CARDIFF BUSINESS SCHOOL
WORKING PAPER SERIES

Cardiff Economics
Working Papers

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E2006/6

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ISSN 1749-6101
January 2006

Competitiveness and Market Contestability of Major British Banks

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December 2005

Abstract

We undertake an empirical assessment of the competitiveness and market contestability of the major British banks post-1980 – a period of major structural changes, mergers, demutualizations and acquisitions. Specifically, we estimate and test the Rosse-Panzar model on a panel of 12 banks for the period 1980-2004; furthermore, we buttress the Rosse-Panzar methodology by estimating the ratio of Lerner indices obtained from interest rate setting equations. The sample of banks corresponds closely to the major British Banking Groups as specified by the British Banking Association. Our results confirm the consensus finding that the British banking market can be described as monopolistically competitive. We also find that on the core business of balance sheet activity, British banks have remained as competitive in the 1990s as in the 1980s. This finding is further supported by evidence from the ratio of Lerner indices for loans and deposits. However, we find a significant worsening of competitiveness on the non-core (off-balance sheet) business of the banks.

Keywords: Competitive conditions; market contestability; British banking

JEL Classification Nos: G21; D43; C51

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1. Introduction

British banking has been in a state of almost continuous evolution since the Competition and Credit Control Act of 1971. However, it was the abolition of exchange control in 1979 and the abolition of the last of the quantitative controls on bank lending that heralded a period of rapid deregulation and competition in British banking. The 1980s was the period of real deregulation. The Corset was abolished in 1980, required reserves were abolished in 1981 Hire Purchase controls, which had restricted consumer borrowing, were abolished in 1982. Furthermore the Building Societies Act (1986) enabled the Building Societies to compete directly in the retail banking market. The 1980s saw a period of mergers of Building Societies and the late 1980s and the 1990s saw a number of the larger Societies de-mutualising and converting into banks. In the context of rapidly changing competition and merger activity in the retail banking sector, this study poses the question: How has competitive conditions in the UK retail banking sector changed since the deregulatory period of the 1980s? To answer this question, we invoke econometric techniques to empirically assess the competitive conditions in, and therefore the market contestability[1] of, the major banks in Great Britain.

This paper undertakes an empirical assessment of the competitiveness and market contestability of the major British banks during the 1980s and 1990s. The methodology used is the Rosse-Panzar approach to modelling the competitive conditions and contestability of banks. Specifically we examine if the conditions of competitiveness and contestability have altered between the 1980s and 1990s by estimating Rosse-Panzar H statistics separately for the total output of banks and the core output of banks. The robustness of the empirical results for the core output of banks is tested by estimating the ratio of Lerner indices for loans and deposits.

[1] In the sense of Baumol (1982) and Baumol et. al. (1982).

The remainder of the paper is structured as follows. The next section details developments in British banking in the period 1980-2004. Section 3 presents the theory of competitiveness and contestability; effectively, this is the framework that theoretically underpins the analysis. The data and the empirical model are discussed in Section 4. The estimation and results are reported in Section 5. Section 6 concludes.

2. British Banking during 1980-2004

While the introduction of Competition and Credit Control in 1971 (CCC) signaled the beginning of the process of deregulation, it is well recognized that the 1979 Banking Act represented the starting point of a permanent change in the competitive character of British banking (Pozdena and Hotti, 1985). The abolition of the clearing bank cartel arrangements in 1971 and the hope of a 'market-based' approach to the control of credit through interest rates soon gave way to the re-appearance of quantitative controls in 1973, in the wake of the rapid growth of bank credit and the secondary banking crisis. The decade of the 70s was punctuated with imposition and relaxation of quantitative controls in the form of controls in the growth of bank liabilities and the call of Supplementary Special Deposits that severely compromised the spirit of the purpose of CCC. The Banking Act regularized banking supervision by extending the supervisory authority of the Bank of England to all deposit taking institutions except for Building Societies. Deposit taking institutions were separated into 'recognized banks' and 'licensed deposit takers', but more significantly, the Banking Act provided a mechanism by which non-bank institutions could enter the retail banking market, removing a former barrier to entry[2]. A further important concession to clearing bank

[2] The 1987 Act effectively removed the distinction. While the conversion from licensed deposit-taker to retail bank has not been rapid following the legislation, the number of retail banks in 1984 was 140 and the most recent statistics from the British Banking Association suggest a membership of 250 institutions (see www.bba.org.uk).

competitors was access to the Clearing House system and the widening market for retail demand deposits.

