Tests by Fama and French (1993) confirmed patterns in average stock returns not explained by CAPM and therefore typically referred to as anomalies. They used a comprehensive sample of US data over a long period (1963-1992). Recently there have been attempts to replicate the results using longer run historical data, see for example (Davis, Fama and French, 2000, Daniel, Titman and Wei, 2001). On the other hand, Kothari, Shanken, and Sloan (1995) argue that a substantial part of the deviations of the three-factor model is due to survivor bias. The data source for book equity contains a disproportionate number of high book-to-market firms that survive distress, so the average return for high book-to-market firms is overstated. Another view is that the misspecifications of the model could be caused due to irrational investors. Over-reaction that leads to underpricing of distressed stocks and overpricing of growth stocks (Lakonishok, Sheifer, and Vishny,1994 and Haugen,1995).

Another limitation of the three-factor model is that it cannot explain the continuation of short-term returns documented by Jegadeesh and Titman (1993). As we indicated above, the momentum effect, as it is known, implies positive serial correlation of returns and appears primarily over short horizons of about one to twelve months. On the other hand, the four-factor model substantially improves on the average pricing errors of the CAPM and the three-factor model. The three-factor model improves on the average pricing errors from the CAPM, since it includes both size and book-to-market equity factors. In contrast, the four-factor model reduces the average pricing errors relative to the three-factor model indicating that it well describes the cross-sectional variation in average stock returns. Size and momentum factors account for most of the explanation. The returns on the top decile funds are strongly, positively correlated with the one-year momentum factor, while the returns in the bottom decile are strongly negatively correlated with the factor. Of the 67 basis point spread in mean monthly return between deciles 1 and 10, the momentum factor explains 31 basis point, or almost half. Carhart's results suggest that concerning momentum proposed by Jegadeesh and Titman's (1993), mutual funds do not follow the momentum strategy but are funds that accidentally end up holding last year's winners. He also concluded that transaction costs can only explain the anomalous underperformance of the worst funds if these funds also have higher costs per transaction.

In view of these omissions in the prior literature, this thesis overcomes the problem of survivorship bias in the three-factor model by using a long period sample. In addition, we use a different database from the one used in Fama and French and Carhart. They used the Chicago Research on Security Prices (CRSP) database whereas we use Datastream that covers the entire population of investment trusts. In addition, they focused on security, bond returns and open-end funds whereas we focus on measuring the discount of closed-end funds or investment trusts. Furthermore, we try to find the importance of management performance and persistence of the excess discount return. The methodology applied is similar to Carhart and Dimson and Minio-Kozerski (2001). In addition, we overcome the misspecifications of the model of Fama and French (1993) and Carhart (1997) that could be due to irrational investors. We incorporate in our six factor model investor irrationality in terms of sentiment by using an investor sentiment index or retail flows. Also, we use expenses in our model to find out if it is statistically significant and affects the persistence of the excess discount return.

3.10 Conclusion of literature review

This chapter reviews the literature of linear single and multifactor risk models. We started our discussion with Markowitz's (1959) modern portfolio theory, which assumes that rational investors prefer certainty to uncertainty. They want to reduce their risk through a diversified balanced portfolio. Furthermore, according to modern portfolio theory, an investor faces two types of risk, market risk and firm-specific risk. Market risk cannot be eliminated by diversification because it is associated with economic or market factors. This leads us to the Capital Asset Pricing Model (CAPM), which is basically derived from modern portfolio theory. Its foundation is based upon the fact that the portfolio is diversified, and the only variable that we have to calculate is market volatility.

From the various tests of CAPM and from the empirical tests of Black, Jensen and Scholes (1972) and Fama and MacBeth (1973) and the serious challenges of CAPM theory from Fama and French (1992), Roll (1977) and Banz (1981) it can be said that CAPM is not a perfect way to describe the relationship between risk and expected returns of securities in the real financial markets. Ross (1976) attempted to provide a better model by introducing the Arbitrage Pricing Theory. The drawback with this theory is that an asset's excess return depends on various factors but without specifying them clearly.

An attempt to make the APT model more specific was introduced by Fama and French's (1993) three-factor model. They confirmed patterns in average stock returns not explained by the CAPM and therefore typically referred to as anomalies. One limitation of the three-factor model is that it cannot explain the continuation of short-term returns documented by Jegadeesh and Titman (1993). Carhart's (1997) four-factor model incorporated the momentum effect to test for short-term persistence. Later, we extend Carhart's model by incorporating investor irrationality in terms of sentiment proxied by retail flows and an investor sentiment index to find out if it is a statistically significant influence on the excess discount return. We also add a second factor related to expenses to test if management fees can explain the excess discount return.

Chapter 4

Economic and behavioural explanations of the discount

4.1 Introduction

UK investment trusts and US closed-end funds are characterised by a discount. Closed-end companies neither issue new shares nor redeem outstanding ones. Investors who wish to purchase or sell closed-end shares must do so on the open market at prices which do not reflect the NAVs of the companies but rather the supply of and demand for the shares. As we saw in Chapter 1, the shares of closed-end investment companies usually sell at discounts, and most of the time at substantial discounts, from the actual values of the portfolios of stocks they hold. The resulting discount or premium of the price at which they trade compared to the NAV has been the focus of much research. (see, for example, Bourdeaux, 1973; Malkiel, 1977; Brickley and Schallheim, 1985; Brauer, 1984, 1988; Weiss, 1989; Kumar and Nornha, 1992; Barclay, Holderness and Pontiff, 1995; Dimson and Minio-Kozerski, 2001, 2002). Specifically, for a sample of 64 closed-end funds, Weiss (1989) showed that within 24 weeks of trading, US closed-end funds traded at a significant average discount of 10 per cent. A theory that explains some aspects of the discount is the limited rationality model of Lee, Shleifer and Thaler (1991).

This chapter has two main purposes. The first one is to make the reader aware of previous studies and to make clear that a lot of studies have been performed regarding this issue. However, none of these studies has been able to fully explain the phenomenon of the discount on the NAV of closed-end funds. Secondly, our intentions are aimed at making the reader familiar with a range of complexities related to this topic. Specifically, we will look at the economic and behavioural explanations of the discount.

4.2 Economic explanation of the discount

4.2.1 Bias in net asset value

The discount could be attributed to the argument that NAV may be overestimated. The NAV of a closed-end fund or investment trust, usually expressed on a 'per share' basis, is the value of all its assets, less its liabilities divided by the number of shares. Thus, the formula for NAV is as follows:

$$NAV = \frac{\text{Total Assets - Liabilities}}{\text{Number of shares}} \qquad (6)$$

According to Equation (6), the NAV of a trust with assets of £10 million, liabilities of £2 million and 16 million ordinary shares would be 50 pence per share. Malkiel (1977) investigates several possible explanations of the overestimation of NAV. His findings suggest that tax liabilities related to unrealised capital gains and restricted stocks are possible causes of this miscalculation. But he concludes that the effects of these factors explain only a small part of the discount. We consider each of these arguments in turn.

4.2.2 Unrealised capital appreciation via the tax treatment of closed-end funds

In the US, closed-end funds are required to distribute realized capital gains, which are then subject to taxation at the shareholder's rate. Unrealized capital appreciation represents a potential tax liability, which is passed on to the next shareholder when closed-end fund shares are sold. Malkiel (1977) reported that unrealised capital gains explain some, but not all, of the cross sectional and time series variations in discounts. Burton and Corner (1970) describe a similar phenomenon for UK investment trusts. British closed-end funds were subject to capital gains tax from 1965 to 1980 but Burton and Corner made no attempt to measure its importance.

Malkiel (1977) found evidence that up to 5 per cent of the discount could be explained by unrealised capital gains. The cross-sectional regression was run over an 8-year period from 1967 to 1974. The sample consisted of 24 major closed-end stock funds. In his regression he isolated restricted stocks from unrealized appreciation and distribution policy as the variables were inter-correlated and because of missing data. Unrealized appreciation tended to increase discounts on closed-end funds, although the coefficient was not always significant. The value of the coefficient had an average value of just under 0.2 over the six years.

4.2.3 Liquidity and restricted stocks

Another factor that may influence the NAV figure is how different asset classes are valued. Malkiel (1977) pointed out the problem related to how fund managers value investments in restricted stocks. This kind of investment includes stocks where the closed-end fund commits itself to keep the asset for a pre-specified period. The fund that buys letter stock is required to sign an "investment letter" pledging that the stock has been bought for investment purposes. One must expect the NAV of the closed-end fund to be overestimated in terms of liquidation. Funds with large amounts of letter stock may, therefore, sell at relatively large discounts.

Malkiel used a cross-sectional regression to measure how letter stocks affect the discounts. However, the measurement of the letter stocks variable presented problems. A fund, for example, with all of its assets in letter stock might sell at quite different discounts under the following three circumstances: (a) The fund values the letter stock at 50 per cent of the market value of the registered stock of the same company (b) The fund values the letter stock at 100 per cent of the market value of the registered stock of the same company (c) There is no market whatsoever for the company's securities and the fund assigns an arbitrary value to its holdings. The funds in his sample did not respond with sufficiently detailed information to make such a detailed analysis of restricted stock. Therefore, it must be emphasized that the letter stock variable was obviously measured with substantial error.

On the other hand, Lee, Shleifer, and Thaler (1991) found that most of the US closed-end funds only have a small portion of their investments dedicated to restricted stocks. Nevertheless they still sell at a discount. Seltzer (1989) suggests that these securities are likely to be worth more than their values because of the difficulty of determining their fair market value.

4.3 Agency costs

Agency costs have also been used in the attempt to explain the discount on closed-end funds. Various management groups hold large percentage blocks of shares in some closed-end funds in order to acquire private benefits. Funds with blockholders who are consuming private benefits trade at discounts because these blockholders have an incentive to resist open-ending proposals. On the other hand, a blockholder and associates can extract private benefits from a closed-end fund by taking large salaries and generating large brokerage commissions. Thus, these direct pecuniary benefits should show up in the fund's expenses. A possible explanation for the discount is that, as managers try to protect their private benefits, expenses increase over the long term and have a statistically significant effect on the discount. From this point of view, the discount may reflect excessive management fees or inadequate management performance. Chay (1992) and Chay and Trzcinka (1999), calculated managerial performance net of expenses by subtracting NAV fund performance from the specific sector's NAV performance. They showed that funds selling at a discount underperform funds selling at a premium. There are, however, some problems with this approach. The theory can neither explain cross-sectional nor periodic fluctuations in the discount. An additional drawback is that the theory cannot explain why rational investors buy into closed-end funds that are issued at a premium, since they are aware of the likelihood of the fund subsequently trading at a discount.

Lee, Shleifer, and Thaler (1991) question the above reasoning of management performance being related to the discount. They point out that new closed-end funds are normally started at a premium, but are traded at a discount just a few months later. The contradiction therefore lies in the fact that the investors must expect superior returns when the new funds are issued, but then quickly change their minds and predict returns to be below normal performance. Lee, Shleifer, and Thaler (1990) conclude that both predictions cannot be accepted as rational at the same time.

Kumar and Noronha (1992) re-examine the role of expenses by developing a present value model that emphasizes expenses relative to dividend income. Using a larger sample and their alternative specification of the expense variable from the one used by Malkiel (1977), Kumar and Noronha find that discounts are related to expenses. Malkiel (1977) defined management expenses (excluding brokerage costs and interest payments) as a percentage of fund assets. The expense variable was calculated for each year by dividing the expenses for the year by the NAV at the end of that year. In contrast, Kumar and Noronha (1992) measure expenses by dividing expenses by the sum of expenses and dividends paid including dividends that are reinvested by shareholders. The sum of expenses and dividends represents gross investment income. The ratio of expenses to this sum represents that portion of investment income that was consumed as expenses and not paid out to shareholders. The problem with their approach was related to measurement issues of dividends reinvested by shareholders. The differences between Malkiel's (1977) results and their results could be due to different periods examined. Finally, Malkiel's sample appears to have a greater proportion of funds with predominantly foreign holdings compared to the earlier years of the sample in their study.

Gemmill and Thomas (2002) found that discounts exist in the long-term because of management expenses, while discounts fluctuate in the shorter-term because of changes in investor sentiment. Our findings reported in Chapter 8 support the view that investor sentiment is a cause of the discount in the long term and that expenses do not affect it.

4.4 Agency problems

Agency problems may also be used to explain the existence of the discount. On the other hand, the discount can be eliminated by unitising or liquidating the fund. If managers owned a large part of share ownership of the fund, they would not benefit appreciably from the elimination of the discount, but would probably lose their jobs if the fund was opened. Consequently, managers resist open-ending proposals and the discounts persist.

Barclay, Holderness, and Pontiff (1995) found a relationship between discounts and managerial stock ownership in their sample between 1979 and 1989. They excluded municipal-bond funds, foreign funds, and funds that were scheduled to be opened. Their final sample consisted of 111 funds in 1989, 41 funds in 1984, and 48 funds in 1979. They found that there is a stable and significant cross-sectional relationship between discounts and the concentration of ownership. At this point it is worth distinguishing between two types of blockholders. According to Barclay, Holderness, and Pontiff (1995), there are friendly and hostile blockholders. One motive for holding a large-percentage block in a closed-end fund is to acquire private benefits which are closely related to management and because they hold their blocks for long periods they resist to open-ending proposals. These are classified as friendly blockholders towards management. On the other hand, other blockholders accumulate their shares as part of an attempt to open the fund, with the objective of gaining the difference between the purchase price of their shares and NAV. These are classified as hostile blockholders towards management. Barclay et al identified such blocks by searching the Dow Jones News Retrieval Service and The Wall Street Journal Index. The greater the managerial stock ownership in the closed-end fund, the larger the discounts to NAV. The average discount for funds with blockholders was found to be 14.2 per cent, whereas the average discount for funds without blockholders was found to be only 4.1 per cent.

The idea is that blockholders receive private benefits that do not accrue to other shareholders and, therefore, tend to preserve these benefits by resisting open-ending proposals which will eliminate the discount. Consistent with Barclay, Holderness, and Pontiff's argument, Clarke and Shastri (2002) used a sample of 266 domestic equity, bond, and international equity closed-end funds to examine the magnitude and the cross-sectional determinants of the bid-ask spread. They found no relation between the spread and the expense ratio or portfolio turnover. However, they found a strong positive relation between aggregate holdings and the spread. They argued that uncertainty in the market about private benefits being paid to blockholders in closed-end funds leads to greater levels of information asymmetry which creates large discounts. They found that the information asymmetry component of the spread is between 10 and 20 per cent. This finding complements the work of Sarin and Shastri (2000) and Heflin and Shaw (2000) who showed that ownership structure can have a substantial impact on market quality.

Dann, Del Guercio, and Partch (2000) argued that fund expense ratios are an important factor of the board's effectiveness in executing their duties. They analyzed board size, director compensation and ownership structure in 476 closed-end funds. They found that boards with a greater degree of effective independence are associated with lower expense ratios.

4.5 Segmented markets

Pratt (1966) pointed out that local market segmentation in terms of selling closed-end funds in comparison with unit trusts influences the size of the discount. He argued that the main reason for the discount was that too little effort was made to sell closed-end funds to the general public and that brokers preferred to sell securities other than closed-end fund shares because of lower commissions. In more detail, according to Pratt (1966, p.80) "if an investor puts $1,000 into a load-type open-end fund, the broker makes about $45. If an investor puts $1,000 into a closed-end company, the total commission comes to about $25 and the salesman gets to keep about 30 per cent of the total, or $7.50. Since investors are unlikely to trade from one closed-end company to another as they might with ordinary stock, brokers know their commission is likely to be a one off. It is clear why brokers are unlikely to be enthusiastic of the shares of closed-end companies."

Nowadays, due to the increased number of funds and use of information technology, expense ratios of US funds are lower and range from 0.20% to 0.30%. On the other hand, according to AITC, annual management charges/staff costs have been more accessible in terms of commissions. These vary depending on the fund but investors are expected to pay between 0.25% and 1% a year for the management of investment trusts. The staff costs will be at the low end and may even be as low as 0.15% per annum.

4.6 Behavioural explanations for the discount

The research based on economic theory can partly explain the level of the discount, but fails to give a good explanation for the persistence of the discount. Due to this, more recent research mostly relies on behavioural explanations. Investors' individual behavioural patterns and sentiments are important in order to explain the discount in relation to NAV.

4.6.1 Investor sentiment model

One possible explanation for the discount was presented by Lee, Shleifer, and Thaler (1991). The model investigated was first developed by De Long, Shleifer, Summers and Waldmann (1989), and is based on two categories of investors. The first category includes rational investors, who make rational decisions in accordance to their preferences. That is, their investment decisions are based on rational expectations about future asset returns, and the investors act within the efficient market hypothesis. On the other hand, there is a second group of investors, the so-called noise traders. These investors do not act fully rationally, and their investment decisions are considered as unpredictable. In some periods, they overestimate expected returns, relative to the rational expectations, and in other periods they underestimate them. Therefore, the prices of securities are a function of both types of investors. As a cause of the unpredictability in the changing expectations of returns, fluctuations in the discounts arise. Two important assumptions are made: rational investors are risk averse and have finite horizons. This implies that noise traders add risk, which it is not possible to diversify away and hence, like fundamental risk, must be priced in order to attract rational investors. This additional priced risk is represented by the discount. Pontiff (1995) provides weak evidence supporting the hypothesis that funds with larger discounts are exposed to greater investor sentiment risk.

In Gemmill and Thomas (2002), the authors conclude that consistent with the noise trading model, changes in the discount for closed-end funds are a function of time-varying noise trader proxied by retail investor flows. They state that the investor sentiment not only affects the discount in the short-term but may also influence its level over periods of several years.

The most recent research tries to respond to critiques of earlier studies about other agents that lead to the discount. Arora, Ju and Ou-Yang (2002) present a model that leads to a potential explanation of the closed-end fund premium (or discount) in the presence of other informed investors. Their model not only relies on the fact that the manager is bound by rules and regulations but on the fact that he is the only one of the many informed traders in the market. The problem with their model is that due to asymmetric information it is not clear if the managers are the only source of informed agents. They conclude that the manager's compensation will remove any misalignment between the manager's interests and the investor's interests and therefore the funds will be traded at a premium. The question that arises is if by imposing extra rules and regulations on the manager this will eliminate the discount.

In line with Arora, Ju and Ou-Yang (2002), Berk and Stanton (2003) also conclude that a rational investor model can explain the discount phenomenon. They conclude that a simple model can generate a discount that exhibits discount behaviour, which contradicts the beliefs of investor irrationality. They base their model on an assumed form of labour contract where the managers sign long-term contracts guaranteeing them a fee each year equal to a fixed fraction of assets under management. Furthermore, they can leave to earn more money elsewhere if they turn out to be successful. The labour contract affects the behaviour of the asset manager and consequently also the performance of the fund. The authors link the performance and the costs to the asset manager. They argue that it is unlikely that a fund manager generates a premium in terms of high performance and low compensation in the long-term. Either he or she will quit the fund for a job with better compensation or he will be given a pay increase. It is rather more likely that a fund manager with worse performance will be paid a too high compensation, which generates a NAV discount.

We can conclude that extensive research has been done on closed-end funds but there is still only a limited picture of discount persistence. There are explanations based on rational investors as well as on irrational ones, but no explanation is completely accepted.

4.6.2 Price reaction to open-ending announcements

Brauer (1984) tested informational efficiency in the US by examining 'open-ending' events. The paper reports that most of the abnormal returns associated with open-ending are exhausted by the end of the announcement month. This suggests, with respect to open-ending, that the behaviour of closed-end fund participants is generally rational which, according to the findings reported in chapter 8 is not true.

Datar and Dubofsky (1999) examined the impact of stock split and stock dividend announcements made by closed-end funds. They found that closed-end funds react no differently than other firms to stock distribution announcements. There is no reason to believe that closed-end fund managers possess inside information about their firms' value. Every week, the values of their assets' NAV are publicly disseminated in the financial press, and prices and bid-ask quotes are reported continuously during the trading day. They used a t-test to test the null hypothesis that the mean event period return for closed-end fund stock distribution announcements equals that of announcements made by other firms. Since they argue that the signalling and private information hypotheses are invalid for closed-end funds, they attribute their reactions to other factors. They tested trading volume and average percentage share turnover. Trading volume is frequently used as a measure of liquidity in many investigations of stock distributions. They tested the hypothesis that trading volume does not change radically after the ex date. The post-distribution volume, in shares traded, is adjusted for the size of the distribution. They found that average daily volume increases for the closed end fund sample from 7,017 shares/day before the ex-distribution day to 8,806 shares/day adjusted for the split factor after the ex day. The mean difference of 1,789 shares is statistically insignificant, as indicated by the t-statistic of 0.71. They also examined average percentage share turnover, defined as the mean of daily shares traded / shares outstanding, before and after the ex date. They concluded that stock distribution announcements are not the reasons for the discount having no liquidity impact on closed-end funds.

4.7 Multifactor models of the closed-end fund discount

Dimson and Minio-Kozerski (2002) used multifactor models to explain changes in the discount to net asset value. Initially, they used the three factors from Fama and French (1993). They found that the book-to-market effect did not have explanatory power so it was excluded from their model. They then constructed a seven-factor model, which included a market effect and a size effect, and five other factors, which they refer to as sector, seasoning, mean-reversion, manager and performance factors. Their 'sector' factor is an index of changes in the discount for all funds in the sector, except the fund of interest. Their 'seasoning' factor takes account of the age of the fund, while their 'mean-reversion' factor is the difference between the mean discount for the sector and the fund's discount. Their 'manager' factor is an index of changes in the discount of all funds in the management group, except the fund of interest, and the 'performance' factor is defined as the difference between the fund's NAV return and the sector's average NAV return.

Their sample comprised 202 closed-end funds during the period 1981-1996. Their seven-factor model explained on average 34 per cent of monthly changes in the discount. In contrast, our sample consists of 120 funds for the UK and 30 funds for the US market for the period 1990 to 2003. In addition, we define our factors differently from their study. For example, in Dimson and Minio-Kozerski (2001), the performance of the equity market is measured by the difference between the return on the FTSE 100 index and the risk-free rate. In our case, we use the excess market return of the FTSE All Share index for the UK and the excess return of the S&P 500 Composite for the US. In their study, the size effect was measured as the difference between the Extended Hoare Govett Smaller Companies index and the return on the large cap FTSE 100 index. In our case, the UK size effect is measured as the difference between the return on the FTSE Smaller Companies Index and the return on the FTSE 100 index. The US size effect is measured as the difference between the return on S&P Small Cap and the return on the S&P 500 composite.

4.8 Conclusion

An extensive review of the possible economic explanations for the closed-end fund discount has been reviewed. The first justification for the existence of the discount is that it might reflect overestimated net asset values. The literature tends to suggest that part of the level of the discount could be accounted for by biases in the NAV.

As discussed extensively in this section, several economic explanations have been proposed but none can explain totally the persistence of the discount. The failure to explain the discount within a rational framework has resulted in the development of behavioural hypothesis. The investor sentiment hypothesis provides an interesting explanation of the closed-end fund discount.

In the following chapters, we focus on methodological and measurement issues concerning the calculation of the discount, average discount by sector, price returns, NAV returns, sample sizes and various databases. In chapter 6, we analyse the time-series properties of the UK and US NAV and discount in terms of autocorrelation, stationarity, normality, and seasonality. Then in chapter 7 we focus on performance persistence. In chapter 8, we extend Fama and French's (1993) three-factor model to add new factors that will explain the excess discount return. We compare the findings with the ones mentioned in the literature.

Chapter 5

Methodological, measurement and sampling issues

5.1 Introduction

This chapter describes the methodology of the research and discusses measurement issues relevant to the definition and calculation of the discount, the average discount by sector, total returns in terms of the share price return, NAV returns and index returns, which include size and value effects. We summarise the models that will be used in the following chapters. We then review the databases available for analysing the discount, NAV and independent variables for the UK investment trust industry and US closed-end funds. Finally, we explain the sample sizes and present a set of descriptive statistics.

5.2 Methodological issues

The main methodological approach that will be used is quantitative. It aims to provide a clearer understanding of a phenomenon that is difficult to explain, by making inferences through hypothesis testing.

The principal research framework is based on the development of theoretical models, which are assessed by testing hypotheses. So in this thesis, the research paradigm or research process reflects the post-positivist deductive scientific method. This method involves the formulation of testable hypotheses from 'a priori' theories or the extant literature, followed by the collection and analysis of numerical data and the application of appropriate statistical tests. To the best of my knowledge, the secondary data used in the thesis are collected from trustful databases, such as Datastream and Thomson Financial Investment View Wiesenberger. Another important aspect of the post-positivist paradigm is high reliability. Hypotheses are proposed based on reason, logic and arguments presented in the extant literature. Relationships are suggested based on currently accepted theory. These relationships are tested using empirical data. However, a number of associated concepts have to be considered, such as measurement error when dealing with the potential problems of multiple regression analysis.

Econometric criteria are used to determine whether the assumptions of the models used are satisfied. Only if these assumptions are satisfied will the estimated coefficients have the desirable properties of unbiasedness, consistency and efficiency. Since relationships in economics and finance are stochastic, rather than deterministic, regression equations must be modified to include a random disturbance, error or stochastic term. The most common problems related to multiple regressions using time-series data are autocorrelation, non-stationarity and multicollinearity which are diagnosed in the subsequent chapters.

Autocorrelation

One of the assumptions of multiple regression analysis is that the value that the error term assumes in one period is uncorrelated to its value in any other period. This ensures that the average value of the dependent variable depends only on the independent variables and not on the error term. The Durbin-Watson statistic tests for first-order autocorrelation. When the error term in one period is positively correlated with the error term in the previous time period, we face the problem of positive first-order autocorrelation. This is common in time-series analysis and leads to downwardly biased standard errors and thus to incorrect statistical tests and confidence intervals. The presence of autocorrelation is tested by utilizing the tabulated value of the Durbin-Watson statistic (see Chapters 7 and 8) at the 5% or 1% levels of significance.

Non-stationarity

Non-stationary series have stochastic trends and/or non-constant variances and will often show spurious high correlation and high R^2 values. This will create a problem in regression models as it suggests a significant relationship between variables when in reality there is none. Non-stationary series in the finance literature can be tested by means of autocorrelation analysis and unit root tests.

Multicollinearity

Another assumption of the regression model is that none of the explanatory variables can be expressed as exact linear functions of the others. Multicollinearity refers to the case in which two or more explanatory variables in the regression model are highly correlated, making it difficult or impossible to isolate their individual effects on the dependent variable. With multicollinearity, the estimated OLS coefficients may be statistically insignificant (and have even the wrong sign) even though R^2 may be high. In addition, the standard errors could be very high or the t-ratios very low. The confidence intervals for the parameters of interest are thus very wide. When the explanatory variables are highly intercorrelated, it becomes difficult to disentangle the separate effects of each of the explanatory variables on the explained variable. It can be overcome or reduced by collecting more data or dropping one of the highly collinear variables.

5.3 The models to be estimated

This section describes the econometric tests and methodologies that will be used in the following chapters. In Chapter 6, we focus on the time-series properties of the excess NAV and the discount return in terms of autocorrelation, normality, stationarity, and seasonality. These tests are crucial as they test the key assumptions of the multiple regression models and determine whether we should use standard regression or cointegration analysis. Chapter 7 is about performance persistence. We try to identify if persistence is related to the anomalies documented in the finance literature in terms of size, value effect or manager skills. The fact that we find some weak evidence for managerial performance persistence motivates us to use a performance measure later in Chapter 8 to investigate whether it affects the excess discount return. Three models are applied in Chapter 7: Fama and French's (1993) three-factor model, an extended version of Fama and French's model that incorporates a market timing variable, and finally the performance persistence correlation analysis also used by Carhart (1997) and Dimson and Minio-Kozerski (2001). In Chapter 8, we focus on the possible factors that cause the fluctuation and persistence of the excess discount return. Four models are applied: Fama and French's (1993) three-factor model, Carhart's (1997) four-factor model and two versions of Guirguis' six-factor model.

5.4 Measurement issues

This section covers measurement issues relating to the dependent and independent variables.

5.4.1 Definition of the discount

The discount on a closed-end fund is calculated as the difference between the share price and NAV divided by the NAV.

$$d_t = \frac{P_t - NAV_t}{NAV_t} \times 100 \tag{7}$$

where d_t is the discount in period t, P_t and NAV_t are the share price and the net asset value per share of the closed-end fund in period t, respectively. As indicated in Chapter 4, the NAV of a closed-end fund or investment trust, usually expressed on a 'per share' basis, is the value of all its assets, less its liabilities, divided by the number of shares.

$$\text{NAV} = \frac{\text{Total Assets - Liabilities}}{\text{Number of shares}} \tag{8}$$

When the share price is below the net asset value it is trading at a discount. Share prices above the net asset value are at a premium. For example, if the closed-end fund is trading at £9.50 and its net asset value is £10, then it is trading at a 5% discount.

5.4.2 Average discount of a category

The average discount $\overline{d}$ of a sector (or category) is defined as follows:

$$\overline{d} = \frac{\sum_{i=1}^{n}\left(\frac{P_i - NAV_i}{NAV_i}\right)}{n} \qquad i = 1,2 \ldots\ldots n \qquad (9)$$

where $\overline{d}$ the discount of a sector and n is is the number of funds in the sector.

5.4.3 Total returns

This section defines total returns for closed-end funds in terms of share price return, NAV return, and index return .We do not take logarithms as the discounts in the UK and the US are approximately normally distributed (see Chapter 6). In addition, the fact that we used NAV returns and not share price returns substantiates the normality of our data.

5.4.4 Share price returns

We define total monthly share price returns as the ratio of the difference of the monthly share price in addition to the fund's annual dividend yield.

$$R_{P_{i,t}} = \left[\left(P_{i,t} - P_{i,t-1} + DY_{i,t}\right) / P_{i,t-1}\right] * 100 \tag{10}$$

where $P_{i,t}$ is the share price of fund i at time t, $DY_{i,t}$ is the annual dividend yield measured at time t.

5.4.5 NAV returns

We define total monthly NAV returns as the ratio of the difference of the monthly NAV in addition to the fund's annual dividend yield.

$$R_{NAV_{it}} = \left[\left(NAV_{it} - NAV_{it-1} + DY_{it}\right) / NAV_{it-1}\right] * 100 \tag{11}$$

where NAV_{it} is the net asset value of fund i at time t, DY_{it} is the annual dividend yield measured at time t. The closed-end fund dividend is paid out of the portfolio's income, after deducting expenses. Dividends are paid out of income, not out of capital. This measure of the total NAV return is, therefore, net of expenses.

5.4.6 Index returns

We define total monthly index returns as the ratio of the difference of the monthly index changes in addition to the fund's annual dividend yield.

$$R_{Index_{it}} = \left[\left(Index_{it} - Index_{it-1} + DY_{it}\right) / Index_{it-1}\right] * 100 \tag{12}$$

where $Index_{it}$ is the value of index i at time t and DY_{it} is the annual dividend yield measured at time t.

5.5 Data sources

This section describes briefly the sources of data available for the analysis of the UK investment trust industry and US closed-end funds.

5.5.1 Association of Investment Trust Companies (AITC)

The AITC publishes the Monthly Information Service including monthly data on each fund in terms of NAV, share price, discount, gearing, total returns, and dividend payment date. The classical way of calculating NAV is by taking the value of the fund's investments less its liabilities (prior charges such as loans, and debentures at their par value) including any borrowings and dividing it by shareholders' funds expressed as an amount per ordinary share.

5.5.2 Datastream

Datastream provides monthly data including NAV, share prices, dividends, retail flows and a wide range of indices. NAV is defined as the market value of total assets less all prior charges valued at their par or asset value, all divided by the number of shares in issue. Prior charges are defined as including all debentures, all loans and short term loans and overdrafts that are to be used for investment purposes, reciprocal foreign currency loans, currency facilities to the extent that they are drawn down.

5.5.3 Thomson Financial Investment View Wiesenberger for US funds

Thomson Financial Investment View Wiesenberger is the leading provider of financial data for the US market. Thomson Financial estimates daily and monthly NAVs as follows: NAV is calculated by taking the value of the fund's investments less its liabilities (such as loans, and debentures) divided by the total number of shares outstanding to be expressed as an amount per ordinary share. Gearing on the other hand is calculated by dividing total assets by net assets and multiplying by 100. In addition, they provide information for dividends, share prices and various US indices.

They enter the most recent asset allocation breakdown into their database. When an official NAV is released by the fund, they back work out what the gross assets are. For example, they multiply the NAV per share by the number of shares in issue and add on any liabilities to arrive to gross asset figures. They then estimate forwards using this new gross assets figure applying the same asset allocation spread as was revealed in the most recent breakdown.

5.5.4 Bankers Thomson Analytics

Thomson Banker One provides detailed price and financial information for over 45,000 UK and international companies. It includes share prices and market indices. The database is very helpful with the research and analysis of a wide range of financial data, which can be formulated into graphs and charts. Features of the former Extel database, such as the Extel cards and news, have been incorporated into this database. Thomson Banker One offers quick and easy access to quotes, earnings estimates and financial fundamentals.

5.5.5 Yale School of Management

The Yale School of Management publishes an investor confidence index, which we use as an investor sentiment proxy in Chapter 8. The sample of US individual investors from 1989 to 1998 was purchased from W. S. Ponton, Inc., a list of "high-grade multi-investors". Starting in 1999, the sample was a random sample of high-income Americans purchased from Survey Sampling, Inc. The index is derived from the responses to a single question that has been asked consistently through time since 1989 to a consistent sample of respondents. The wording of the question focused on how pessimistic or optimistic investors are towards the stock market.

5.6 Sample sizes and descriptive statistics

According to AITC, there were 263 conventional trusts with total assets of £55.6 billion in 2005 in the UK. Each fund is allocated to one of 16 different categories. The largest category of US closed-end funds in terms of assets under management is municipal bond funds which occupy around 42%. In October 2003, there were 286 municipal funds with almost $135 billion under management. These funds invest in bonds issued by state and local government and agencies. In addition, a majority of municipal bond closed-end funds employ leverage to enhance their return potential. This category is out of the scope of our research as we focus mainly on equity funds.

Each of the funds that we study is allocated to one of the 16 categories described in Table 1 for UK investment trusts and one of the 4 categories described in Table 2 for US closed-end funds. This study investigates almost half of the entire investment trust industry, with the exception of funds that invest in unquoted securities such as venture and development, private equity and specialist funds (such as the Energy sector), emerging market funds, hedge funds, municipal bond funds and split capital trusts. The reason for excluding unquoted securities is that if a significant proportion of investments held are unquoted, there will be some uncertainty as to the true value of the underlying assets. By excluding the above, our sample consists finally of 16 categories with a total number of 120 funds including the "dead" ones. On the other hand, we investigate 4 categories of US closed-end funds with a total number of 30 funds.

The different categories of funds, the total number of funds, and average discount by category are described in Table 1 and 2. In addition, Tables 3 to 8 show descriptive statistics for the UK and US categories concerning the discount, share price and NAV. Tables 9 and 10 detail the various funds by category. Table 11 shows the "dead funds" included in our dataset in terms of liquidated, unitised or open-ended and merged funds for UK investment trusts. On the other hand, the only information that we have for US closed-end funds from Thomson Financial Investment View database is that the Progressive Return Fund and Investor First Fund were converted to the Cornerstone Strategic Value Fund which belongs to the Equity Income category under the CEFA classification. We use a full data set with no missing data from January 1990 to January 2003. All the funds that we analyze have a full history in terms of share price, NAV and discount.

In Chapter 7 we investigate the performance of live and 30 "dead" UK investment trusts. In the sample investigated, we include the different types of dead funds in order to avoid survivorship bias. Specifically, our sample of funds has the potential to avoid survivorship bias as it contains defunct and surviving funds. Survivorship may be expected to bias a performance measure upwards especially when we get averages for the whole sector or for industries within specific sectors (e.g. see Grinblatt and Titman,1988; Brown, Goetzmann, Ibbotson and Ross,1992; Brown and Goetzmann,1995; Malkiel,1995). Elton, Gruber and Blake (1996b) included defunct funds and showed that with and without defunct funds they obtained different results of performance measurement. The problem of funds disappearing because of bad performance and poor management may result in evidence of performance persistence when in reality there is no clear sign of it. Our analysis eliminates the problem of survivorship bias by including the dead funds that disappeared during the period 1990 to 2003, namely 27 liquidated, 1 merged and 2 unitised or open-ended. These 30 funds correspond to the funds that Datastream classifies as "dead" funds and for which it keeps a back history. The overall sample covers 120 different funds.

In this study we investigate the behaviour of UK investment trusts and US closed-end funds over the period January 1990 to January 2003. Table 1 presents the various sectors of UK investment trusts in terms of number of funds and average discount classified by AITC.

