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A test of perfect competition in the UK retail-banking deposit market

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Abstract

This paper presents a test for perfect competition in the deposit market of the UK retail-banking sector. The model employed draws from the NEIO technique forwarded by Hannan and Liang (1993). The test is applied to a sample of 8 UK retail banks between 1992-97. The presence of perfect competition is rejected for all banks. The empirical evidence does not support the qualitative evidence of increasing competitiveness amongst UK retail banks.

1 Introduction

A large number of changes to the operating environment of UK retail banks have occurred in the last decade. These changes included the re-regulation of the entire financial services industry, changes in the market structure of retail banking, the development of new technology for delivering banking services and the changing form of retail bank branch networks. All these factors can be interpreted as influential on the form of competition prevalent in the core markets of the retail banks. This study will test whether these qualititive factors have been influential in the competitiveness of a retail banking core market through testing for the presence of perfect competititon in the retail banking deposit market.

The analysis of competition in the UK retail bank deposit market is also important and timely for two reasons. First, there is a gap in the empirical literature of competition in UK retail banking deposit markets. Previous work considering competition in UK banking has been limited to the analysis of contestability in UK retail banking loans markets (see Molyneux *et al*, 1995 and Bikker and Groeneveld, 1998). A degree of contestability in the UK banking loans market is indicated by both studies Second, the study is important in accommodating the findings of the UK banking efficiency literature (for example Ashton, 1999) that sub-optimal operating behaviour exists in UK banks. It is posited that the competitive conditions prevailing in retail banking markets may be a primary cause of such sub-optimal behaviour.

The paper is organised as follows. Section 2 considers previous work in this area, section 3 outlines the model specification employed, section 4 presents the data set to be used and the results of the empirical analysis and section 5 provide a summary and conclusions.

2 Previous work

A number of previous approaches have been used to quantify competition in banking. These may be broadly divided into the Structure Conduct Performance (SCP) paradigm (from Bain, 1951) and New Economic Industrial Organisation (NEIO) approaches (see Bresnahan, 1989).

The SCP paradigm considers how the observable characteristics of a market or industry may affect the conduct and performance of participants within the market. Development of this approach was partly driven by difficulties experienced in the empirical measurement of concepts used by economic theory (such as marginal cost and elasticity) and partly by the desire to build a theory of sub-optimal behaviour.

Previous SCP studies have used a range of proxies to represent market structure and market performance. Market structure has been represented by the relationship between buyer and seller costs, the degree of product differentiation, the degree of concentration within a market place, the degree of market share, and the entry conditions for potential new firms. Profitability, the relation of rates of return to assets, the scale of the costs of selling and efficiencies have been used to represent market performance. Other factors, including risk, leverage, buyer and seller concentration and foreign competition and macro-economic factors, have all been considered in various SCP studies.

Principal findings of SCP studies include the rejection of the concept of long-term equilibrium, a link between the performance of the firm and the concentration of the market and the connection between performance and the market power of individual firms. Problems with the SCP paradigm have been numerous, although the central problem of whether high profits indicate good or bad performance has been a serious block on further research.

A number of empirical studies have tested hypotheses relating to the SCP framework for depository financial institutions. Lloyd-Williams and Molyneux (1994) considered the

effect of governmental and regulatory pressures upon banks to merge and the consequent effects upon market structure and conduct in a study of Spanish banks. Assuming that a higher degree of market concentration will engender collusion among firms in the industry, it follows that within an industry of increasing concentration Spanish banks may receive substantially larger profits, irrespective of other changes within the industry, such as efficiency. This hypothesis was tested using a sample of 92 banks for the 3-year period 1986-1988. The results suggested that the concentrated market had reduced the cost of collusion and led to higher profits for all incumbents.

Goldberg and Rai (1996) considered the relationships between market structure and performance for a number of European banks between 1988-91. The traditional SCP hypothesis and the structure-efficiency hypothesis were tested using a range of performance indicators. Little support was found for either hypothesis.