The abolition of exchange controls in 1979 removed an important form of protection from international competition. Time deposits would have to pay the same return as equivalent maturity euro-sterling deposits. Competition increased further with the break-up of the Building Societies cartel in 1983. The Building Societies Act created room for more competition in banking with the provision for banking services, unsecured lending, credit cards, and commercial loans of up to 10% of assets.

The deregulatory trend was extended to the Stock Exchange, with the deregulation of the financial markets. With the 'Big Bang' in 1986, the banks became more aggressive in the marketing and positioning of their off-balance sheet products and services. Many banks entered the securities business acquiring stock broking and jobbing firms while non-banking financial institutions, such as insurers, retailers and building societies, challenged the banks on their traditional balance sheet activity.

The rest of the period from 1987 - 2003 saw a number of demutualization's, consolidations, mergers, acquisitions and diversification that affected the banking sector. Abbey National was the first Building Society to convert to plc status in 1989. Banks took over Building Societies (Lloyds with Cheltenham and Gloucester). After 1995, there were a number of demutualizations of Building Societies (Halifax, Alliance and Leicester, Northern Rock, Woolwich and Bradford and Bingley) and Building Society acquisitions by banks (Bristol and West by Bank of Ireland Group and Birmingham and Midshires by Halifax). In 1995 Lloyds and TSB merged to form the Lloyds-TSB group, Barclays took-over Woolwich in 2000 and the Royal Bank of Scotland acquired National Westminster in the same year. In 2001 Bank of Scotland and Halifax merged to form the HBOS group.

The number of mergers, consolidations and acquisitions that occurred during the 1990s and in the new century might suggest an increase in concentration and worsening of competition. However, the evidence from the data sample used in this paper would suggest otherwise. Moreover, the market structural indicators measured by the asset-based 2-bank concentration ratio, 5-bank concentration ratio and HHI[3] show a modest decline in the second half of the the 1990s compared with the earlier period (Table 1). Although too much cannot be read into aggregate measures of concentration and HHI because of the competitive potential that arises from contestability, it can at least be argued that mergers and acquisitions during the 1990s have not altered market concentration appreciably.

Table 1 below presents concentration and Herfindahl-Hirschman Indices (HHI) for the sample period (a detailed discussion of the data is left to section 4).

Table 1

Concentration Ratios and HHI for the Biggest Two and Biggest Five Banks

Year/Measure	CR2	CR5	HHI
1986	0.421	0.767	1428.470
1991	0.441	0.738	1423.817
1996	0.316	0.630	1051.831
2002	0.383	0.688	1249.696

There have been remarkably few studies of competitiveness of UK banks relating to the two decades of the 20th century. A notable exception is Heffernan (1993) and (2002) who

[3] The U.S. Department of Justice considers a market with a result of less than 1,000 to be a competitive marketplace; a result of 1,000-1,800 to be a moderately concentrated marketplace; and a result of 1,800 or greater to be a highly concentrated marketplace. As a general rule, mergers that increase the HHI by more than 100 points in concentrated markets raise antitrust concerns.

examined competition in the retail banking market in the 1980s in the former study and the 1990s in the latter. Heffernan examines deposit rate, loan rate, mortgage rate, and credit card rate setting behavior of individual banks and Building Societies from econometric models of interest rate equations using monthly panel data. The results indicate an increase in competition in the mortgage market and low interest checking accounts, but show the existence of price discrimination behavior in other products. The findings suggest that the retail banking sector in Britain is best described as monopolistic competition based on imperfect information, particularly in the case of unsecured loans and credit card rate setting behavior. Cournot type behavior was evident in the credit card market as interest rate setting was sensitive to the number of suppliers.