Table 1 Description of various sectors of UK investment trusts

AITC Category	List Mnemonic	Number of Funds 1/1990 – 1/2003	Average Discount 1/1990 – 1/2003 (%)
Global Growth	LITGLBGW	21	-6.10
Global Growth & Income	LITGLBGI	2	-9.62
Global Smaller Companies	LITGLBSC	2	-9.89
UK Growth	LITUKGRO	12	-8.90
UK Growth & Income	LITUKGRI	9	-6.02
UK Smaller Companies	LITUKSCO	12	-13.36
North America	LITNAMER	2	-10.41
North America Smaller Companies	LITNAMSC	2	-15.15
Far East (Including Japan)	LITFEIJP	2	-14.40
Far East (Excluding Japan)	LITFEXJP	6	-12.37
Japan	LITJAPAN	3	-9.49
Japanese Smaller Companies	LITJAPSC	2	-15.45
Europe	LITEUROP	7	- 6.74
European Smaller Companies	LITEURSC	3	-12.26
Country Specialist - Far East	LITCSFAR	3	- 12.22
Sector Specialist – Property	LITSSPRO	2	-19.62
Total	16	90	-11.38

Source: Datastream University of Piraeus, Athens, Greece. Association of Investment Trust Companies (AITC).

According to Table 1, all sectors by AITC are traded at a significant discount. In more detail, the Sector Specialist Property sector traded at the largest average discount of -19.62 per cent. The North America Smaller Companies sector average discount was -15.15 per cent and the Japanese Smaller Companies sector average discount was -15.45 per cent. In contrast, the sectors with the lowest average discounts were UK Growth and Income estimated at -6.02 per cent and Global Growth with a discount of -6.10 per cent. The overall average discount of the 16 sectors was -11.38 per cent.

Table 2 shows the average discount of the various categories of US closed-end funds classified by CEFA.

Table 2 Description of various sectors of US closed-end funds.

CEFA Category	List Mnemonic	Number of Funds 1/1990 – 1/2003	Average Discount 1/1990 – 1/2003 (%)
Equity Income	FMUFDB	9	-5.66
Global Equity	FMUFDC	3	-5.77
Growth and Income	FMUFDD	8	-3.71
Growth Domestic	FMUFDE	10	-7.38
Total	4	30	-5.63

Source: Datastream University of Piraeus, Athens, Greece and Thomson Financial Investment View

According to Table 2, it is clear that all sectors by CEFA category also traded at a discount, but the levels are not as high as in UK investment trusts. To be specific, the lowest discount was Growth and Income which was traded at -3.71 per cent and the largest discount was Growth Domestic which traded at -7.38 per cent. The overall average discount of the 4 sectors was -5.63 per cent.

Table 3 summarises descriptive statistics of the average discount of UK investment trusts by AITC sectors for the period January 1990 to January 2003.

Table 3 Descriptive statistics of the UK average discount.

AITC Category	Mean	Standard deviation	Range	Min	Max
Global Growth	-6.10	5.83	28.98	-26.19	2.78
Global Growth & Income	-9.62	4.91	20.25	-19.41	0.84
Global Smaller Companies	-9.89	7.53	33.30	-30.68	2.62
UK Growth	-8.90	2.86	16.17	-18.08	-1.90
UK Growth & Income	-6.02	5.31	22.71	-17.52	5.19
UK Smaller Companies	-13.36	6.07	28.61	-26.30	2.30
North America	-10.41	5.20	23.59	-22.09	1.50
North America Smaller Companies	-15.15	5.38	27.06	-29.84	-2.78
Far East (Including Japan)	-14.40	5.48	25.32	-26.21	-0.88
Far East (Excluding Japan)	-12.37	5.41	25.34	-25.33	0.00
Japan	-9.49	5.14	24.53	-21.46	3.07
Japanese Smaller Companies	-15.45	6.89	34.02	-30.59	3.43
Europe	- 6.74	4.20	25.70	-19.59	6.11
European Smaller Companies	-12.26	4.95	25.70	-27.69	-1.98
Country Specialist - Far East	- 12.22	4.84	25.50	-23.50	2.00
Sector Specialist - Property	-19.62	5.67	32.95	-38.62	-5.67
Average	-11.38	5.35	26.23	-25.19	1.04

Source: calculated by the author

According to Table 3, it is clear that there is a wide range between the lower and upper bounds in each category by AITC. For example, Japan has a range of 24.53 percentage points with a lower bound of -21.46 per cent and an upper bound of 3.07 per cent. UK Growth has a range of 16.17 percentage points with a lower bound of -18.08 per cent and an upper bound of -1.90 per cent. This suggests that there is an active interaction between arbitrageurs and noise traders. So if investment trusts trade at a discount to NAV, an apparent arbitrage profit can be realised by holding the fund's shares. However, if the discount stays relatively constant over the investment horizon, the arbitrageurs make no profit. In addition, from the means and standard deviations, we see that there is a high degree of dispersion in all sectors by AITC category. For example, for Sector Specialist Property, the coefficient of variation (a measure of relative dispersion calculated as the percentage of the standard deviation to the mean) is 28.90%. Japanese Smaller Companies has a coefficient of variation of 44.60%. In general, the average fund by sector has an average discount of -11.38%, a coefficient of variation of 47.01% and a range of 26.23 percentage points with a lower bound of -25.19% and an upper bound of 1.04 %.

Table 4 Descriptive statistics of the UK average NAV return

AITC Category	Mean	Standard deviation	Range	Min	Max
Global Growth	0.62	3.62	22.57	-10.14	12.42
Global Growth & Income	0.19	4.57	27.32	-14.39	12.94
Global Smaller Companies	0.53	6.24	40.86	-18.83	22.03
UK Growth	0.48	4.21	25.40	-13.97	11.44
UK Growth & Income	0.32	4.70	27.54	-15.50	12.05
UK Smaller Companies	0.22	5.72	40.86	-21.32	19.54
North America	0.61	5.09	28.61	-13.81	14.80
North America Smaller Companies	0.67	5.04	33.48	-17.39	16.08
Far East (Including Japan)	0.04	6.18	30.17	-14.73	15.44
Far East (Excluding Japan)	0.40	7.44	42.43	-19.18	23.25
Japan	0.02	7.93	42.83	-18.49	24.33
Japanese Smaller Companies	0.21	10.31	80.71	-22.00	58.70
Europe	0.57	5.81	38.93	-20.17	18.76
European Smaller Companies	0.51	6.61	56.33	-22.20	34.13
Country Specialist - Far East	0.19	6.28	34.73	-15.27	19.45
Sector Specialist – Property	0.18	4.79	29.14	-13.86	15.28
Average	0.36	5.91	37.62	-16.95	20.67

Source: calculated by the author

Table 4 summarises descriptive statistics of the average NAV return of UK investment trusts by AITC sectors for the period January 1990 to January 2003. According to Table 4, it is clear that there is a wide dispersion between the lower and upper bounds in each category by AITC. For example, the Global Growth sector has a range of 22.57 percentage points with a lower bound of -10.14 per cent and an upper bound of 12.42 per cent. The UK Smaller Companies sector has a range of 40.86 percentage points with a lower bound of -21.32 per cent and an upper bound of 19.54 per cent. The Far East Excluding Japan sector has a range of 42.43 percentage points with a minimum value of -19.18 per cent and a maximum value of 23.25 per cent. This suggests that there is a large fluctuation in NAV returns. We see also that there is a high degree of dispersion between the sectors by AITC category. For example, the Global Smaller Companies sector has a coefficient of variation of 11.77 per cent compared with the coefficient of variation of Japanese Smaller Companies sector, which is 49.10 per cent. Similarly, UK Growth has a lower coefficient of variation compared with UK Smaller Companies, which is 8.77 per cent. In general, the average fund by sector has an average NAV return of 0.36 per cent, a standard deviation of 5.91 per cent and a wide range of 37.62 percentage points with a lower bound of -16.95 per cent and an upper bound of 20.67 per cent.

Table 5 shows descriptive statistics of the average share price return of UK investment trusts by AITC sectors for the period January 1990 to January 2003.

Table 5 Descriptive statistics of the UK average share price return

AITC Category	Mean	Standard deviation	Range	Min	Max
Global Growth	0.72	4.27	32.35	-12.74	19.61
Global Growth & Income	0.25	5.28	37.55	-20.49	17.06
Global Smaller Companies	0.56	7.85	54.52	-24.04	30.48
UK Growth	0.43	4.55	28.62	-14.38	14.24
UK Growth & Income	0.41	5.24	36.36	-17.66	18.70
UK Smaller Companies	0.24	6.66	43.18	-21.28	21.90
North America	0.66	5.87	34.31	-16.72	17.59
North America Smaller Companies	0.77	6.18	44.11	-23.62	20.49
Far East (Including Japan)	0.12	7.60	43.29	-19.76	23.53
Far East (Excluding Japan)	0.44	8.75	50.42	-22.51	27.91
Japan	0.02	8.94	46.25	-18.29	27.96
Japanese Smaller Companies	0.27	11.53	82.70	-25.82	56.88
Europe	0.45	6.97	44.86	-22.39	22.47
European Smaller Companies	0.44	7.72	54.37	-26.74	27.64
Country Specialists - Far East	0.06	6.53	48.23	-24.74	23.49
Sector Specialists – Property	0.21	7.09	53.63	-20.97	32.65
Average	0.38	6.94	45.92	-20.76	25.16

Source: calculated by the author

According to Table 5, the wide dispersion of the share price return reflects the fact that investment trusts are companies quoted on the stock market and the share price is affected by demand and supply in the market. There is a wide difference between the minimum and maximum value in each category by AITC. For example, the Global Smaller Companies sector has a range of 54.52 percentage points with a lower bound of -24.04 per cent and an upper bound of 30.48 per cent. The UK Smaller Companies sector has a range of 43.18 percentage points with a lower bound of -21.28 per cent and an upper bound of 21.90 per cent.

This suggests that there is a very large fluctuation in share price returns which in turn suggests that NAV returns, rather than share price returns, should be used to measure managerial performance in Chapter 7 as they are not affected by the supply and demand in the market. In addition, we use the coefficient of variation to compare relative dispersion. We see that there is a high degree of dispersion between the sectors by AITC. For example, the UK Growth sector has a lower coefficient of variation of 10.58 per cent compared to the coefficient of variation of UK Smaller Companies, which is 27.75 per cent. The Far East Including Japan sector has a high dispersion of 63.33 per cent relative to Far East Excluding Japan, which is 19.89 per cent. In general, the average fund by sector has an average share price return of 0.38 per cent, a standard deviation of 6.94 per cent and a very wide range of 45.92 percentage points with a lower bound of -20.76 per cent and an upper bound of 25.16 per cent.

Table 6 Descriptive statistics of the US average discount

CEFA Category	Mean	Standard deviation	Range	Min	Max
Equity Income	-5.66	4.90	22.52	-16.85	5.67
Global Equity	-5.77	5.53	45.71	-18.36	27.35
Growth and Income	-3.71	5.25	25.97	-13.39	12.58
Growth Domestic	-7.38	3.35	16.72	-13.63	3.09
Average	-5.63	4.76	27.73	-15.56	12.17

Source: calculated by the author

Table 6 summarises descriptive statistics of the average discount of US closed-end funds by CEFA sectors for the period January 1990 to January 2003. According to Table 6, it is obvious that there is a difference in the fluctuations of the discount documented in the UK and the US. A simple comparison could be made based on the average discount. For example, the Growth and Income category has a mean of -3.71 and a range of 25.97 with maximum value of 12.58 and a minimum value of -13.39. In contrast, all UK sectors display discounts higher than 6%.

One possible explanation for this phenomenon is based on the observation that individual investors own the largest stake of US closed-end funds. Despite the fact that British closed-end funds go through periods of discount and premium similar to most US funds, their clientele is and has been over the last decade, almost entirely institutional. The proportion of closed-end fund shares held by institutions in the United Kingdom was 77% per cent in 2003. In contrast, in the US, closed-end funds owned by institutional investors were only 6.6% (see Chapter 2).

Table 7 summarises descriptive statistics of the average NAV return of US closed-end funds by CEFA sectors for the period January 1990 to January 2003.

Table 7 Descriptive statistics of the US average NAV return

CEFA Category	Mean	Standard deviation	Range	Min	Max
Equity Income	-0.11	3.38	20.63	-13.88	6.75
Global Equity	-0.08	4.85	27.82	-15.49	12.32
Growth and Income	0.01	2.91	17.76	-10.91	6.85
Growth Domestic	0.11	4.10	24.48	-15.43	9.04
Average	-0.02	3.81	22.67	-13.93	8.74

Source: calculated by the author

According to Table 7, it is clear that the NAV returns of the US market differ from those of UK investment trusts. There is a wide difference between the lower and upper bounds in each category by CEFA, but not as large as in the UK. For example the Equity Income sector has a range of 20.63 percentage points with a lower bound of -13.88 per cent and an upper bound of 6.75 per cent. The Global Equity sector has a range of 27.82 percentage points with a lower bound of -15.49 per cent and an upper bound of 12.32 per cent. In general, the average fund by sector has an average NAV return of -0.02 per cent, a standard deviation of 3.81 per cent and a range of 22.67 percentage points with the lower bound estimated at -13.93 per cent and the upper bound at 8.74 per cent. In contrast, the average fund by UK sector has a higher average NAV return of 0.36 per cent, a higher standard deviation of 5.91 per cent and a wider range of 37.62 percentage points. In addition, from the coefficient of variation, we see that there is a high degree of relative dispersion between all sectors by CEFA category. For example, the Global Equity sector has a coefficient of variation of 60.63 per cent compared with the coefficient of variation of 30.73 per cent of Equity Income.

Table 8 shows descriptive statistics of the average share price return of US closed-end funds by CEFA sectors for the period January 1990 to January 2003.

Table 8 Descriptive statistics of the US average share price return

CEFA Category	Mean	Standard deviation	Range	Min	Max
Equity Income	-0.08	3.23	20.46	-14.27	6.20
Global Equity	-0.04	5.72	36.36	-16.04	20.32
Growth and Income	0.09	3.25	23.59	-13.38	10.22
Growth Domestic	0.16	4.61	30.22	-17.93	12.29
Average	0.03	4.20	27.66	-15.41	12.26

Source: calculated by the author

Again, there is a wide difference between the minimum and maximum value in each category by CEFA, but not as wide as in the UK market. For example, the Equity Income sector has a range of 20.46 percentage points and the Growth Domestic sector has a range of 30.22 percentage points. This suggests that there is a very large fluctuation in share price returns as they are affected by supply and demand in the market. In general, the average US sector has an average share price return of 0.03, a standard deviation of 4.20 and a range of 27.66 with a minimum value of -15.41 and a maximum value of 12.26. In contrast, the average fund by UK sector has a higher average share price return of 0.38, a higher standard deviation of 6.94 and a much wider range of 45.92.

Tables 9 and 10 show the various funds allocated to the 16 categories of UK investment trusts and 4 categories of US closed-end funds. Our sample consists of 120 UK investment trusts and 30 US closed-end funds. We use a full data set with no overlapping or missing data between January 1990 and January 2003. The funds all have a full history in terms of share price, NAV and discount.

Table 9 Details the funds in each AITC category of UK investment trusts

Global Growth
ALLIANCE TRUST
ANGLO & OVERSEAS
BANKERS INV.TRUST
BRITISH EMPIRE SECS
BRUNNER INV.TST
FOREIGN & COLONIAL
GARTMORE GLOBAL TST
HENDERSON ELEC.&GEN
JUPITER PRIMADONA GROWTH
LAW DEBENTURE
LONDON & ST.LAWRENCE
MAJEDIE INVS.
MONKS INV.TRUST
PERSONAL ASSETS
RIT CAPITAL PARTNERS
SCOTTISH AMERICAN
SCOTTISH INV.
SCOTTISH MORTGAGE
SECOND ALLIANCE
TRIBUNE TRUST
WITAN INV.TRUST
JUP.INTL.GREEN ORD. DELISTED 19/03/01
MCIT CAPITAL. DELISTED 25/06/98
BARING STRATTON UNITISED 05/05/98
Turkey Trust Delisted 25/11/99
TR Technology Delisted 22/10/99

Global Growth & Income
BRITISH ASSETS
MURRAY INTL.
Global Smaller Companies
F&C SMALLER COS.
HENDERSON STRATA
GENERAL CONS.CAP. DELISTED 06/01/98
HENDERSON American CAP. DELISTED 26/02/99
Gartmore American Smaller Secs
UK Growth
ALBANY INV.TRUST
CAPITAL GEARING TST.
EDINBURGH INV.TRUST
·EDINBURGH UK TRACKER
FINSBURY GROWTH TST.
FLEMING MERCANTILE
HANSA TRUST
JPMF.CLAVERHOUSE
JPMF MID CAP IT.
KEYSTONE IT.
UK SELECT TRUST
Group Trust Delisted 17/08/01
British Inv.Trust dead 19/05/97
Brit.AM& General
Sphere Inc & Resi.Cap
Radiotrust
UK Growth & Income
CITY OF LONDON
DUNEDIN INC.GROWTH
LOWLAND INV.
MERCHANTS TRUST
MURRAY INCOME
SECURITIES TST.
SHIRES INCOME TST.
TEMPLE BAR
VALUE & INCOME
FLEM.INTL. DELISTED 31/10/96
JUP.EXTRA INC.ORD. DELISTED 28/09/00
Gartmore Value
UK Smaller Companies
ALLIANZ DRESDNER SMCOS.
DUNEDIN SMALLER COS.
GARTMORE SMALLER COS.
HENDERSON SMALLER COS
I&S.UK SMALLER COS.
INVESCO ENGLISH &

INTERNATIONAL
INVESCO PERP.UK SMCOS.
PLATINUM INV.TST.
SCHRODER UK MID & SMALL
SMALLER COMPANIES IT.
THROGMORTON TRUST
3I SM.QUOTED COS.TRUST
Throgmorton USM
North America
AMERICAN OPPOR.TST.
EDINBURGH US TRACKER TST.
US INV.TST. DEAD /Unitised(01/01/2000)
North America Smaller Companies
JPMF US DISCOVERY
NORTH ATLANTIC SMCOS.
Far East (Including Japan)
F&C PACIFIC
MARTIN CURRIE PACIFIC
Far East (Excluding Japan)
ABERDEEN NEW DAWN IT.
EDINBURGH DRAGON TST.
HENDERSON FAR EAST INC.
HENDERSON TR PAC.IT
PACIFIC ASSETS
PACIFIC HORIZON
SIAM SELECTIVE GW. DELISTED 23/07/01
Trio Trust dead 12/1/93
Pacific Property
Gartmore Emerg.Pacific delisted 04/10/99
First Philippine delisted 26/06/97
Japanese Smaller Companies
BAILLIE SHIN NIPPON
JPMF JAPANESE SMCOS.
Japan
BAILLIE GIFF.JAPAN
FLEMING JAPANESE
PERPETUAL JAPAN
JF JAPAN OTC DELISTED 27/07/98
THORNTON ASIAN EMRG. 'DELISTED 26/03/97'
Europe
F&C EUROTRUST
FLEMING CONT.EUROPE
GARTMORE EUROPEAN

INVESCO PERP.EUR.IT.
MARTIN CURRIE EUR.
HEND.EUROTR.ORD
MERRILL LYNCH EUROPEAN
JUP.EUROPEAN ORD. DELISTED 20/11/00
CHARTER EUROPEAN DELISTED 22/04/02
GERMAN INV.TST. DEAD – ACQ

Charter European Delisted 22/04/02
Schroder Mediterranean Delisted 06/08/96
Paribas French Inv Dead 31/08/97
European Smaller Companies
EUROPEAN ASSETS TST.
JPMF EUROPEAN FLEDGELING
TR EUROPEAN GROWTH

Country Specialists - Far East
ABERDEEN NEW THAI
NEW ZEALAND INV.
STOCKS CONVERTIBLE TST.
Sector Specialists – Property
TR PROPERTY INV.
TRUST OF PROPERTY

Source: Datastream University of Piraeus, Athens, Greece. Association of Investment Trust Companies (AITC).

Table 10 Details the funds in each CEFA category of US closed-end funds

Equity Income
Adams Express Company
Boulder Growth and Income Fund
Cornerstone strategic value Fund
Cornerstone total return fund
J Hancock Patriot Prem Div Fd I
Liberty all star equity fund
Source Capital
Tri-continental corporation
Global Equity
Aberdeen Australia Equity Fund
z-seven fund
J Hancock Global Trends Fund
Growth and Income
Bancroft Convertible Fund
Blue Chip Value Fund
Castle convertible Fund
Ellsworth convertible growth
Franklin Multi Income Trust
Lincoln National Convertible
TWC Convertible Securities Fund
Zweig Total Return Fund
Growth Domestic
Central Securities
Engex

Gabelli Equity Trust
General American Investors
Liberty All-star growth Fund
NAIC Growth Fund
Royce Focus Trust
Royce Value Trust
Salomon Brothers Fund
Zweig Fund
First Financial Fund

Source: Datastream University of Association of Investment Trust Companies (AITC).

Table 11 summarises the sample of 30 "dead" UK investment trusts. As mentioned above, the term "dead" can mean liquidated, unitised or open-ended, or merged. In the sample investigated, we included the different types of dead funds by AITC category in order to avoid survivorship bias.

Table 11 Dead funds included in our dataset in terms of liquidated, unitised or open-ended and merged for UK Investment Trusts.

AITC Category / Name of Fund	Status of Dead Funds
Global Growth	
JUP.INTL.GREEN ORD. DELISTED 19/03/01	Liquidated
MCIT Capital IT Delisted 25/06/98	Liquidated
Turkey Trust Delisted 25/11/99	Liquidated
TR Technology Delisted 22/10/99	Liquidated
BARING STRATTON UNITISED 05/05/98	Unitised
Global Smaller Companies	
Henderson American. Cap Delisted 26/02/99	Liquidated
Gartmore American Small Secs	Liquidated
General Cons. Cap. Delisted 06/01/98	Liquidated
UK Growth & Income	
FLEM.INTL. DELISTED 31/10/96	Liquidated
JUP.EXTRA INC.ORD. DELISTED 28/09/00	Liquidated
Gartmore Value	Liquidated
UK Smaller Companies	
Throgmorton Trust	Liquidated
UK Growth	
Group Trust Delisted 17/08/01	Liquidated
British Inv.Trust dead 19/05/97	Liquidated
Brit.AM & General	Liquidated
Sphere Inc & Resi.Cap	Liquidated
Radiotrust	Liquidated
North America	
US INV.TST. DEAD /Unitised(01/01/2000)	Unitised
Far East (Excluding Japan)	
SIAM SELECTIVE GW. DELISTED 23/07/01	Liquidated
Trio Trust dead 12/1/93	Liquidated
Pacific Property	Liquidated
Gartmore Emerg.Pacific delisted 04/10/99	Liquidated
First Philippine delisted 26/06/97	Liquidated
Japan	
THORNTON ASIAN EMRG.	Liquidated

'DELISTED 26/03/97'	
JF Japan OTC Delisted 27/07/98	Liquidated
Europe	
JUP.EUROPEAN ORD. DELISTED 20/11/00	Liquidated
Charter European Delisted 22/04/02	Liquidated
Schroder Mediterranean Delisted 06/08/96	Liquidated
Paribas French Inv Dead 31/08/97	Liquidated
GERMAN INV.TST. DEAD – ACQ	Merged
Total	**30**

Source: Datastream "University of Piraeus".

5.7 Conclusion

In this chapter, we have reviewed the main methodological and measurement issues relating to the studies in subsequent chapters. The use of five databases, namely the Association of Investment Trust Companies (AITC), Datastream, Thomson Banker One, the Yale School of Management database and Thomson Financial Investment View yields extensive information on the closed-end fund industry in the UK and the US. The databases that were mainly used are Datastream, Thomson Financial Investment View and the Yale School of Management database. Datastream provides most of the funds that disappeared. This chapter describes some issues relevant to the definition of the closed-end fund discount and returns. We also describe the sample sizes and present sets of descriptive statistics. In the following chapter, we investigate the time-series properties of the excess NAV return, the discount and the excess discount return as a preliminary to the econometric studies presented in Chapters 7 and 8.

Chapter 6

Time-series properties of the NAV and the discount

6.1 Introduction

This chapter analyses the time-series properties of the excess NAV return and the excess discount return in terms of autocorrelation, stationarity, normality and seasonality. The excess NAV return is the difference between the NAV return (as defined in Chapter 5) and the one-month risk-free rate. The excess discount return is the difference between the discount first difference and the one-month risk-free rate. In the next chapter, we use the excess NAV return as an indicator of managerial performance in models designed to identify performance persistence. Finally, in Chapter 8, we investigate the possible factors that might explain the persistence of the excess discount return in the UK and the US, using managerial performance as one of the possible factors.

Gemmill and Thomas (2002) found that the discounts in 11 UK sectors were non-stationary but became stationary at their first differences by applying the Augmented Dickey-Fuller (ADF) unit root test. The sectors investigated were Emerging Markets, Europe, Far East Including Japan, Far East Excluding Japan, International, Japan, North America, Property, UK Income, UK Smaller Companies, and UK Composite. On the other hand, Pontiff (1995) conducted an ADF test on 49 funds in the US with more than 25 months of data for the discount first difference. For 53 per cent of the funds the test rejected a unit root at the 10 per cent significance level. Similarly, Ammer (1990) by testing a large number of investment trusts, concluded that the discount first differences of UK investment trusts were stationary. Our results show that excess NAV returns are not autocorrelated in their levels. In addition, through ADF tests we find that discounts are highly autocorrelated in their levels, but not in their first differences. On the other hand, the excess NAV returns and excess discount returns are stationary. Finally, there are no significant differences in the discount during the month of January and other months. Thus, we have no evidence that the UK investment trust and the US closed-end fund discounts are characterised by a January effect.

6.2 Autocorrelation of the excess NAV return

Autocorrelation analysis is the first step in characterising the time series properties of the excess NAV return. Table 12 shows the autocorrelation coefficients of the excess NAV return of the various sectors of UK investment trusts. According to Table 12, the first-order autocorrelation coefficient is 0.2 and decays to 0.01 after 12 lags. The t-statistics for all order autocorrelation coefficients in excess NAV levels are all insignificant except for the first and second coefficients, which implies that there is no autocorrelation problem. This result is consistent with the UK excess NAV being stationary.

Table 13 summarises the average first to twelfth order autocorrelation coefficients of excess NAV returns for US closed-end funds.

Table 12 Autocorrelation of the excess NAV return of UK investment trusts

The table shows the average first to twelfth-order autocorrelation levels. The t-statistics of the autocorrelation coefficients are shown. The results are based on the average for all sixteen sectors of UK investment trusts. We use monthly data from January 1990 to January 2003[1].

	AC	t-Stat
1	0.167	2.11
2	0.155	1.95
3	0.099	1.24
4	0.122	1.53
5	-0.014	-0.17
6	0.05	0.62
7	-0.145	-1.82
8	0.022	0.27
9	0.007	0.09
10	0.012	0.15
11	-0.061	-0.76
12	0.013	0.16

Source: calculated by the author

Table 13 Autocorrelation of the excess NAV return of US closed-end funds

The table shows the average first to twelfth-order autocorrelation of excess NAV return. The t-statistics of the autocorrelation coefficients are shown. The results are the average for all four categories. We use monthly data from January 1990 to January 2003[2].

	AC	t-Stat
1	0.297	3.87
2	0.114	1.43
3	0.131	1.65
4	0.055	0.69
5	0.104	1.30
6	0.086	1.07
7	0.107	1.34
8	0.04	0.50
9	0.078	0.97
10	0.076	0.95
11	0.067	0.84
12	-0.035	-0.44

Source: calculated by the author

[1] The autocorrelation of UK excess NAV returns was also tested for each individual sector. As shown in appendix B all sectors show no autocorrelation.

[2] The autocorrelation of US excess NAV return was also tested for each individual sector. All sectors show no autocorrelation. The results are presented in Appendix B.

According to Table 13, the first-order autocorrelation coefficient is equal to 0.3 and decays to -0.04 after 12 lags. The t-statistics for all order autocorrelation coefficients in excess NAV returns are all insignificant except for the first one, which implies that there is no autocorrelation problem. So this result is consistent with the US excess NAV being stationary.

6.3 Autocorrelation of the discount

Autocorrelation analysis is the first step in characterising the time-series behaviour of the discount. We start by investigating the autocorrelation process of the discount, and then the excess discount return, which is the dependent variable that will be used in Chapter 8. Tables 14 and 15 show the results for the discount and the excess discount return for all sixteen sectors of UK investment trusts.

Table 14 Autocorrelation of the UK discount of investment trusts

The table shows the average first to twelfth-order autocorrelation coefficients of discount levels. The t-statistics of the autocorrelation coefficients are shown. The results are based on the average for all sixteen sectors of UK investment trusts. We use monthly data from January 1990 to January 2003.

	AC	t-Stat
1	0.912	27.33
2	0.847	20.09
3	0.796	16.60
4	0.746	14.12
5	0.708	12.55
6	0.672	11.24
7	0.650	10.65
8	0.617	9.84
9	0.577	8.86
10	0.541	7.99
11	0.494	7.00
12	0.463	6.45

Source: calculated by the author

According to Table 14, by using monthly data, the average first-order autocorrelation coefficient is 0.91 and decays to 0.46 for the twelfth-order autocorrelation. The t-statistics for all order autocorrelation coefficients in discount levels are highly significant which implies a high degree of autocorrelation. The result suggests that the discount is strongly autocorrelated (to the 12^{th} lag), which probably reflects long-run trends in the series. What is more important is to investigate the excess discount return. Table 15 summarises the average first to twelfth order autocorrelation coefficients for the excess discount return.

Table 15 Autocorrelation of the UK excess discount return of UK investment trusts

The table shows the average first to twelfth-order autocorrelation coefficients of the excess discount return. The t-statistics of the autocorrelation coefficients are shown. The results are the average for all sixteen categories of UK investment trusts. We use monthly data from January 1990 to January 2003.[3]

	AC	t-Stat
1	-0.161	-2.03
2	0	0.00
3	0.16	-2.02
4	-0.026	-0.32
5	-0.064	-0.80
6	0.052	0.65
7	0.077	0.96
8	-0.021	-0.26
9	-0.032	-0.40
10	-0.023	-0.29
11	0.006	0.07
12	-0.078	-0.97

Source: calculated by the author

According to Table 15, the first-order autocorrelation coefficient is -0.16 and decays to -0.08 after 12 lags. The t-statistics for all autocorrelation coefficients are insignificant. Although, the discount in the previous table is strongly autocorrelated,

[3] Autocorrelation of UK excess discount return was tested for each individual sector. All sectors show no autocorrelation. The results are presented in Appendix B.

the excess discount return has insignificant autocorrelation coefficients (from the first lag onwards), which is consistent with the first-difference series being stationary.

Tables 16 and 17 show the autocorrelation coefficients of the discount and the excess discount return for all four categories of US closed-end funds. According to Table 16, by using monthly data, the average first-order autocorrelation coefficient is 0.86 and decays to 0.40 at the twelfth lag. The t-statistics for all order autocorrelation coefficients in discount levels are highly significant which implies a high degree of autocorrelation. The result suggests that the discount is strongly autocorrelated (to the 12th lag), which probably reflect long-run trends in the series. It is important, therefore, to investigate the first difference of the discount or, equivalently, the excess discount return.

Table 17 summarises the average first to twelfth order autocorrelation coefficients of the excess discount return for the US closed-end fund market. According to Table 17, the first-order autocorrelation coefficient is 0.14 and decays to 0.06. The t-statistics for all autocorrelation coefficients are insignificant. Although the discount in Table 16 is strongly autocorrelated, the excess discount return has insignificant autocorrelation coefficients (from the first lag onwards), which is consistent with the excess discount return being stationary.

Table 16 Autocorrelation of the US discount of closed-end funds

The table shows the average first to twelfth-order autocorrelation coefficients of discount levels. The t-statistics of the autocorrelation coefficients are shown. The results are the average for all four categories. We use monthly data from January 1990 to January 2003.

	AC	t-Stat
1	0.861	20.98
2	0.798	16.60
3	0.752	14.12
4	0.678	11.55
5	0.610	9.58
6	0.576	8.86
7	0.544	7.99
8	0.511	7.38
9	0.480	6.81
10	0.465	6.63
11	0.438	6.10
12	0.404	5.43

Source: calculated by the author

Table 17 Autocorrelation of the US excess discount return of closed-end funds

The table shows the average first to twelfth-order autocorrelation of excess discount return. The t-statistics of the autocorrelation coefficients are shown. The results are the average for all four categories. We use monthly data from January 1990 to January 2003. [4]

	AC	t-Stat
1	0.136	1.71
2	0.101	1.26
3	0.017	0.21
4	0.052	0.65
5	0.065	0.81
6	0.02	0.25
7	0.096	1.20
8	0.134	1.68
9	0.020	0.25
10	-0.014	-0.17
11	0.028	0.35
12	0.062	0.77

Source: calculated by the author

[4] Autocorrelation of US excess discount return was tested for each individual sector. All sectors show no autocorrelation. The results are presented in Appendix B.

6.4 Stationarity

A non-stationary series tends to yield statistically significant spurious correlation when variables are regressed. Therefore we now test whether the excess NAV, the discount and the excess discount return on UK investment trusts and US closed-end funds follow a random walk, a random walk with drift and trend or are stationary.

6.4.1 Unit root test

A popular test of stationarity is the unit root test. The specifications of the test are the following:

$$\Delta Y_t = \gamma Y_{t-1} + \varepsilon_t \qquad (13)$$

where the null hypothesis to be tested is γ=0. ε_t is the stochastic error term that is assumed to be non-autocorrelated with a zero mean and with a constant variance. Such an error term is also known as a white noise error term.

The main problem when performing ADF tests is to decide whether to include a constant term and a linear trend or neither in the test regression. The general principle is to choose a specification that is a plausible description of the data under both the null and alternative hypotheses (Hamilton, 1994, p.501). If the series seems to contain a trend, we should include both a constant and trend in the test regression. If the series seems not to contain a trend, we should include neither a constant nor a trend in the test regression. We start by testing if the excess NAV return and excess discount return in the UK and the US follow simple random walks (with no constant and no time trend) or are stationary. We state the hypotheses as follows:

H_o: $\gamma = 0$

H_1: $\gamma < 0$

Table 18 shows the ADF test for the excess NAV return for the UK investment trust sectors defined by AITC.

Table 18 ADF test of the UK excess NAV return by excluding a constant and a trend

This table shows an ADF test of the excess NAV return by all AITC sectors for the period January 1990 to January 2003 for two different critical values (one per cent and five per cent). We test if the excess NAV return follows a random walk by excluding a constant and a linear time trend.[5]

ADF Test Statistic	-4.189743	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: calculated by the author

For a level of significance of 1 per cent and a sample size larger than 100 observations, the critical value of the t-statistic from Dickey-Fuller's tables for no intercept and no trend is -2.58. According to Table 18, we can reject the null hypothesis, namely the existence of a unit root with one per cent significance level. The ADF test statistic is -4.19. In other words, the excess NAV return is stationary.

Table 19 summarises the unit root test for the US closed-end funds sector defined by CEFA.

[5] We checked the unit root test for excess NAV return for UK investment trusts by individual sectors. They are all stationary at their levels by excluding a constant and a linear time trend. The results are presented in Appendix B.

Table 19 ADF test of US excess NAV return by excluding a constant and a trend

This table shows ADF test for the period January 1990 to January 2003 for two different critical values (one per cent and five per cent). We test if the excess NAV return follows a random walk by excluding a constant and a linear time trend.[6]

ADF Test Statistic	-4.091810	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: calculated by the author

For a level of significance of 1 per cent and a sample size larger than 100 observations, the critical value of the t-statistic from Dickey-Fuller's tables for no intercept and no trend is -2.58. According to Table 19, we can reject the null hypothesis, namely the existence of a unit root at the one per cent significance level. The ADF test statistic is -4.09. In other words, the excess NAV return is stationary.

Similarly, we test if the discount and the excess discount return in the UK and the US follow random walks or are stationary. Table 20 summarises the unit root test of the discount for the UK investment trusts sector defined by AITC.

Table 20 ADF test of UK discount by excluding a constant and a trend

This table shows an ADF test for the period January 1990 to January 2003 for two different critical values (one per cent and five per cent). We test if the discount follows a random walk by excluding a constant and a linear time trend.

ADF Test Statistic	-0.347150	1% Critical Value*	-2.5791
		5% Critical Value	-1.9419
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: calculated by the author

According to the Table 20, we cannot reject the null hypothesis, namely the existence of a unit root at the one per cent significance level. The ADF test statistic is -0.35 which is greater than the critical value of -2.58. In other words, the discount follows a random walk and is not stationary.