Molyneux and Forbes (1995) consider the SCP paradigm for banks in 18 countries. The sample taken between 1986-89 includes banks operating in a broad range of regulatory environments. The study provides empirical support for the traditional SCP paradigm concluding that the degree of concentration has an effect on the level of competition within the industry. Other SCP banking studies have been conducted by Bourke (1989), and Berger and Hannan (1989). A review of many of the SCP studies is provided by Molyneux *et al* (1996).

A number of different (NEIO) techniques have been employed to measure the form of competitiveness or the closely related concept of contestability. These include conduct parameter methods grounded in the theory of 'conjectural variations' to estimate a conduct parameter, other conjectural variations models and the Rosse-Panzar statistic to estimate the degree of contestability of a market.

The Rosse-Panzar statistic may be used to test for long-run competitive equilibrium (or perfect competition), monopoly (or perfect cartel conditions) and monopolistic competition (or long-run Chamberlinian equilibrium). The testing procedure is undertaken in two stages. Validity of the overall or competitive equilibrium test requires that the sample be in long-run equilibrium. Thus, presence of long-run equilibrium has to be tested first. The competitive environment statistic (*H*), which may then be estimated, can be viewed as the sum of firm level elasticities of total revenue with respect to input prices. This can be written as:

$$H = \sum w_i \partial R / \partial w_i / R \qquad (1)$$

where w = input price, R = the revenue function, for i firms. How the statistic enables testing for distinct forms of market conduct and behaviour may be explained intuitively. The Rosse-Panzar or *H* statistic quantifies the responsiveness of total revenue to a proportional increase in all input prices. Cost is assumed to be linearly homogeneous in input prices, so that a one per cent increase in input prices will inflate costs by one per cent for all output levels. The symmetry assumption is imposed *a priori* and presupposes that the quantity of output produced will not vary with differing forms of market conduct.

Nathan and Neave (1989) applied the Rosse-Panzar statistic to a sample of Canadian financial institutions. Cross-sectional samples of 14 schedule A and 58 schedule B banks and 39 trust companies were considered for 1982 and 1984. Monopolistic behaviour was indicated for Canadian financial institutions. Molyneux *et al* (1994) used the Rosse-Panzar statistic to assess competitive conditions in a number of European banking markets. This broad ranging study incorporated a number of variables to control for risk, cost and size characteristics of the institutions considered. A sample of German, French, Italian, Spanish and UK banks were considered for the period 1986-89. The study concluded that monopolistic competition existed in the UK banking market (a result of 0.628 was estimated for the Rosse-Panzar statistic). Similar results were obtained for the other European markets. Vesala (1995) used a similar approach to assess the levels of competition in

Finnish banks between 1985 and 1992. Cross- sections were estimated for every year. A substantial increase in the level of contestability of Finnish banking was observable over the sample period, with the H statistic estimates rising from 0.182 in 1985 to 0.620 in 1992. This increase in contestability coincided with the substantial re-regulation of the Finnish banking sector in 1986.

Bikker and Groeneveld (1998) measured the H statistic for a number of European Union banking sectors. The H statistic is estimated for all EU banks (the data is pooled) and for individual countries, for the period 1989-96. Monopolistically competitive banking markets are reported in most European banking markets. The level of contestability appears to change only slightly over time.

Spiller and Favaro (1984) considered the form of competition that was present in the Uruguayan banking sector. The analysis suggested that banking firms do not have the same conjectures, or respond differently to actions of other banking firms within the same market. Size was viewed to be a determinant of differing conjectures. Gelfand and Spiller (1987) employed a multiproduct model to assess oligopolistic conditions in Uruguayan banking between 1977-80. It is suggested that the removal of entry barriers for foreign banks reduced the degree of oligopolistic rivalry occurring between banks and eventually led to an increase in the level of competition in the Uruguayan domestic banking market.