The government enquiry into competition in UK Banking, as per the report by Cruikshank (2000), concluded that while the market for personal retail banking was consistent with monopolistic competition as evidenced by sustained abnormal return, there were signs of 'new entry and increased competition' that would improve information flows and result in a convergence of pricing. The report recognized that banking involves 'joint products' or 'bundled' services that can lead to overpricing and underpricing on different products. However, new entrants target specific banking products and even though they may be part of a larger banking group. They often specialize in such products as mortgages, unsecured loans, and credit cards, which have dynamic effects on improving competition in those niche markets.

Other studies have examined the UK bank competitiveness in the context of wider studies of international bank competition using the Rosse-Panzar approach followed in this paper[4]. These studies typically use a panel set of data provided by Fitch/Bankscope and

[4] For example Molyneux et. al. (1994), Bikker and Haaf (2002), Claessens and Laeven (2004) and most recently Casu and Girardone (2005).

include a large number of banks in a country irrespective of specialist practice (in the case of the UK, many individual banks are either wholly owned or partially owned by larger parent banks that constitute the major British banks). The advantage of such studies is that they deal with the aggregate of banking activity in a country and provide a snapshot of competitive conditions in totality. The disadvantage, as Llewellyn (2005) notes, is that aggregate studies disguise the areas of banking that have strong competition from those that do not, which can only be revealed by more micro based studies of specific banking markets. Banking studies using the Rosse-Panzar approach with aggregate data have to be interpreted as an examination of competitive conditions for the package of banking services rather than specific banking markets.

3. An Illustrative Model

The theory of competitiveness and contestability assumes that firms can enter or leave rapidly any market without losing their capital, and that potential competitors possess the same cost functions as firms that already serve in the market. The key argument is that if the market is contestable, the threat of market entry with price-cutting by potential competitors enforces marginal cost pricing by incumbents, so that in equilibrium they will not earn excess profits and no entry is observed to occur.

To illustrate the theory, it is helpful to reproduce the relevant arguments in the model by Rosse and Panzar (1977) and Panzar and Rosse (1982, 1987) as well as the extensions made by Nathan and Neave (1989) and Perrakis (1991).

The model considers a profit-maximizing firm in an oligopolistic industry. It is assumed that industry output, given by Y, is scalar, which is a simplifying assumption given that banks are multi-product firms, and P is the prevailing price of bank output. The inverse

demand curve is given by *P(Y)*; and the output of the *k*th firm, where there is $k = 1, \ldots\ldots, n$ firms, is given by y_k. Profit maximization conditions are given by:

$$P(Y) + l_k y_k P'(Y) = C_{yk}(y_k, W, Z_k) \qquad (1)$$

where $l_k \equiv dY/dy_k$ is the conjectural variation of industry output in response to a change in y_k; $P' \equiv dP/dY$; C_{yk} is the marginal cost of firm k; W = vector of input prices; and Z_k = a vector of exogenous parameters in the firm's maximization problem. Hence, equation (1) determines y_k as a function of W, Y and Z_k for every k. Aggregate demand, which determines Y in short run equilibrium is given by:

$$Y = \sum_{k=1}^{n} y_k(Y, W, Z_k) \qquad (2)$$

To model the degree of competitiveness of the banks in this oligopoly setting, it is necessary to proceed from the term $l_k y_k P'(Y)$ in equation (1) and set $l_k y_k = LY$ for all k, where the parameter L is independent of industry output Y. Thus, the two limiting cases are derived as follows. For $L = 0$; the perfectly competitive case is derived from (1), where price equals marginal cost. For $L = 1$, the perfect collusion case is derived.