Table 21 summarises the unit root test of the excess discount return for the UK investment trust sector defined by AITC.

Table 21 ADF test of UK excess discount return by excluding a constant and a trend

This table shows an ADF test for the period January 1990 to January 2003 for two different critical values (one per cent and five per cent). We test if the excess discount return follows a random walk by excluding a constant and a linear time trend.[7]

ADF Test Statistic	-5.077	1% Critical Value*	-2.5793
		5% Critical Value	-1.942
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: calculated by the author

According to the Table 21, we can reject the null hypothesis, namely the existence of a unit root at the one per cent significance level. The ADF test statistic is -5.08 which is less than the critical value of -2.58. In other words, the excess discount return does not follow a random walk and is stationary.

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[6] We checked the unit root test for excess NAV return for US closed-end funds by individual sectors. They are all stationary at their levels by excluding a constant and a linear time trend. The results are presented in Appendix B.

[7] We checked the unit root test for excess discount return for UK investment trusts by individual sectors. They are all stationary at their levels by excluding a constant and a linear time trend. The results are presented in Appendix B.

Table 22 summarises the unit root test of the discount for US closed-end defined by CEFA.

Table 22 ADF test of US discount by excluding a constant and a trend

This table shows an ADF test for the period January 1990 to January 2003 for two different critical values (one per cent and five per cent). We test if the discount follows a random walk by excluding a constant and a linear time trend.

ADF Test Statistic	-1.631350	1% Critical Value*	-2.5791
		5% Critical Value	-1.9419
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: calculated by the author

According to the Table 22, we cannot reject the null hypothesis, namely the existence of a unit root at the one per cent significance level. The ADF test statistic is -1.63 which is greater than the critical value of -2.58. In other words, the discount does follow a random walk and it is not stationary.

Table 23 summarises the unit root test of the US excess discount return for the sectors defined by CEFA.

Table 23 ADF test of US excess discount return by excluding a constant and a trend.

This table shows an ADF test for the period January 1990 to January 2003 for two different critical values (one per cent and five per cent). We test if the excess discount return follows a random walk by excluding a constant and a linear time trend.[8]

ADF Test Statistic	-4.235335	1% Critical Value*	-2.5793
		5% Critical Value	-1.9420
*MacKinnon critical values for rejection of hypothesis of a unit root.			

Source: calculated by the author

[8] We checked the unit root test for excess discount return for US closed-end funds by individual sectors.They are all stationary at their levels by excluding a constant and a linear time trend. The results are presented in Appendix B.

According to the Table 23, we can reject the null hypothesis, namely the existence of a unit root at the one per cent significance level. The ADF test statistic is -4.24. In other words, the US excess discount return does not follow a random walk and is stationary.

The next set of tables (Tables 24-29) summarise the unit root test with a constant and time trend for the excess NAV, the discount and the excess discount return for UK investment trusts and US closed-end funds. The specifications and hypothesis of the test are the following:

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \sum_{\lambda=4} a_\lambda \Delta Y_{t-\lambda} + \beta t + \varepsilon_t \qquad (14)$$

where μ is the drift, $\sum_{\lambda=4} a_\lambda \Delta Y_{t-\lambda}$ are lags included so that ε_t contains no autocorrelation, and βt is a time trend.

We state the hypotheses as follows:

H_0 : $\beta, \gamma = 0$ (existence of a unit root)

H_1 : $\beta, \gamma < 0$ (stationarity)

The existence of a unit root is measured using an ADF test. For a one per cent significance level and a sample size larger than 100 observations, the critical value of the t-statistic from Dickey-Fuller's tables is -4.02. Table 24 summarises the unit root test of the excess NAV return for UK investment trust sectors by AITC.

Table 24 ADF test of UK excess NAV return by including a constant and a trend

This table shows an ADF test for the period January 1990 to January 2003 for two different critical values (one per cent and five per cent). We test if the excess NAV return follows a random walk by including a constant and a linear time trend.[9]

ADF Test Statistic	-4.531134	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
*MacKinnon critical values for rejection of hypothesis of a unit root.			
F-statistic	17.97964		

Source: calculated by the author

According to the Table 24, the sample evidence suggests that we can reject the null hypothesis, namely the existence of a unit root at the one per cent significance level. The t-statistic for all UK sectors is -4.53, which is less than the critical value of -4.02. Thus the UK excess NAV return is stationary. To check if there is a time trend, we compare the F-statistic of the model with the one given from the ADF tables. From our model, the F statistic is 17.98 > 6.34, so we reject the null hypothesis.

Table 25 summarises the unit root test with a constant and a time trend for US closed-end funds defined by CEFA. According to Table 25, the sample evidence suggests that we can similarly reject the null hypothesis, namely the existence of a unit root at the one per cent significance level and conclude that the US excess NAV return is stationary.

Tables 26 and 27 summarise the unit root tests with a constant and a time trend for the discount and the excess discount return in the UK.

[9] We checked the unit root test for excess NAV return for UK investment trusts by individual sectors. They are all stationary at their levels by including a constant and a linear time trend. The results are presented in Appendix B.

Table 25 ADF test of US excess NAV return by including a constant and a trend

This table shows an ADF test for the period January 1990 to January 2003 for two different critical values (one per cent and five per cent). We test if the excess NAV return follows a random walk by including a constant and a linear time trend or drift.[10]

ADF Test Statistic	-4.421175	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
*MacKinnon critical values for rejection of hypothesis of a unit root.			
F-statistic	14.02866		

Source: calculated by the author

Table 26 ADF test of UK discount by including a constant and a trend

This table shows an ADF test for the period January 1990 to January 2003 for two different critical values (one per cent and five per cent). We test if the discount follows a random walk by including a constant and a linear time trend.

ADF Test Statistic	-1.968091	1% Critical Value*	-4.0208
		5% Critical Value	-3.4399
*MacKinnon critical values for rejection of hypothesis of a unit root.			
F-Statistic: 1.88			

Source: calculated by the author

Table 27 ADF test of UK excess discount return by including a constant and a trend

This table shows an ADF test for the period January 1990 to January 2003 for two different critical values (one per cent and five per cent). We test if the excess discount return follows a random walk by including a constant and a linear time trend.[11]

ADF Test Statistic	-5.206948	1% Critical Value*	-4.0212
		5% Critical Value	-3.4401
*MacKinnon critical values for rejection of hypothesis of a unit root.			
F-statistic	35.14127		

Source: calculated by the author

[10] We checked the unit root test for excess NAV return for US closed-end funds by individual sectors. They are all stationary at their levels by including a constant and a linear time trend. The results are presented in Appendix B.

[11] We checked the unit root test for excess discount return for UK investment trusts by individual sectors. They are all stationary at their levels by including a constant and a linear time trend. The results are presented in Appendix B.

According to the Table 26, the sample evidence suggests that we cannot reject the null hypothesis, namely the existence of a unit root at the one per cent significance level. The t-statistic for all UK sectors is -1.97, which is greater than the critical value. Thus the UK discount is non-stationary. To check if there is a time trend, we compare the F-statistic of the model with the one given from the ADF tables. From our model, the F statistic is 1.88 < 6.34, so we cannot reject the null hypothesis.

According to the Table 27, the sample evidence suggests that we can reject the null hypothesis, namely the existence of a unit root at the one per cent significance level. The t-statistic for all UK sectors is -5.21, which is less than the critical value. Thus the UK excess discount return is stationary. To check if there is a time trend, we compare the F-statistic of the model with the one given from the ADF tables. From our model, the F statistic 35.14 > 6.34, so we reject the null hypothesis.

Tables 28 and 29 summarise the unit root tests with a constant and a time trend for the discount and excess discount return of US closed-end funds defined by CEFA.

According to the Table 29, the sample evidence suggests that we cannot reject the null hypothesis at the one per cent significance level. Thus the US discount is non-stationary.

According to the Table 29, the sample evidence suggests that we can reject the null hypothesis, namely the existence of a unit root at the one per cent significance level. Thus, the US excess discount return is stationary.

Table 28 ADF test of US discount by including a constant and a trend

This table shows an ADF test for the period January 1990 to January 2003 for two different critical values (one per cent and five per cent). We test if the discount follows a random walk by including a constant and a linear time trend or drift.

ADF Test Statistic	-1.815153	1% Critical Value*	-4.0208
		5% Critical Value	-3.4399
*MacKinnon critical values for rejection of hypothesis of a unit root.			
F-statistic	3.650400		

Source: calculated by the author

Table 29 ADF test of US excess discount return by including a constant and a trend

This table shows an ADF test for the period January 1990 to January 2003 for two different critical values (one per cent and five per cent). We test if the excess discount return follows a random walk by including a constant and a linear time trend or drift.[12]

ADF Test Statistic	-5.292898	1% Critical Value*	-4.0216
		5% Critical Value	-3.4403
*MacKinnon critical values for rejection of hypothesis of a unit root.			
F-statistic	18.34110		

Source: calculated by the author

6.5 Normality

This section focuses on tests of normality related to the dependent variables, namely the excess NAV return and the excess discount returns for the UK and US. We show a histogram, Jarque Bera test and related descriptive statistics. Table 30 and Figure 7 show the results of the Jarque Bera test, which is used to test if the UK excess NAV series is normal or non-normal. This type of test uses the chi-squared distribution and specifically is a goodness-of-fit test. So we state the hypothesis as follows:

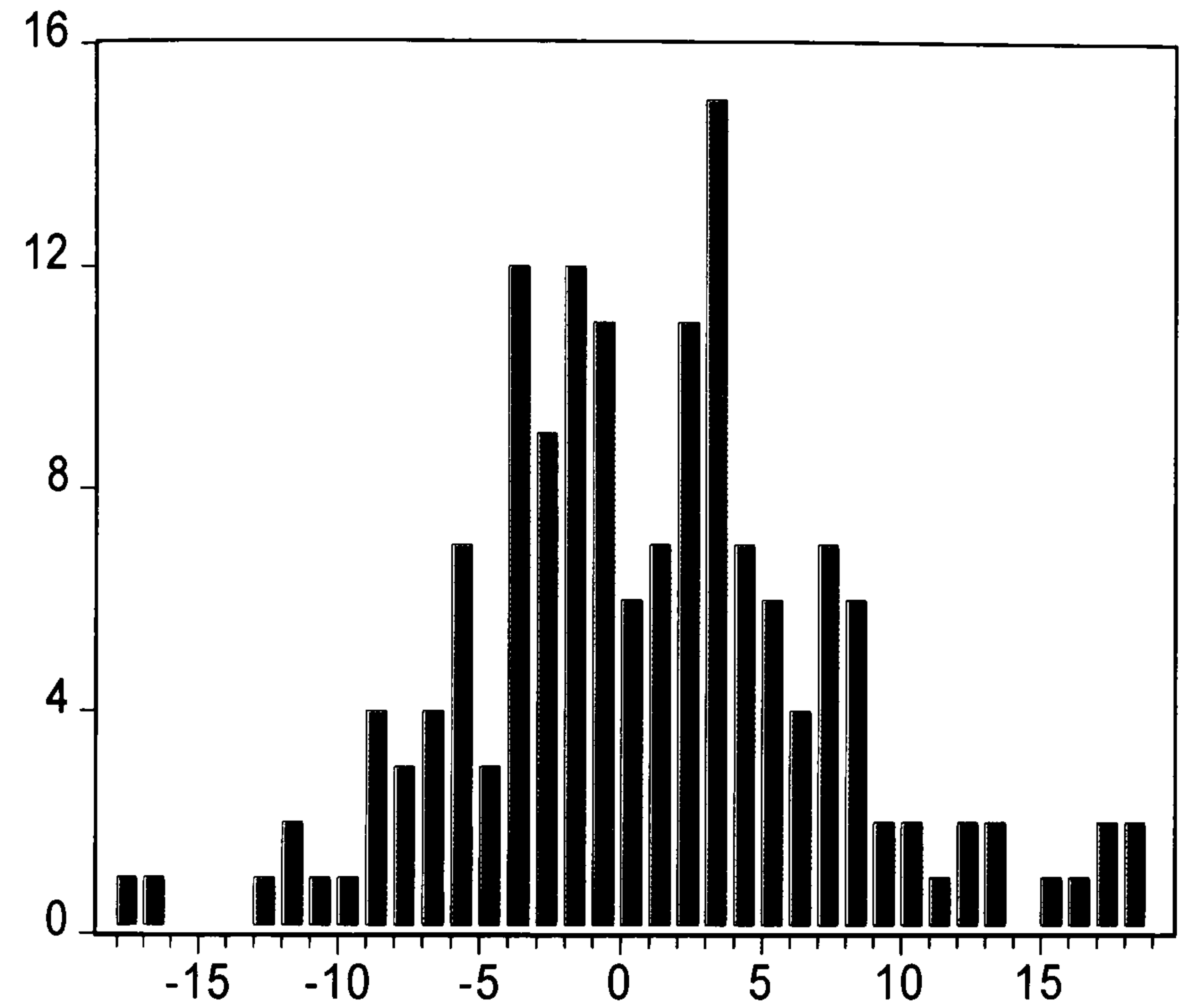
[12] We also checked the unit root test for excess discount return for US closed-end funds by individual sectors. They are all stationary at their levels by including a constant and a linear time trend. The results are presented in Appendix B.

H_0: Excess NAV return is normally distributed

H_1: Excess NAV return is not normally distributed

Table 30 and Figure 7 Jarque Bera normality test of UK excess NAV return

Table 30 and Figure 7 show the results of Jarque Bera test of normality and related descriptive statistics for UK excess NAV return. We use monthly data from January 1990 to January 2003. [13]



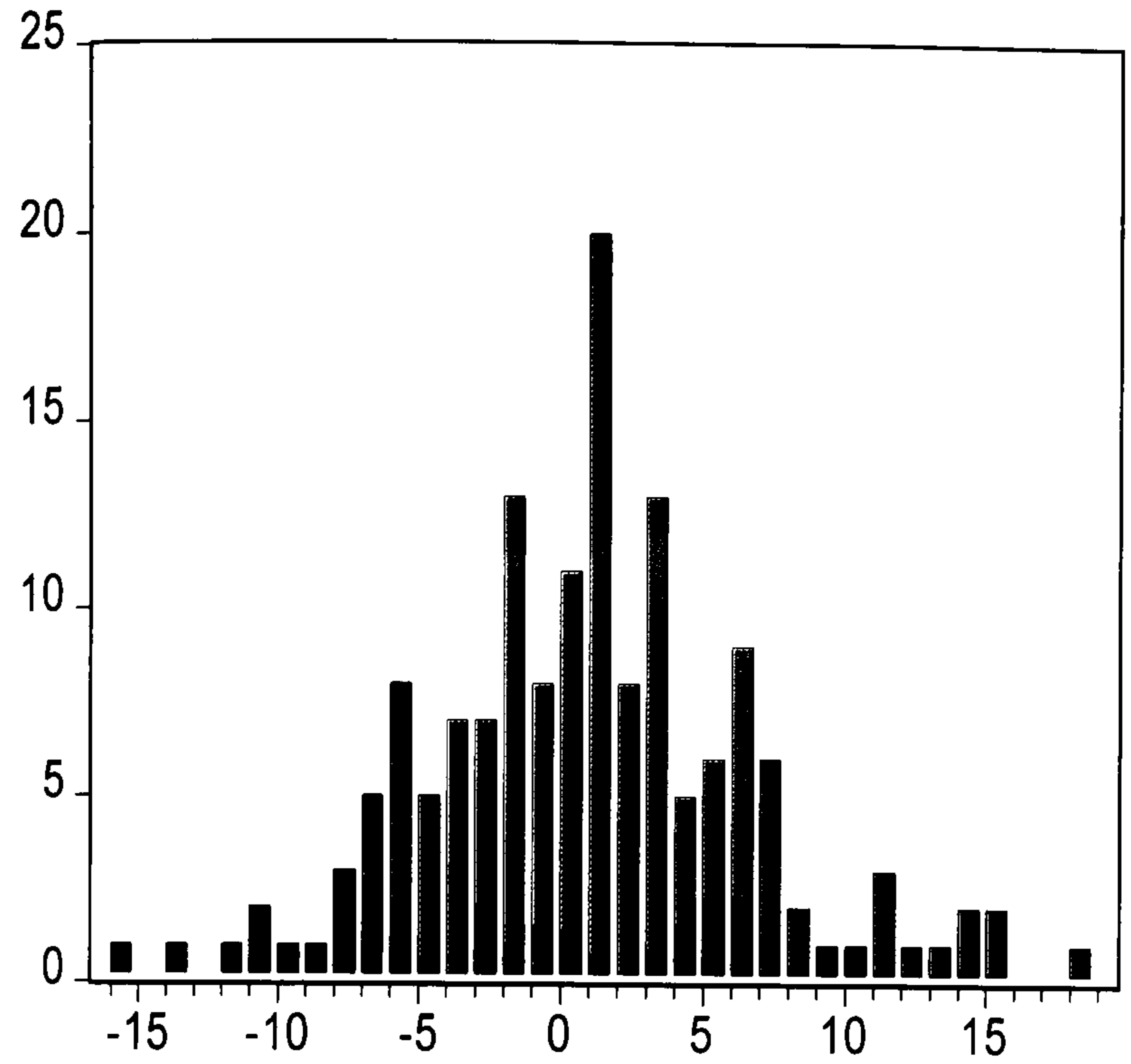
Series: NAV	
Sample 2 158	
Observations 156	
Mean	1.160473
Median	0.957070
Maximum	18.62115
Minimum	-17.81061
Std. Dev.	6.583173
Skewness	0.199221
Kurtosis	3.481567
Jarque-Bera	2.539308
Probability	0.280929

From Table 30, the χ^2 statistic (2.54) is below the critical value at the 5% significance level, so we accept H_0, even though the distribution is slightly positively skewed and has positive kurtosis. We apply the same test for the US excess NAV return in Table 31 and Figure 8.

[13] We checked the normality tests for UK excess NAV return by individual sectors. They are all normally distributed. The results are presented in Appendix B.

Table 31 and Figure 8 Jarque Bera normality test of US excess NAV return

Table 31 and Figure 8 show the results of Jarque Bera test of normality and related descriptive statistics of US excess NAV return. We use monthly data from January 1990 to January 2003.[14]



Series: NAV	
Sample 3 158	
Observations 155	
Mean	1.080131
Median	1.354454
Maximum	18.40418
Minimum	-15.89950
Std. Dev.	5.812126
Skewness	0.174792
Kurtosis	3.511818
Jarque-Bera	2.481078
Probability	0.289228

From Table 31, the χ^2 statistic (2.48) is below the critical value at 5% significance level, so we cannot reject H_0, even though the distribution is slightly positively skewed and has positive kurtosis.

Next, we apply the same test for the UK and US excess discount returns. Tables 32 and 33 and Figures 9 and 10 show the results for the UK and US excess discount returns respectively. We can state the hypotheses as follows:

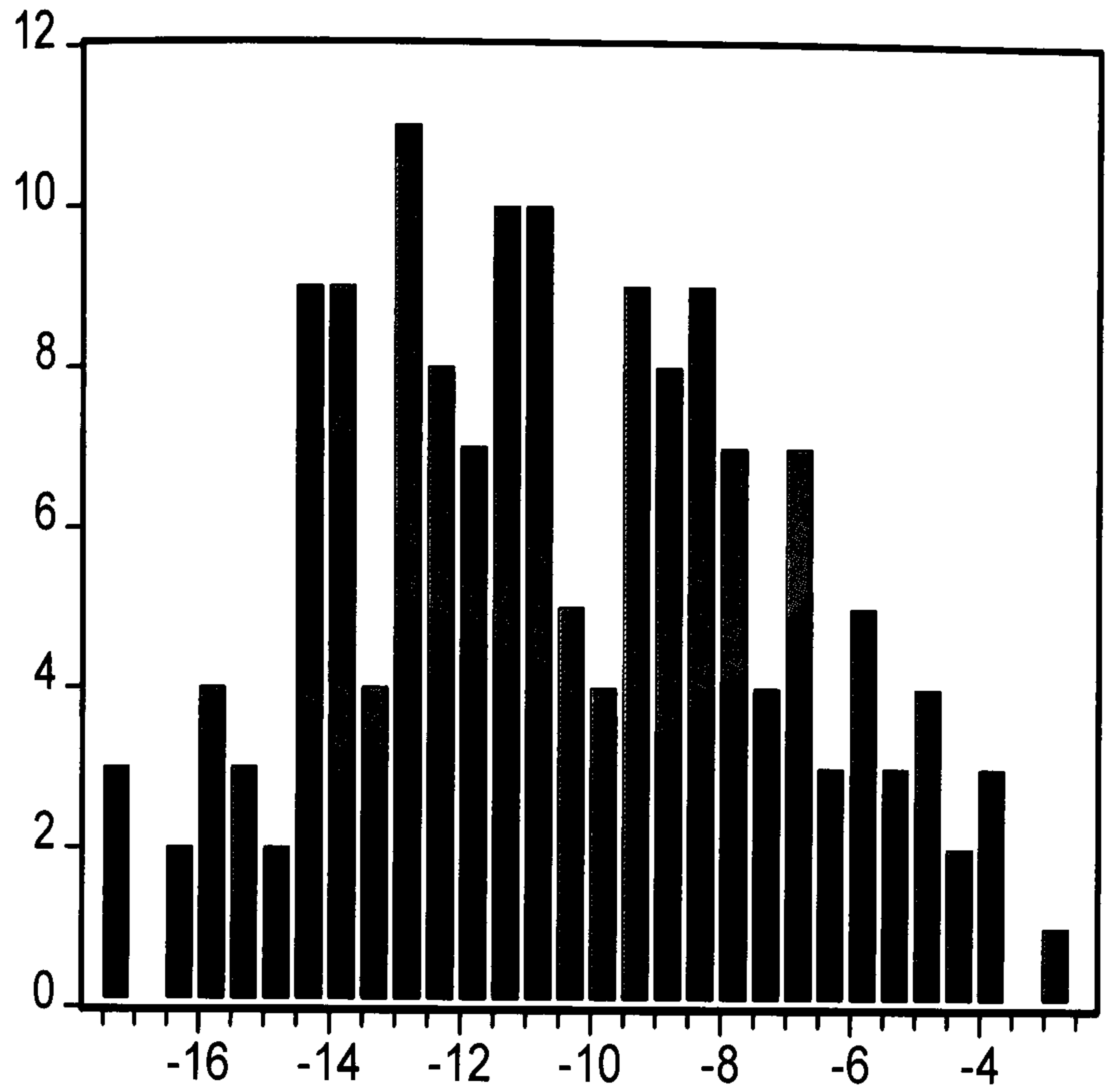
H_0: Excess discount return is normally distributed

H_1: Excess discount return is not normally distributed

[14] We checked the normality tests for US excess NAV return by individual sectors. They are all normally distributed. The results are presented in Appendix B.

Table 32 and Figure 9 Jarque Bera normality test of UK excess discount return

Table 32 and Figure 9 show the results of Jarque Bera test of normality and related descriptive statistics of UK excess discount return. We use monthly data from January 1990 to January 2003.[15]



Series: DIS	
Sample 3 158	
Observations 156	
Mean	-10.39519
Median	-10.74000
Maximum	-2.750000
Minimum	-17.37000
Std. Dev.	3.317673
Skewness	0.114079
Kurtosis	2.264017
Jarque-Bera	3.859222
Probability	0.145205

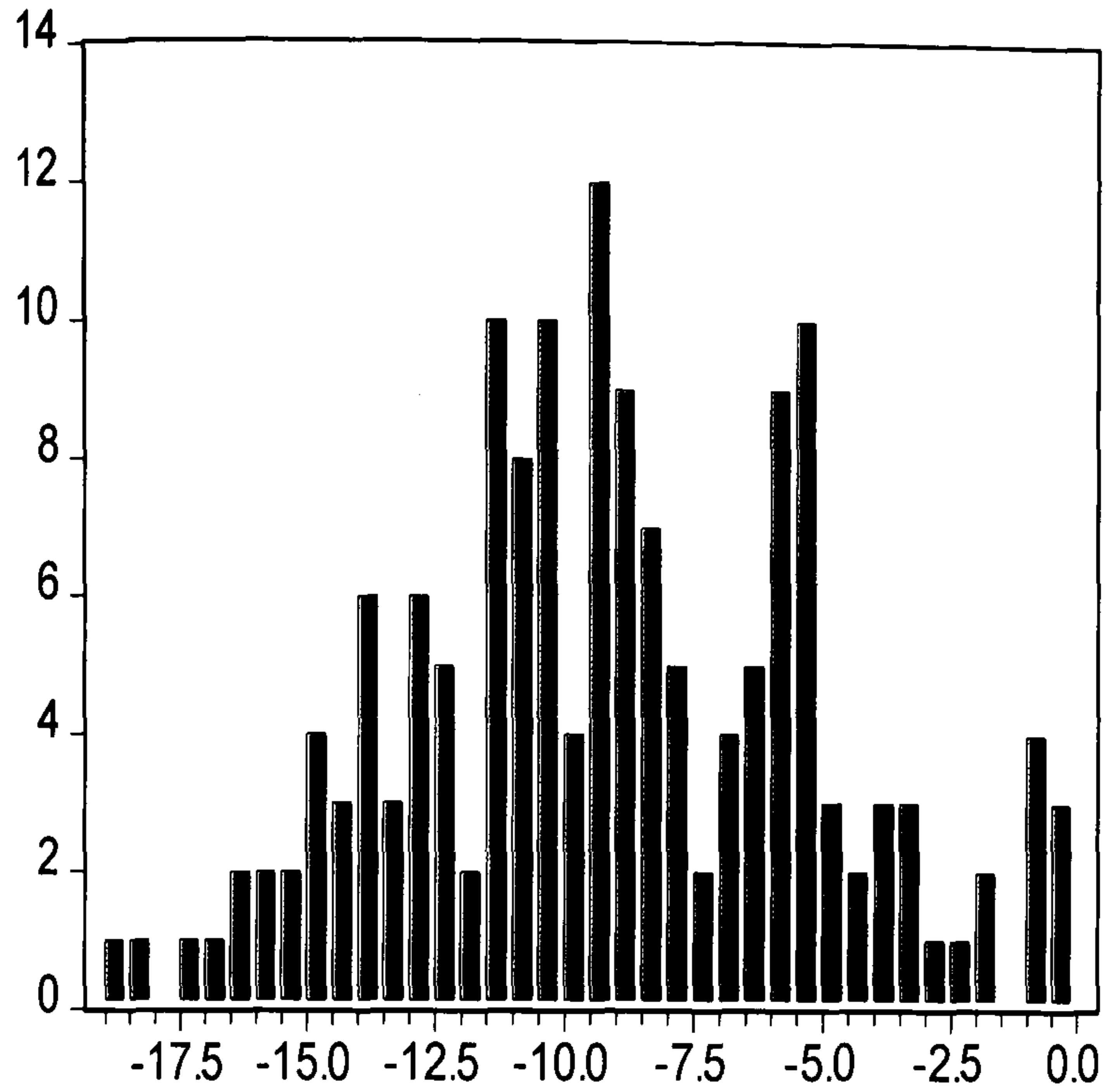
From Table 32, the χ^2 statistic (3.86) is below the critical value at the 5% significance level, so again we accept H_0, even though the distribution is slightly positively skewed and has positive kurtosis. Therefore, we cannot reject the hypothesis that the UK excess discount return is normally distributed.

From Table 33, the χ^2 statistic of 1.06 is also below the critical value at the 5% significance level, so we cannot reject H_0, even though the distribution is slightly positively skewed and has positive kurtosis. Therefore, we cannot reject the hypothesis that the US excess discount return is normally distributed.

[15] We checked the normality tests for UK excess discount return by individual sectors. They are all normally distributed. The results are presented in Appendix B.

Table 33 and Figure 10 Jarque Bera normality test of US excess discount return

Table 33 and Figure 10 show the results of Jarque Bera test of normality and related descriptive statistics for US excess discount return. We use monthly data from January 1990 to January 2003.[16]



Series: DIS	
Sample 3 158	
Observations 156	
Mean	-9.042308
Median	-9.185000
Maximum	-0.220000
Minimum	-18.99000
Std. Dev.	4.034628
Skewness	0.084526
Kurtosis	2.633406
Jarque-Bera	1.059302
Probability	0.588810

6.6 Seasonality of the discount

This last section tries to identify if there is any seasonality in the UK and US discount series. We did not test for NAV seasonality as it is the underlying asset value of the fund which, unlike the share price, is not affected by supply and demand. Specifically, we are interested in whether the discount during the month of January is significantly different from the rest of the year. To test this hypothesis, we calculate the discount percentage changes during the month of January and compare them with the other months. The results show that, on average, the discount is not affected significantly during the month of January and the other months.

[16] We checked the normality tests for US excess discount return by individual sectors. They are all normally distributed. The results are presented in Appendix B.

Table 34 summarises our results on discount seasonality for UK investment trusts by AITC Category.

Table 34 Discount seasonality of UK investment trusts

The table shows the average discount based on our sample of 120 UK funds by each AITC sector. The results are shown as percentage values. The figures shown represent the average of January months and the average of all other months. The abbreviations used are the following: CFE: Country Far East, EU: Europe, EUS: European Smaller Companies, FEXJ: Far East Excluding Japan, FEIJ: Far East Including Japan, GGI: Global Growth and Income, GG: Global Growth, GSC: Global Smaller Companies, J: Japan, JSC: Japan Smaller Companies, NA: North America, NASC: North America Smaller Companies, SSP: Sector Specialist Property, UKG: UK Growth, UKGI: UK Growth and Income, UKSC: UK Smaller Companies.

	CFE	**EU**	**EUS**	**FEXJ**	**FEIJ**	**GG**	**GGI**	**GSC**
January	-1.93	-0.91	-0.49	-0.34	-0.32	-0.43	-1.53	-0.77
All other months	-1.83	-1.04	-0.39	-0.40	-0.39	-0.37	-1.45	-0.95

Source: calculated by the author

	J	**JSC**	**NASC**	**NA**	**SSP**	**UKG**	**UKGI**	**UKSC**
January	-0.50	-0.45	-0.65	-0..91	-0.20	-0.61	-0.56	0.81
All other months	-0.47	-0.26	-0.73	-0. 86	-0.28	-0.67	-0.60	0.84

Source: calculated by the author

According to Table 34, the North America category shows an average January discount of -0.91 compared to -0.86 for the other months. UK Growth displays an average January discount of -0.61 compared to -0.67 during the other months. The Country Far East sector shows an average discount of -1.93 during January compared to -1.83 in the other months. At first sight, there seems to be no evidence of a January effect. To substantiate this, we use a t-test. Thus the hypotheses are as follows:

$H_0: \mu_1 - \mu_2 = 0$

$H_1: \mu_1 - \mu_2 \neq 0$

The calculated t-value is –0.93, which is within the ± 2.13 acceptance range at the 5 per cent significance level. So the sample evidence suggests that there is no difference between the average discount during the month of January and the other months. Therefore, there is no evidence of January effect in the UK.

Table 35 summarises our results of discount seasonality for US closed-end funds by CEFA category.

Table 35 Discount seasonality of US closed-end funds

The table shows the average discount based on our sample of 30 US funds by each CEFA sector. The results are shown as percentage values. The figures shown represent the average of January months and the average of all other months. The abbreviations used are the following: EI: Equity Income, GD: Growth Domestic, GE: Global Equity, GI: Growth and Income.

	EI	**GE**	**GI**	**GD**
January	0.33	-5.90	-0.18	-1.03
All other months	0.28	-5.12	-0.21	-1.01

Source: calculated by the author

According to Table 35, the Global Equity category shows largest average discount of -5.90 in January, compared to a discount of -5.12 in the other months. Growth Domestic displays an average January discount of -1.03 compared to -1.01 during the other months. The Equity Income sector shows an average premium of 0.33 during January compared to 0.28 in the other months.

The calculated t-value is only -0.92, so the sample evidence suggests that at the 5% significance level, there is no difference between the average discount during the month of January and other months. Therefore, there is no evidence of January effect in the US.

6.7 Conclusion

In autocorrelation analysis, we find that the excess NAV return is not autocorrelated. Discounts are highly autocorrelated in their levels, but the excess discount return is not autocorrelated. Similarly, ADF tests show that the UK and US excess NAV returns and excess discount returns are stationary series. We also find that the UK and US excess NAV returns and excess discount returns are normally distributed by using a Jarque-Bera test. Finally, we find no evidence of seasonality in the behaviour of the discount. Changes in the discount during the month of January are not significantly different from the other months.

We now turn to the main part of our empirical study: in the next chapter, we test for performance persistence and in Chapter 8 we try to identify the factors that might explain the fluctuation and persistence of the excess discount return in the UK and the US.

Chapter 7

Performance persistence

7.1 Introduction

The main purpose of this chapter is to test whether management performance is persistent among closed-end funds. The results are mixed, but sufficient to motivate us to use this factor in Chapter 8 to investigate its effect on the excess discount return. This chapter has four objectives. The first one is to investigate whether performance persistence is related to anomalies documented in the finance literature, such as size and the book-to-market effect. The second objective is to test if fund managers have market timing ability and can predict the movement of the market. The third objective is to test performance and discount persistence by using the approach followed by Carhart (1997) and Dimson and Minio-Kozerski (2001). The fourth objective is to assess the performance of UK "dead" funds.

The argument that discounts reflect the quality of the management has been investigated in the past but the results were mixed. However, in these studies managerial performance is measured by the raw return on the fund's NAV (Grinblatt and Titman, 1992; Elton, Gruber, Das and Hlavka, 1993; and Elton, Gruber, and Blake, 1996a). Possible sources of persistence in raw return figures include differences in risk exposures, size, the book-to-market ratio and fund manager skills. In this study, fund performance is measured by the excess NAV return net of expenses. The reason that we use a net figure is that all funds are required by law to pay out dividends annually. The closed-end fund dividend is paid out of the portfolio's income, after deducting expenses. By law, at least 85 per cent of the dividend received from the holdings must be paid out. Dividends are paid out of income, not out of capital. Our measure of the excess NAV return is, therefore, net of expenses.

We measure the manager's quality after controlling for various anomalies documented in the finance literature. Three approaches are followed: Fama and French's (1993) three-factor model, an extended version of the Fama and French model to include the market timing ability variable from a model developed by Treynor and Mazuy (1966) and finally the approach followed by Carhart (1997) and Dimson and Minio-Kozerski (2001). By applying Fama and French's three-factor model, we find that for both the UK and the US the results are mixed, suggesting that managerial performance is a factor that needs more investigation. From the extended Fama and French model, we also find mixed results for both the UK and the US markets. Finally, by using the method of Carhart (1997) and Dimson and Minio-Kozerski (2001), we find weak evidence of performance persistence in the US (but not the UK) and strong evidence of discount persistence in both countries.

Finally, we assess the performance of UK "dead" funds and the results show that during the last five years of trading, funds that open-ended, merged or unitised were characterized by a wide discount and very weak NAV performance. By the term 'dead' we mean funds that were liquidated, merged, or unitised.

7.2 Models and data

The quality of mutual fund management has been investigated in the literature largely in relation to the ability to select stocks and market timing ability. The aim of this chapter is to test the null hypothesis that fund managers cannot outperform the market and do not have market timing skills. The alternative hypothesis is that fund managers can outperform the market and have market timing skills which enable them to predict the movement of the market.

To test these hypotheses, we use a rolling methodology for the first, third, fifth and ninth years. The term 'rolling' means that the third year includes the first, second and third years and the fifth year includes all the previous years, and so on. We test the hypothesis of Hendricks, Patel, and Zeckhauser (1993), Goetzmann and Ibboston (1994), Brown and Goetzmann (1995), and Wermers (1996) who found evidence of persistence in mutual fund performance over relatively short-term horizons of one to three years and attribute the persistence to skilled and market timing fund managers. The ninth year includes observations that start from the fifth year. We test the hypothesis of Grinblatt and Titman (1992), Elton, Gruber, Das and Hlavha (1993), and Elton, Gruber, Das, and Blake (1996a) who documented mutual fund return persistence over longer periods of five to ten years and attribute the persistence to skilled managerial performance. The rolling methodology approach is consistent with Gruber (1996), Fama and French (1993) and Carhart (1997).

Our first approach follows Fama and French's (1993) three-factor model and aims to measure performance as the intercept from the regression that includes size, a book-to-market factor and the excess market return as independent variables. Our second approach is the Fama and French (1993) three-factor model extended to include a variable from the Treynor and Mazuy (1966) model related to market timing ability. This additional independent variable is the square of the market rate of return. The third approach is an application of rank correlation analysis to test for Carhart's (1997) momentum effect. The different models are tested and compared and a summary of the empirical evidence is presented.