A number of NEIO approaches have been developed to quantify the level of competitiveness directly. These methods consider the responsiveness of prices to changes in demand elasticities and costs where the oligopolist is assumed to maximise perceived profits through consideration of the reaction of other incumbent firms. Whilst a number of methods for estimating conduct parameters have been forwarded in the NEIO literature

the basic model suggests the conduct parameter may be estimated as the monopolist's first order condition:

$$c = P + q\ Q\ P'\ (Q) \qquad (2)$$

where c denotes marginal cost, P is the oligopoly price, Q is industry output and q is the conduct parameter. Within this model, monopoly is indicated by q =1 and perfect competition is indicated by q = 0. This model has been estimated with a number of different techniques and in a range of differing formats although the basic model requires a supply or demand relation (incorporating a measure of marginal costs) and a price setting relation be estimated simultaneously using aggregate industry data. Such a procedure assumes the profit maximising firm will set cost equal to their perceived marginal revenue. For monopoly the perceived marginal revenue will equal the industry's marginal revenue, whilst in perfect competition perceived marginal revenue would equal the demand price. Intermediate values of q are related to other oligopoly positions (see Bresnahan, 1982, 1989 for further discussion of these techniques).

Shaffer (1994) estimated a one-product conjectural variation model to estimate the degree of competition in the Canadian banking sector (1965-1989). The existence of perfect competition in the Canadian banking sector was proposed. Vesala (1995), in a research monograph, estimated a number of models of firm conduct, including the Rosse-Panzar statistic, for the Finnish banking industry during the late 1980s and early 1990s. A broad range of issues were considered, including the nature and level of oligopolistic behaviour,

the measurement of price competition over time, and an analysis of the interdependence between deposit and loans market.

Berg and Kim (1998) considered the oligopolistic behaviour of Norwegian banks between 1990-92 with both retail and corporate banking markets. Using a conjectural variation model it was estimated banks have significant market power in retail banking markets. Due to stronger incentives and informational advantages Norwegian banks are assumed to have far less market power in corporate banking markets. Suominen (1994) considered a two-product conjectural variation test for competition in the Finnish banking industry between 1986 and 1990. It was concluded " … that some monopoly power was present in the pricing of banking services during the late 1980s" (p. 107).

A number of criticisms have been made of NEIO conjectural variation methods of estimating conduct parameters. These include criticism of the theoretical basis of these tests (Lindh, 1992) and particularly strong criticism of the econometric methods employed in estimation of conduct parameters (Corts, 1999). Applied studies that have considered consistency of NEIO conduct parameter estimation techniques have suggested the estimation methods employed in most studies may lead to an over estimation of the competitiveness within market (see for example Genesove and Mullin, 1998).

Using a distinct NEIO testing technique, that does not rely on the 'theory' of conjectural variations, Hannan and Liang (1993) considered the deviation of three deposit interest rates of 300 US commercial banks from treasury interest rates matched with the same

degree of maturity. The degree of deviation of deposit interest rates from relevant treasury rates is used to test for the presence of perfect competition and to ascertain if any firm specific institutional factors are significant in the determination of pricing conduct. Perfect competition in US commercial bank deposit markets is rejected. In two of the three deposit markets considered the level of market concentration is reported to have a significant and negative influence on competitive behaviour. This study whilst not providing the degree of information that conjectural variation conduct parameter models purport to provide does allow the testing of competitive conduct directly. As previously stated, the method of testing perfect competition employed in this study draws from the study performed by Hannan and Liang.

The study will consider the form of competition in the UK retail banking deposit market for the sample period, 1992-1996. Firm-specific measures of the relationship between deposit interest rates and government security interest rates are quantified to test for the presence of perfect competition using the methods of testing proposed by Hannan and Liang (1993). This approach is deemed to be appropriate for a range of European banking markets in that it does not require a particularly wide span of time series observations or an estimation procedure as used in conjectural variation studies. The technique may also be used to test for perfect competition in markets with few participants; a feature of the UK banking markets as well as many European banking markets.