In equation (1), if we denote $P(Y) + l_k y_k P'(Y)$ by *F(Y)*, this implies that $F(Y) = P(Y)\left[1 - \left(L/e\right)\right]$, where the price elasticity of demand is given by $e \equiv -P(Y)/YP'(Y)$. Hence, if the equation is written as $P(Y)\left[1 - (L/e)\right] = F(Y) = C_{yk}(y_k, W, Z_k)$, it is inferred that $e > L$, such that equilibrium is consistent with any value of e. It is also assumed that the marginal cost is log-linear such that under market equilibrium conditions:

$$\ln C_{yk} = b_0 + b_1 \ln y_k + \sum_{i=1}^{3} c_i \ln w_i + b_2 \ln Z_k \qquad (3)$$

Where w_i, i = 1,2,3 are the prices of three potential inputs. To characterize the output of the *k*th firm, we substitute (3) into (1) and solve to obtain, after some re-arrangement:

$$\ln y_k = A_0 + A_1 \ln[F(y)] + \sum_{i=1}^{3} B_i \ln w_i + A_2 \ln Z_k \qquad (4)$$

Thus the main factors are *Y, W* and *Z*, thus $y_k = G[F(Y), W, Z_k]$, where *G* is increasing in *F(Y)*. If we substitute y_k into the market equilibrium conditions in equation (2) and differentiate with respect to *L*, it is found that industry output varies inversely with the parameter *L*, such that parameter *L* is an appropriate measure of the competitiveness of the industry; thus, *L = 0* suggests the perfectly competitive case, where price equals marginal cost, while *L = 1* suggests the perfect collusion and oligopoly case.

By substituting into equation (4), the constant elasticity of the form of the industry *P(Y)* and *F(Y)*, as denoted by their log-linear forms, we see that the *k*th firm's Py_k can be stated as:

$$\ln(Py_k) = \ln R_k = D_0 + D_1 \ln Z_k + \sum_{i=1}^{3} E_i \ln w_i \qquad (5)$$

where $E_i = -B_i(1-e) / (e + A_1)$ and R_k = the *k*th firm reduced form revenue.

For estimation and testing purposes, we cast equation (5) in empirical form, as follows:

$$\ln REV = \alpha_0 + \alpha_1 \ln PL + \alpha_2 \ln PK + \alpha_3 \ln PF + \alpha_4 \ln RISKASS + \alpha_5 \ln ASSET + \alpha_6 \ln BR + u \qquad (6)$$

where, *REV* = ratio of bank revenue to total assets; *PL* = personnel expenses to employees (unit price of labour); *PK* = capital expenses to fixed assets (unit price of capital); *PF* = ratio of annual interest expenses to total loanable funds (unit price of funds). The exogenous bank specific factors are; *RISKASS* which measures the riskiness of the bank's overall portfolio given by the ratio of provisions to total assets; *ASSET* is a proxy for size and measures the extent of scale economies; *BR* is the ratio of the number of branches of each bank to the total number of branches of the whole banking system. Branching has been viewed as a traditional way of maintaining market share by providing consumers with close-quarter access to financial services, mitigating to some extent price competition[5].

The *H*-statistic is calculated from reduced form revenue equations and measures the sum of elasticities of total revenue of the firm with respect to the firm's input prices. For example, in the context of equation (5), the H-statistic is defined as the sum of the elasticities of Py_k with respect to the variables in the w_i vector, hence, $H = \sum_{i=1}^{3} E_i$, which implies that $H = A_1(1-e)/(e + A_1)$, which means H can be negative or positive. Rosse and Panzar (1977), Panzar and Rosse (1982, 1987) show that the *H*-statistic is negative ($H<0$) when this structure is a monopoly, a perfectly colluding oligopoly, or a conjectural variation short-run oligopoly, as under these conditions an increase in input prices will increase marginal costs, reduce equilibrium output and subsequently reduce total firm revenue. In contrast, the *H*-statistic is equal to one ($H=1$) when there is perfect competition, as any increase in input prices increases both marginal and average costs without altering the optimal output of any individual firm. *H* is also unity for a natural monopoly operating in a perfectly contestable

[5] See Northcott (2004) But also branching is a component of cost and there will be a trade-off between maintaining market share and increasing cost of branch maintenance.

market and also for a sales-maximising firm subject to break-even constraints. If 0<H<1, this is a case of monopolistic competition.