In terms of the signs of the coefficients of the independent variables, we expect to find positive values for the coefficients of the market return and size, and negative values for the book-to-market effect. The market effect has always played an important role in return explanation, based on the CAPM, and we expect to find a positive estimate of the beta. The size effect was documented in Fama and French's model in which small firms outperform big firms, which leads us to expect a positive estimated coefficient on the size variable. The book-to-market effect is expected to have a negative value based on the results obtained by Pontiff (1997), who found that the book-to market effect was negative (but insignificant) and affected funds with low premiums and discounts. With regard to the momentum effect, Jegadeesh and Titman (1993) showed that buying past winners and selling past losers could generate significant profits when returns are measured over three to twelve-month periods. This hypothesis is tested later by using deciles and trying to test the significance between rankings. In contrast, momentum is expected to be insignificant over the long term as we assume that information both private and public is incorporated in the prices of funds.

The study focuses on a large number of UK investment trusts with the exception of funds that invest in unquoted securities, venture and development, private equity, specialist funds (such as IT funds), emerging market funds, hedge funds, and split capital trusts. The reason of excluding unquoted securities is that if a significant proportion of investments held are unquoted, there will be some uncertainty as to the true value of underlying assets. This leaves us with 16 sectors with a total number of 120 funds. In addition, we investigate 4 categories of US closed end funds with a total number of 30 funds.

In the sample investigated, to avoid survivorship bias due to the problem of funds disappearing because of poor performance, we include the 30 UK funds that disappeared during the period 1990 to 2003 for the selected sectors. These correspond to the funds that Datastream classifies as "dead" funds and for which it keeps a back history.

In the studies, a decision has to be taken whether to use a performance measure based on the market value of the fund shares or on asset values. According to Malkiel (1977) market values "include the effects of changing premiums and discounts, the variable that we are trying to explain. Therefore, in order to measure the performance of the fund managers themselves, it is important to use asset values rather than the market prices of the fund shares." (Malkiel, 1977, p.853)

7.3 Tests for non-stationarity and multicollinearity

In the models estimated in this chapter, fund performance (the dependent variable) is measured by the excess NAV return, which was shown to be stationary in Chapter 6.

The independent variables used are the excess market return, size, the book-to-market effect, and the square of the market return. Sets of descriptive statistics for these independent variables for the UK and the US are presented in Tables 36 and 37 respectively. An ADF unit root test is used to test these variables for non-stationarity and the results are summarised for the UK and the US respectively in Tables 38 and 39.

Table 36 Descriptive statistics of the UK independent variables

The abbreviations used are the following: $(R_m - R_f)$ is the excess market return for the UK, $(R_s - R_b)$ is the size effect, $(R_g - R_v)$ is the book-to-market effect and $(R_m)^2$ measures market timing ability . We use monthly data from January 1990 to January 2003.

	$(R_m - R_f)$	$(R_s - R_b)$	$(R_g - R_v)$	$(R_m)^2$
Mean	-2.04	-12.89	-0.20	18.84
Standard Deviation	7.51	8.72	2.23	22.02
Kurtosis	0.43	0.40	1.50	3.40
Skewness	-0.20	-0.21	-0.47	1.71
Range	43.21	50.20	14.49	127.50
Minimum	-25.37	-38.65	-8.11	-3.95
Maximum	17.85	11.56	6.38	123.55

Source: calculated by the author

Table 37 Descriptive statistics of the US independent variables

The abbreviations used are the following: $(R_m - R_f)$ is the excess market return for US, $(R_s - R_b)$ is the size effect, $(R_g - R_v)$ is the book-to-market effect, and $(R_m)^2$ measures market timing ability . We use monthly data from January 1990 to January 2003.

	$(R_m - R_f)$	$(R_s - R_b)$	$(R_g - R_v)$	$(R_m)^2$
Mean	0.11	0.02	0.06	23.42
Standard Deviation	7.34	3.59	2.32	23.45
Kurtosis	0.87	4.59	0.41	0.70
Skewness	0.09	0.40	-0.13	1.21
Range	42.08	30.54	12.68	101.37
Minimum	-21.39	-12.96	-6.58	-4.80
Maximum	20.70	17.57	6.10	96.57

Source: calculated by the author

Table 38 ADF tests of UK independent variables

This table shows the results of unit root tests of the independent variables for the UK. The abbreviations used are the following. $(R_m - R_f)$ is the excess market return for UK, $(R_s - R_b)$ is the size effect, $(R_g - R_v)$ is the book-to-market effect and $(R_m)^2$ measures market timing ability. We use monthly data from January 1990 to January 2003.

Variable	*ADF-statistic*
$(R_m - R_f)$	-5.14**
$(R_s - R_b)$	-3.66**
$(R_g - R_v)$	-4.98**
$(R_m)^2$	-5.01**

Source: calculated by the author

* Significant at 5% level
** Significant at 1% level

Table 39 ADF tests of US independent variables

Table 39 shows the results of unit root tests of US independent variables. The abbreviations used are the following. $(R_m - R_f)$ is the excess market return for US, $(R_s - R_b)$ is the size effect, $(R_g - R_v)$ is the book-to-market effect and $(R_m)^2$ measures market timing ability. We use monthly data from January 1990 to January 2003.

Variable	*ADF-statistic*
$(R_m - R_f)$	-5.93**
$(R_s - R_b)$	-7.02**
$(R_g - R_v)$	-4.87**
$(R_m)^2$	-5.46**

Source: calculated by the author

* Significant at 5% level
** Significant at 1% level

From the ADF unit root tests, it is clear that, for the UK and the US, all four independent variables are I(0) at the 1% level of significance and therefore stationary. Since all variables are stationary, standard OLS regression may be used.

Multicollinearity refers to the case in which two or more explanatory variables in the regression model are highly correlated, making it difficult or impossible to isolate their individual effects on the dependent variable. To test for multicollinearity, we construct correlation matrices and compute variance-inflation factors.

Tables 40 and 41 show the correlation matrices for the four independent variables used in UK and US models respectively.

Table 40 Correlation matrix of UK independent variables

The table shows the correlation matrix of the UK independent variables. The abbreviations used are the following. $(R_m - R_f)$ is the excess market return for UK, $(R_s - R_b)$ is the size effect, $(R_g - R_v)$ is the book-to-market effect and $(R_m)^2$ measures market timing ability. We use monthly data from January 1990 to January 2003.

	$(R_m - R_f)$	$(R_s - R_b)$	$(R_g - R_v)$	$(R_m)^2$
$(R_m - R_f)$	1			
$(R_s - R_b)$	0.14	1		
$(R_g - R_v)$	-0.04	0.03	1	
$(R_m)^2$	-0.11	0.06	0.09	1

Source: calculated by the author

Table 41 Correlation matrix of US independent variables

The table shows the correlation matrix of the independent variable. The abbreviations used are the following. $(R_m - R_f)$ is the excess market return for UK, $(R_s - R_b)$ is the size effect, $(R_g - R_v)$ is the book-to-market effect and $(R_m)^2$ measures market timing ability. We use monthly data from January 1990 to January 2003

	$(R_m - R_f)$	$(R_s - R_b)$	$(R_g - R_v)$	$(R_m)^2$
$(R_m - R_f)$	1			
$(R_s - R_b)$	0.01	1		
$(R_g - R_v)$	-0.04	-0.33	1	
$(R_m)^2$	0.18	-0.06	-0.03	1

Source: calculated by the author

According to both tables, none of the correlation coefficients is greater than 0.2 and therefore the independent variables are not strongly correlated.

Another method for detecting multicollinearity is the variance-inflation factor (VIF). It is calculated as:

$$VIF_i = \frac{1}{1 - R_i^2} \qquad (15)$$

where VIF is the variance-inflation factor and R_i^2 is the squared multiple correlation coefficient obtained from a regression of the ith independent variable on the other independent variables. A high VIF suggests a collinearity problem, but a VIF less than 10 indicates that there is unlikely to be a collinearity problem. Table 42 summarises the results for the UK and Table 43 summarises the results for the US.

Table 42 VIF results of the UK independent variables

Table 42 shows the VIF results of the UK independent variables. The abbreviations used are the following. $(R_m - R_f)$ is the excess market return for UK, $(R_s - R_b)$ is the size effect, $(R_g - R_v)$ is the book-to-market effect and $(R_m)^2$ measures market timing ability. We use monthly data from January 1990 to January 2003.

	$(R_m - R_f)$	$(R_s - R_b)$	$(R_g - R_v)$	$(R_m)^2$
VIF	1.64	1.18	1.13	1.93

Source: calculated by the author

Table 43 VIF results of the US independent variables

Table 43 shows the VIF results of the US independent variables. The abbreviations used are the following. $(R_m - R_f)$ is the excess market return for US, $(R_{s,} - R_{b,})$ is the size effect, $(R_g - R_v)$ is the book-to-market effect and $(R_m)^2$ measures market timing ability. We use monthly data from January 1990 to January 2003

	$(R_m - R_f)$	$(R_{s,} - R_{b,})$	$(R_g - R_v)$	$(R_m)^2$
VIF	1.02	1.26	1.38	1.06

Source: calculated by the author

It is clear from both tables that all the independent variables show a VIF less than 2, which is a sign that there is no multicollinearity.

7.4 Fama and French's (1993) three-factor model

As we saw in Chapter 3, the model of Fama and French (1993) was constructed and implemented on various portfolios of shares to explain various anomalies in financial markets in terms of size and the book-to-market ratio. This led to the three-factor model. Gruber (1996) tested performance persistence by identifying four factors: the local equity market index, a size index, a bond index and an index which measures the performance of the difference between growth and value stocks. The last factor is used because of the importance of the book-to-market ratio in explaining returns (Fama and French, 1993). We ignore the bond index factor as we do not focus on income funds that invest in bonds. Even the Equity Income category is dominated by shares.

Following Gruber (1996) and Fama and French (1993), we define one, three, five and nine year performance based on monthly returns, which are defined as excess NAV returns for the period January 1990 to January 2003. The intercepts ($\alpha's$) from the regression equations for one, three, five and nine years respectively are used to measure the contribution of the manager to the performance of the fund. Thus, a positive and statistically significant alpha indicates superior performance of the fund, whereas negative values or statistically insignificant values represent inferior or neutral managerial performance.

The hypotheses to be tested are as follows:

$H_0: \alpha \leq 0$, Fund managers have an inferior or neutral performance

$H_1: \alpha > 0$ Fund managers have a superior performance

The model that will be used for each UK and US sector is the following:

$$RNAV_{s,t} = \alpha + \beta_1(R_{m,t} - R_{f,t}) + \beta_2(R_{s,t} - R_{b,t}) + \beta_3(R_{g,t} - R_{v,t}) + \varepsilon_t \qquad (16)$$

where the β's are the coefficients measuring the sensitivity of each factor. $RNAV_{s,t}$ is the excess NAV return for each sector and $R_{f,t}$, represents the risk-free rate, proxied by the one-month treasury bill rate, consistent with Fama and French (1993). $(R_{s,t} - R_{b,t})$ is the size factor which is measured as the difference between the return on a small stocks index and the return on a large stocks index. $(R_{g,t} - R_{v,t})$ is the book-to-market factor which is measured as the difference between the return on an index of high book-to-market stocks (or growth stocks) and the return on an index of low book-to- market stocks (or value stocks). The intercept, α, from regressing the excess NAV returns on the market variables, is interpreted as a measure of the contribution of the manager.

Consistent with Elton, Gruber and Blake (1996a) and Fama and French (1993), we use two style indices to measure the size effect and the book-to-market effect. Specifically, the UK size effect is measured as the difference between the return on the FTSE Smaller Companies index and the return on the FTSE 100 index. The FTSE

100 is used as a proxy for the return on large companies. The US size effect is measured as the difference between the return on S&P Small Cap and the return on the S&P 500 Composite, the latter being used as a proxy for the return on large companies. The UK book-to-market effect is measured as the difference between the return on the FTSE 350 Growth index and the return on the FTSE 350 Value index. The US book-to-market effect is measured as the difference between the return on the S&P 500/Barra Growth index and the return on the S&P 500/Barra Value index.

Table 44 summarises the results of Fama and French's (1993) model for the UK market.

Table 44 Fama and French's three-factor model of UK excess NAV return

We use 12, 36, 60 and 109 observations by applying a rolling methodology. The sample includes 16 sectors of UK investment trusts with total number of 120 funds. We use two style indices to measure the size effect, and the book-to-market effect. Specifically, the UK size effect is measured as the difference between the return on the FTSE Smaller Companies index and the return on the FTSE 100 index. The FTSE 100 is used as a proxy for the return on large companies. The UK book-to-market effect is measured as the difference between the return on the FTSE 350 Growth index and the return on the FTSE 350 Value index.

AITC Category		Coefficients	1Y	3Y	5Y	9Y
Global Growth	Adj R^2		0.89	0.71	0.67	0.48
		α	3.87 (3.30)**	0.72 (1.27)	1.91 (3.01)**	-0.56 (-0.89)
		Market (β_1)	1.68 (9.70)**	0.81 (9.74)**	0.65 (4.45)**	0.69 (5.85)**
		Size (β_2)	1.29 (2.99)**	0.73 (1.91)*	0.33 (3.25)**	0.49 (3.30)**
		Book-to-market (β_3)	-1.85 (-1.99)*	0.71 (2.11)*	-0.05 (-0.22)	0.39 (1.58)
	D/W		2.10	2.11	1.96	1.95
Global Growth & Income	Adj R^2		0.87	0.71	0.83	0.55
		α	1.60 (2.95)**	1.18 (2.02)*	0.37 (0.97)	-0.46 (-1.15)
		Market (β_1)	0.95 (8.60)**	0.82 (10.89)**	0.86 (17.78)**	0.66 (6.92)**
	.	Size (β_2)	0.66 (4.22)**	-0.00 (-0.02)	-0.05 (-1.18)	-0.02 (-0.17)
		Book-to-market (β_3)	0.72 (1.55)	-0.28 (-0.52)	-0.11 (-0.48)	-0.18 (-0.77)
	D/W		2.10	2.13	1.98	2.04
Global Smaller Companies	Adj R^2		0.89	0.74	0.67	0.49
		α	3.54 (3.24)**	-0.42 (-0.33)	1.91 (3.01)**	-0.45 (-0.70)
		Market (β_1)	1.64 (10.34)**	1.13 (10.06)**	0.65 (4.45)**	0.71 (5.77)**
		Size (β_2)	1.25 (2.99)**	0.20 (0.99)	0.33 (3.25)**	0.49 (3.30)**
		Book-to-market (β_3)	-1.73 (-1.91)*	-0.89 (-1.78)*	-0.05 (-0.22)	0.39 (1.57)
	D/W		2.03	1.95	1.96	1.97
UK Growth	Adj R^2		0.90	0.84	0.80	0.78
		α	2.27 (1.60)	0.81 (1.50)	0.53 (1.29)	0.12 (0.34)
		Market (β_1)	0.82 (6.64)**	0.69 (13.15)**	0.82 (15.56)**	0.82 (13.54)**
		Size (β_2)	0.20 (2.36)**	0.68 (5.96)**	0.02 (2.18)*	0.83 (9.65)**
		Book-to-market (β_3)	-0.18 (-2.10)*	-0.63 (-1.73)*	-0.40 (-1.26)	0.06 (0.23)
	D/W		2.00	1.98	2.05	2.01
UK Growth & Income	Adj R^2		0.84	0.81	0.77	0.76
		α	1.88 (1.08)	1.23 (2.02)*	0.22 (0.46)	0.06 (0.16)
		Market (β_1)	0.74 (4.29)**	0.68 (11.00)**	0.86 (13.55)**	0.77 (9.24)**
		Size (β_2)	0.23 (2.25)*	0.70 (5.70)**	-0.11 (-1.03)	0.82 (9.48)**
		Book-to-market (β_3)	-0.13 (-1.09)	-0.67 (-2.43)**	-0.63 (-1.83)*	0.06 (0.22)
	D/W		2.07	1.95	2.10	1.93
UK Smaller	Adj R^2		0.89	0.84	0.69	0.79

Companies						
		α	2.43 (1.65)*	0.85 (1.58)	1.97 (2.43)**	0.13 (0.38)
		Market (β_1)	0.84 (5.92)**	0.68 (13.44)**	0.54 (4.76)**	0.83 (13.94)**
		Size (β_2)	0.20 (2.32)*	0.70 (6.42)**	0.60 (5.21)**	0.84 (9.54)**
		Book-to-market (β_3)	-0.19 (-2.06)*	-0.67 (-1.86)*	-0.10 (-0.84)	0.06 (0.23)
	D/W		2.04	1.97	1.99	2.06
North America	Adj R^2		0.53	0.76	0.79	0.69
		α	-0.93 (-0.89)	0.99 (1.53)	0.48 (1.05)	0.64 (1.77)*
		Market (β_1)	0.47 (3.52)**	0.92 (10.11)**	0.95 (14.82)**	0.77 (9.53)**
		Size (β_2)	-0.61 (-1.86)*	0.67 (2.33)*	0.62 (2.98)**	0.43 (4.37)**
		Book-to-market (β_3)	1.51 (-1.80)*	-0.21 (-1.30)	-0.09 (-0.98)	0.19 (0.97)
	D/W		2.05	2.09	1.99	2.06
North America Smaller Companies	Adj R^2		0.79	0.84	0.61	0.69
		α	1.98 (1.37)	0.82 (1.44)	0.28 (0.25)	0.63 (1.73)*
		Market (β_1)	0.58 (3.16)**	0.86 (2.97)**	0.69 (6.23)**	0.71 (9.56)**
		Size (β_2)	0.93 (3.34)**	0.49 (3.46)**	0.40 (1.73)*	0.43 (4.40)**
		Book-to-market (β_3)	-1.30 (-1.79)*	0.25 (0.79)	-0.43 (-1.76)*	0.18 (0.94)
	D/W		1.95	1.92	1.97	2.07
Far East (Including Japan)	Adj R^2		0.68	0.78	0.75	0.53
		α	-1.45 (-0.66)	0.93 (1.38)	0.87 (1.60)	-0.17 (-0.32)
		Market (β_1)	0.63 (2.07)**	0.96 (10.05)**	0.91 (12.96)**	0.82 (11.06)**
		Size (β_2)	0.12 (0.34)	0.24 (1.92)*	0.14 (1.08)	0.27 (2.03)*
		Book-to-market (β_3)	-0.03 (-0.04)	-0.16 (-1.03)	-0.37 (-1.21)	0.24 (1.09)
	D/W		1.96	2.15	2.08	1.97
Far East (Excluding Japan)	Adj R^2		0.63	0.44	0.24	0.25
		α	-1.75 (-0.49)	0.85 (0.68)	0.85 (0.81)	-0.09 (-0.11)
		Market (β_1)	0.29 (1.35)	0.79 (4.28)**	0.57 (2.54)**	0.39 (4.01)**
		Size (β_2)	-0.13 (-0.17)	-0.13 (-0.42)	-0.26 (-0.74)	0.08 (0.63)
		Book-to-market (β_3)	2.10 (1.86)*	0.84 (1.19)	-0.12 (-0.20)	0.49 (2.31)*
	D/W		2.04	2.02	1.92	1.92
Japan	Adj R^2		0.91	0.74	0.77	0.53
		α	4.40	-0.11	-0.14	-0.18

			(5.00)**	(-0.08)	(-0.24)	(-0.33)
		Market (β_1)	1.70 (10.85)**	1.16 (9.78)**	1.13 (16.43)**	0.81 (19.99)**
		Size (β_2)	0.83 (2.04)*	0.24 (0.86)	0.51 (3.05)**	0.28 (2.07)*
		Book-to-market (β_3)	-0.76 (-2.82)**	-0.84 (-1.72)*	-0.42 (-1.21)	0.53 (1.55)
	D/W		1.93	2.03	1.96	1.98
Japanese Smaller Companies	Adj R^2		0.80	0.80	0.65	0.53
		α	3.54 (1.99)*	0.35 (0.32)	0.40 (0.48)	-0.18 (-0.33)
		Market (β_1)	9.90 (9.50)**	1.15 (12.57)**	0.98 (8.01)**	0.81 (19.99)**
		Size (β_2)	5.40 (6.00)**	0.84 (3.96)**	0.59 (2.82)**	0.28 (2.07)*
		Book-to-market (β_3)	-1.01 (-1.50)	-0.51 (-0.82)	-0.37 (-0.77)	0.26 (1.78)*
	D/W		1.95	1.92	1.96	1.98
Europe	Adj R^2		0.37	0.78	0.75	0.41
		α	0.84 (1.36)	0.68 (1.19)	0.67 (1.33)	-0.03 (-0.07)
		Market (β_1)	0.60 (2.85)**	0.73 (10.05)**	0.79 (11.05)**	0.67 (5.23)**
		Size (β_2)	0.32 (0.75)	0.16 (1.52)	0.04 (0.50)	0.16 (0.93)
		Book-to-market (β_3)	-0.25 (-0.37)	-0.03 (-0.12)	-0.02 (-0.08)	-0.02 (-0.08)
	D/W		1.94	1.99	1.97	2.08
European Smaller Companies	Adj R^2		0.89	0.90	0.88	0.71
		α	0.69 (0.88)	-0.11 (-0.28)	0.48 (1.52)	-0.48 (-1.28)
		Market (β_1)	0.90 (12.45)**	0.86 (21.13)**	0.84 (16.27)**	0.84 (10.13)**
		Size (β_2)	0.44 (2.30)*	0.32 (3.19)**	0.23 (2.66)**	0.49 (3.69)**
		Book-to-market (β_3)	0.50 (1.07)	0.40 (1.92)*	0.02 (0.11)	0.30 (-1.36)
	D/W		2.02	2.05	2.02	2.06
Country Specialists Far- East	Adj R^2		0.83	0.87	0.80	0.53
		α	1.65 (2.45)**	0.32 (0.52)	1.16 (1.82)*	-0.17 (-0.30)
		Market (β_1)	0.93 (7.91)**	0.99 (13.50)**	0.94 (13.62)**	0.82 (6.62)**
		Size (β_2)	0.64 (3.58)**	0.32 (3.45)**	-0.02 (2.31)*	0.27 (2.11)*
		Book-to-market (β_3)	0.45 (0.78)	0.25 (-4.18)**	-0.07 (-0.91)	0.24 (1.04)
	D/W		2.01	2.09	2.06	1.97
Sector Specialists Property	Adj R^2		0.67	0.58	0.30	0.69

		α	3.17 (1.50)	0.22 (0.20)	0.99 (0.94)	0.60 (1.64)*
		Market (β_1)	0.90 (4.39)**	0.70 (6.03)**	0.51 (3.23)**	0.70 (9.53)**
		Size (β_2)	1.03 (1.53)	0.46 (2.00)*	0.35 (2.04)*	0.42 (4.28)**
		Book-to-market (β_3)	-1.95 (-3.40)**	-0.40 (-1.58)	-0.23 (-1.09)	0.19 (0.99)
	D/W		2.05	2.01	2.09	2.04
Total observations			12	36	60	109

Source: author calculation

* represents t –value that is statistically significant at 5% significance level

** represents t-value that is statistically significant at 1% significance level

According to Table 44, the adjusted R squared for most AITC categories is higher than 0.50. In addition, there is no evidence of first-order autocorrelation in the above regressions as on average the Durbin/Watson statistic (D/W) for each sector is close to 2.00. For example, the European Smaller Companies category has an adjusted R squared value of 0.89 for the first 12 months and 0.88 for the first 60 months. Similarly, UK Growth has an adjusted R squared value of 0.90 for the first 12 months and 0.84 for the first 36 months.

As indicated above, α is used to measure the ability of managers to outperform the base index. A positive and statistically significant α indicates a skilled fund manager whose decisions add value to the fund. Rhodes (2000) argued that "persistent performance shows that some fund managers are able to outperform their peers. This implies that the fund managers must either have access to information that is insider or not widespread or make use of information in a speedier way than other managers. As markets become more efficient it will be more difficult for any fund manager to outperform the market continuously" (Rhodes, 2000, p.7). On the other hand, negative α values or statistically insignificant values represent inferior or neutral performance of the manager. In other words, a negative α indicates a poorly performing manager whose decisions affect negatively the value of the fund. According to Table 44, the results are mixed. Eleven out of the sixteen sectors display an α that is positive and statistically significant at the 1% or 5% levels (in one-tailed tests) for at least one of the time periods. In more detail, Global Growth and Income shows a positive and statistically significant α for the first year at the 1% level and at the 5% significance level for the first three years. Japan displays a significant α for the first year at the 1% significance level. Global Smaller Companies show a positive and statistically significant α at the 1% level the first five years. Finally, Japanese Smaller Companies and Country Specialist Far East display a positive and statistically significant α for the first 12 months at the 1% and 5% levels respectively. On the other hand, the rest of the sectors show a mixed picture of positive and negative alphas that are not statistically significant at the 5% or 1% levels. Furthermore, only two alphas are significant for the nine-year period at the 5% level in one-tailed tests. So while there is some evidence for managerial performance persistence in the short-term, there is little evidence for persistence in the long run.

Most of the sectors show significant t-statistics for both the market return and size. The t-statistic for the UK size effect measured as the difference between the return on the FTSE Smaller Companies index and the return on the FTSE 100 index is statistically significant at the 1% and 5% level. On the other hand, the UK book-to-market effect measured as the difference between the return on the FTSE 350 Growth index and the return on the FTSE 350 Value index is negatively and positively significant for some of the sectors and statistically insignificant for most of the sectors. Thus, consistent with Pontiff (1997), we find that the book-to-market factor does not seem to have any significant explanatory power. Through his cross-sectional regression, Pontiff found that the book-to-market effect only influenced funds with low premiums and discounts.

Table 45 summarises the results of the Fama and French's (1993) model for the US market.

Table 45 Fama and French's three-factor model of US excess NAV return

We use 12, 36, 60 and 109 observations of data by applying a rolling methodology. The sample includes 4 sectors of US closed-end funds with total number of 30 funds. We will use two style indices to measure the size effect, and the book to market effect. Specifically, the US size effect is measured as the difference between the return on S&P Small Cap and the return on the S&P 500 Composite as it is used as a proxy for the return on large companies. The US book-to-market effect is measured as the difference between the return on the S&P 500/Barra Growth index and the return on the S&P 500/Barra Value index.

CEFA Category		**Coefficients**	**1Y**	**3Y**	**5Y**	**9Y**
Equity Income	Adj R^2		0.79	0.60	0.83	0.69
		α	1.68 (1.33)	0.28 (0.25)	0.88 (2.06)**	0.61 (1.70)*
		Market (β_1)	0.54 (3.37)**	0.70 (6.14)**	0.90 (15.75)**	0.71 (9.56)**
		Size (β_2)	0.95 (3.31)**	0.40 (1.78)*	0.42 (3.83)**	0.43 (4.36)**
		Book-to-market (β_3)	-1.26 (-1.72)*	-0.40 (-1.66)*	0.04 (0.17)	0.18 (0.96)
	D/W		1.99	1.97	1.95	2.06
Global Equity	Adj R^2		0.86	0.85	0.70	0.78
		α	2.41 (1.43)	0.79 (1.49)	1.83 (2.26)*	0.11 (0.31)
		Market (β_1)	0.84 (4.59)**	0.67 (14.30)**	0.57 (5.00)**	0.81 (13.00)**
		Size (β_2)	0.22 (2.27)*	0.70 (6.44)**	0.61 (5.59)**	0.83 (9.57)**
		Book-to-market (β_3)	-0.18 (-1.55)	-0.64 (-1.77)*	-0.13 (-1.14)	0.06 (0.23)
	D/W		2.14	1.98	1.95	2.00

Growth and Income	Adj R^2		0.86	0.73	0.63	0.53
		α	2.41 (1.43)	0.28 (0.25)	0.31 (0.35)	-0.22 (-0.39)
		Market (β_1)	0.84 (4.59)**	1.05 (6.21)**	0.96 (7.89)**	0.82 (6.53)**
		Size (β_2)	0.22 (2.27)*	0.79 (3.68)**	0.59 (2.77)**	0.28 (2.16)*
		Book-to-market (β_3)	-0.18 (-1.55)	-0.43 (-0.68)	-0.42 (-0.87)	0.22 (0.94)
	D/W		2.14	1.97	2.00	1.95
Growth Domestic	Adj R^2		0.47	0.87	0.57	0.77
		α	0.22 (0.15)	0.35 (0.56)	1.28 (2.20)*	1.20 (1.85)*
		Market (β_1)	0.59 (2.64)**	0.99 (3.50)**	0.66 (8.33)**	0.89 (11.49)**
		Size (β_2)	1.02 (2.23)*	0.32 (3.44)**	1.06 (3.68)**	-0.10 (-0.87)
		Book-to-market (β_3)	0.60 (0.82)	0.24 (-4.08)**	-0.43 (1.00)	0.09 (0.57)
	D/W		1.95	2.04	2.00	2.01
Total observations			12	36	60	109

Source: author calculation

* represents t –value that is statistically significant at 5 % significance level

** represents t-value that is statistically significant at 1% significance level

According to Table 45, the adjusted R squared for most CEFA categories is higher than 0.50. In addition, there is no first-order autocorrelation problem in the above regression as on average the Durbin/Watson statistic for each sector is close to 2.00. Based on our regression results, three out of four sectors display an α that is positive and statistically significant at the 1% level for various years. For example, Global Equity displays a positive and statistically significant alpha for the first five years. Similarly, Equity Income and Growth Domestic show a positive and statistically significant alpha for the first five and nine years. Most of the sectors show a significant t-statistic for both the market return and size. For most time periods the t-statistic for US size is statistically significant at the 1% level. The book-to-market effect is negatively and statistically significant for some sectors and not statistically significant for most of the sectors. Thus, consistent with Pontiff (1997) and our UK results, we find that the book-to-market factor does not seem to have any significant explanatory power.

The objective of the next study is to investigate if fund managers have market timing ability (namely the ability to predict the movement of the market) by extending Fama and French's (1993) three-factor model to include Treynor and Mazuy's (1966) variable of market timing ability.

7.5 Extended Fama and French's (1993) model

In this section, we extend Fama and French's model estimated in section 7.4 to include an additional independent variable following the Treynor and Mazuy (1966) model. The extra variable is the square of the market return, which is included in an attempt to capture market timing ability. The intercepts ($\alpha's$) from the regression equations for one, three, five and nine years respectively are used to measure the contribution of the manager to the performance of the fund. Thus, as before, a positive and statistically significant alpha indicates superior managerial performance of the fund, whereas negative values or statistically insignificant values represent inferior or neutral managerial performance. In their paper, Treynor and Mazuy (1966) assume that if a mutual fund is not engaged in market timing and maintains a constant fund beta, the relationship between the fund return and the return on the benchmark will be linear. However, if the fund is successful at market timing, the fund return will be higher than the benchmark return, and the relationship between the fund return and the return on the benchmark will be non-linear. Thus we can test for timing ability by testing for this nonlinearity. To do this, we include the square of the market return as an additional independent variable (with coefficient γ). A negative or zero γ means that fund managers do not have market timing ability, whereas a positive γ would imply that fund managers have market timing ability.

The hypotheses to be tested are as follows:

H_0 : $\alpha \leq 0,\ \gamma \leq 0$ Fund managers have an inferior or neutral performance

H_1: $\alpha > 0,\ \gamma > 0$ Fund managers have a superior performance

The model that will be used is the following:

$$RNAV_{s,t} = \alpha + \beta_1(R_{m,t} - R_{f,t}) + \beta_2(R_{s,t} - R_{b,t}) + \beta_3(R_{g,t} - R_{v,t}) + \gamma\left(R_{m,t}\right)^2 + \varepsilon_t \qquad (17)$$

where the β's and γ are the coefficients measuring the sensitivity of each factor. $RNAV_{s,t}$ is the monthly excess NAV return for each sector and $R_{f,t}$ is the return on one-month treasury bills. $(R_{s,t} - R_{b,t})$ is the size factor which is measured as the difference between the return on a small stocks index and the return on a large stocks index. $(R_{g,t} - R_{v,t})$ is the book-to-market factor which is measured as the difference between the return on an index of high-book-to-market stocks (or growth stocks) and the return on an index of low-book-to- market stocks (or value stocks). The intercept, a, from regressing NAV excess returns on the market measures the contribution of the manager and γ is the coefficient that measures market timing ability.

Table 46 summarises the results of Fama and French's (1993) extended three-factor model that includes the market timing ability variable for the UK. As before, we use a rolling methodology with 12, 36, 60 and 109 observations. The sample includes 16 sectors of UK investment trusts with a total number of 120 funds.

Table 46 Extended Fama and French's three-factor model of UK excess NAV return

We use 12, 36, 60 and 109 observations by applying a rolling methodology. The sample includes 16 sectors of UK investment trusts with total number of 120 funds both alive and dead.