3 Model specification

As previously stated the model of competitive conduct draws from Hannan and Liang (1993) for many of its basic assumptions. Reference to Klein (1971, Bulow and Pfleiderer (1983)[1] and Hannan (1991) is also made in the development of this model. Since the Competition and Credit Control amendments (1971) UK retail banks have been allowed to set their interest rates in line with what they determine to be the competitive rate in accordance with the levels of competition from other deposit taking institutions. The interest rate set by individual banks are generally altered in line with the general trend in interest rates of government securities and by other factors such as market power and product diversification. Through the comparison of a market where individual banks may have little market power, such as the market for government securities and a market in which banks would be expected to act as price takers (the deposit market) the level of market power and product diversification may be determined.

The study therefore tests for the form of competition prevalent in the retail bank deposit market through comparing the interest rate (or price) of deposits with the interest rate of a financial product which is determined within what is perceived or assumed to be a perfectly competitive market (here the interest rates of short-term (3 month) UK government securities are used). This price or interest rate of this financial product is assumed to be determined in a perfectly competitive market as it is internationally traded by a large number of institutions where no individual bank has a significant influence over the price of the government security. Assuming that risk and the net gain from

[1] Bolow and Pfleiderer (1983) suggested only three generalised functional forms may be used in the measurement of the the exercise of market power. To consider the measurement of the exercise of market power which is sensitive to the market structure of the industry considered, only two functional forms are appropriate.

investing in government securities are exogenous to the model the profit maximising rate of interest can be expressed as:

$$R_d^i\left\{1+\left(1/e_d^i\right)\right\}=\left\{R_{gs}^i-MC_d^i\right\} \quad (3)$$

Where:

R_d^i	=	bank *i* deposit rate.
MC_d^i	=	bank *i* marginal cost of deposit production.
e_d^i	=	bank *i* deposit supply elasticity.
R_{gs}^i	=	Interest rate for short-term (3 month) UK government securities

This equality (see Hannan, 1991 and Hannan and Liang 1993) indicates the marginal level of expenses for every pound of deposits produced ($R_d^i\left\{1+\left(1/e_d^i\right)\right\}$) should equal the marginal gain from investing that pound in securities (as opposed to a deposit customer) ($\left\{R_{gs}^i-MC_d^i\right\}$). Deposit supply elasticity may be viewed as the conjecture about the responses of its rivals to a change in its interest rate. Rearrangement of this equality suggests the level of interest of deposits is equal to:

$$R_d^i=\left\{e_d^i/\left(1+e_d^i\right)\right\}\left\{R_{gs}^i-MC_d^i\right\} \quad (4)$$

Following Hannan and Liang (1993) we may re-arrange (2) to express R_d^i as an equation to be estimated. This may be written as:

$$R_d^i = \alpha_o + \alpha_i^1 \{R_{gs}^i - MC_d^i\} \quad (5)$$

where $\alpha_i^1 = e_d^i / (1 + e_d^i)$ and α_o is a constant to be estimated.

The conjecture α_i^1 is assumed to quantify both the degree of product diversification and the perceived reaction to interest rate change by other incumbent banks. The measure therefore incorporates both the reaction to change and the degree of market power exercised through distinct loan products offered by incumbent banks.

The test for perfect competition is based on the assumption that in a perfectly competitive market the supply elasticity (e_d^i) of any product would be infinite. This would therefore suggest that the conjecture (α_i^1) would closely resemble or equal one in a perfectly competitive market. Any significant deviation of the estimated bank specific conjectures from one would allow either the rejection of perfect competition in the retail bank deposit market or suggest that this market is highly differentiated in terms of products (in itself an indication of monopolistically competitive behaviour). The testing procedure may therefore be divided into two parts. Initially, marginal costs need to be estimated to allow the estimated of bank specific conjectures. Secondly, the bank specific conjectures need to estimate following equation (5).

Marginal costs are estimated from a multi-product cost function of retail bank production. The production model is employed (see Sealey and Lindley, 1977). This approach views

the production process as a transformation of three inputs (e.g. capital, and labour; X_1, X_2) into outputs (e.g. loans (Y_1) and deposits (Y_2)) where banks are assumed to minimise costs. Cost is defined as the operational costs of the bank. Outputs are quantified by their values at the end of the financial year. The price of labour (P_1) is measured by the total wage bill divided by the number of full-time equivalent employees. The price of capital (P_2) is proxied by the aggregation of property and equipment rentals and depreciation divided by the quantity of physical capital, providing a measure of capital cost for every £1 of physical capital.