An important feature of the *H*-statistic is that the tests must be undertaken on observations that are in long run equilibrium. This suggests that competitive capital markets will equalise risk-adjusted rates of return across banks such that, in equilibrium, rates of returns should not be correlated statistically with input prices. Thus, in the context of the theory of competitiveness and contestability set out in the model above, we specify a model for obtaining measures of the competitive banking environment by including a specification for equilibrium conditions:

$$\ln ROA = \beta_0 + \beta_1 \ln PL + \beta_2 \ln PK + \beta_3 \ln PF + \beta_4 \ln RISKASS + \beta_5 \ln ASSET + \beta_6 \ln BR + \varepsilon \quad (7)$$

where, *ROA* = net profits to total assets; and the remaining variables are as above for equation (6). The full definition of these variables is given in the Appendix.

Table 2
The theory and interpretation of the *H*-statistic

Equilibrium test	
$H = 0$	Equilibrium
$H < 0$	Disequilibrium
Competitive conditions	
$H \leq 0$	Monopoly or conjectural variations short-run oligopoly
$H = 1$	Perfect competition or natural monopoly in a perfectly contestable market or sales maximising firm subject to a break even constraint
$0 < H < 1$	Monopolistic competition

Hence, to test for equilibrium, the Rosse-Panzar statistic is calculated with the return on assets (equity) replacing bank revenue as the left hand variable in the regression equation. If we find that $H < 0$, we infer market disequilibrium; whereas $H=0$ would indicate equilibrium.

Table 2 summarises these theoretical underpinnings of the main theory for measuring competitiveness and contestability in the banking market, including the tests for equilibrium conditions.

4. Data and Methodology

The data source was Annual Reports of individual banks and Annual Abstract of Banking Statistics (British Bankers Association). The data sample broadly corresponds to the British Banker Association (BBA) Major British Banking Groups (MBBG), covering 7 of the total 9 big banking groups in MBBG[6] but excluding Bradford & Bingley and Northern Rock Plc[7] and including Standard Chartered Plc[8]. Specifically, the sample included Abbey National Plc (1985-2004), Alliance & Leicester Plc (1994-2004), Barclays Plc (1985-2004), Woolwich Plc (1996-2002)[9], Halifax Plc (1986-2004), Bank of Scotland (1986-2004)[10], Midland Bank Plc

[6] The total 9 banking groups in MBBG account for approximately 80% of all private sector sterling deposits held at banks and sterling lending by all banks to UK residents (see http://www.bba.org.uk).
[7] North Rock Plc and Bradford & Bingley Plc became a member of MBBG in 1999 and 2000 respectively after converting from a building society to a bank.
[8] Standard Chartered Group was a component of the MGGB before 1997. The reason why Standard Chartered is included but Bradford & Bingley and Northern Rock are excluded lies in our central concern on the dynamics of the intensity of the competition during the past two decades. Standard Chartered has been actively operating in the retailing banking market whereas Bradford & Bingley and Northern Rock Plc demutualized late in the sample period. The inclusion of Standard Chartered Plc would be more pertinent to the estimation and moreover, the sum of key operational indicators of Bradford & Bingley and Northern Rock Plc, such as total assets, total revenue, total deposits and total loans, is less than that of Standard Chartered.
[9] Woolwich Plc was absorbed by Barclays Bank Plc in 2000, and an annual report is not available after 2003.
[10] In 2001, Halifax Plc and Bank of Scotland merged to form HBOS group, but separate annual report for both bank is still available thereafter.

[11](1980-2004), Lloyds-TSB bank Plc (1982-2004)[12], The Royal Bank of Scotland Plc (1984-2003), National Westminster Bank Plc(1980-2003) and Standard Chartered Plc (1985-2004).

The former 10 banks are the major banks in each of the 7 groups, and more importantly they are commonly either the sole owner (100% share stake) or the controlling owner (at least 50% share stake) of the rest of banks belonging to the same group. The dominant shareholder role they play motivates our employment of the consolidated annual data for those banks. Consequently, the data captures an overall picture of the 7 groups. One exception is the Royal Bank of Scotland acquisition of National Westminster in 2000. To avoid double counting, we utilised unconsolidated data for The Royal Bank of Scotland during the period of 2001-2003, while continuing with the consolidated data for National Westminster. In sum, our data consists of 12 banks covering an uneven time frame 1980-2004 with a total number of bank years of 219.