AITC Category		Coefficients	1Y	3Y	5Y	9Y
Global Growth	Adj R^2		0.90	0.73	0.81	0.45
		α	2.53 (1.44)	-0.28 (-0.34)	0.50 (1.14)	-0.15 (-0.25)
		Market (β_1)	1.79 (12.68)**	0.80 (10.74)**	0.60 (6.78)**	0.58 (4.33)**
		Size (β_2)	1.36 (3.41)**	0.82 (2.27)*	0.35 (3.45)**	0.49 (3.21)**
		Book-to-market (β_3)	-1.21 (-1.67)*	0.01 (0.07)	0.02 (0.07)	0.42 (1.77)*
		market timing ability (γ)	0.05 (1.39)	0.03 (1.96)*	0.02 (3.07)**	-0.01 (-0.81)
	D/W		2.07	2.02	2.03	1.94
Global Growth & Income	Adj R^2		0.85	0.72	0.83	0.55
		α	1.21 (1.44)	1.53 (2.27)*	0.28 (0.63)	-0.20 (-0.43)
		Market (β_1)	0.95 (7.99)**	0.70 (6.00)**	0.85 (12.72)**	0.61 (5.21)**
		Size (β_2)	0.63 (3.52)**	-0.06 (-0.43)	-0.05 (-1.14)	-0.01 (-0.13)
		Book-to-market (β_3)	0.71 (1.46)	-0.35 (-0.70)	-0.10 (-0.47)	-0.18 (-0.69)
		market timing ability (γ)	0.01 (0.73)	-0.01 (-1.62)	0.00 (0.41)	-0.01 (-0.50)
	D/W		2.07	2.00	2.00	2.02
Global Smaller Companies	Adj R^2		0.90	0.73	0.82	0.48
		α	1.69 (0.79)	-0.89 (-0.70)	0.47 (1.07)	-0.29 (-0.48)
		Market (β_1)	1.70 (14.83)**	1.16 (8.35)**	0.61 (6.79)**	0.69 (4.21)**
		Size (β_2)	1.28 (3.69)**	0.23 (1.03)	0.36 (3.61)**	0.49 (3.21)**
		Book-to-market	-1.18 (-1.60)	-0.79 (-1.72)*	0.03 (0.14)	0.38 (1.58)

		(β_3)				
		market timing ability (γ)	0.04 (1.48)	0.01 (0.83)	0.02 (2.97)**	-0.00 (-0.26)
	D/W		2.13	2.10	2.00	1.94
UK Growth	Adj R^2		0.92	0.84	0.80	0.78
		α	0.55 (0.30)	0.65 (0.85)	0.68 (1.50)	0.24 (0.57)
		Market (β_1)	0.60 (2.69)**	0.67 (10.50)**	0.84 (12.92)**	0.82 (14.22)**
		Size (β_2)	0.17 (2.61)**	0.68 (5.84)**	0.01 (2.10)*	0.83 (9.31)**
		Book-to-market (β_3)	-0.12 (-1.18)	-0.61 (-1.51)	-0.41 (-1.27)	0.08 (0.28)
		market timing ability (γ)	0.01 (1.52)	0.00 (0.44)	-0.00 (-0.77)	-0.00 (-0.68)
	D/W		2.03	1.95	2.02	2.02
UK Growth & Income	Adj R^2		0.88	0.83	0.76	0.76
		α	-0.03 (-0.01)	0.76 (1.02)	0.34 (0.61)	0.42 (0.95)
		Market (β_1)	0.48 (10.82)**	0.68 (10.46)**	0.87 (11.21)**	0.79 (12.63)**
		Size (β_2)	0.20 (2.19)*	0.68 (5.79)**	-0.11 (-1.04)	0.82 (8.92)**
		Book-to-market (β_3)	-0.05 (-0.39)	-0.65 (-1.66)*	-0.63 (-1.83)*	0.10 (0.37)
		market timing ability (γ)	0.01 (1.55)	0.00 (0.36)	-0.00 (-0.42)	-0.01 (-1.44)
	D/W		2.10	1.94	2.09	2.01
UK Smaller Companies	Adj R^2		0.89	0.84	0.71	0.78
		α	0.36 (0.17)	0.81 (1.13)	1.35 (2.00)*	0.23 (0.55)
		Market (β_1)	0.68 (2.90)**	0.67 (10.45)**	0.52 (4.90)**	0.83 (14.50)**
		Size (β_2)	0.10 (1.09)	0.70 (6.21)**	0.64 (5.46)**	0.84 (9.32)**
		Book-to-market (β_3)	-0.07 (-0.69)	-0.66 (-1.74)*	-0.25 (-1.80)*	0.07 (0.27)
		market timing ability (γ)	0.01 (1.40)	0.00 (0.14)	0.01 (1.63)	-0.00 (-0.56)
	D/W		2.12	1.97	2.04	2.03
North America	Adj R^2		0.47	0.76	0.79	0.69
		α	-1.14 (-0.47)	0.99 (1.53)	0.48 (1.05)	0.64 (1.77)*
		Market (β_1)	0.49 (4.19)**	0.92 (10.11)**	0.95 (14.82)**	0.77 (9.53)**
		Size (β_2)	0.59 (2.46)*	0.34 (2.14)*	0.01 (1.04)	0.44 (4.28)*
		Book-to-market (β_3)	1.55 (1.73)*	0.52 (1.52)	0.44 (-2.30)*	0.19 (1.01)
		market timing ability (γ)	0.01 (0.25)	0.03 (3.94)**	0.01 (3.01)**	-0.00 (-0.35)
	D/W		2.05	2.09	1.99	2.06
North America	Adj R^2		0.80	0.62	0.83	0.69

Smaller Companies						
		α	2.84 (1.35)	1.06 (0.85)	0.63 (1.41)	0.80 (2.05)*
		Market (β_1)	0.31 (2.16)*	0.76 (6.11)**	0.86 (10.81)**	0.71 (9.15)**
		Size (β_2)	1.18 (2.51)**	0.44 (2.25)*	0.43 (3.79)**	0.44 (4.30)**
		Book-to-market (β_3)	-0.96 (-1.88)*	-0.38 (-1.64)*	0.03 (0.13)	0.19 (0.98)
		market timing ability (γ)	-0.01 (-0.85)	-0.01 (-1.22)	0.00 (0.92)	-0.00 (-0.39)
	D/W		2.04	2.01	1.97	2.06
Far East (Including Japan)	Adj R^2		0.73	0.85	0.77	0.54
		α	0.17 (0.06)	0.66 (0.84)	0.38 (0.84)	-0.80 (-1.35)
		Market (β_1)	0.62 (2.44)**	0.90 (10.16)**	0.86 (6.61)**	0.83 (7.12)**
		Size (β_2)	0.22 (0.76)	0.48 (3.71)**	0.13 (2.52)**	0.27 (2.00)*
		Book-to-market (β_3)	0.49 (0.90)	-0.09 (-0.26)	-0.36 (-1.64)*	0.22 (0.79)
		market timing ability (γ)	-0.01 (-1.40)	0.01 (1.69)*	0.01 (1.33)	0.01 (0.83)
	D/W		1.96	2.08	2.09	2.05
Far East (Excluding Japan)	Adj R^2		0.59	0.42	0.24	0.25
		α	-2.34 (-0.63)	0.70 (0.43)	1.14 (0.84)	-0.44 (-0.55)
		Market (β_1)	0.12 (0.25)	0.76 (4.38)**	0.61 (3.07)**	0.37 (3.56)**
		Size (β_2)	-0.46 (-0.45)	-0.13 (-0.40)	-0.28 (-0.75)	-0.01 (-1.12)
		Book-to-market (β_3)	2.58 (1.71)*	0.85 (1.17)	-0.13 (-0.21)	0.46 (-2.18)*
		market timing ability (γ)	-0.02 (-0.88)	0.00 (0.14)	-0.01 (-0.27)	0.01 (1.78)*
	D/W		2.00	2.04	1.94	1.94
Japan	Adj R^2		0.55	0.74	0.77	0.53
		α	3.44 (0.78)	-0.68 (-0.48)	0.29 (0.41)	-0.79 (-1.33)
		Market (β_1)	0.86 (10.66)**	1.16 (9.90)**	1.18 (15.39)**	0.82 (17.19)**
		Size (β_2)	1.58 (1.28)	0.33 (1.09)	0.34 (2.08)*	0.27 (2.03)*
		Book-to-market (β_3)	-2.46 (-1.75)*	-0.76 (-1.66)*	-0.54 (-1.50)	0.24 (0.89)
		market timing ability (γ)	-0.05 (-0.65)	0.01 (1.54)	-0.01 (-1.94)*	0.01 (0.80)
	D/W		1.97	2.14	1.95	2.05
Japanese Smaller Companies	Adj R^2		0.89	0.76	0.65	0.53
		α	1.78 (0.73)	0.49 (0.35)	-0.15 (-0.17)	-0.79 (-1.33)
		Market (β_1)	1.67	1.26	0.93	0.82

			(14.71)**	(8.87)**	(6.40)**	(17.19)**
		Size (β_2)	1.22 (3.28)**	0.50 (2.93)**	0.64 (2.91)**	0.27 (2.03)*
		Book-to-market (β_3)	-1.46 (-1.80)*	-0.70 (-0.97)	-0.32 (-0.68)	0.24 (0.89)
		market timing ability (γ)	0.04 (1.19)	-0.00 (-0.10)	0.01 (1.06)	0.01 (0.80)
	D/W		1.95	1.97	1.96	2.05
Europe	Adj R^2		0.56	0.78	0.75	0.41
		α	1.54 (1.63)	0.58 (0.99)	0.89 (1.73)*	-0.37 (-0.71)
		Market (β_1)	0.60 (2.74)*	0.72 (6.97)**	0.82 (9.43)**	0.71 (7.32)**
		Size (β_2)	0.35 (0.72)	0.17 (1.68)*	0.03 (0.36)	0.14 (0.83)
		Book-to-market (β_3)	-0.18 (-0.25)	-0.02 (-0.08)	-0.03 (-0.13)	-0.03 (-0.12)
		market timing ability (γ)	-0.01 (-0.51)	0.00 (0.26)	-0.00 (-0.78)	0.01 (0.68)
	D/W		2.03	1.98	1.98	2.12
European Smaller Companies	Adj R^2		0.84	0.89	0.88	0.71
		α	0.85 (0.94)	-0.28 (-0.65)	0.39 (1.30)	-0.42 (-0.93)
		Market (β_1)	0.83 (6.07)**	0.82 (11.38)**	0.84 (13.03)**	0.83 (8.49)**
		Size (β_2)	0.26 (2.92)**	0.33 (3.31)**	0.24 (2.75)**	0.49 (3.66)**
		Book-to-market (β_3)	0.49 (0.71)	0.42 (1.94)*	0.03 (0.17)	0.31 (1.35)
		market timing ability (γ)	-0.01 (-0.43)	0.00 (0.95)	0.00 (0.17)	-0.00 (-0.15)
	D/W		2.04	1.99	2.03	2.07
Country Specialists Far- East	Adj R^2		0.80	0.86	0.79	0.54
		α	1.71 (2.02)*	0.22 (0.29)	1.17 (1.73)*	-0.80 (-1.35)
		Market (β_1)	0.93 (7.37)**	0.90 (9.81)**	0.94 (11.84)**	0.83 (7.12)**
		Size (β_2)	0.64 (3.22)**	0.37 (3.66)**	-0.02 (2.40)**	0.27 (2.00)*
		Book-to-market (β_3)	0.42 (0.52)	0.06 (0.56)	-0.07 (-0.90)	0.22 (0.79)
		market timing ability (γ)	-0.00 (-0.08)	0.01 (1.34)	-0.00 (-0.05)	0.01 (0.83)
	D/W		2.01	2.09	2.06	2.05
Sector Specialists Property	Adj R^2		0.74	0.60	0.33	0.69
		α	5.28 (1.94)*	1.21 (0.98)	0.99 (0.94)	0.78 (1.99)*
		Market (β_1)	0.69 (3.86)**	0.78 (5.66)**	0.51 (3.23)**	0.70 (9.09)**
		Size (β_2)	0.78 (2.81)**	0.53 (2.62)**	0.35 (2.04)*	0.43 (4.19)**

		Book-to-market (β_3)	-1.29 (-6.41)**	-0.40 (-1.74)*	-0.23 (-1.09)	0.20 (1.04)
		market timing ability (γ)	-0.08 (-2.04)*	-0.02 (-1.53)	0.00 (0.16)	-0.00 (-0.41)
	D/W		2.07	2.10	2.08	2.03
Total observations			12	36	60	109

Source: author calculation

* represents t –value that is statistically significant at 5% significance level

** represents t-value that is statistically significant at 1% significance level

The adjusted R squared for most AITC categories is higher than 0.50. There is no autocorrelation problem in the above regressions, as on average the Durbin/Watson statistic for each sector is close to 2.00. The results are mixed. Only seven out of the sixteen sectors show a positive and statistically significant market timing ability (γ) at the 1% or 5% significance levels. These are:

- Global Growth over three and five years
- Global Smaller Companies over five years
- North America over three and five years
- Far East (Including Japan) over three years
- Far East (Excluding Japan) over nine years
- Japan over five years
- Sector Specialists Property over one year

In addition and consistent with our previous results, seven out of the sixteen sectors display an α that is positive and statistically significant at the 1% or 5% significance levels. These are:

- Global Growth and Income over three years
- UK Smaller Companies over five years

- North America over nine years
- North America Smaller Companies over nine years
- Europe over five years
- Country Specialists Far East over one and three years
- Sector Specialists Property over one and nine year

The mixed results provide a picture of semi-strong and strong form market efficiency in the UK through the various years. Efficiency is said to be semi-strong if today's prices reflect all available information and strong if the available information (public and inside) is reflected in current shares or fund prices. The estimated coefficient of the market return, size and book-to market effects are qualitatively similar to those reported above for the Fama and French model.

Table 47 summarises the results of Fama and French's (1993) extended three-factor model that includes the market timing ability variable for the US.

Table 47 Extended Fama and French's three-factor model of US excess NAV return

Table 47 shows the results of Fama and French (1993) extended three-factor model for the US. We use 12, 36, 60 and 109 observations by applying a rolling methodology. The sample includes 4 sectors of US closed-end funds with total number of 30 funds.

CEFA Category		**Coefficients**	**1Y**	**3Y**	**5Y**	**9Y**
Equity Income	Adj R^2		0.81	0.61	0.82	0.69
		α	2.70 (1.30)	1.15 (0.91)	0.69 (1.54)	0.79 (2.01)*
		Market (β_1)	0.31 (2.41)**	0.77 (6.14)**	0.86 (10.62)**	0.71 (9.15)**
		Size (β_2)	1.18 (2.65)**	0.45 (2.31)*	0.43 (3.77)**	0.44 (4.26)**
		Book-to-market (β_3)	-0.98 (-1.81)*	-0.36 (-1.63)	0.04 (0.16)	0.19 (1.01)
		market timing	-0.01 (-0.80)	-0.01 (-1.32)	0.00 (0.93)	-0.00 (-0.39)

		ability (γ)				
	D/W		2.09	1.97	1.96	2.05
Global Equity	Adj R^2		0.90	0.85	0.71	0.78
		α	-0.01 (-0.00)	0.73 (1.00)	1.39 (2.16)*	0.26 (0.61)
		Market (β_1)	0.57 (2.35)**	0.66 (10.49)**	0.54 (3.94)**	0.81 (13.85)**
		Size (β_2)	0.17 (2.31)*	0.70 (6.25)**	0.64 (5.36)**	0.83 (9.29)**
		Book-to-market (β_3)	-0.09 (-0.87)	-0.64 (-1.63)	-0.24 (-1.63)	0.08 (0.29)
		market timing ability (γ)	0.02 (1.92)*	0.00 (0.22)	0.01 (0.93)	-0.00 (-0.81)
	D/W		2.10	1.97	2.02	2.01
Growth and Income	Adj R^2		0.90	0.75	0.63	0.53
		α	-0.01 (-0.01)	0.85 (0.68)	-0.27 (-0.29)	-0.86 (-1.46)
		Market (β_1)	0.57 (2.35)**	1.19 (9.38)**	0.91 (6.39)**	0.83 (7.03)**
		Size (β_2)	0.17 (2.31)*	0.45 (2.96)**	0.64 (2.86)**	0.27 (2.05)*
		Book-to-market (β_3)	-0.01 (-0.87)	-0.82 (-1.43)	-0.37 (-0.78)	0.20 (0.73)
		market timing ability (γ)	0.02 (1.92)*	-0.00 (-0.42)	0.01 (1.12)	0.01 (0.85)
	D/W		2.10	2.00	1.98	2.04
Growth Domestic	Adj R^2		0.42	0.86	0.77	0.51
		α	1.49 (0.65)	0.20 (0.26)	1.40 (2.03)*	-0.82 (-1.41)
		Market (β_1)	1.11 (2.54)**	0.92 (10.41)**	0.94 (12.86)**	0.79 (6.94)**
		Size (β_2)	1.31 (2.26)*	0.35 (3.62)**	1.06 (3.68)**	0.26 (1.88)*
		Book-to-market (β_3)	-0.25 (-0.16)	0.13 (1.68)*	0.08 (0.55)	0.30 (1.18)
		market timing ability (γ)	0.06 (1.91)*	0.01 (1.18)	-0.01 (-1.04)	0.01 (0.66)
	D/W		1.98	2.00	1.98	1.98
Total observations			12	36	60	109

Source: author calculation

* represents t –value that is statistically significant at 5 % significance level

** represents t-value that is statistically significant at 1% significance level

In this case, the size effect is statistically significant at the 1% and 5% levels and market effect is significant at the 1% level. Three out of four sectors (i.e. Global Equity, Growth and Income, and Growth Domestic) show a positive and statistically significant market timing performance (γ) over the first 12 months, but not in the longer-term. The other results are all qualitatively similar to the Fama and French results reported above. In addition, the adjusted R squared for most categories of CEFA is higher than 0.50 and there is no autocorrelation problem in the above regressions as on average the Durbin/Watson statistic for each sector is close to 2.00.

We have analysed if fund managers have market timing ability by extending Fama and French's (1993) three-factor model. The coefficient estimates obtained by applying the above model vary from sector to sector, but the most marked difference is between the UK, where there is evidence of market timing ability in the long run in some sectors and the US, where there is very limited evidence restricted to the first year.

7.6 Performance persistence rank correlation analysis

Mutual fund persistence is well documented in the finance literature. Wermers (1996) suggests that it is momentum that generates short-term persistence. Carhart (1997) argues that persistence of returns can be attributed mainly to the difference in expenses charged. Much of the remaining persistence is driven by the one-year momentum effect of Jegadeesh and Titman (1993). In more detail, Jegadeesh and Titman (1993) show that buying past winners and selling past losers generates significant profits when returns are measured over three to twelve-month periods.

They show, with NYSE and AMEX securities over the period 1965-1989, that a successful momentum strategy was buying the winners from the previous six months, (for example, the assets at the top of the rankings) and selling the losers from the previous six months. This shows that asset returns exhibit momentum, which means that the winners of the past continue to perform well and the losers of the past continue to perform badly. Fama and French (1993) stress that their model does not explain the short-term persistence of returns highlighted by Jegadeesh and Titman (1993). Carhart (1997), on the other hand, suggests that performance persistence is due to the use of momentum strategies by the fund managers, rather than the managers being particularly skilful at picking winning stocks.

Using our sample of 120 investment trusts funds, both alive and dead, and 30 US closed end funds, we test the hypothesis of managerial performance persistence and secondly, we test the hypothesis of discount persistence. Performance is defined as gross managerial performance less expenses charged by managers. Funds are grouped into portfolios ranked on the level of past performance and allocated to deciles. As before, past performance is measured over one, three five and nine year periods by using monthly data from 01/01/1990 to 01/01/2003. In the finance literature, the most frequent test that is used to test performance persistence is the Spearman rank correlation coefficient. The method is to break down the distribution into percentile groups (say, deciles) based on past performance in order to be able to detect persistence among the selected groups through the subsequent years. A weakness of this methodology is that researchers arbitrarily choose as a benchmark the past performance that will be compared with subsequent years. Dimson and Minio-Kozerski (2001) found that there is managerial performance persistence during the first two years of the life of the funds. Similarly, Allen and Tan (1999) used as a benchmark the first two-year period compared with the subsequent two-year period. Our approach is different in terms of the subsequent years. We test for short- and long-term persistence by using as a benchmark the first two years, measured as the average NAV return, and test for persistence over the first year, the first three years, the first five years and then the nine-year period starting at the fifth year.

Tables 48 and 49 show the deciles and the Spearman rank correlation coefficients, together with t-tests for the UK and US respectively. Spearman rank correlation is a nonparametric test measuring the correlation between the ranks of the deciles over the subsequent performance periods. In other words, Spearman's rank correlation test checks for the existence, strength and direction of a relationship between two rankings.

Table 48 Managerial performance persistence of the UK market

Funds are ranked on past performance and grouped into portfolio over one, three five and nine years measured and allocated to deciles. Spearman rank correlation coefficients are also computed in SPSS between the value of each decile's average performance and its rank. The sample includes 120 UK Investment trusts over the period 1990-2003.

Decile of Average NAV performance	1Y	3Y	5Y	9Y
1(Highest performance)	-0.28	0.41	0.61	0.55
2	-0.62	0.02	0.35	0.15
3	0.62	0.79	0.97	0.55
4	1.14	0.90	0.99	0.48
5	1.17	0.79	0.92	0.51
6	1.13	0.94	0.85	0.48
7	0.57	0.78	0.88	0.53
8	1.33	1.33	1.92	0.56
9	0.41	0.97	0.92	0.59
10(Lowest performance)	0.26	0.94	0.82	0.51
Spearman rank correlation test				
Correlation coefficient	-0.24	-0.77**	-0.26	-0.32
Significance t-statistic	0.51	0.01	0.47	0.37
Number of observations	12	36	60	133

Source: author calculation

**represents t –value that is statistically significant at 1% significance level

* represents t –value that is statistically significant at 5% significance level

From Table 48, we see that for the UK, all the correlation coefficients are wrong-signed, so there is no evidence of performance persistence. This lack of evidence of performance persistence in the UK contradicts Dimson and Minio-Kozerski's (2001) finding of short-term persistence in the UK market, and Gruber's (1996) findings of performance persistence in US mutual funds. Gruber used the same methodology as ours. Funds were ranked and placed into deciles on the basis of past returns. His sample was free of survivorship bias and he used five years of data (1990-1994) to examine S&P 500 index funds and bond index funds. He found that all of the rank correlations were statistically significant at the 1% significance level.

Table 49 Managerial performance persistence of the US market

Funds are ranked on past performance and grouped into portfolio over one, three, five and nine years measured and allocated to deciles. Spearman rank correlation coefficients are computed between the value of each decile's average performance and its rank. The sample includes 30 US closed-end funds over the period 1990-2003.

Decile of NAV performance	1Y	3Y	5Y	9Y
1(Highest performance)	2.01	0.96	1.10	-0.56
2	0.09	0.00	0.26	-0.98
3	1.13	0.59	0.63	-0.57
4	0.66	0.33	0.41	-0.10
5	0.55	0.49	0.62	-0.16
6	0.01	0.24	0.63	-0.26
7	0.25	-0.19	0.20	-0.29
8	0.37	-0.26	0.04	-0.13
9	-0.28	-0.14	-0.01	-0.42
10(Lowest performance)	1.16	0.29	0.34	-0.35
Spearman rank correlation test				
Correlation coefficient	0.31	0.61	0.64*	-0.37
Significance t-statistic	0.39	0.06	0.04	0.29
Number of observations	12	36	60	133

Source: author calculation

**represents t –value that is statistically significant at 1% significance level

* represents t –value that is statistically significant at 5% significance level

Our findings for the US market shown in Table 49 are consistent with Grinblatt and Titman (1992), Elton, Gruber, Das and Hlavha (1993), and Elton, Gruber, Das, and

Blake (1996a). They document mutual fund return predictability over longer periods of five to ten years. In more detail, the rank correlation coefficients of 0.61 and 0.64 show that the rankings of the deciles are positively correlated over the three and five year periods. The correlation is much weaker over the one-year period (0.31) and negative over the nine-year period. Our results contradict Hendricks, Patel, and Zeckhauser (1993), Goetzmann and Ibbotson (1994), Brown and Goetzmann (1995), and Wermers (1996) who find evidence of persistence in mutual fund performance in the US over relatively short- term horizons of one to three years.

On the other hand, our evidence for the UK and the US provides only limited support for the Jegadeesh-Titman momentum hypothesis. In more detail, Jegadeesh and Titman (1993) show that the strategies of buying past winners and selling past losers generate significant profits when returns are measured over three- to twelve-month periods. According to our results, past winners do not seem to do better than past losers. On the contrary, performance measured over one and three years by using monthly observations is characterized by a negative and insignificant rank correlation coefficient for the first year (-0.24) and a negative and significant rank correlation coefficient for the first three years (-0.77) in the UK investment trust market. In the US, there is only weak evidence of performance persistence in the short term.

7.6.1 Discount persistence

Discount persistence is investigated by using the same method as that employed in Carhart (1997) and Dimson and Minio-Kozerski (2001). The 120 funds for the UK and 30 funds for the US are allocated to deciles based on their discount levels. The hypothesis that the discount persists over the life of the fund means that the small-discount portfolio (Decile 1) should show a low discount or premium in subsequent time periods. We test for short and long-term persistence by using as a benchmark the average discount in the first two years.

Table 50 shows the results of discount persistence in the UK market. Funds are ranked based on the discount and, as before, grouped into portfolios over one, three, five and nine years.

Table 50 Discount persistence of the UK market

Funds are ranked based on their discount level and grouped into portfolios over one, three, five and nine years measured and allocated to deciles. Spearman rank correlation coefficients are also computed in SPSS between the value of each decile's average performance and its rank. The sample includes 120 UK Investment trusts over the period 1990-2003.

Decile of average discount	1Y	3Y	5Y	9Y
1(Largest Premium)	19.90	25.73	11.86	3.91
2	-4.50	-4.31	-4.56	-7.19
3	-11.89	-8.70	-7.94	-8.30
4	-7.21	-5.29	-5.40	-8.78
5	-12.50	-8.82	-7.98	-9.64
6	-13.88	-9.24	-9.49	-12.30
7	-17.11	-14.02	-13.32	-13.12
8	-19.72	-15.43	-12.88	-14.07
9	-17.82	-11.28	-9.54	-10.53
10(Largest discount)	-27.36	-20.03	-4.96	-9.46
Spearman rank correlation test				
Correlation coefficient	0.98**	0.95**	0.60	0.75**
Significance t-statistic	0.00	0.00	0.06	0.01
Number of observations	12	36	60	133

Source: author calculation

**represents t –value that is statistically significant at 1% significance level

* represents t –value that is statistically significant at 5% significance level

According to Table 50, the rank correlation coefficients are significant at the 1% level in the first year, the first three years and for the nine-year period, which implies that there is momentum during the first year and a long-run trend over the three- and nine-year periods. This is consistent with the evidence presented in Chapter 6, which showed the UK discount to be autocorrelated and non-stationary.

Table 51 shows the results of discount persistence in the US market. Funds are ranked based on the discount and, as before, grouped into portfolios over one, three, five and nine years and allocated to deciles.

Table 51 Discount persistence of the US market

Funds are ranked based on their discount level and grouped into portfolio over one, three, five and nine years measured and allocated to deciles. Spearman rank correlation coefficients are computed between the value of each decile's average performance and its rank. The sample includes 30 US closed-end funds over the period 1990-2003.

Decile of average discount	**1Y**	**3Y**	**5Y**	**9Y**
1(Largest Premium)	3.82	0.36	4.82	1.39
2	7.69	5.34	4.30	1.61
3	1.75	1.02	-1.48	-0.60
4	-3.28	-7.35	-8.44	-6.88
5	-0.69	-5.42	-7.95	-8.14
6	-5.28	-6.04	-7.97	-10.03
7	-2.94	-4.87	-7.30	-8.23
8	-8.94	-10.67	-11.98	-11.01
9	-9.51	-10.73	-12.86	-12.18
10(Largest Discount)	-16.34	-16.55	-15.67	-13.32
Spearman rank correlation test				
Correlation coefficient	0.93**	0.86**	0.89**	0.98**
Significance t-statistic	0.00	0.00	0.00	0.00
Number of observations	12	36	60	133

Source: author calculation

**represents t –value that is statistically significant at 1% significance level

* represents t –value that is statistically significant at 5% significance level

Table 51 shows that the rank correlation coefficients are positive and significant for all periods, a result that is consistent with our finding in Chapter 6 that the discount is autocorrelated and non-stationary.

7.7 Empirical assessment of the performance of UK "dead" funds

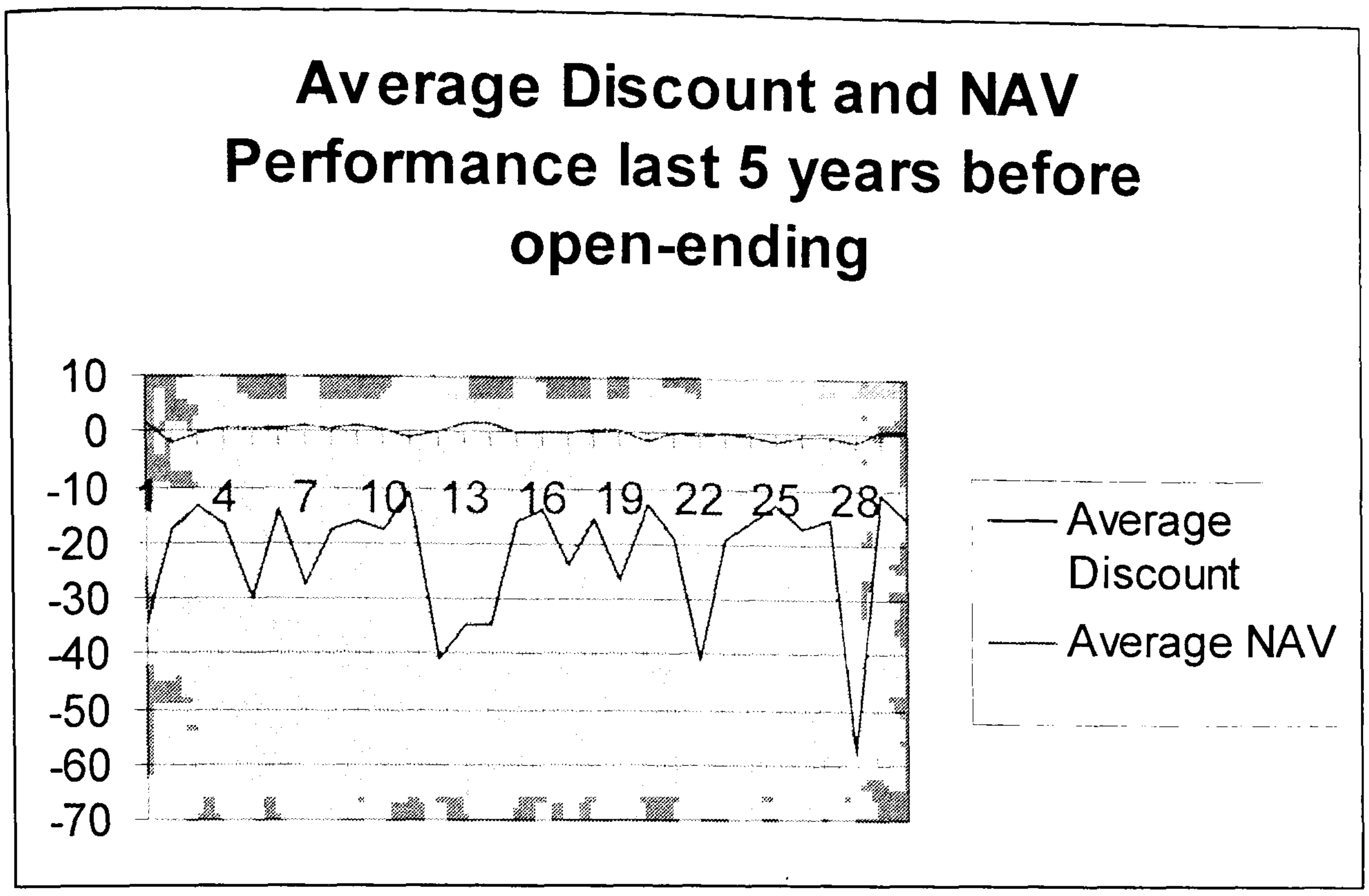
This section is of interest to investors, as it investigates how a "dead" fund behaves before liquidation, takeover or unitisation. The UK investment trust industry has gone through intense changes and restructuring. There have been several departures from the industry. Datastream provides data for 30 funds that disappeared between 1990 and 2003 for the sixteen sectors selected in this study. This section investigates the performance of these funds during the months preceding their disappearance. Takeovers, liquidations and unitisations are referred to as open-ending.

The first characterisation of the funds that have disappeared is to measure their average discount and average performance in terms of NAV during the last five years of trading. We define the average discount as the difference of the price to NAV ratio across the 30 UK "dead" funds. Figure 11 shows the results.

The funds seem to have traded at a large discount, an average of more than 20 per cent during the last years of trading. The discount disappears when the fund is open-ended. During the last year of trading the discount gradually moves towards zero, particularly during the last 6 months of trading. Table 52 summarises the average discount and managerial performance of the 30 UK "dead" funds over their last five years.

Figure 11 average discount and average NAV before open-ending.

The graph shows the average discount and NAV performance of 30 "dead" funds before open-ending. The average discount during the 60 observation or 5 years preceding open-ending is measured as the difference of the price to NAV ratio across the 30 UK "dead" funds that disappeared during the period from January 1990 to January 2003. NAV performance is measured as the ratio of the difference between the return of the succeeding and preceding return



Source: Author's calculation based on data obtained from Datastream.

Table 52 Average discount and managerial performance of 30 UK "dead" funds

Table 52 shows the results of average discount and managerial performance of 30 UK "dead" funds. We use 60 monthly observations or the last five years of the life of each fund in order to investigate the characteristics before open-ending or unitisation, liquidation and merging. The sample includes 30 UK dead funds from various sectors.

Fund Type	Management Group	Average Discount	Average NAV
JUP.EUROPEAN DELISTED 20/11/00	Jupiter	-34.80	1.50
SIAM SELECTIVE GW. DELISTED 23/07/01	Management International (Guernsey)	-17.44	-2.15
THORNTON ASIAN EMRG. 'DELISTED 26/03/97'	Thornton Asset Management	-13.27	-0.60
JUP.EXTRA INC. DELISTED 28/09/00	Jupiter	-16.32	0.58
JUP.INTL.GREEN DELISTED 19/03/01	Jupiter	-30.22	0.63
FLEMING INTL.DELISTED 31/10/96	Jupiter	-13.67	0.68
HENDERSON AMERICAN CAP. DELISTED 26/02/99	Henderson Investors	-27.56	1.11
BARING STRATTON UNITISED 05/05/98	Baring Private	-17.32	0.83
USDC INV.TST. DEAD - CONVERTED	Wellington	-15.94	0.99
GERMAN INV.TST. DEAD - ACQ. BY 926246	Hill Samuel	-17.73	0.58
JF JAPAN OTC DELISTED 27/07/98	Jardine Fleming	-10.54	-1.10
CHARTER EUROPEAN DELISTED 22/04/02	Charter Asset Management	-41.07	0.02
GENERAL CONS.CAP. DELISTED 06/01/98	Henderson Investors	-34.78	1.43
MCIT CAPITAL IT. DELISTED 25/06/98	Martin Currie	-34.51	1.79
GROUP TRUST DELISTED	Legal and General	-16.15	0.25

17/08/01	Ventures		
TURKEY TRUST DELISTED 25/11/99	Henderson Investors	-13.80	-0.08
BRITISH INV.TRUST DEAD - 19/05/97	Edinburgh Fund Managers	-23.96	-0.04
SCHRODER MEDITERRANEAN DELISTED 06/08/96	Schroder	-15.60	0.58
TRIO TRUST DEAD 12/1/93	Henderson Investors	-26.55	0.67
BRIT.AM.&GENERAL	Ivory and Sime	-12.84	-1.20
SPHERE INC.& RESI.CAP	Glasgow Investment Managers	-19.14	0.08
PACIFIC PROPERTY	Ivory and Sime	-40.79	-0.15
RADIOTRUST	Lombard Odier	-19.20	0.08
GARTMORE AMERICAN SECS.	Gartmore	-15.90	-0.17
GARTMORE EMRG.PACIFIC DELISTED 04/10/99	Gartmore	-12.86	-1.37
FIRST PHILIPPINE 26/06/97	Jupiter	-16.93	-0.34
THROGMORTON USM	Framlington	-15.42	-0.49
TR TECHNOLOGY . DELISTED 22/10/99	Henderson Investors	-58.14	-1.59
PARIBAS FRENCH INV. DEAD – 31/08/97	Paribas	-10.83	0.88
GART.VALUE ORD.	Gartmore	-15.60	0.78
Total	30	-21.96	0.14

Source: Datastream University of Piraeus, Athens, Greece.

The results show that during the last five years of trading, funds that open-ended are characterized by a wide discount and poor NAV performance. In more detail, according to Table 52, TR Technology, delisted 22/10/99, showed the widest discount of -58.14 and poor performance of -1.59 under Henderson Investors management group. Similarly, Pacific Property showed a large average discount of -40.79 and negative performance of -0.15 under the Ivory and Sime management group (see appendix A for a detailed list of the management groups). From the overall sample of 30 dead funds, average investors will hold a fund with an average discount of -21.96. Moreover, the analysis identifies 5 groups (Henderson Investors, Ivory and Sime, Charter Asset Management, Jupiter, and Martin Currie) as the least successful managers. The average discount of the funds under management is significantly higher than the discount of the industry. The question that arises is: does the management group tend to affect the discount or can other factors explain this persistence. The evidence suggests that future research should focus on the management group and analyse the factors and problems that lead to open-ending. A possibility would be to investigate the management contracts and the management ownership structure.

The performance of the sample of "dead" funds suggests that funds disappear after periods of poor NAV performance and wide discounts. At open-ending, we find evidence that share prices increase toward NAV. Future research could also attempt to identify the benchmark that managers actually aim to beat when they are in a critical positions, for example during a merger.

7.8 Conclusion

By estimating Fama and French's three-factor model and the extended version to include the market timing ability variable from Treynor and Mazuy, we can conclude that for both the UK and the US the results are mixed and therefore managerial performance is a factor that needs more investigation. We find evidence of managerial performance persistence, but only for some sectors over certain time periods in both the UK and the US.

By using rank correlation analysis, we find no evidence of performance persistence in the UK. Our findings for the US market are consistent with Grinblatt and Titman (1992), Elton, Gruber, Das and Hlavha (1993), and Elton, Gruber, Das, and Blake (1996a). They document mutual fund return predictability over longer horizons periods of five to ten years. In more detail, rank correlation coefficients of 0.61 and 0.64 for the US market show that the ranking of the deciles are positively strongly correlated during the first three and the first five years. On the other hand, in terms of discount persistence when funds are ranked on discount levels, measured over one, three, five and nine years and allocated to deciles the bottom performing portfolios tend to be characterised by larger discounts. In both the UK and the US markets, all the correlation coefficients are positive and significant.

Finally, we assess the performance of UK "dead" funds and the results show that during the last five years of trading, funds that open-ended, merged or unitised were characterized by a wide discount and poor NAV performance.

Chapter 8

Determination of the excess discount return

8.1 Introduction

After analysing the time-series properties and related problems of the discount and excess discount return in Chapter 6 and finding some evidence of managerial performance persistence in some sectors in Chapter 7, we attempt in this chapter to extend Fama and French's three-factor model to explain the fluctuations of the excess discount return in the UK and the US. We first take into account market risk, small firm risk and book-to-market risk. Then an attempt is made to explain the excess discount return by introducing additional factors, such as momentum, noise-trader sentiment and expenses.

Dimson and Minio-Paluello (2002) extended Fama and French's (1993) three-factor model by including management performance (measured as the difference between the fund's NAV return in excess of the mean NAV performance for the sector). A sector factor (measured using equally-weighted changes in the discount where they included all the funds in a sector except the fund of interest), and a mean-reversion factor (defined as the difference between the mean discount for the sector and the fund's discount). However, they did not include an analysis of the time-series properties of their dependent and independent variables in terms of stationarity, normality and multicollinearity. Their sample consisted of 244 UK investment trusts during the period January 1980 to March 1997. The results indicated that their multi-factor model explained on average 35% of the month-to-month changes in the discount of UK investment trusts.