A non-decreasing relationship between inputs and outputs, concavity of the cost function and homogeneity of degree one of input prices are assumed. The expansion of the problem into a second-order translog cost model allows measurement of potential benefits of multi-product production. The production cost model may be written as:

$$\mathrm{L}nC = a_0 + \sum_i b_i Ln\,Y_i + \sum_j a_j Ln\,P_j + 1/2\Big(\sum_i \sum_l g_{il} Ln\,Y_i\,Ln\,Y_l\Big) +$$

$$1/2\Big(\sum_j \sum_k w_{jk} Ln\,P_j\,Ln\,P_k\Big) + \sum_i \sum_j d_{ij} Ln\,Y_i\,Ln\,P_j + e \qquad (6)$$

for $i, l = 1, 2$ and $j, k = 1, 2$.

Following Shephard's Lemma, cost share equations are obtained and are used to form the system to be estimated, where:

$$S_j = \partial LnC/\partial LnP_j = a_j + \sum_k w_{jk} LnP_k + \sum_i d_{ij} Ln Y_i + e_j \qquad (7)$$

Following Greene (1993), the capital share equation (S_2) is dropped from the estimation. This step is taken to make the model operational and to " … solve the problem of singularity of the disturbance covariance matrix of the share equations" (p.505). In accordance with established cost and production theory, the following restrictions are imposed:

$$\sum_j a_j = 1, \qquad \sum_j d_{ij} = 0 \qquad (8)$$

where C represents total costs, Y represents outputs, P represents input prices and a, b, g, d, l, k, j, h and w are parameters to be estimated. e and e represents the error terms, which are assumed to have zero means and constant variances and may vary across the three equations. A seeming unrelated regression (SUR) system of two equations is used to estimate the cost model. Greene (1993, 1995) discusses this estimation technique in more detail.

Employing the parameter estimates 'fitted' marginal costs for the incumbent retail banks are estimates for all sample years following the procedure used by Roberts and Samuelson (1988). 'Fitted' marginal cost may be defined as:

$$\partial C/\partial Q = C/Q \, \partial LnC/\partial LnQ = C/Q \, (b_i + \sum_i g_{il} LnQ + \sum_i d_{ij} LnP) \qquad (9)$$

The 'fitted' marginal cost estimates are then employed to estimate the bank specific conjectures. The bank specific conjectures (a_i^1 from equation 3) are estimated as a pure time series for each of the incumbent retail banks. An ordinary non-linear least squares estimator is used following the procedure outlined by Greene (1993, 1995).

4. The data set and results

The values for monthly firm-specific interest rates were taken from the Annual Abstract of Banking Statistics. The monthly interest rates of short-term (three-month) government securities were taken from Economic Trends (1998). The cost and output data was constructed with data from the Annual Reports and Accounts of 8 UK retail banks from 1992 to 1997. All of the 8 banks are recorded in the Annual Abstract of Banking Statistics produced by the British Bankers Association. The data are deflated using the Retail Price Index. The banks included in the sample are the Royal Bank of Scotland, TSB, Barclays, Lloyds, Midland, Natwest, Bank of Scotland and Abbey National. Subsidiary banks including Clydesdale and Co-operative banks are excluded due to difficulties in obtaining interest rate data. The parameter estimates and diagnostic statistics of the translog cost function are displayed in Table 1. The estimates of bank specific conjectures are made in Table 2.