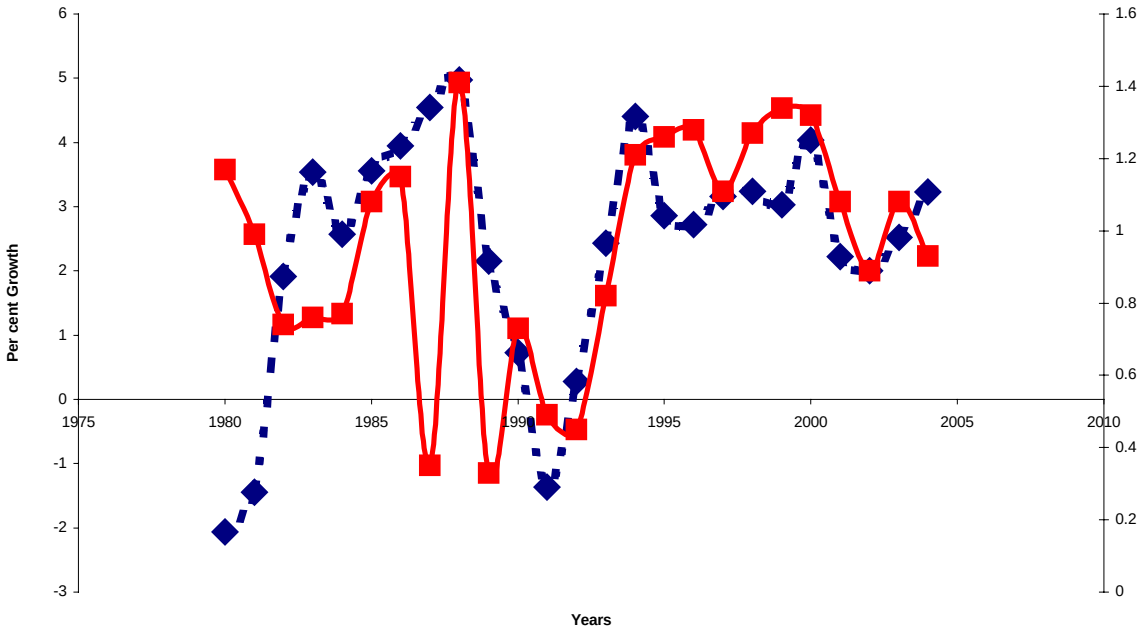
Equations (6) and (7) are estimated and tested on the data as an unbalanced panel, thus exploiting both the time series as well as the cross-section dimensions. To allow for heterogeneity across the sample of banks, we use the error-component method. However, it should be noted that previous studies that have employed the Rosse-Panzar methodology tend to use a large number of banks and a small number of time periods. In contrast, the sample used in this study has a small number of banks but constituting the majority of asset share, and a long period of time. The period 1980-2004 covers two recessions; the 1980-81 recession and 1991-92 recession. It is well known that the profitability and revenue of a bank is highly sensitive to the business cycle. Bad debts and non-performing loans vary positively with the business cycle and accounting conventions mean that the timing of a default does not

[11] HSBC banking group acquired Midland in 1992, but the annual report was continually made separately from the consolidated accounts of HSBC Bank Plc.

[12] The annual data for Lloyds Bank Plc is from 1982 to 1994, while the annual data for TSB Bank Plc is from 1984-2004. In 1995, two banks merged to form Lloyds TSB Bank Plc.

invariably coincide with the turning point of the recession, so bank performance may lead or lag the business cycle[13]. Figure 1 below shows the movement of the weighted average ROA for the sample of banks (weighted by asset share) against real GDP growth.