The superiority of the study presented in this chapter is that it also includes the US market for comparison and uses other factors to explain the excess discount return. In addition, we investigate in detail the time-series properties of the UK and US excess discount return and related independent variables. We find that the Guirguis six-factor model explains 67% of the variation of the excess discount return in the UK market and 66% of the variation in the US market.

8.2 Explanation of factor selection

The most common approach for choosing factors that affect stock returns are firm specific attributes. As we have seen, a well-known model is the three-factor model of Fama and French (1993). Fama and French group common stocks according to their size and their ratios of book-to-market value.

From the standpoint of both the academic researcher and practitioner, it is crucial to be able to identify which factors best capture stock return variation and specifically the discount variation. As a result, there has been a proliferation of research that attempts to identify the various factors. The importance of market risk, book-to-market risk and small firm risk in explaining cross-sectional differences in stock returns is discussed in Fama and French (1993). Carhart (1997) adds a fourth factor to these three risk measures, which is based on the results of Jegadeesh and Titman (1993), that mutual funds are affected by momentum, namely that past winners will continue to be next winners the following year and past losers will continue to be losers. In other words, a firm's past return helps to predict future returns (Chan, Jegadeesh and Lakonishok,1996; Chopra, Lakonishok and Ritter, 1992; DeBondt and Thaler,1985; Rosenberg, Reid and Lanstein, 1984). We found some evidence for this managerial performance persistence in our empirical studies reported in Chapter 7. Momentum creates the suspicion that management performance might influence the discount return. Momentum is defined as the difference between a fund's NAV return and the sector's average NAV return ($RNAV_{fd} - RNAV_{se}$). Past performance is measured over the full history of the funds. We test the momentum anomaly documented in Carhart's four-factor model.

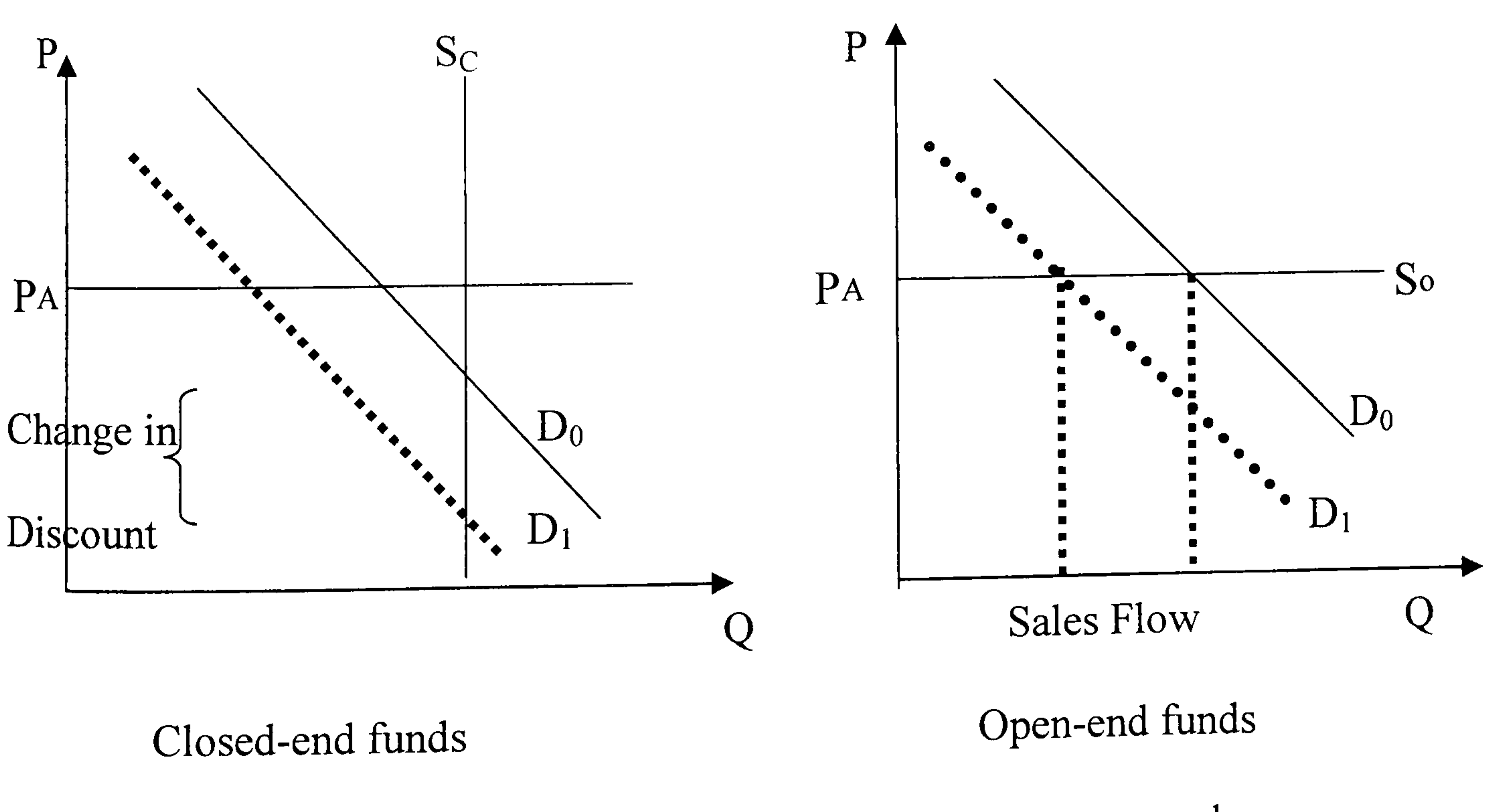
We add two more factors to these four risk measures. The first one is based on the results of Lee, Shleifer and Thaler (1991) that closed-end funds are subject to systematic "investor sentiment risk". In more detail, one possible explanation for variations in the discount is based on the existence of two categories of investors. The first category includes rational investors, namely arbitrageurs, who make rational decisions in accordance with their preferences. The second category includes the so-called noise traders. These investors do not act fully rationally, and their investment decisions are considered as unpredictable. In some periods they overestimate expected returns relative to the rational expectations and in other periods they underestimate them. Therefore, prices of securities are a function of both categories.

The interaction of these two categories of investors may help to explain the variation of the discount. For arbitrageurs to buy funds that are characterized by a constant discount would be costly and, therefore not always profitable. In more detail, if investment trusts trade at a discount and then at a premium to NAV, an apparent arbitrage profit can be realised by selling the fund's share above the risk free rate.

However, if the discount stays relatively constant over the investment horizon, the arbitrageurs make no profit. According to the descriptive statistics presented in Chapter 5, there is a wide range between the lower and upper bounds of the discount in each AITC and CEFA category, which suggests that there is active interaction between both parties. This active interaction can be measured quantitatively by using as proxies the retail flows of each sector or by using an investor sentiment index.

The retail flow measure was first used by Malkiel (1977) to measure general investor sentiment regarding investment companies. According to him "when individuals were showing little enthusiasm for open-end funds, it is probable that they showed a similar lack of enthusiasm for closed- end funds" (Malkiel, 1977, p.856). The relationship between changes in fund discounts and net redemptions of open-end funds can be seen in Figure 12.

Figure 12 : Relationship between changes in fund discounts and net redemptions



Source: Malkiel (1977), the valuation of closed-end investment company shares

In Figure 12, according to Malkiel (1977), " S_0 is the supply curve of open-end funds, which is infinitely elastic because open-end funds will sell as many new shares or redeem outstanding ones at net asset value (P_A). The supply curve for the closed-end funds (Sc) is perfectly inelastic as there is a fixed supply of shares. Shifts in the demand curve for open-end shares will result in changes in the quantity of shares outstanding or net sales" (Malkiel, 1977, p.856). Shifts in the demand curve for closed-end funds will result in changes in fund discounts or premiums. In a perfect market, demand shifts will not change the level of the discount but due to the interactions of noise and rational traders, we expect net sales of open-end funds to be associated with changes in the discount. Malkiel (1977) found that an increase in net sales of open-end funds was associated with an increase in the average discount, but the coefficients were not significant. The problem with his study was that he only used 24 US closed-end funds and not all companies could be included in his cross-sectional regression because of missing data. So the explanatory power of his model was weak.

On the other hand, Gemmill and Thomas (2002) conducted a more detailed analysis to find out whether investor sentiment could explain fluctuations in the discount. They found that monthly flows of retail investment into particular sectors were closely related to changes in sector discounts. According to their findings investor sentiment not only affects the discount in the short-term but may also influence its level over periods of several years. They investigated 11 UK sectors, which consisted of 158 closed-end equity funds.

The second additional factor is management expenses. Malkiel (1977) defines management expenses as a percentage of fund assets. The problem is that the ratio of expenses to cash flow is not constant over the life of a fund. As the long-term expense to cash flow ratio is not observable, it can be proxied by current monthly expenses as a percentage of fund assets. In this chapter, we define expenses as the monthly management charge (or staff costs), auditors and custody fees, directors fees and marketing costs as a percentage of fund assets. We test two contradictory hypotheses. The first one is Barclay, Holderness and Pontiff's (1995) view that a possible explanation of the discount is that as managers try to protect their private benefits, expenses increase over the long term and have an effect on the discount. The second one is Malkiel (1977) who claims that an expense ratio will not be significant due to the difficulty of measuring it accurately. The ratio of expenses to cash flow is not constant over the life of a fund.

As in Chapter 7, the market factor is the difference between the return on the relevant index and one-month risk-free rate. The UK size effect is measured as the difference between the return on the FTSE Smaller Companies index and the return on the FTSE 100 index. The FTSE 100 is used as a proxy for the return on large companies. The size effect is used to test the anomaly documented in Fama and French's three-factor model. The UK book-to-market effect is measured as the difference between the return on the FTSE 350 Growth index and the return on the FTSE 350 Value index. The US size effect is measured as the difference between the return on S&P Small Cap and the return on the S&P 500 Composite as it is used as a proxy for the return on large companies. The US book-to-market effect is measured as the difference between the return on the S&P 500/Barra Growth index and the return on the S&P 500/Barra Value index.

8.3 Data, sample description and independent variables

As in Chapter 7, this study focuses on a large number of UK investment trusts with the exception of funds that invest in unquoted securities, venture and development, private equity, specialist funds, emerging market funds, hedge funds, and split capital trusts. The purpose of excluding unquoted securities is justified by the argument if a significant proportion of investments held are unquoted, there will be some uncertainty as to the true value of underlying assets namely NAV. This leaves us with 16 sectors with a total number of 90 funds. On the other hand, we investigate 4 categories of US closed end funds with a total number of 30 funds.

The different categories of funds, the total number of funds, and average discount by category are described in Tables 1 and 2 (see Chapter 5). In addition, Tables 9 and 10 detail the funds in the UK and US. We use a full data set with no missing data between the periods of January 1990 to January 2003. See Chapter 5 for the definition of the discount, index and NAV monthly returns.

The overall sample covers 120 different funds for both UK and US. Table 71 and 72 detail the individual fund by category and their management groups (see appendix A)

8.3.1 Tests for non- stationarity and multicollinearity

In the models estimated in this chapter, the dependent variable is the excess discount return, which was shown to be stationary in Chapter 6. The independent variables used are the excess market return, size, the book-to-market effect, momentum, sentiment (proxied first by retail flows and secondly by an investor sentiment index) and expenses. The investor sentiment index was available for the US market only and for a smaller sample. Descriptive statistics for the first three of these variables were presented in Chapter 7, where the variables were also shown to be stationary. Descriptive statistics for the remaining three independent variables (four for the US) are shown in Tables 53 and 54. ADF unit root tests were also performed on these variables and the results are summarised in Tables 55 and 56 for the UK and the US respectively.

Table 53 Descriptive statistics of the UK independent variables

The abbreviations used are the following: ($RNAV_{fd}$ -$RNAV_{se}$) is momentum, ($Flow_t$ – $Flow_{t-1}$) is sentiment and Exp_t is expenses. We use monthly data from January 1990 to January 2003.

	($RNAV_{fd}$ - $RNAV_{se}$)	($Flow_t$- $Flow_{t-1}$)	Exp_t
Mean	-0.19	-1.14	5.74
Standard Deviation	0.37	4.23	0.84
Kurtosis	4.46	14.94	-0.90
Skewness	-0.46	-0.74	-0.56
Range	3.09	27.08	3.24
Minimum	-1.57	-24.15	3.66
Maximum	1.52	2.93	6.90

Source: calculated by the author

Table 54 Descriptive statistics of the US independent variables

The abbreviations used are the following: ($RNAV_{fd}$ – $RNAV_{se}$) is momentum, ($Flow_t$ – $Flow_{t1}$) is retail flow used as a sentiment proxy and Exp_t is expenses. We use monthly data from January 1990 to January 2003. ISI is an investor sentiment index. It is measured by using monthly data from October 1996 to January 2003.

	($RNAV_{fd,}$- $RNAV_{se}$)	($Flow_t$- $Flow_{t-1}$)	(ISI_t)	Exp_t
Mean	0.09	0.17	5.77	3.86
Standard Deviation	1.46	1.09	1.28	0.86
Kurtosis	26.45	31.49	6.38	-1.12
Skewness	1.29	0.46	0.70	0.42
Range	15.3	12.30	1.94	2.71
Minimum	-3.51	-3.22	-1.61	2.70
Maximum	11.84	9.08	25.42	5.41

Source: calculated by the author

Table 55 ADF tests of UK independent variables

($RNAV_{fd}$ – $RNAV_{se,}$) is momentum, ($Flow_t$ – $Flow_{t-1}$) is the change in retail flows used as a sentiment proxy and Exp is expenses.

We use monthly data from January 1990 to January 2003.

Variable	*ADF-statistic*
($RNAV_{fd}$ – $RNAV_{se}$)	-5.37**
($Flow_t$ – $Flow_{t-1}$)	-4.90**
Exp	-6.15**

Source: calculated by the author

* Significant at 5% level
** Significant at 1% level

Table 56 ADF tests of US independent variables

($RNAV_{fd} - RNAV_{se}$) is momentum, ($Flow_t - Flow_{t-1}$) is the change in retail flows used as a sentiment proxy, and Exp is expenses. We use monthly data from January 1990 to January 2003. ISI is an investor sentiment index. It is measured by using monthly data from October 1996 to January 2003.

Variable	*ADF-statistic*
($RNAV_{fd} - RNAV_{se}$)	-3.83**
($Flow_t - Flow_{t-1}$)	-7.64**
(ISI)	-4.42**
Exp	-6.88**

Source: calculated by the author
* Significant at 5% level
** Significant at 1% level

From the ADF unit root tests reported in Tables 55 and 56, it is clear that, for the UK and the US all independent variables are I(0) at the 1% significance level and therefore stationary. Since all variables are stationary, standard OLS regression may be used.

As we saw in Chapter 7, multicollinearity refers to the case in which two or more explanatory variables in the regression model are highly correlated, making it difficult or impossible to isolate their individual effects on the dependent variable. To test for multicollinearity, we construct correlation matrices and compute variance-inflation factors.

Table 57 and 58 show the correlation matrices for the full set of independent variables used in the UK and US models respectively.

Table 57 Correlation matrix of UK independent variables

The abbreviations used are the following: $(R_m - R_f)$ is the excess market return for UK, $(R_s - R_b)$ is the size effect, $(R_g - R_v)$ is the book-to-market effect, ($RNAV_{fd}$ - $RNAV_{se}$) is momentum, ($Flow_t$ - $Flow_{t-1}$) is the change in retail flows used as a sentiment proxy, and Exp is expenses. We use monthly data from January 1990 to January 2003.

	$(R_m - R_f)$	$(R_s - R_b)$	$(R_g - R_v)$	($RNAV_{fd}$ - $RNAV_{se}$)	($Flow_t$ - $Flow_{t-1}$)	Exp_t
$(R_m - R_f)$	1					
$(R_s - R_b)$	0.14	1				
$(R_g - R_v)$	-0.04	0.03	1			
($RNAV_{fd}$ - $RNAV_{se}$)	0.05	-0.09	-0.14	1		
($Flow_t$ - $Flow_{t-1}$)	0.04	0.04	-0.08	-0.07	1	
Exp	-0.03	0.15	0.11	0.15	-0.05	1

Source: calculated by the author

Table 58 Correlation matrix of US independent variables

The abbreviations used are the following: $(R_m - R_f)$ is the excess market return for UK, $(R_{s,} - R_b)$ is the size effect, $(R_g - R_v)$ is the book-to-market effect, ($RNAV_{fd}$ - $RNAV_{se,}$) is momentum, ($Flow_t$ - $Flow_{t-1}$) is the change in retail flows used as a sentiment proxy, and Exp is expenses. We use monthly data from January 1990 to January 2003

	$(R_m - R_f)$	$(R_{s,} - R_b)$	$(R_g - R_v)$	($RNAV_{fd}$ - $RNAV_{se,}$)	($Flow_t$ - $Flow_{t-1}$)	Exp_t
$(R_m - R_f)$	1					
$(R_{s,} - R_b)$	0.01	1				
$(R_g - R_v)$	-0.04	-0.33	1			
($RNAV_{fd}$- $RNAV_{se}$)	0.03	0.03	-0.17	1		
($Flow_t$ - $Flow_{t-1}$)	0.02	0.07	0.00	-0.35	1	
Exp	-0.09	-0.00	0.02	0.02	-0.06	1

Source: calculated by the author

Table 59 shows correlation matrix between the independent variables of the different categories of US closed-end funds for the second version of the Guirguis six-factor model, which includes the investor sentiment index as an alternative indicator of sentiment.

Table 59 Correlation matrix of US independent variables of Guirguis II six- factor model

The table shows the correlation matrix of the independent variables. The abbreviations used are the following: $(R_m - R_f)$ is the excess market return for UK, $(R_{s,} - R_b)$ is the size effect, $(R_g - R_v)$ is the book-to-market effect, ($RNAV_{fd}$ - $RNAV_{se,}$) is momentum, (ISI) is sentiment proxied by investor sentiment index, and Exp is expenses. We use monthly data from October 1996 to January 2003.

	$(R_m - R_f)$	$(R_{s,} - R_b)$	$(R_g - R_v)$	($RNAV_{fd}$ - $RNAV_{se,}$)	ISI_t	Exp_t
$(R_m - R_f)$	1					
$(R_{s,} - R_b)$	-0.46	1				
$(R_g - R_v)$	-0.02	0.17	1			
($RNAV_{fd}$- $RNAV_{se}$)	0.21	-0.16	-0.21	1		
(ISI)	-0.23	0.13	0.07	0.02	1	
Exp	0.03	-0.05	-0.01	-0.16	-0.07	1

Source: calculated by the author

According to Tables 57 to 59, none of the correlation coefficients is greater than 0.5 and therefore the independent variables are not strongly correlated.

Another measure to detect multicollinearity is the variance-inflation factor (VIF), defined in Chapter 7. Table 60 summarises the results for the UK and Tables 61 and 62 summarise the results for the two US models.

Table 60 VIF results of the UK independent variables

The abbreviations used are the following: $(R_m - R_f)$ is the excess market return for UK, $(R_s - R_b)$ is the size effect, $(R_g - R_v)$ is the book-to-market effect, ($RNAV_{fd}$ - $RNAV_{se,}$) is momentum, ($Flow_t$ - $Flow_{t-1}$) is change in retail flows used as a sentiment proxy, and Exp is expenses. We use monthly data from January 1990 to January 2003.

	$(R_{m,} - R_f)$	$(R_s - R_b)$	$(R_g - R_v)$	($RNAV_{fd}$ - $RNAV_{se,}$)	($Flow_t$ - $Flow_{t-1}$)	Exp
VIF	1.64	1.18	1.13	1.21	1.04	1.23

Source: calculated by the author

Table 61 VIF results of the US independent variables (model I)

The abbreviations used are the following: $(R_m - R_f)$ is the excess market return for US, $(R_s - R_b)$ is the size effect, $(R_g - R_v)$ is the book-to-market effect, ($RNAV_{fd}$ - $RNAV_{se,}$) is momentum, ($Flow_t$ - $Flow_{t-1}$) is the change in retail flows used as a sentiment proxy, and Exp is expenses. We use monthly data from January 1990 to January 2003

	$(R_m - R_f)$	$(R_s - R_b)$	$(R_g - R_v)$	($RNAV_{fd}$ - $RNAV_{se,}$)	($Flow_t$ - $Flow_{t-1}$)	Exp_t
VIF	1.02	1.26	1.38	1.45	1.35	1.03

Source: calculated by the author

Table 62 VIF results of the US independent variables (model II)

The abbreviations used are the following: $(R_m - R_f)$ is the excess market return for US, $(R_s - R_b)$ is the size effect, $(R_g - R_v)$is the book-to-market effect, ($RNAV_{fd}$ - $RNAV_{se}$) is momentum, (ISI) is sentiment proxied by investor sentiment index, and Exp is expenses. We use monthly data from October 1996 to January 2003.

	$(R_m - R_f)$	$(R_s - R_b)$	$(R_g - R_v)$	($RNAV_{fd}$ - $RNAV_{se}$)	ISI	Exp
VIF	1.42	1.32	1.10	1.15	1.67	1.63

Source: calculated by the author

It is clear from the above tables that all the independent variables show a VIF less than 2, which is a sign that there is no multicollinearity.

8.4 Analysis and results

We begin this section by investigating the importance of Fama and French's three factors in explaining discount changes for UK investment trusts and US closed-end funds. The results show that the factors in terms of the market, size and the book-to-market effect cannot fully explain discount changes. We then introduce additional factors for the analysis of the excess discount return in terms of momentum, sentiment and expenses.

From the theory, and for consistency with the CAPM and the Fama and French and Carhart models, we expect to find positive values for the coefficients of the market return and size, and negative values for the book-to-market effect and momentum. For consistency with Lee, Shleifer and Thaler (1991), discussed above, we expect sentiment to have a positive coefficient. And following Barclay, Holderness and Pontiff's (1995) view, we expect expenses to have a negative coefficient, though if Malkiel (1977) is correct (see above), the expenses variable will be insignificant.

8.4.1 Fama and French's (1993) three-factor model

Fama and French (1993) show the importance of market risk, small firm and book-to-market risk in explaining cross-sectional differences in stock returns. The famous model of Fama and French (1993) was constructed and implemented on various portfolios of shares to explain various anomalies in financial markets in terms of size. book/market ratio etc. Equation (18) enables us to test the significance of these three factors in relation to the excess discount return. We use the excess discount return because changes in the discount can be interpreted as returns, and the discount was shown in Chapter 6 to be non-stationary.

$$d_t = \alpha + \beta_1(R_{m,t} - R_{f,t}) + \beta_2(R_{s,t} - R_{b,t}) + \beta_3(R_{g,t} - R_{v,t}) + \varepsilon_{s,t} \tag{18}$$

where: d_t is the excess discount return for each sector at time t

$(R_{m,t} - R_{f,t})$ is the excess market return

$(R_{s,t} - R_{b,t})$ is the size factor (small minus big), i.e the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks.

$(R_{g,t} - R_{v,t})$ is the book to market factor (high minus low), i.e the difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio of low-book-to- market stocks

ε_t is the distrurbance term

We test the significance of the estimated coefficients using t-statistics and F-tests. We also use the Durbin/Watson statistic to check for autocorrelation. The estimation results are shown in Table 63 for the UK and Table 64 for the US.

Table 63 Fama and French's three-factor model of the UK excess discount return

The regressions by sector are estimated over the period January 1990 to January 2003 by using monthly observations. The sample covers 90 funds for UK investment trusts. The t-statistic for each factor is displayed in parentheses. In addition, we provide tests of autocorrelation.

				Factor 1	Factor 2	Factor 3
Fund Name by AITC category	D/W	F-Ratio	Adjusted R^2	Market $(R_{m,t} - R_{f,t})$	Size $(R_{s,t} - R_{b,t})$	Book to market $(R_{g,t} - R_{v,t})$
Global Growth	2.07	30.43	0.36	0.26 (7.22)**	0.16 (4.41)**	-0.36 (-2.65)**
Global Growth & Income	2.01	37.52	0.41	0.34 (3.19)**	0.11 (2.30)*	-0.36 (-2.52)**
Global Smaller Companies	1.94	47.17	0.47	0.41 (7.24)**	0.07 (1.78)*	-0.40 (-3.23)**
UK Growth	2.05	40.40	0.43	0.28 (3.01)**	0.15 (3.52)**	-0.41 (-3.05)**
UK Growth & Income	1.97	62.85	0.54	0.44 (9.92)**	0.11 (3.03)**	-0.33 (-2.64)**
UK Smaller Companies	1.97	49.72	0.49	0.41 (5.54)**	0.14 (3.32)**	-0.25 (-1.77)*
North America	2.06	35.43	0.40	0.46 (8.08)**	0.10 (1.79)*	-0.31 (-1.88)*
North America Smaller Companies	2.07	25.75	0.32	0.26 (2.24)*	0.13 (2.54)**	-0.64 (-3.43)**
Far East (Including Japan)	2.06	45.77	0.46	0.39 (4.05)**	0.14 (3.18)**	-0.21 (-1.51)
Far East (Excluding Japan)	2.02	24.33	0.31	0.27 (7.31)**	0.14 (3.07)**	-0.24 (-1.41)
Japanese Smaller Companies	2.03	34.57	0.39	0.30 (3.23)**	0.11 (2.19)*	-0.43 (-2.78)*
Japan	1.95	46.12	0.47	0.40 (5.58)**	0.15 (3.52)**	-0.27 (-1.92)*
Europe	2.03	49.67	0.49	0.36 (3.47)**	0.12 (2.55)*	-0.40 (-2.84)**
Country Specialists – Far East	2.02	38.17	0.42	0.39 (5.89)**	0.15 (3.37)**	-0.45 (-2.41)**
Sector Specialists - Property	2.06	30.78	0.37	0.25 (7.28)**	0.17 (4.70)**	-0.36 (-2.65)**
European Smaller Companies	2.05	34.67	0.39	0.30 (3.23)**	0.11 (2.19)*	-0.42 (-2.73)**
Average	2.02		0.42			

Source : author calculation

* Statistically significant at 5% level

** Statistically significant at 1 % level

From Table 63, we see that on average, the three-factor model can explain 42% of the variations in the UK excess discount return by taking into consideration market, size, and the book-to-market effect. As expected, the coefficients of the market and size effect are positive and statistically significant for all sectors, while the coefficients of the book-to-market effect are negative and significant for most of the 16 sectors. Thus we find that the book-to-market factor does have some explanatory power. It has a significant negative influence on the excess discount return. Our results contradict Pontiff (1997), who found that the book-to-market effect is insignificant and only affects funds with low premiums and discounts.

There is no evidence of autocorrelation in the time-series of 158 monthly observations from January 1990 to January 2003. On average, the D/W statistic is 2.02. The F-ratio is used to test the overall significance of the regression test. Overall, all the sectors show a significant F-ratio which implies that the model as a whole has a significant degree of explanatory power. As an example, Europe has an F-ratio of 49.67, which exceeds the tabulated value of 3.04 at the 5% significance level with degrees of freedom of 2 and 155.

To summarise the UK results, the UK book-to-market effect, measured as the difference between the return on the FTSE 350 Growth index and the return on the FTSE 350 Value index has a negative and statistically significant influence for most of the AITC sectors. As an example, UK Growth and North America Smaller Companies have significant t-statistics of -3.05 and -3.43. The coefficient for the UK size effect, measured as the difference between the return on the FTSE Smaller Companies index and the return on the FTSE 100 index, is statistically significant at the 1% or 5% levels for most of the sectors. For example, Global Growth and UK Growth and Income show significant t-statistics of 4.41 and 3.03. Finally, the market effect is positive and statistically significant for all sectors. Global Growth and UK Growth and Income have significant t-statistics of 7.22 and 9.92. Far East (Excluding Japan) and Japan have t-statistics of 7.31 and 5.58.

Table 64 Fama and French's three-factor model of the US excess discount return

The regressions by sector are estimated over the period January 1990 to January 2003 by using monthly observations. The sample covers 30 funds for US closed-end funds. The t-statistic of each factor is displayed in parentheses. In addition, we provide tests of autocorrelation.

				Factor 1	**Factor 2**	**Factor 3**
Fund Name by CEFA category	D/W	F-Ratio	Adjusted R^2	Market $(R_{m,t} - R_{f,t})$	Size $(R_{s,t} - R_{b,t})$	Book to market $(R_{g,t} - R_{v,t})$
Equity Income	1.99	84.25	0.62	0.62 (11.73)**	0.02 (0.55)	0.00 (0.01)
Global Equity	1.96	67.45	0.56	0.58 (13.20)**	0.14 (2.50)**	0.01 (0.92)
Growth and Income	1.96	67.00	0.48	0.55 (7.53)**	0.09 (0.82)	0.06 (0.29)
Growth Domestic	1.90	117.14	0.69	0.67 (13.2)**	0.22 (2.31)*	0.60 (3.86)**
Average	1.95		0.59			

Source : author calculation

* Statistically significant at 5% level

** Statistically significant at 1 % level

From Table 64, we see that the three-factor model can explain 59% of the variation in the US excess discount returns by taking into consideration market, size, and the book-to-market effect. As expected, the coefficients are statistically significant for the market and size effect for most of the sectors. There is no evidence of autocorrelation in the time-series of 158 observations from January 1990 to January 2003. On average the Durbin/Watson statistic is 1.95. Overall, all the sectors show a significant F-ratio, implying that the model as a whole has explanatory power. As an example, the Growth and Income sector has an F-ratio of 67.00 which exceeds the tabulated value of 3.04 at the 5% significance level with degrees of freedom of 2 and 155.

To summarise the US results, the US book-to-market effect is statistically insignificant for most of the CEFA sectors, except the Growth Domestic sector which has an unexpected positive sign. One possible explanation is that this sector is sensitive to the book-to-market index as it is dominated from growth funds and behaves in an irregular way. The t-statistics of the US size effect are statistically significant at the 1% significance level for Global Equity (2.50) and the Growth Domestic sector (2.31). On the other hand, the market effect is highly statistically significant for all sectors. Equity Income, Global Equity, and Growth and Income display significant t-statistics of 11.73, 13.20, and 7.53 respectively.

8.4.2 Carhart's(1997) four-factor model

Carhart (1997) constructed his four-factor model using Fama and French's (1993) three-factor model plus an additional factor capturing Jegadeesh and Titman's (1993) one-year momentum anomaly. This was motivated by the three-factor model's inability to explain cross-sectional variation in portfolio returns (Fama and French (1993)). Chan, Jegadeesh and Lakonishok (1996) suggest that the momentum anomaly is market inefficiency due to slow reaction to information. However, the effect is robust to time periods (Jegadeesh and Titman (1993), Asness, Liew, and Stevens (1996)).

Equation (19) enables us to test the significance of the four factors for each sector in relation to the excess discount return.

$$d_t = \alpha + \beta_1(R_{m,t} - R_{f,t}) + \beta_2(R_{s,t} - R_{b,t}) + \beta_3(R_{g,t} - R_{v,t}) + \beta_4(RNAV_{fd,t} - RNAV_{se,t}) + \varepsilon_t \tag{19}$$

where: d_t is the excess discount return for each sector at time t

$(R_{m,t} - R_{f,t})$ is the excess market return

$(R_{s,t} - R_{b,t})$ is the size factor (small minus big), i.e the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks.

$(R_{g,t} - R_{v,t})$ is the book to market factor (high minus low), i.e the the difference between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to- market stocks

($RNAV_{fd,t} - RNAV_{se,t}$) is the momentum factor measured as the difference between the fund and sector NAV return

ε_t is the distrurbance term

We test the significance of the estimated coefficients using t-statistics and F-tests. We also use the Durbin/Watson statistic to check for autocorrelation. The estimation results are shown in Table 65 for the UK and Table 66 for the US.

Table 65 Carhart's four-factor model of UK excess discount return

The regressions by sector are estimated over the period January 1990 to January 2003 by using monthly observations. The sample covers 90 funds for UK investment trusts. The t-statistic of each factor is displayed in parentheses. In addition, we provide tests of autocorrelation.

				Factor 1	Factor 2	Factor 3	Factor 4
Name by C category	D/W	F-Ratio	Adjusted R^2	Market $(R_{m,t} - R_{f,t})$	Size $(R_{s,t} - R_{b,t})$	Book to market $(R_{g,t} - R_{v,t})$	Momentum ($RNAV_{fd,t}$ − $RNAV_{se,t}$)
obal Growth	2.05	24.23	0.37	0.28 (3.03)**	0.15 (3.22)**	-0.35 (-2.50)**	-0.56 (-1.18)
bal Growth & Income	2.10	47.02	0.54	0.48 (9.88)**	0.07 (2.03)*	-0.32 (-2.42)**	0.79 (1.23)
obal Smaller Companies	1.98	39.61	0.50	0.45 (9.56)**	0.05 (1.51)	-0.38 (-2.85)**	0.12 (0.39)
JK Growth	2.08	32.70	0.45	0.33 (2.58)**	0.14 (2.75)**	-0.39 (-2.99)**	-1.24 (-1.71)*
K Growth & Income	2.00	50.80	0.56	0.44 (10.58)**	0.09 (2.84)**	-0.24 (-2.01)*	-3.01 (-2.64)**
JK Smaller Companies	2.05	30.77	0.43	0.47 (8.29)**	0.11 (2.03)*	-0.31 (-1.87)*	-0.57 (-1.93)*
orth America	1.96	27.92	0.41	0.47 (8.25)**	0.09 (1.64)	-0.27 (-1.58)	-0.56 (-1.84)*
orth America ller Companies	2.02	32.11	0.45	0.32 (9.23)**	0.12 (3.35)**	-0.41 (-2.89)**	-0.08 (-0.39)
East (Including Japan)	2.07	32.15	0.44	0.37 (9.71)**	0.15 (3.74)**	-0.22 (-1.50)	-1.13 (-0.91)
East (Excluding Japan)	2.11	29.68	0.43	0.39 (3.12)**	0.09 (1.75)*	-0.22 (-1.77)*	-1.21 (-2.72)**
anese Smaller Companies	2.10	19.93	0.33	0.32 (6.23)**	0.18 (3.74)**	-0.33 (-1.88)*	-0.71 (-1.83)*
Japan	2.05	24.23	0.37	0.28 (7.54)**	0.15 (4.17)**	-0.33 (-2.42)**	-0.51 (-1.51)
Europe	2.00	32.65	0.45	0.33 (2.77)**	0.12 (2.62)**	-0.41 (-2.76)**	-0.08 (-0.42)
ntry Specialists - Far East	2.04	21.17	0.34	0.33 (2.60)**	0.16 (2.93)**	-0.38 (-2.09)*	-0.68 (-1.82)*
tor Specialists – Property	1.95	22.09	0.35	0.41 (3.44)**	0.04 (0.55)	-0.26 (-1.51)	-0.88 (-1.77)*
ropean Smaller Companies	2.03	31.57	0.37	0.28 (2.63)**	0.11 (2.20)*	-0.42 (-2.67)**	-0.31 (1.20)
Average	2.04		0.42				

Source : author calculation

* Statistically significant at 5 % level

** Statistically significant at 1% level

Table 65 shows that on average, the four-factor model can explain 42% of the variation in the UK excess discount return by taking into consideration market, size, the book-to-market factor and momentum. As expected, the coefficients for the UK are positive and statistically significant for the market and the size effect. In addition, the coefficients are negative and statistically significant for the book-to-market effect for some of the sectors. The explanatory power is no better than the three-factor model. However, momentum is only negative and statistically significant (at the 5% level in one-tailed tests) in five out of the sixteen sectors. Thus, we have very limited evidence that managerial performance has any influence on the excess discount return in the UK in the long-run. There is no evidence of autocorrelation. On average the Durbin/Watson statistic is 2.04. Overall, all the sectors show a significant F-ratio. As an example, the North America Smaller Companies sector has an F-ratio of 32.11 which exceeds the tabulated value of 2.65 at the 5% significance level with degrees of freedom of 3 and 154.

To summarise the UK results, the book-to-market effect is negative and statistically significant for some of the AITC sectors, but insignificant for most of the sectors. As an example, UK Growth and Global Growth and Income have t-statistics of -2.99 and -2.42. The UK size effect is positive and statistically significant at the 1% or 5% level for most of the sectors. For example, Global Growth and Far East including Japan show significant t-statistics of 3.22 and 3.74. Also, the market effect is positive and highly statistically significant for all sectors at the 1% level. For example, UK Growth and Income and UK Smaller Companies have t-statistics of 10.58 and 8.29. Japan and Sector Specialist Property shows t-statistics for the market effect of 7.54 and 3.44.

Table 66 Carhart's four-factor model of the US excess discount return

The regressions by sector are estimated over the period January 1990 to January 2003 by using monthly observations. The sample covers 30 funds for US closed-end funds. The t-statistic of each factor is displayed in parentheses. In addition, we provide tests of autocorrelation .