Table 1 Parameter estimates and diagnostic statistics from the cost model

Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error

α_0	0.803	(0.156)*	γ_{11}	-0.775	(1.490)	ω_{12}	-0.002	(0.003)
β_1	2.847	(6.732)	γ_{22}	0.614	(1.084)	δ_{11}	-0.011	(0.012)
β_2	-1.416	(6.645)	γ_{12}	0.042	(1.166)	δ_{12}	0.777	(0.349)*
α_1	1.059	(0.083)*	ω_{11}	-0.051	(0.012)*	δ_{21}	0.016	(0.012)
α_2	-0.059	(0.083)	ω_{22}	0.052	(0.014)*	δ_{22}	-0.782	(0.348)*

Standard errors in brackets. * = significant at 10%*

Diagnostic Statistics
F statistic for model = 9.66, prob. = 0.000
Adj. R^2 =0.6918, Durbin Watson = 1.4907
F statistic for the restrictions = 32.9140 prob. = 0.000, Log Likelihood = 5.7913
Partial derivative of cost with respect to labour price = 1.3073, (0.1553)*
Partial derivative of cost with respect to capital price = 0.1503, (0.0573)*

Table 2 The bank specific conjectures.

Bank	α_i	Standard Error	Bank	α_i	Standard Error
Bank of Scotland	-0.0436	(0.0136)*	Natwest	0.4388	(0.0480)*
Barclays	0.2794	(0.0304)*	Royal Bank of Scotland	0.1496	(0.0347)*
Lloyds	0.0794	(0.0269)*	TSB	0.1418	(0.0252)*
Midland	0.3802	(0.0259)*	Abbey National	-0.0705	(0.0066)*
Average			0.1694		(0.0264)*

* = significantly different from 1 at 10% significance

Despite the low proportion of parameter estimates that are significantly different from zero[2] the diagnostic statistics considering the level model fit, are both statistically significant and indicate an acceptable level of model fit. The partial derivatives of cost with respect to input prices are non-negative in accordance with expectation. Other results indicate the test for the restrictions placed on the model is significant, a linear form of the model is rejected and a slight degree of autocorrelation may be present.

[2] The low proportion of significant parameter estimates is related to the small sample employed to estimate the cost function (48 observations).

All estimated conjectures are all significantly less than one indicating that perfect competition in the UK retail banking market may be rejected. The difference between the estimated conjectures and one increases over time indicating a decline in the degree of competitive conduct or an increase in the level of product differentiation in this sector.

5. Summary and conclusions

In this study the form of competition in the UK retail banking deposit market is tested. It is estimated that perfect competition may be rejected for all major UK retail banks in the deposit market over the sample period 1992-1997. This result occurs at a time of rising profitability of the sector as a whole. These findings appear to be consistent with other studies which assessed the degree of contestability in the UK banking loans market using the Rosse-Panzar statistic (see Molyneux *et al*, 1995 and Bikker and Groeneveld, 1998).

While the implications of low levels of competition in deposits markets may have a number of substantial ramifications, the possible relationship between competition and efficiency and productivity may be of particular importance for the long-term. The level of competition may influence the efficiency of a depository institution in a number of ways. The impact of a low cost entrant on a depository institution's core market may be substantial. A new entrant, with relatively low costs, would be expected to cause a degree of disturbance in the stability of market shares, the long-run equilibrium of the market

and the subsequent profitability of incumbents. This would occur as it can be assumed that low cost new entrants would increase the levels of competition where " … competition causes efficient organisations to prosper at the expense of inefficient ones" (Vickers, 1995, p.1).

The degree of competition may also influence the efficiency of depository institutions through the 'sharpening' of incentives and monitoring of managers to ensure that the objectives of cost minimisation and efficiency maximisation are followed. Although a limited amount of empirical and anecdotal evidence exists supporting such a process (see Vickers, 1995 and Nickell, 1996, for a discussion of the literature), the methods of transmission of information about the differential performance of individual managers are less than clear. It has even been suggested that the level of competition has very little influence on the efficiency and productivity of the individual firm, where the existence of competition may be influential in providing a framework or environment in which many differing innovations, approaches or ideas may be employed. Nickell (1996) exploring this issue, suggested that " … if there are lots of ways of doing things, competition allows many to be tried and then selects the best, something a monopoly finds hard to replicate" (Nickell, 1996, p.741).

To conclude, it may be also be stated that qualitative evidence suggesting intensification of competition in UK retail banking, such as the changing regulatory environment or the development and high levels of investment in information technology in retail banking

appear to present misleading interpretation of what may really be occurring in this market.

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