Figure 1: Weighted ROA and real GDP growth



The dotted line is real GDP growth and is read from the left-hand scale while the firm line is weighted ROA and can be read from the right-hand scale. It can be seen that there is a strong correspondence between the two measures although at times ROA lags growth and at other times it leads growth. Bank revenue and profit functions that ignore measures of the business cycle will be dynamically misspecified and could result in omitted variables bias if the included variables are correlated with excluded variable[14]. The equations to be estimated are

[13] See Cruikshank (2000) Appendix C.
[14] It is strongly likely that the input prices and total assets will be correlated with GDP growth.

modified to include a pure time series variable - real GDP growth and described by (6') and (7')[15].

$$\ln TREV_{it} = \alpha_0 + \alpha_1 \ln PL_{it} + \alpha_2 \ln PK_{it} + \alpha_3 \ln PF_{it} + \alpha_4 \ln RIKASS_{it} + \alpha_5 \ln ASSET_{it} + \alpha_6 \ln BR_{it} + \alpha_7 GROWTH_t + u_{it} \quad (7')$$

where i denotes banks and $i = 1...N$; and t denotes time $t = 1....T$. The model assumes a one-way error component model as described by:

$$u_{it} = \mu_i + v_{it} \quad (8)$$

where μ_i denotes the unobservable bank specific effect and v_{it} denotes a random term which is assumed to be IID. The H statistic is obtained as $H = \alpha_1 + \alpha_2 + \alpha_3$. Similarly:

$$\ln ROA_{it} = \beta_0 + \beta_1 \ln PL_{it} + \beta_2 \ln PK_{it} + \beta_3 \ln PF_{it} + \beta_4 \ln RISKASS_{it} + \beta_5 \ln ASSET_{it} + \beta_6 \ln BR_{it} + \beta_7 GROWTH_t + \varepsilon_{it} \quad (7')$$

and $$\varepsilon_{it} = \eta_i + \upsilon_{it} \quad (9)$$

where η_i is the bank specific effect and υ_{it} is an IID random error. The banking market is deemed to be in equilibrium if $\beta_1 + \beta_2 + \beta_3 = 0$.

The Rosse-Panzar methodology is only one of a number of ways of modelling competitiveness[16]. Uchida and Tsutsui (2004) use the Cournot oligopoly version of the Monti-Klein model of the banking firm to derive a loan interest rate setting function in terms of the cost of funds and marginal operational costs of servicing loans and deposits. The estimated coefficient on the cost of funds (deposit rate) is the ratio of the Lerner indices of

[15] Coccorese (2004) recognises the role of regional macroeconomic indicators in assessing bank competition in Italy.
[16] See also Bresnahan (1982) and Bresnahan (1997).

loans and deposits adjusted for the number of competitor banks. As the number of competitor banks increase, the ratio of the Lerner indices approaches unity, which is the perfect competition case[17].

This study buttresses the *H* statistic obtained from the Rosse-Panzar methodology by estimating the ratio of Lerner indices obtained from loan interest rate setting equations. In this way the robustness of the estimated results using the Rosse-Panzar method can be tested using an alternative methodology. The next section presents the empirical results and answers the question whether competitiveness in the 1990s worsened compared with the 1980s focussing separately on the traditional and non-traditional activity of banking business.

5. Empirical Analysis

The reduced form functions have, as the dependent variable, both the logarithm of total revenue and interest revenue, respectively. The inclusion of non-interest revenue recognises the importance of non-interest income and fee earnings to bank profitability[18]. We test for differences between the 1980s and 1990s by using intercept and slope dummies for input prices. The dummy variable takes the value zero for 1980-91 and unity for 1992-2004. The period was chosen both because it represented an approximate halfway point in the time dimension of the data but more so because 1991 was the end of the 1991-2 recession, so the first half of the period captures a full business cycle. Our starting point is to test if the British banking market is in long-run equilibrium. Table 3 presents the results for ln *ROA* as described by equation (8').

[17] See Freixas and Rochet (2002) for a formal derivation.
[18] A number of studies use total bank revenue; for example De Bandt and Davies (2000) and Casu and Girardone (2005) but interest revenue is used by Molyneaux et. al. (1994), and Bikker and Haaf (2002).