				Factor 1	**Factor 2**	**Factor 3**	**Factor 4**
Fund Name by CEFA category	D/W	F-ratio	Adjusted R^2	Market $(R_{m,t} - R_{f,t})$	Size $(R_{s,t} - R_{b,t})$	Book to market $(R_{g,t} - R_{v,t})$	Momentum $(RNAV_{fd,t} - RNAV_{se,t})$
Equity Income	1.93	83.32	0.68	0.65 (12.41)**	0.44 (2.94)**	0.08 (1.05)	0.09 (0.24)
Global Equity	2.02	52.00	0.57	0.61 (8.01)**	0.46 (2.81)**	0.10 (0.93)	0.06 (0.13)
Growth and Income	1.92	77.23	0.66	0.55 (12.20)**	0.48 (2.92)**	0.16 (-2.01)*	0.03 (0.11)
Growth Domestic	1.97	89.41	0.70	0.68 (14.29)**	0.53 (3.32)**	0.12 (1.40)	-0.00 (-0.04)
Average	1.96		0.65				

Source : author calculation

* Statistically significant at 5% significance level

** Statistically significant at 1 % significance level

Table 66 shows that, on average, the four-factor model can explain 65% of the variation in the US excess discount return by taking into consideration the market effect, size, the book-to-market effect and momentum. Thus, there is a small improvement compared with the three-factor model. The coefficients for the US are statistically significant for the market and the size effect for all sectors. There is no autocorrelation. On average the Durbin/Watson statistic is 1.96. Overall, all the sectors show a significant F-ratio. As an example, Growth Domestic sector has an F-ratio of 89.41 which exceeds the tabulated value of 2.65 at the 5% significance level with degrees of freedom of 3 and 154.

However, the US book-to-market effect is statistically insignificant for most of the CEFA sectors. As an example, Global Equity has an insignificant t-statistic of 0.93. The t-statistic for the US size effect is statistically significant at the 1% significance level for Global Equity 2.81 and Growth Domestic sector 3.32. Finally, the market effect is highly statistically significant for all sectors. Equity Income, Global Equity and Growth and Income have significant t-statistics of 12.41, 8.01, and 12.20. However, the momentum variable is insignificant in all four sectors.

8.4.3 Guirguis six-factor model (I)

In this section we extend the four-factor model of Carhart (1997) by adding sentiment and expenses, as defined earlier. The purpose is to strengthen the four-factor model and finally verify which factors are statistically significant and able to explain the fluctuations and persistence of the excess discount return over the longer term.

Equation (20) enables us to test the significance of the six factors in relation to the excess discount return.

$$
\begin{aligned}
d_t = \alpha + \beta_1(R_{m,t} - R_{f,t}) + \beta_2(R_{s,t} - R_{b,t}) + \beta_3(R_{g,t} - R_{v,t}) + \beta_4(RNAV_{fd,t} - RNAV_{se,t}) + \\
\beta_5(Flow_t - Flow_{t-1}) + \beta_6 Exp_t + \varepsilon_t
\end{aligned}
\tag{20}
$$

where: d_t is the excess discount return for each sector at time t

$(R_{m,t} - R_{f,t})$ is the excess market return

$(R_{s,t} - R_{b,t})$ is the size factor (small minus big), i.e the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks.

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$(R_{g,t} - R_{v,t})$ is the book to market factor (high minus low), ie the difference between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to- market stocks.

$(RNAV_{fd,t} - RNAV_{se,t})$ is the momentum factor

$(Flow_t - Flow_{t-1})$ is the difference of retail flows by sector used as a proxy for investor sentiment

Exp_t is the expense factor.

ε_t is the disturbance term

As before, we test the significance of the estimated coefficients using t-statistics and F-tests. We also use the Durbin/Watson statistic to check for autocorrelation. The estimated results are shown in Table 67 for the UK and Table 68 for the US.

Table 67 Guirguis six-factor model of the UK excess discount return

Equation (21) measures the sensitivity of the excess discount related to the market, size, book- to-market factor, momentum, sentiment and expenses. The regressions by sector are estimated over the period January 1990 to January 2003 by using monthly observations. The sample covers 90 funds for UK investment trusts. The coefficient and t-statistic of each factor is displayed in parenthesis. In addition, we provide tests of autocorrelation.

				Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
nd e by TC gory	D/W	F/ratio	Adj R^2	Market $(R_{m,t} - R_{f,t})$	Size $(R_{s,t} - R_{b,t})$	Book to market $(R_{g,t} - R_{v,t})$	Momentum (RNAV$_{fd,t}$ – RNAV$_{se,t}$)	Sentiment $(Flow_t - Flow_{t-1})$	Expense (Exp_t)
bal wth	2.12	17.25	0.39	0.28 (3.98) **	0.13 (2.48) **	-0.01 (-0.57)	-0.26 (-1.25)	1.49 (3.20)**	0.59 (1.38)
bal th & me	1.93	50.24	0.66	0.43 (10.49) **	0.12 (3.50) **	-0.14 (-1.23)	0.33 (0.66)	0.87 (3.54)**	-0.25 (-1.06)
bal ller anies	1.96	42.83	0.62	0.40 (7.91)**	0.11 (3.16)**	-0.09 (-0.68)	0.60 (-1.96)*	0.82 (7.50)**	-0.04 (-0.14)
(wth	2.04	60.65	0.70	0.58 (12.90)**	0.06 (2.11) *	-0.15 (-1.41)	-2.76 (-6.89)**	0.88 (3.18)**	0.08 (0.46)
(th &	1.97	57.98	0.69	0.45 (11.31)**	0.10 (3.22)**	-0.14 (-1.31)	-2.43 (-2.54)**	0.89 (6.60)**	0.68 (1.84)*

ome									
K aller panies	1.99	45.06	0.63	0.40 (9.90)**	0.09 (2.83)**	-0.11 (-0.90)	-0.22 (-0.49)	1.02 (5.81)**	-0.04 (-0.09)
rth erica	2.02	72.44	0.73	0.42 (9.42)**	0.13 (3.52)**	-0.14 (-1.07)	0.02 (0.16)	0.98 (13.41)**	0.03 (0.06)
rth erica aller panies	1.97	70.10	0.73	0.43 (10.61)**	0.11 (3.82)**	-0.17 (-1.42)	-1.02 (-1.47)	0.97 (11.60)**	-0.11 (-0.55)
East uding pan)	2.05	65.31	0.71	0.45 (11.27)**	0.13 (4.18)**	-0.18 (-1.42)	-1.44 (-1.53)	0.68 (6.52)**	-0.49 (-2.45)**
East luding pan)	2.06	62.34	0.70	0.37 (4.78)**	0.12 (3.11)**	-0.15 (-1.30)	-1.20 (-3.57)**	0.92 (7.97)**	-0.55 (-1.73)*
inese aller panies	1.97	87.79	0.77	0.44 (10.13)**	0.10 (3.07)**	-0.15 (-1.33)	0.15 (1.05)	0.93 (12.98)**	1.13 (2.29)**
pan	1.94	92.07	0.78	0.46 (11.41)**	0.12 (3.98)**	-0.19 (-1.82)*	0.17 (1.42)	0.94 (14.58)**	-0.59 (-2.71)*
rope	2.02	49.04	0.65	0.49 (11.26)**	0.10 (3.12)**	-0.34 (-2.81)**	0.15 (0.87)	0.32 (3.89)**	-0.34 (-0.98)
intry ialists r East	1.97	41.03	0.61	0.39 (9.67)**	0.12 (3.33)**	-0.17 (-1.23)	-0.27 (-0.91)	0.78 (8.89)**	-0.21 (-0.64)
ctor ialists operty	1.97	95.97	0.79	0.43 (9.82)**	0.11 (3.66)**	-0.20 (-1.80)*	-0.15 (-0.58)	1.02 (14.78)**	0.14 (0.87)
opean aller panies	1.96	53.41	0.61	0.39 (9.67)**	0.12 (3.33)**	-0.17 (-1.23)	-0.27 (-0.91)	0.78 (8.89)**	-0.21 (-0.64)
erage	2.00		0.67						

Source : author calculation

* Statistically significant at 5 % significance level

** Statistically significant at 1% significance level

Table 67 shows that, on average, the six-factor model can explain 67% of the variation in the excess discount return by taking into consideration market, size, book-to- market effect, momentum, sentiment and expenses. The coefficients for the UK are statistically significant for the market, the size effect and sentiment. The book-to-market effect, momentum and expenses have t-statistics that are insignificant or negatively significant. In more detail, momentum is negative and statistically significant (at the 1% and 5% level in one tailed tests) in four out of the sixteen sectors. Thus, we have limited evidence of managerial performance persistence over the long-run. In addition, our results contradict the hypothesis proposed by Barclay, Holderness and Pontiff's (1995) view that a possible explanation of the discount is that as managers try to protect their private benefits, expenses increase over the long term and have an effect on the discount. There is no autocorrelation in the time-series of our 158 monthly observations from January 1990 to January 2003. On average the Durbin/Watson statistic is 2.00. Overall, all the sectors show a significant F-ratio. As an example, Japan sector has an F-ratio of 92.07 which exceeds the tabular value of F =2.27 at the 5% significance level with degrees of freedom of 5 and 152.

To summarise the UK results, the book-to-market effect and expenses are statistically insignificant for most of the AITC sectors. For example, Global Smaller Companies, UK Smaller Companies and North America Smaller Companies have insignificant t-statistics for the book-to-market effect of -0.68, -0.90, and -1.42. In addition, the same sectors have insignificant t-statistics for expenses of -0.14, -0.09, and -0.55. The t-statistics for the UK size effect and sentiment are statistically significant at the 1% level for most of the sectors. For example, North America Smaller Companies, Japanese Smaller Companies, Japan and Country Specialist Far East have significant t-statistics for the size effect of 3.82, 3.07, 3.98 and 3.33. The same sectors display a statistically significant sentiment effect of with t-statistics equal to 11.60, 12.98, 14.58 and 8.89 respectively.

As in the other models, the market effect is positive and highly statistically significant for all sectors. UK Growth, Far East Including Japan, and European Smaller Companies have significant t-statistics of 12.90, 11.27 and 9.67.

Table 68 Guirguis six-factor model (I) of the US excess discount return

The regressions by sector are estimated over the period January 1990 to January 2003 by using monthly observations. The sample covers 30 funds for US closed-end funds. The t-statistic of each factor is displayed in parentheses. In addition, we provide tests of autocorrelation.

Fund Name by CEFA Category	D/W	F/Ratio	Adj R^2	Factor 1 Market $(R_{m,t} - R_{f,t})$	Factor 2 Size $(R_{s,t} - R_{b,t})$	Factor 3 Book to market $(R_{g,t} - R_{v,t})$	Factor 4 Momentum $(RNAV_{fd,t} - RNAV_{se,t})$	Factor 5 Sentiment $(Flow_t - Flow_{t-1})$	Factor 6 Expense (Exp_t)
quity ncome	1.98	43.14	0.62	0.40 (7.95)**	0.11 (3.26)**	-0.09 (-0.69)	0.60 (1.98)*	0.83 (7.53)**	-0.05 (-0.20)
lobal quity	2.00	77.15	0.75	0.43 (9.70)**	0.11 (3.32)**	-0.17 (-1.44)	-0.17 (-0.61)	0.92 (8.80)**	0.18 (0.91)
rowth nd ncome	2.00	56.53	0.68	0.44 (11.19)**	0.10 (3.38)**	-0.20 (-2.48)**	-2.60 (-3.04)**	0.81 (6.01)**	0.61 (1.60)
rowth omesti	2.02	46.28	0.64	0.40 (9.86)**	0.09 (2.77)**	-0.09 (-0.72)	-0.22 (-0.50)	1.02 (6.06)**	0.05 (0.11)
verage	2.00		0.66						

Source : author calculation

* Statistically significant at 5% significance level

** Statistically significant at 1 % significance level

On average, for the US the six-factor model can explain 66 % of the variation in the excess discount return by taking into consideration market, size, book-to-market effect, momentum, sentiment and expenses. The coefficients for the US are statistically significant for the market and the size effect for all sectors. There is no autocorrelation as on average the Durbin/Watson statistic is 2.00. Overall, all the sectors show a significant F-ratio. As an example, the Global Equity sector has an F-ratio of 77.15 which exceeds the tabulated value of 2.27 at the 5% significance level with degrees of freedom of 5 and 152. The momentum variable is significant in just two of the four sectors and the expenses variable is insignificant in all sectors. The sentiment factor is highly significant in all four sectors. In more detail, Equity

Income, Global Equity, Growth and Income and Growth Domestic category have t-statistics of 7.53, 8.80, 6.01 and 6.06 respectively.

The US book-to-market effect is statistically insignificant for most of the CEFA sectors. As an example, Global Equity has an insignificant t-statistic of -1.44. The US size effect is statistically significant at the 1% level for all sectors. Global Equity, Equity Income and Growth and Income have t-statistics of 3.32, 3.26 and 3.28. Similarly, the market effect is highly statistically significant for all sectors. Equity Income, Global Equity and Growth and Income have t-statistics of 7.95, 9.70, and 11.19 respectively.

8.4.4 Guirguis six-factor model (II)

In this section, we amend the six-factor model by changing the sentiment factor from retail flows to an investor sentiment index. The only behavioural data available was for the US market. Investors are said to be confident when the news about the future is good and stock prices are relatively high. According to the Yale Management School, a sample of US individual investors from 1989 to 1998 was purchased from W.S.Ponton Inc, a list of "High-Grade Multi-Investors." Starting in 1999, the sample was a random sample of high-income Americans purchased from Survey Sampling, Inc. We use the US investor sentiment index constructed by the Yale School of Management as it is the most suitable one to represent investor sentiment in the US market. It is measured as the percentage of respondents who support a particular view. It is derived from the responses to a single question that has been asked consistently through time since 1989 to a consistent sample of respondents.

Equation (21) enables us to test the significance of these six factors in relation to excess discount return.

$$d_t = \alpha + \beta_1(R_{i,t} - R_{f,t}) + \beta_2(R_{s,t} - R_{b,t}) + \beta_3(R_{g,t} - R_{v,t}) + \beta_4(RNAV_{fd,t} - RNAV_{se,t}) + \beta_5(ISI_t) + \beta_6 Exp_t + \varepsilon_t \qquad (21)$$

where: d_t is the excess discount return of each sector at time t

$(R_{m,t} - R_{f,t})$ is the excess market return

$(R_{s,t} - R_{b,t})$ is the size factor (small minus big), i.e the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks.

$(R_{g,t} - R_{v,t})$ is the book to market factor (high minus low), i.e the difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio of low-book-to- market stocks

$(RNAV_{fd,t} - RNAV_{se,t})$ is the momentum factor

(ISI_t) is the investor sentiment index obtained from the Yale School of Management

(Exp_t) is the expense factor.

ε_t is the distrurbance term

As usual, we test the significance of the estimated coefficients using t-statistics and F-tests. We also use Durbin/Watson statistic to check for autocorrelation.

Table 69 Guirguis six-factor model (II) of US excess discount return

The regressions by sector are estimated over the period October 1996 to January 2003 by using monthly observations. The sample covers 30 funds for US Closed-end funds. The t-statistic of each factor is displayed in parentheses. In addition, we provide tests of autocorrelation.

Name by CEFA category	D/W	F/ratio	Adj R^2	Factor 1 Market $(R_{m,t} - R_{f,t})$	Factor 2 Size $(R_{s,t} - R_{b,t})$	Factor 3 Book to market $(R_{g,t} - R_{v,t})$	Factor 4 Momentum $(RNAV_{fd,t} - RNAV_{se,t})$	Factor 5 Sentiment (ISI_t)	Factor 6 Expense (Exp_t)
e	1.97	2.83	0.32	0.06 (0.66)	-0.11 (-0.98)	-0.22 (-0.56)	-0.49 (-8.35)**	0.63 (2.37)**	3.75 (1.73)*
l Equity	2.07	2.38	0.26	0.25 (2.28)*	-0.13 (-0.99)	0.12 (0.55)	-0.20 (-2.08)*	0.03 (0.39)	2.37 (1.44)
h and ie	2.04	3.18	0.36	0.35 (2.65)**	0.13 (1.46)	-0.21 (-1.09)	-3.10 (-1.36)	0.29 (1.93)*	-1.19 (-0.87)
h stic	2.03	3.50	0.39	0.33 (3.52)**	-0.04 (-0.43)	-0.19 (-1.05)	-1.26 (-1.63)	0.21 (1.34)	1.11 (0.52)
ge	2.03		0.33						

Source : author calculation

* Statistically significant at 5 % significance level

** Statistically significant at 1% significance level

Table 69 shows that, on average, the six-factor model can explain just 33% of the variation in the excess discount return by taking into consideration market effect, size, book-to-market, momentum, sentiment and expenses. This is not directly comparable with the previous models because of the much smaller sample size. The coefficients for US market are statistically significant for 3 out of four sectors at the 1% and 5% levels in one-tailed tests. There is no autocorrelation in the time-series of our 26 monthly observations from October 1996 to January 2003. On average the Durbin/Watson statistic is 2.03. Overall, all the sectors show a significant F-ratio. As an example, the Equity Income sector has an F-ratio of 2.83 which exceeds the tabulated value of F 2.27 at the 5% significance level with degrees of freedom of 5 and 152. The US size, book-to-market effect, momentum and expenses are statistically insignificant for most of the sectors of CEFA.

On the other hand, the results for the sentiment factor are mixed. In more detail, Equity Income, Growth and Income show a statistically significant sentiment effect, with t-statistics of 2.37 and 1.93 respectively. A possible explanation of this mixed picture is that the sample is small and surveys were initially conducted at six-month intervals from October 1996 to April 2001. Then surveys were conducted at a monthly basis. Our sample includes only 26 observations, and this small sample reduces the explanatory power of the model. Thus, a possible area of future research is to include a larger sample measured on a daily basis and try to isolate the interaction of arbitrageurs and noise traders to identify shifts in the discounts of closed end funds.

8.5 Conclusion

In this chapter we have attempted to extend the three-factor model of Fama and French (1993) and the four-factor model of Carhart (1997) in order to explain the excess discount return. We added two more factors to the four risk measures included in the Carhart model, namely sentiment and expenses.

On average, the six-factor model can explain 67% of the variation in the excess discount return in the UK market by taking into consideration market, size, book-to-market effect, momentum, sentiment and expenses. In contrast, Fama and French's (1993) three-factor and four-factor model can explain only 42% of the variation of the excess discount return. The coefficients of the six-factor model for the UK are statistically significant for the market, size effect and sentiment, but mainly statistically insignificant for the book-to-market effect, momentum and expenses.

For the US market, on average, the six-factor model can explain 66 % of the variation of the excess discount return by taking into consideration the market effect, size, book-to-market, momentum, sentiment and expenses. In contrast, Fama and French (1993), three-factor model can explain 59% of the excess discount return variation and Carhart's (1997) four-factor model can explain 65% of the variation.

The other version of my six-factor model applied in the US market can explain only 33% of the variation in the excess discount returns by changing the sentiment factor from retail flows to an investor sentiment index. The only behavioural data available was for the US market from the Yale Management School, but our sample includes only 26 observations, so reducing the explanatory power of the model. Thus, a possible area of future research is to include a larger sample measured on a daily basis and try to isolate the interaction of arbitrageurs and noise traders to identify shifts in the discount returns of closed end funds.

Chapter 9

Conclusion

9.1 Attempts to reduce the discount

The persistence of the discount is a problem that may discourage and confuse investors. They may be uncertain whether to invest in closed-end funds or alternative investments. After conducting our study we find that the excess discount return is influenced by several factors, the most important being:

- Investor sentiment
- Size factor
- Market factor

Although the above factors are important, the excess discount return on some funds is also influenced negatively by the book-to-market value and momentum. While large discounts may provide an investment opportunity for arbitrageurs, the widening and persistence of discounts is likely to discourage investors. Arbitrageurs only become active during open ending as the share price increases and the discount disappears. Nowadays, a number of potential solutions have been suggested to eliminate the discount. The variety of approaches can be interpreted as a sign that no-one knows how to solve this problem fully. The proposed measures are as follows:

- Share buybacks
- Treasury shares
- Redeemable shares
- Continuation votes

9.1.1 Share buybacks

Share buybacks are an investment scheme that aims to repurchase or buy back the shares of the fund. It is a very effective way for managers to increase their company's share price when they expect a rising or bullish market. Without buybacks a lot of funds will continue to be on a wider discount and they would have disappeared. With this technique, fund managers try to keep the discount within certain limits. However, according to Close Wins professional brokers “Edinburgh Dragon and ISIS UK Select have both announced discount targets in the past which were not met. So the question is how effective is this plan.” (Close Wins, 2004, p.11). There are several reasons why trusts may wish to buy back shares. The main ones are listed in a report for the AITC by Kershaw (2002). They include:

- Discount reduction
- Reduction in discount volatility
- Balancing supply and demand

We use the results of Andy et al (2004) to present their findings concerning buying back shares and propose further study of this effect. Kershaw “states that trusts which use share buybacks have lower discounts than those which do not”. (Kershaw, 2002, appendix 6). On the other hand, Andy et al (2004) found that any discount reduction through buying back shares is weak, but there are significant differences between sectors. They looked at average discounts within sectors to compare companies with share buyback schemes with those that do not have such schemes. Their data were split over the AITC sector classifications (e.g. Global Growth, UK Growth, UK Growth and Income, etc), and included:

- Date of the buyback
- Method of buyback (e.g. repurchase or tender)
- Price paid
- Percentage of outstanding shares bought back

Their data was supplied for the two-year period starting 1 January 1999 and ending on 31 December 2000. The start date of 1 January 1999 was chosen as there were very few buybacks before that date. They found that over short periods of time the average discount of investment trusts with buybacks was less volatile compared to those without. However, over the whole period of investigation, only within the Global and UK Growth sectors were trust discounts with buybacks less volatile. They proposed that future work should investigate whether these results are a function of the incidence of the buybacks or simply an observation that these sectors had a larger number of trusts with buybacks than without buybacks.

Further, they carried out an event study of the discount in various sectors. They found that the Global Growth sector showed a small reduction of the discount after a share buyback, limited to approximately 14 days. This empirical finding supports the argument that one of the benefits of buybacks is to offset and reduce temporary imbalances in supply and demand.

9.1.2 Treasury shares

In 2003, companies were able for the first time to hold shares in treasury. Thus instead of having to cancel shares that are repurchased through share buybacks a company can sell these shares back to the market at a later date. The key potential benefits of treasury shares are as follows:

- Investment trusts can increase control over their share capital structure by buying shares temporarily into treasury in order to sell them later instead of buying then cancelling them.
- Investment trusts could sell treasury shares without the imposition of stamp duty.
- Investment trusts have the ability to raise funds for new investment opportunities other than through gearing or the sales of other investments. Treasury shares allow the equity base of the trust to be changed as easily as its debt level, which gives greater operational flexibility in the way managers use their investments.

The key features of treasury shares are the following:

- Treasury shares permit an investment trust, having carried out a share buy-back, to hold up to 10% of its share capital in treasury.

- An investment trust can hold treasury shares for as long as they wish or cancel them at a later date. Moreover, it can sell them for cash at a price generally no less than 10% below the mid-market price.
- For regulatory and management accounting purposes, shares acquired into treasury are treated as tax free on any profits. Finally, no stamp duty is payable by investors buying treasury shares

According to Close Wins (2004), only three funds have taken the decisions, to re-sell treasury shares at a discount (Close Finsbury Eurotech, Finsbury Growth and Scottish Value). According to Close Wins, fund managers should be cautious towards treasury shares until there is enough evidence of their pros and cons. For example, according to them, "by offering treasury shares, will they make a fund more liquid as far as most investors are concerned? Will they have the ability to exit the stock when they wish? Or will treasury shares act as an overhang depressing a company's share price".(Close Wins, 2004, p12).

9.1.3 Redeemable shares

According to Close Wins (2004), a number of closed-end funds have adopted a measure where shares can be redeemed periodically. Many of these are domiciled in the Channel Islands due to the greater flexibility that is available on the distribution of capital. According to them "two funds, Martin Currie European and Henderson European Micro, have stated that they will offer shareholders an exit at NAV if they do not outperform a target return over a specified period of time. For MC European, this is an on-going commitment to be measured over rolling three year periods, whereas for Henderson European Micro it is a one-off target to 30 June 2004." (Close Wins, 2004, p.13)

9.1.4 Continuation votes

According to Close Wins (2004), several investment trusts have annual votes, including Edinburgh US Tracker, Merrill Lynch World Mining and 3i European Technology. This gives a hope to investors that the board in the future will review the fund. On the other hand, several funds prefer to use the right of continuation vote if their shares trade at a wider discount. In some cases, this is measured over the whole year.

9.2 Split capital investment trusts

Split capital investment trusts were first introduced in 1965. The first split, Dualvest, was launched in May 1965. Splits are collective companies with a portfolio of investments just like conventional trusts but issue two or more different types of share classes. Income shareholders are entitled to all the income generated from the investments held by the trust during its life, whilst capital shareholders receive, at wind-up, the capital value of the trust, including any capital growth achieved by the trust over its life. A more aggressive structure was created by the inclusion of zero dividend preference shares (ZDPs). This was the first time ZDPs had been issued by an investment trust. Zero shares pay a pre-determined capital sum when the trust is wound up before any distribution of capital can be made to other lower-ranking shareholders. They have no entitlement to income, so there is no liability to income tax for the investor.

According to AITC, an important concept to understand is limited life. At least one class of share in a split is likely to have a limited life. This means that at a specified date the trust will need to realise a specific value from the underlying investments to distribute to specific shareholders. If the whole trust has a limited life, this means that the company will be terminated at the specified date. This includes realising its assets, paying off holders of loan capital (if any) and other creditors, and distributing the remaining assets among shareholders according to the correct order of priority and the various share class entitlements. For example, if the company has prior charges such as bank loans, these rank ahead of equity shareholders. Then ZDP shares are paid next. They offer a predetermined capital return at a specific date dependent on sufficient assets being available at wind-up. The next category of shares paid to investors is income shares. They are concerned with an income flow with an entitlement to a predetermined capital return on wind-up. The following class of shares to be repaid is ordinary income shares. They include a combination of the potential for high and rising income and potential for capital growth at a higher relative risk to other classes of share. Finally, capital shares are repaid to investors. Capital shares are the lowest ranking security in a split capital company. Usually, capital shareholders are entitled to all the assets remaining once the prior charges have been repaid in full. This makes them the highest risk security, which means that they can offer a high reward.

This bias towards income rather than capital has made it difficult to persuade investors to invest in new issues of capital shares. On the other hand, new trends in split capital investment trusts such as the barbell approach have decreased the popularity of capital shares trusts. The fund manager simply divides the assets of the company into two parts. The first part is invested in a portfolio of very high yielding securities, such as corporate bonds or income shares of other split capital investment trusts. The other part of the portfolio is invested in a low yielding growth portfolio to provide the asset growth for the company.

Further, investment trusts are able to borrow money to invest in shares of other companies so that the returns on the additional investments will exceed the costs of borrowing. This is known as financial gearing. If a trust gears up, the market rises and the return exceeds the costs of borrowing, the return of the investor will be increased. However, if the opposite happens, then losses incurred by the investor may be substantial due to the effect of gearing. If a trust has financial gearing, it is important to establish what the characteristics of the borrowings are, such as the costs and the type of borrowing. According to the Financial Services Authority (FSA, 2002), there are 134 Splits in issue, having a combined market capitalisation of £13.2 billion at 31 March 2002. Between 1990 and 1999, 55 Splits were launched on the LSE and between 1999 and 2001, 34 were launched. According to the Financial Services Authority (FSA, 2002), the recent problems in the Splits sector have been widely covered and are well known. A number of Splits have invested a portion of their portfolio in the shares of other Splits. Some have also borrowed funds from banks for leverage. According to FSA (2002), Table 70 illustrates a number of Splits that have invested a portion of their portfolio in the shares of other Splits.

Table 70 Number of Splits that have invested a portion of their portfolio in the shares of other splits

	31 March 2002	
	Number	Market capitalisation (£ million)
Splits in issue	134	13,200
Splits with no cross holdings	51	6,300
Splits with cross holdings	83	6,900
% of portfolio held in other Splits	32	3,200
Under 20 %	24	2,100
21 – 40%	16	1,000
41 – 70%	11	600
Over 70%		

Source: Financial Services Authority, 2002, p5

According to Table 70, reported under the FSA, "16 splits have cross holdings in other splits of between 21% and 40%. 11 have cross holdings between the range of 41% and 70%. Of these, 10 have total borrowings of 74% of gross assets. So, many of these splits have both high gearing and high cross holdings, which in some cases are holdings in splits which have the same characteristics. This exposes investors to exponential risk as the gearing effect is multiplied. These factors have caused a dramatic fall in the price of some Splits over the last 3 years . . . ." (FSA, 2002, p 5).

Table 71 Market changes during period 31 March 1999 to 31 March 2002

FTSE 100	-16.2%
FTSE All – Share	-11.7%
Example of share price movements of Splits	
No cross holdings	-39.1%
Cross holdings of	
Under 20%	-82.21%
21-40%	-88.23%
41-70%	-97.85%
Over 70%	-97.97%

Source: Financial Services Authority, 2002, p 6

According to FSA during 2001, a number of Splits announced that they had breached their banking agreements. These are summarised in Table 72.

Table 72 Splits announced that they have breached their banking covenants

Announcement	**Number of Splits**
Dividend suspensions	11
Dividend cuts	7
Restructurings	5
Debt repayment	12
Conversion of bank debt and new money injected by manager	1
Insolvency	1

Source: Financial Services Authority, 2002, p 6

When a new split is launched it is required to publish a prospectus that is in accordance with the UK authority rules. It is also important for firms who advice to explain clearly the risks that investor will face.

Another problem faced by split investment trusts is the use of treasury shares. It is more difficult for split capital investment trusts than conventional trusts to use treasury shares due to the various share classes and their interaction. On the other hand, a company may not hold more than 10% of the value of its share capital in treasury. If the company has more than one class of share capital, the 10% limit is applied to each share class separately.

9.3 Opportunities for future research

The selected research topic is very wide and there are many sub-areas in which future research could be directed. Here we outline some of the areas for future research.

Alternative approach to measure performance persistence

- It would be interesting to divide the funds into subgroups measured by their market capitalisation. Then by using a rolling methodology to test for significance in ranking. For example, Volkman and Wohar (1995) considered 332 funds. They found a significantly positive relationship between the performance of a fund and deciles that are composed of medium sized funds. They also found negative persistence in performance for both small and large funds.

Performance measurement of "dead" funds

- The average discount of the funds under management is significantly higher than the discount of the industry. The question that arises is whether the management group tends to affect the discount or whether other factors can explain this persistence. The evidence suggests that future research should focus on the management group and analyse the factors and problems that lead to open-ending. A possibility would be to investigate the management contracts and the management ownership structure. The performance of the sample of "dead" funds suggests that funds disappear after periods of poor NAV performance and wide discounts. At open-ending, we find evidence that share prices increase toward NAV. Future research could also attempt to identify the benchmark that managers actually aim to beat when they are in a critical position, for example during a merger.

Split capital trusts and asymmetric information

- The present study has omitted split capital trusts as they invest in more than one share. Future research could develop and employ better models for transforming qualitative data, such as asymmetric information, into quantitative data. Other problems were related to the governance of Splits. For example, one individual was responsible for the board of 15 different splits. Another problem faced by split investment trusts is the use of treasury shares. It is more difficult for split capital investment trusts than conventional trusts to use treasury shares due to the various share classes and their interaction. On the other hand, a company may not hold more than 10% of the value of its share capital in treasury. If the company has more than one class of share capital, the 10% limit is applied to each share class separately.

Interaction of the various mechanisms to eliminate the discount

- Another area that needs deeper investigation is the interaction of share buybacks, treasury shares, redeemable shares, and continuation votes (all discussed above) throughout the life of the funds. What effects will these mechanisms have in each sector by AITC or CEFA?

Investor sentiment indices

- Investor sentiment indices are a relatively new branch in behavioural finance that measure psychological factors related to investors' attitudes towards the stock market. This area of research covers many problems. For example, how to find an accurate index that incorporates investor surveys and is not out of date by the time it is released. In the UK, we were not able to find a representative index that measures sentiment or the mood of investors. Of course, fundamentals are still important, such as rising productivity, investment activity, and rising industrial production but they are not closely related to investor sentiment.

9.4 Concluding remarks

Investment trusts or closed-end funds are known and described by the existence of the discount. We have seen that closed-end fund shares are issued at up to a 10 per cent premium to NAV. This premium represents the underwriting fees and start-up costs. Within months, the shares trade at a discount which persists and fluctuates. Upon termination of the fund, share prices rise and discounts disappear.

The main aims of the empirical studies presented in the thesis were (a) to use multifactor models to investigate managerial performance persistence in the UK investment trust industry and the US closed-end fund industry and (b) to investigate the determinants of the excess discount return in the UK and US.

To these-ends, the main purpose of Chapter 7 was to test whether management performance is persistent among closed-end funds. By applying Fama and French's three factor-model we came to the conclusion that for the UK and the US the results are mixed and therefore managerial performance is a factor that needs more investigation. According to the extended Fama and French model that incorporates market timing ability we again found mixed results. Finally, by calculating rank correlation coefficient of performance persistence by using deciles over one, three, five and nine year periods, we found no evidence of performance persistence in the UK but weak evidence of performance persistence in the US. Our findings for the US market are consistent with Grinblatt and Titman (1992), Elton, Gruber, Das and Hlavha (1993), and Elton, Gruber, Das, and Blake (1996a), who document mutual fund return predictability over longer periods of five to ten years.

The main purpose of Chapter 8, was to extend the multifactor model of Fama and French's (1993) three-factor model and the model of Carhart (1997) in order to explain the excess discount return in the UK and the US, using the Guirguis six-factor model. On average, the Guirguis six-factor model can explain 67% of the variation of the excess discount return in the UK market by taking into consideration the market effect, size, the book-to-market effect, momentum, sentiment and expenses. In contrast, Fama and French's (1993) three-factor and Carhart's four-factor model can explain only 42% of the variation of the excess discount return.

Furthermore, the six-factor model can explain 66 % of the variation of the excess discount returns in the US market. In contrast, Fama and French's (1993), three-factor model can explain 59% of the US excess discount return variation and Carhart's (1997) four-factor model can explain 65% of the variation.

The other version of the Guirguis six-factor model, with an investor sentiment index used as a proxy for sentiment, was applied to the US market (but with a reduced sample size). This model was able to explain only 33 % of the variation of the excess discount returns. A possible explanation of this reduction in explanatory power is that the sample is small and the surveys were initially conducted from Yale Management School at six-month intervals from October 1996 to August 2001. Then surveys were conducted on a monthly basis. Our sample therefore includes only 26 observations. Thus, a possible area of future research is to include a larger sample measured on a daily basis and try to isolate the interaction of arbitrageurs and noise traders to identify shifts in the discounts of closed end funds.

Our study might be affected by data limitations and therefore the results need to be interpreted with caution. For example, we report a small sample of US funds by sector and they do not include any dead funds, so maybe there is survivorship bias. Thomson

Investment View does not provide any data for US dead funds. As a result, further research could incorporate the US dead funds by sector.

Appendix A

Table 73 Details the various funds of UK trusts and their management group

AITC Category	Management Group
Global Growth	
ALLIANCE TRUST	Independent
ANGLO & OVERSEAS	Morgan Grenfell
BANKERS INV.TRUST	Edinburgh Fund Managers
BRITISH EMPIRE SECS	Ivory&Sime
BRUNNER INV.TST	Kleinwort Benson
FOREIGN & COLONIAL	Foreign & Colonial
GARTMORE GLOBAL TST	Gartmore
HENDERSON ELEC.&GEN	Henderson Investors
JUPITER PRIMADONA GROWTH	Jupiter
LAW DEBENTURE	Independent
LONDON & ST.LAWRENCE	Independent
MAJEDIE INVS.	Independent
MONKS INV.TRUST	Independent
PERSONAL ASSETS	Independent
RIT CAPITAL PARTNERS	Rothschild (J) Capital
SCOTTISH AMERICAN	Stewart Ivory
SCOTTISH INV.	Independent
SCOTTISH MORTGAGE	Baillie Gifford
SECOND ALLIANCE	Independent
TRIBUNE TRUST	Independent
WITAN INV.TRUST	Henderson Investors
JUP.INTL.GREEN ORD. DELISTED 19/03/01	Jupiter
MCIT CAPITAL. DELISTED 25/06/98	Martin Currie
BARING STRATTON UNITISED 05/05/98	Baring Private
Turkey Trust Delisted 25/11/99	Henderson Investors
TR Technology Delisted 22/10/99	Henderson Investors
Global Growth & Income	
BRITISH ASSETS	Ivory & Sime
MURRAY INTL.	Murray Johnstone
Global Smaller Companies	
F&C SMALLER COS.	Foreign & Colonial
HENDERSON STRATA	Henderson Investors
GENERAL CONS.CAP. DELISTED 06/01/98	Henderson Investors
HENDERSON AMERICAN CAP. DELISTED 26/02/99	Henderson Investors
Gartmore American Small Secs	Gartmore
UK Growth	
ALBANY INV.TRUST	Independent
CAPITAL GEARING TST.	Independent

EDINBURGH INV.TRUST	Edinburgh Fund Managers
EDINBURGH UK TRACKER	Edinburgh Fund Managers
FINSBURY GROWTH TST.	Finsbury
FLEMING MERCANTILE	Fleming
HANSA TRUST	Independent
JPMF.CLAVERHOUSE	
JPMF MID CAP IT.	
KEYSTONE IT.	
UK SELECT TRUST	
Group Trust Delisted 17/08/01	Legal and General Ventures
British Inv.Trust dead 19/05/97	Edinburgh Fund Managers
Brit.AM& General	Ivory & Sime
Sphere Inc & Resi.Cap	Glasgow Investment Managers
Radiotrust	Lombard Odier
UK Growth & Income	
CITY OF LONDON	Independent
DUNEDIN INC.GROWTH	Edinburgh Fund Managers
LOWLAND INV.	Henderson Investors
MURRAY INCOME	Murray Johnstone
SECURITIES TST.	OLIM
SHIRES INCOME TST.	Glasgow Investment Managers
TEMPLE BAR	Guinness Flight
VALUE & INCOME	OLIM
JUP.EXTRA INC.ORD. DELISTED 28/09/00	Jupiter
FLEM.INTL. DELISTED 31/10/96	Fleming
Gartmore Value	Gartmore
UK Smaller Companies	
ALLIANZ DRESDNER SMCOS.	Abtrust Fund Managers
DUNEDIN SMALLER COS.	Edinburgh Fund Managers
GARTMORE SMALLER COS.	Gartmore
HENDERSON SMALLER COS	Henderson Investors
I&S.UK SMALLER COS.	Ivory&Sime
INVESCO ENGLISH & INTERNATIONAL	INVESCO
INVESCO PERP.UK SMCOS.	INVESCO
PLATINUM INV.TST.	Framlington
SCHRODER UK MID & SMALL	Schroder
SMALLER COMPANIES IT.	Abtrust
THROGMORTON TRUST	Framlington
3I SM.QUOTED COS.TRUST	3i
Throgmorton USM	Framlington
North America	
AMERICAN OPPOR.TST.	Hambro (J O)
EDINBURGH US TRACKER TST.	Edinburgh Fund Managers
US INV.TST. DEAD /Unitised(01/01/2000)	Wellington
North America Smaller Companies	
JPMF US DISCOVERY	Fleming
NORTH ATLANTIC SMCOS.	Hambro (J O)

Far East (Including Japan)	
F&C PACIFIC	Foreign & Colonial
MARTIN CURRIE PACIFIC	Martin Currie
Far East (Excluding Japan)	
ABERDEEN NEW DAWN IT.	Aberdeen Fund Managers
EDINBURGH DRAGON TST.	Edinburgh Fund Managers
HENDERSON FAR EAST INC.	Henderson Investors
HENDERSON TR PAC.IT	Henderson Investors
PACIFIC ASSETS	Ivory&Sime
PACIFIC HORIZON	Baillie Gifford
SIAM SELECTIVE GW. DELISTED 23/07/01	Management International (Guernsey)
Trio Trust dead 12/1/93	Henderson Investors
Pacific Property	Ivory and Sime
Gartmore Emerg.Pacific delisted 04/10/99	Gartmore
First Philippine delisted 26/06/97	Jupiter
Japanese Smaller Companies	
BAILLIE SHIN NIPPON	Baillie Gifford
JPMF JAPANESE SMCOS.	Fleming
Japan	
BAILLIE GIFF.JAPAN	Baillie Gifford
FLEMING JAPANESE	Fleming
JF JAPAN OTC DELISTED 27/07/98	Jardine Fleming
THORNTON ASIAN EMRG. 'DELISTED 26/03/97'	Thornton Asset Management
PERPETUAL JAPAN - N.A.V. (PAR)	Perpetual
Europe	
F&C EUROTRUST	Foreign & Colonial
FLEMING CONT.EUROPE	Fleming
GARTMORE EUROPEAN	Gartmore
INVESCO PERP.EUR.IT.	Invesco
MARTIN CURRIE EUR.	Martin Currie
JUP.EUROPEAN ORD. DELISTED 20/11/00	Jupiter
CHARTER EUROPEAN DELISTED 22/04/02	Charter Asset Management
GERMAN INV.TST. DEAD - ACQ.	Hill Samuel
Schroder Mediterranean Delisted 06/08/96	Schroder
Paribas French Inv Dead 31/08/97	Paribas
MERRILL LYNCH EUROPEAN	Merrill Lynch
HEND.EUROTR.ORD.	Henderson Investors
Country Specialists - Far East	
ABERDEEN NEW THAI	Aberdeen Fund Managers
NEW ZEALAND INV.	Exeter Asset Management
STOCKS CONVERTIBLE TST.	Framlington
Sector Specialists – Property	

TR PROPERTY INV.	Thornton
TRUST OF PROPERTY	Thornton
European Smaller Companies	
EUROPEAN ASSETS TST.	Ivory&Sime
JPMF EUROPEAN FLEDGELING	Fleming
TR EUROPEAN GROWTH	Henderson Investors

Source: AITC

Table 74 Details the various US funds and their corresponding management group

CEFA Category	Management Group
Equity Income	
Adams Express Company	Adam Express/Petroleum & Resources
Boulder Growth and Income Fund	Boulder Investment Advisers
Cornerstone strategic value Fund	Cornerstone Advisers
Cornerstone total return fund	Cornerstone Advisers
J Hancock Patriot Prem Div Fd I	John Hancock Advisers
Liberty all star equity fund	Liberty Asset Management
Source Capital	First Pacific Advisors
Tri-continental corporation	Seligman, J.W, Advisors
Global Equity	
Aberdeen Australia Equity Fund	Aberdeen Asset Management Limited
z-seven fund	Top Fund Management
J Hancock Global Trends Fund	Top Fund Management
Growth and Income	
Bancroft Convertible Fund	Davis/Dinsmore Management
Blue Chip Value Fund	Denver Investment Advisors
Castle convertible Fund	Fred Alger Management
Ellsworth convertible growth	Davis/Dinsmore Management
Franklin Multi Income Trust	Templeton Investment Management
Lincoln National Convertible	Lincoln Investment Mgmt
TCW Convertible Securities Fund	TCW Funds Management
Zweig Total Return Fund	Zweig Advisors
Growth Domestic	
Central Securities	Central Securities Corporation
Engex	American Investors Advisors
Gabelli Equity Trust	Gabelli Funds
General American Investors	General American Investors Management
Liberty All-star growth Fund	Liberty Asset Management
NAIC Growth Fund	National Assoc of investors Corp
Royce Focus Trust	Royce & Associates
Royce Value Trust	Royce & Associates
Salomon Brothers Fund	Salmon Brothers Asset Management
Zweig Fund	Zweig Advisors
First Financial Fund	Salmon Brothers Asset Management

Appendix B

Table 75 Autocorrelation results of UK excess NAV return by sectors

We define the excess NAV return as the difference between the NAV return and the return on one month risk free rate. We use monthly data from January 1990 to January 2003. The abbreviations used are the following: CFE: Country Far East, EU: Europe, EUS: European Smaller Companies, FEXJ: Far East Excluding Japan, FEIJ: Far East Including Japan, GGI: Global Growth and Income, GG: Global Growth, GSC: Global Smaller Companies, J: Japan, JSC: Japan Smaller Companies, NA: North America, NASC: North America Smaller Companies, SSP: Sector Specialist Property, UKG: UK Growth, UKGI: UK Growth and Income, UKSC: UK Smaller Companies.

Categories of AITC	Lag	ACF	t-statistic
CFE	1	0.146	1.84
	2	0.191	2.42
	3	0.182	2.30
	4	0.038	0.47
	5	0.025	0.31
	6	0.051	0.64
	7	-0.046	-0.57
	8	0.026	0.32
	9	0.093	1.16
	10	-0.015	-0.19
	11	0.02	0.25
	12	0.035	0.44
EU	1	0.001	0.01
	2	0.16	2.02
	3	0.05	0.62
	4	0.014	0.17
	5	-0.012	-0.15
	6	0.05	0.62
	7	-0.095	-1.19
	8	0.126	1.58
	9	-0.016	-0.20
	10	0.133	1.67
	11	-0.042	-0.52
	12	0.047	0.59
EUS	1	0.027	0.34
	2	0.053	0.66
	3	-0.003	-0.04
	4	0	0.00
	5	-0.053	-0.66
	6	-0.091	-1.14
	7	-0.111	-1.39
	8	0.043	0.54
	9	0.013	0.16
	10	-0.025	-0.31
	11	-0.022	-0.27
	12	0.095	1.19

FEXJ	1	0.118	1.48
	2	0.175	2.21
	3	0.121	1.52
	4	0.053	0.66
	5	0.102	1.28
	6	0.025	0.31
	7	0.003	0.04
	8	0.081	1.01
	9	0.054	0.67
	10	-0.023	-0.29
	11	-0.028	-0.35
	12	0.023	0.29
FEIJ	1	0.131	1.65
	2	0.164	2.07
	3	0.166	2.10
	4	0.064	0.80
	5	0.044	0.55
	6	0.05	0.62
	7	-0.102	-1.28
	8	0.073	0.91
	9	0.034	0.42
	10	-0.009	-0.11
	11	-0.06	-0.75
	12	0.013	0.16
GGI	1	0.089	1.11
	2	0.131	1.65
	3	0.075	0.94
	4	0.056	0.70
	5	-0.059	-0.74
	6	-0.004	-0.05
	7	-0.157	-1.98
	8	0.015	0.19
	9	-0.045	-0.56
	10	0.023	0.29
	11	-0.101	-1.26
	12	0.031	0.39
GG	1	0.025	0.31
	2	0.182	2.30
	3	0.075	0.94
	4	0.09	1.13
	5	0.041	0.51
	6	-0.021	-0.26
	7	-0.002	-0.02
	8	-0.004	-0.05
	9	0.06	0.75
	10	0.093	1.16
	11	-0.077	-0.96
	12	-0.004	-0.05
GSC	1	0.182	2.30

	2	0.12	1.50
	3	0.004	0.05
	4	0.026	0.32
	5	-0.084	-1.05
	6	0.077	0.96
	7	-0.089	-1.11
	8	0.068	0.85
	9	-0.007	-0.09
	10	0.048	0.60
	11	-0.049	-0.61
	12	0.018	0.22
J	1	-0.476	-6.74
	2	-0.035	-0.44
	3	0.009	0.11
	4	0.055	0.69
	5	-0.05	-0.62
	6	0.144	1.81
	7	-0.242	-3.11
	8	0.205	2.61
	9	-0.074	-0.92
	10	-0.038	-0.47
	11	0.071	0.89
	12	0.004	0.05
JSC	1	0.284	3.69
	2	0.131	1.65
	3	0.08	1.00
	4	0.128	1.61
	5	0.041	0.51
	6	0.019	0.24
	7	-0.075	-0.94
	8	0.006	0.07
	9	-0.032	-0.40
	10	-0.015	-0.19
	11	-0.007	-0.09
	12	-0.061	-0.76
NA	1	0.097	1.21
	2	0.152	1.91
	3	0.067	0.84
	4	0.011	0.14
	5	-0.112	-1.40
	6	-0.059	-0.74
	7	-0.189	-2.40
	8	-0.071	-0.89
	9	0.001	0.01
	10	0.034	0.42
	11	-0.092	-1.15
	12	0.059	0.74

NASC	1	0.298	3.89
	2	0.155	1.95
	3	0.051	0.64
	4	0.059	0.74
	5	-0.099	-1.24
	6	-0.065	-0.81
	7	-0.14	-1.76
	8	-0.058	-0.72
	9	-0.055	-0.69
	10	0.002	0.02
	11	-0.089	-1.11
	12	-0.019	-0.24
SSP	1	0.159	2.01
	2	0.128	1.61
	3	0.112	1.40
	4	0.152	1.91
	5	0.061	0.76
	6	0.037	0.46
	7	-0.074	-0.92
	8	-0.087	-1.09
	9	0.05	0.62
	10	-0.112	-1.40
	11	-0.1	-1.25
	12	-0.097	-1.21
UKG	1	0.061	0.76
	2	0.131	1.65
	3	0.088	1.10
	4	0.122	1.53
	5	-0.041	-0.51
	6	-0.004	-0.05
	7	-0.108	-1.35
	8	-0.051	-0.64
	9	-0.037	-0.46
	10	0.03	0.37
	11	-0.134	-1.68
	12	0.032	0.40
UKGI	1	0.096	1.20
	2	0.112	1.40
	3	0.059	0.74
	4	0.131	1.65
	5	-0.068	-0.85
	6	0.074	0.92
	7	0.053	0.66
	8	-0.074	-0.92
	9	-0.102	-1.28
	10	-0.103	-1.29

	11	-0.149	-1.88
	12	-0.097	-1.21
UKSC	1	0.203	2.58
	2	0.097	1.21
	3	-0.002	-0.02
	4	0	0.00
	5	-0.125	-1.57
	6	0.043	0.54
	7	-0.048	-0.60
	8	0.01	0.12
	9	0.011	0.14
	10	0.036	0.45
	11	-0.06	-0.75
	12	0.029	0.36

Source: calculated by the author

Table 76 Autocorrelation results of US excess NAV return by sectors

We define the excess NAV return as the difference between the NAV return and the return on one month risk free rate. We use monthly data from January 1990 to January 2003. The abbreviations used are the following: EI: Equity Income, GD: Growth Domestic, GE: Global Equity, GI: Growth and Income.

Categories of CEFA	Lag	ACF	t-statistic
EI	1	0.189	2.40
	2	0.051	0.64
	3	-0.031	-0.39
	4	-0.084	-1.05
	5	-0.008	-0.10
	6	0.096	1.20
	7	0.057	0.71
	8	0.104	1.30
	9	0.017	0.21
	10	0.04	0.50
	11	0.062	0.77
	12	-0.009	-0.11
GD	1	0.208	2.65
	2	0.068	0.85
	3	-0.059	-0.74
	4	-0.078	-0.97
	5	-0.04	-0.50
	6	0.031	0.39
	7	0.101	1.26
	8	0.015	0.18
	9	0.015	0.19
	10	0.125	1.57

	11	-0.12	-1.50
	12	-0.197	-2.50
GE	1	0.198	2.51
	2	0.085	1.06
	3	0.159	2.01
	4	0.057	0.71
	5	0.049	0.61
	6	0.0134	0.17
	7	0.0189	0.24
	8	0.014	0.17
	9	0.0209	0.26
	10	0.06	0.75
	11	0.015	0.19
	12	-0.013	-0.16
GI	1	0.261	3.37
	2	0.11	1.38
	3	0.047	0.59
	4	0.089	1.11
	5	0.034	0.42
	6	0.095	1.19
	7	0.102	1.28
	8	0.0146	0.18
	9	0.0182	0.23
	10	0.083	1.04
	11	0.06	0.75
	12	0.002	0.02

Source: calculated by the author

Table 77 Autocorrelation results of UK excess discount return by sectors

We define the excess discount return as the difference between the discount first difference and the return on one month risk free rate. We use monthly data from January 1990 to January 2003. The abbreviations used are the following: CFE: Country Far East, EU: Europe, EUS: European Smaller Companies, FEXJ: Far East Excluding Japan, FEIJ: Far East Including Japan, GGI: Global Growth and Income, GG: Global Growth, GSC: Global Smaller Companies, J: Japan, JSC: Japan Smaller Companies, NA: North America, NASC: North America Smaller Companies, SSP: Sector Specialist Property, UKG: UK Growth, UKGI: UK Growth and Income, UKSC: UK Smaller Companies.

Categories of AITC	Lag	ACF	t-statistic
CFE	1	-0.267	-3.45
	2	-0.048	-0.60
	3	-0.065	-0.81
	4	0.045	0.56
	5	-0.038	-0.47
	6	0.036	0.45
	7	-0.034	-0.42
	8	0.025	0.31
	9	-0.002	-0.02
	10	-0.006	-0.07

	11	-0.072	-0.90
	12	0.04	0.50
EU	1	-0.267	-3.45
	2	-0.061	-0.76
	3	-0.012	-0.15
	4	-0.004	-0.05
	5	-0.089	-1.11
	6	0.067	0.84
	7	0.003	0.04
	8	0.041	0.51
	9	0.038	0.47
	10	0.015	0.19
	11	-0.051	-0.64
	12	-0.106	-1.33
EUS	1	-0.248	-3.19
	2	-0.022	-0.27
	3	-0.026	-0.32
	4	-0.051	-0.64
	5	0.025	0.31
	6	0.18	2.28
	7	-0.122	-1.53
	8	0.036	0.45
	9	-0.016	-0.20
	10	-0.089	-1.11
	11	0.096	1.20
	12	-0.098	-1.23
FEXJ	1	-0.221	-2.82
	2	-0.097	-1.21
	3	0.031	0.39
	4	-0.007	-0.09
	5	-0.022	-0.27
	6	0.058	0.72
	7	0.042	0.52
	8	-0.111	-1.39
	9	-0.017	-0.21
	10	0.064	0.80
	11	-0.074	-0.92
	12	-0.051	-0.64
FEIJ	1	-0.22	-2.81
	2	-0.086	-1.07
	3	-0.034	-0.42
	4	-0.053	-0.66
	5	0.113	1.42
	6	0.032	0.40
	7	-0.041	-0.51
	8	-0.15	-1.89

	9	0.059	0.74
	10	0.067	0.84
	11	-0.078	-0.97
	12	-0.184	-2.33
GGI	1	-0.61	-9.58
	2	0.186	2.36
	3	0.063	0.79
	4	-0.238	-3.05
	5	0.0247	0.31
	6	-0.289	-3.76
	7	0.219	-2.79
	8	-0.063	-0.79
	9	-0.042	-0.52
	10	0.104	1.30
	11	-0.116	-1.45
	12	0.075	0.94
GG	1	-0.192	-2.44
	2	-0.275	-3.56
	3	0.073	0.91
	4	-0.083	-1.04
	5	-0.065	-0.81
	6	0.028	0.35
	7	0.063	0.79
	8	-0.074	-0.92
	9	0.094	1.18
	10	-0.02	-0.25
	11	-0.101	-1.26
	12	0.114	1.43
GSC	1	-0.094	-1.18
	2	-0.175	-2.21
	3	0.021	0.26
	4	0.025	0.31
	5	-0.087	-1.09
	6	-0.003	-0.04
	7	0.104	1.30
	8	0.018	0.22
	9	0.127	1.59
	10	-0.123	-1.54
	11	-0.078	-0.97
	12	0.004	0.05
J	1	-0.298	-3.89
	2	-0.122	-1.53
	3	0.006	0.07
	4	0.03	0.37
	5	0.111	1.39
	6	-0.208	-2.65
	7	-0.001	-0.01

	8	0.101	1.26
	9	0.034	0.42
	10	0.009	0.11
	11	-0.147	-1.85
	12	0.041	0.51
JSC	1	-0.376	-5.05
	2	-0.024	-0.30
	3	0.042	0.52
	4	-0.01	-0.12
	5	0.105	1.31
	6	-0.171	-2.16
	7	0.073	0.91
	8	-0.037	-0.46
	9	0.129	1.62
	10	0.011	0.14
	11	-0.192	-2.44
	12	0.059	0.74
NA	1	-0.202	-2.57
	2	-0.128	-1.61
	3	0.013	0.16
	4	-0.041	-0.51
	5	-0.029	-0.36
	6	0	0.00
	7	-0.009	-0.11
	8	-0.001	-0.01
	9	0.128	1.61
	10	-0.016	-0.20
	11	0.065	0.81
	12	-0.092	-1.15
NASC	1	-0.194	-2.46
	2	-0.022	-0.27
	3	-0.075	-0.94
	4	-0.09	-1.13
	5	-0.093	-1.16
	6	0.029	0.36
	7	-0.05	-0.62
	8	0.121	1.52
	9	-0.12	-1.50
	10	0.195	2.48
	11	-0.145	-1.82
	12	0.035	0.44
SSP	1	-0.227	-2.90
	2	-0.046	-0.57
	3	-0.073	-0.91
	4	-0.113	-1.42
	5	0.134	1.68
	6	-0.03	-0.37

	7	-0.076	-0.95
	8	-0.015	-0.19
	9	-0.035	-0.44
	10	0.017	0.21
	11	0.021	0.26
	12	-0.025	-0.31
UKG	1	-0.537	-7.93
	2	0.138	1.73
	3	-0.046	-0.57
	4	-0.006	-0.07
	5	-0.005	-0.06
	6	-0.091	-1.14
	7	0.179	2.27
	8	-0.156	-1.97
	9	0.087	1.09
	10	-0.006	-0.07
	11	-0.016	-0.20
	12	-0.025	-0.31
UKGI	1	-0.243	-3.12
	2	0.06	0.75
	3	-0.164	-2.07
	4	-0.027	-0.34
	5	0.041	0.51
	6	-0.07	-0.87
	7	0.14	1.76
	8	-0.05	-0.62
	9	0.044	0.55
	10	0.001	0.01
	11	0.038	0.47
	12	0.058	0.72
UKSC	1	-0.127	-1.59
	2	-0.097	-1.21
	3	-0.151	-1.90
	4	0.008	0.10
	5	0.011	0.14
	6	0.051	0.64
	7	0.093	1.16
	8	-0.097	-1.21
	9	-0.019	-0.24
	10	-0.044	-0.55
	11	0.006	0.07
	12	-0.014	-0.17

Source: calculated by the author

Table 78 Autocorrelation results of US excess discount return by sectors

We define the excess discount return as the difference between the discount first difference and the return on one month risk free rate. We use monthly data from January 1990 to January 2003. The abbreviations used are the following: EI: Equity Income, GD: Growth Domestic, GE: Global Equity, GI: Growth and Income.

Categories of CEFA	Lag	ACF	t-statistic
EI	1	-0.471	-6.65
	2	0.03	0.37
	3	0.029	0.36
	4	-0.126	-1.58
	5	0.119	1.49
	6	-0.158	-1.99
	7	0.041	0.51
	8	0.115	1.44
	9	-0.112	-1.40
	10	0.073	0.91
	11	-0.001	-0.01
	12	0.045	0.56
GD	1	-0.519	-7.56
	2	0.059	0.74
	3	-0.084	-1.05
	4	0.099	1.24
	5	-0.019	-0.24
	6	-0.024	-0.30
	7	-0.016	-0.20
	8	0.038	0.47
	9	0.049	0.61
	10	-0.125	-1.57
	11	0.123	1.54
	12	-0.207	-2.63
GE	1	-0.505	-7.28
	2	-0.066	-0.82
	3	0.177	2.24
	4	-0.062	-0.77
	5	-0.201	-2.55
	6	0.318	4.18
	7	-0.188	-2.38
	8	-0.014	-0.17
	9	0.091	1.14
	10	-0.056	-0.70
	11	-0.113	-1.42
	12	0.0269	0.34
GI	1	-0.674	-11.36
	2	0.239	0.30
	3	-0.053	-0.66
	4	0.002	0.02
	5	0.093	1.16

	6	-0.196	-2.49
	7	0.0191	0.24
	8	-0.058	-0.72
	9	-0.084	-1.05
	10	0.0166	0.21
	11	-0.164	-2.07
	12	0.077	0.96

Source: calculated by the author

Table 79 ADF tests of UK excess NAV return of the different sectors by excluding a constant and a linear time trend

The abbreviations used are the following: CFE: Country Far East, EU: Europe, EUS: European Smaller Companies, FEXJ: Far East Excluding Japan, FEIJ: Far East Including Japan, GGI: Global Growth and Income, GG: Global Growth, GSC: Global Smaller Companies, J: Japan, JSC: Japan Smaller Companies, NA: North America, NASC: North America Smaller Companies, SSP: Sector Specialist Property, UKG: UK Growth, UKGI: UK Growth and Income, UKSC: UK Smaller Companies.

CFE

ADF Test Statistic	-4.189303	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
		10% Critical Value	-1.6168

EU

ADF Test Statistic	-4.452763	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
		10% Critical Value	-1.6168

EUS

ADF Test Statistic	-5.225734	1% Critical Value*	-2.5792
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

FEIJ

ADF Test Statistic	-3.996819	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
		10% Critical Value	-1.6168

FEXJ

ADF Test Statistic	-3.693897	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
		10% Critical Value	-1.6168

GG

ADF Test Statistic	-3.371151	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
		10% Critical Value	-1.6168

GGI

ADF Test Statistic	-4.598956	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
		10% Critical Value	-1.6168

GSC

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ADF Test Statistic	-4.984926	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
		10% Critical Value	-1.6168

J

ADF Test Statistic	-8.790439	1% Critical Value*	-2.5800
		5% Critical Value	-1.9421
		10% Critical Value	-1.6169

JSC

ADF Test Statistic	-4.283911	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
		10% Critical Value	-1.6168

NA

ADF Test Statistic	-5.139920	1% Critical Value*	-2.5792
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

NASC

ADF Test Statistic	-4.830835	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
		10% Critical Value	-1.6168

SSP

ADF Test Statistic	-3.866981	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
		10% Critical Value	-1.6168

UKG

ADF Test Statistic	-4.355694	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
		10% Critical Value	-1.6168

UKGI

ADF Test Statistic	-5.963518	1% Critical Value*	-2.5792
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

UKSC

ADF Test Statistic	-5.404235	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
		10% Critical Value	-1.6168

Table 80 ADF tests of US excess NAV return of the various sectors by excluding a constant and a linear time trend

The abbreviations used are the following: EI: Equity Income, GD: Growth Domestic, GE: Global Equity, GI: Growth and Income.

EI

ADF Test Statistic	-5.646683	1% Critical Value*	-2.5798
		5% Critical Value	-1.9420
		10% Critical Value	-1.6168

GD

ADF Test Statistic	-5.611391	1% Critical Value*	-2.5792
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

GE

ADF Test Statistic	-4.430277	1% Critical Value*	-2.5792
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

GI

ADF Test Statistic	-4.333997	1% Critical Value*	-2.5792
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

Table 81 ADF tests of UK excess discount return of the various sectors by excluding a constant and a linear time trend

The abbreviations used are the following: CFE: Country Far East, EU: Europe, EUS: European Smaller Companies, FEXJ: Far East Excluding Japan, FEIJ: Far East Including Japan, GGI: Global Growth and Income, GG: Global Growth, GSC: Global Smaller Companies, J: Japan, JSC: Japan Smaller Companies, NA: North America, NASC: North America Smaller Companies, SSP: Sector Specialist Property, UKG: UK Growth, UKGI: UK Growth and Income, UKSC: UK Smaller Companies.

CFE

ADF Test Statistic	-6.774598	1% Critical Value*	-2.5792
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

EU

ADF Test Statistic	-16.25458	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

EUS

ADF Test Statistic	-16.00377	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

FEIJ

ADF Test Statistic	-15.53550	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

FEXJ

ADF Test Statistic	-15.51270	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

GG

ADF Test Statistic	-15.06163	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419

		10% Critical Value	-1.6168

GGI

ADF Test Statistic	-17.46657	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

GSC

ADF Test Statistic	-13.68541	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

J

ADF Test Statistic	-16.85341	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

JSC

ADF Test Statistic	-18.41904	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

NASC

ADF Test Statistic	-15.19528	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

NA

ADF Test Statistic	-15.23343	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

SSP

ADF Test Statistic	-15.63579	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

UKG

ADF Test Statistic	-22.61499	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

UKGI

ADF Test Statistic	-15.87911	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

UKSC

ADF Test Statistic	-14.14880	1% Critical Value*	-2.5789
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

Table 82 ADF tests of US excess discount return of the various sectors by excluding a constant and a linear time trend

The abbreviations used are the following: EI: Equity Income, GD: Growth Domestic, GE: Global Equity, GI: Growth and Income

EI

ADF Test Statistic	-6.078711	1% Critical Value*	-2.5788
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

GD

ADF Test Statistic	-4.185023	1% Critical Value*	-2.5788
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

GE

ADF Test Statistic	-5.533921	1% Critical Value*	-2.5788
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

GI

ADF Test Statistic	-10.09430	1% Critical Value*	-2.5788
		5% Critical Value	-1.9419
		10% Critical Value	-1.6168

Table 83 ADF tests of UK excess NAV return of the various sectors by including a constant and a linear time trend

The abbreviations used are the following: CFE: Country Far East, EU: Europe, EUS: European Smaller Companies, FEXJ: Far East Excluding Japan, FEIJ: Far East Including Japan, GGI: Global Growth and Income, GG: Global Growth, GSC: Global Smaller Companies, J: Japan, JSC: Japan Smaller Companies, NA: North America, NASC: North America Smaller Companies, SSP: Sector Specialist Property, UKG: UK Growth, UKGI: UK Growth and Income, UKSC: UK Smaller Companies.

CFE

ADF Test Statistic	-4.330685	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
		10% Critical Value	-3.1449

EU

ADF Test Statistic	-4.672812	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
		10% Critical Value	-3.1449

EUS

ADF Test Statistic	-5.438150	1% Critical Value*	-4.0212
		5% Critical Value	-3.4401
		10% Critical Value	-3.1442

FEIJ

ADF Test Statistic	-4.187331	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
		10% Critical Value	-3.1449

FEXJ

ADF Test Statistic	-4.099588	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
		10% Critical Value	-3.1449

GG

ADF Test Statistic	-4.079016	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
		10% Critical Value	-3.1449

GGI

ADF Test Statistic	-5.019078	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
		10% Critical Value	-3.1449

GSC

ADF Test Statistic	-5.510069	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
		10% Critical Value	-3.1449

J

ADF Test Statistic	-8.728475	1% Critical Value*	-4.0245
		5% Critical Value	-3.4417
		10% Critical Value	-3.1452

JSC

ADF Test Statistic	-7.933984	1% Critical Value*	-4.0245
		5% Critical Value	-3.4417
		10% Critical Value	-3.1452

NA

ADF Test Statistic	-5.647342	1% Critical Value*	-4.0212
		5% Critical Value	-3.4401
		10% Critical Value	-3.1442

NASC

ADF Test Statistic	-5.296372	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
		10% Critical Value	-3.1449

SSP

ADF Test Statistic	-4.068640	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
		10% Critical Value	-3.1449

UKG

ADF Test Statistic	-4.971897	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
		10% Critical Value	-3.1449

UKGI

ADF Test Statistic	-4.964147	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
		10% Critical Value	-3.1449

UKSC

ADF Test Statistic	-5.678516	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
		10% Critical Value	-3.1449

Table 84 ADF tests of US excess NAV return of the various sectors by including a constant and a linear time trend

The abbreviations used are the following: EI: Equity Income, GD: Growth Domestic, GE: Global Equity, GI: Growth and Income

EI

ADF Test Statistic	-5.101777	1% Critical Value*	-4.0237
		5% Critical Value	-3.4413
		10% Critical Value	-3.1449

GD

ADF Test Statistic	-5.290851	1% Critical Value*	-4.0212
		5% Critical Value	-3.4401
		10% Critical Value	-3.1442

GE

ADF Test Statistic	-4.511445	1% Critical Value*	-4.0212
		5% Critical Value	-3.4401
		10% Critical Value	-3.1442

GI

ADF Test Statistic	-4.670510	1% Critical Value*	-4.0212
		5% Critical Value	-3.4401
		10% Critical Value	-3.1442

Table 85 ADF tests of UK excess discount return of the various sectors by including a constant and a linear time trend

The abbreviations used are the following: CFE: Country Far East, EU: Europe, EUS: European Smaller Companies, FEXJ: Far East Excluding Japan, FEIJ: Far East Including Japan, GGI: Global Growth and Income, GG: Global Growth, GSC: Global Smaller Companies, J: Japan, JSC: Japan Smaller Companies, NA: North America, NASC: North America Smaller Companies, SSP: Sector Specialist Property, UKG: UK Growth, UKGI: UK Growth and Income, UKSC: UK Smaller Companies.

CFE

ADF Test Statistic	-6.759249	1% Critical Value*	-4.0212
		5% Critical Value	-3.4401
		10% Critical Value	-3.1442

EU

ADF Test Statistic	-16.23645	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

EUS

ADF Test Statistic	-15.94421	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

FEIJ

ADF Test Statistic	-15.43511	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

FEXJ

ADF Test Statistic	-15.49666	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

GG

ADF Test Statistic	-14.97722	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

GGI

ADF Test Statistic	-25.19130	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394

		10% Critical Value	-3.1438

GSC

ADF Test Statistic	-13.68909	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

J

ADF Test Statistic	-16.77980	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

JSC

ADF Test Statistic	-18.32526	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

NASC

ADF Test Statistic	-15.09517	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

NA

ADF Test Statistic	-15.14007	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

SSP

ADF Test Statistic	-15.54161	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

UKG

ADF Test Statistic	-22.54893	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

UKGI

ADF Test Statistic	-15.82948	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

UKSC

ADF Test Statistic	-14.12298	1% Critical Value*	-4.0197
		5% Critical Value	-3.4394
		10% Critical Value	-3.1438

Table 86 ADF tests of US excess discount return by including a constant and a linear time trend

The abbreviations used are the following: EI: Equity Income, GD: Growth Domestic, GE: Global Equity, GI: Growth and Income

EI

ADF Test Statistic	-9.314841	1% Critical Value*	-4.0193
		5% Critical Value	-3.4392
		10% Critical Value	-3.1437

GD

ADF Test Statistic	-10.69767	1% Critical Value*	-4.0193
		5% Critical Value	-3.4392
		10% Critical Value	-3.1437

GE

ADF Test Statistic	-12.18057	1% Critical Value*	-4.0193
		5% Critical Value	-3.4392
		10% Critical Value	-3.1437

GI

ADF Test Statistic	-10.56032	1% Critical Value*	-4.0193
		5% Critical Value	-3.4392
		10% Critical Value	-3.1437

Table 87 Normality tests of UK excess NAV return by sectors

The abbreviations used are the following: CFE: Country Far East, EU: Europe, EUS: European Smaller Companies, FEXJ: Far East Excluding Japan, FEIJ: Far East Including Japan, GGI: Global Growth and Income, GG: Global Growth, GSC: Global Smaller Companies, J: Japan, JSC: Japan Smaller Companies, NA: North America, NASC: North America Smaller Companies, SSP: Sector Specialist Property, UKG: UK Growth, UKGI: UK Growth and Income, UKSC: UK Smaller Companies.

Categories of AITC	**Jarque Bera Normality tests**
CFE	2.35
EU	4.48
EUS	4.05
FEXJ	2.52
FEIJ	1.74
GGI	4.69
GG	1.16
GSC	2.42
J	4.23
JSC	3.30
NA	0.41
NASC	3.12
SSP	0.88
UKG	3.62
UKGI	3.92
UKSC	0.35

Table 88 Normality tests of US excess NAV return by sectors

The abbreviations used are the following: EI: Equity Income, GD: Growth Domestic, GE: Global Equity, GI: Growth and Income.

Categories of CEFA	**Normality tests**
EI	3.91
GD	4.74
GE	3.67
GI	0.88

Table 89 Normality tests of UK excess discount return by sectors

The abbreviations used are the following: CFE: Country Far East, EU: Europe, EUS: European Smaller Companies, FEXJ: Far East Excluding Japan, FEIJ: Far East Including Japan, GGI: Global Growth and Income, GG: Global Growth, GSC: Global Smaller Companies, J: Japan, JSC: Japan Smaller Companies, NA: North America, NASC: North America Smaller Companies, SSP: Sector Specialist Property, UKG: UK Growth, UKGI: UK Growth and Income, UKSC: UK Smaller Companies.

Categories of AITC	**Jarque Bera / Normality tests**
CFE	2.97
EU	4.37
EUS	3.84
FEXJ	3.38
FEIJ	4.70
GGI	4.61
GG	2.88
GSC	4.51
J	2.94
JSC	4.81
NA	1.43
NASC	2.98
SSP	4.60
UKG	3.88
UKGI	4.84
UKSC	4.08

Table 90 Normality tests of US excess discount return by sectors

The abbreviations used are the following: EI: Equity Income, GD: Growth Domestic, GE: Global Equity, GI: Growth and Income.

Categories of CEFA	**Jarque Bera / Normality tests**
EI	4.78
GD	3.75
GE	3.10
GI	3.98

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