Table 3: Tests of Equilibrium.
Dependent variable ln *ROA* (t values in parenthesis)

Variable	1-way Fixed Effects	1-way Fixed Effects	2-Way Fixed Effects
Intercept	0.0265*** (3.82)	0.0234** (2.03)	-.0020 (-0.10)
ln*PL*	0.0001 (0.12)	-.0004 (-0.30)	-.0024* (1.69)
ln*PK*	-.0016** (-2.34)	-.0015 (-1.23)	0.0008 (0.63)
ln*PF*	-.0009 (-0.96)	-.0014 (-0.56)	-.0086** (-2.35)
DUM92	-	0.0047 (0.55)	0.0156 (0.45)
ln*PL*DUM92*	-	0.0004 (0.34)	0.0024* (1.65)
ln*PK*DUM92*	-	-.0004 (-0.24)	-.0019 (-1.25)
ln*PF*DUM92*	-	0.0010 (0.39)	0.0060 (1.58)
ln*RISKASS*	-.6257*** (-13.41)	-.6213*** (-12.92)	-.6140*** (-10.60)
ln*ASSET*	-.0020*** (-3.34)	-.0019** (-2.83)	-.0015* (-1.71)
ln*BR*	-.0016*** (-2.63)	-.0014* (-1.84)	-.0007 (-0.72)
GROWTH	0.0007*** (4.38)	0.0007*** (3.98)	0.008 (0.30)
Lloyds-TSB DUM	0.0056*** (3.77)	0.0053*** (3.49)	0.0035** (2.27)
Barclays DUM	-.0008 (-0.22)	-.0004 (-0.11)	0.0005 (0.15)
R^2 Within	0.6176	0.6190	0.7096
H0: $\eta_i = 0$	F(11,198) = 4.7*** Reject	F(11,194) = 4.1*** Reject	F(11,170) = 4.1*** Reject
H0: $\lambda_t = 0$	-	-	F(1,170) = 0.04 Accept
H0: H = 0	F(1.198) = 3.25 Accept	F(1,194) = 0.12 Accept	F(1,170) = 3.65 Accept

*** significant at the 1%, ** significant at the 5%, * significant at the 10%

We allow for the Lloyds-TSB merger with a zero-one dummy (1995-2004 = 1, 0 otherwise) and Barclays acquisition of Woolwich (2003-2004 = 1, 0 otherwise). We also test for the 2-way error component model (the 2-way error component disturbances are described by:

$u_{it} = \mu_i + \lambda_t + v_{it}$ where λ_t accounts for any time-specific effect that is excluded from the regression)[19].

The consistent result of Table 3 is that the sum of the input price elasticities, with and without the slope dummies for 1992 sum to zero indicating that despite the dynamic changes to British banking scene, the banking market was in long-run equilibrium throughout the period. The 2-way error-component model is rejected (column 4) on the conventional level of significance. It can also be seen that the growth of real GDP is a strong determinant of ROA in the one-way fixed effects regression model but is insignificant when time dummies are included in the 2-way error component model.

Tables 4 and 5 present the results using the logarithm of total bank revenue as a fraction of total assets (ln *TREV*) and the log of interest revenue as a fraction of total assets (ln *INTREV*) respectively. We present results for the 1-way error component and 2-way error component model and we also test for any change in the H statistic by including shift and slope dummies for the input price elasticities for the period 1992 onwards. Table 4 presents the results for ln *TREV*. Out of the three input price, the unit price of funds was the only significant variable at the conventional level of significance - a finding that is also supported by the most recent study using the Rosse-Panzar method with UK data[20]. The log of total assets is a proxy for size and measures the extent of scale economies. The impact of this variable on revenue suggests significant cost diseconomies. The variable *RISKSS* measures the riskiness of the bank's overall portfolio, measured by the ratio of provisions to total assets. The effect of the risk measure on revenue is ambiguous. An increase in provisions is a diversion of capital from earnings, which could have a negative effect on revenue.

[19] Baltagi (2001)
[20] See Casu and Girardone (2005)

Table 4
Dependent Variable ln *TREV*; t values in parenthesis

Variable	1-way FE	2-way FE	1-way FE	2-way FE
Intercept	-.2891 (-1.48)	-.5928 (-0.96)	0.1131 (0.36)	-.9565* (-1.78)
Ln*PL*	-.0084 -(0.46)	-.0109 (-0.56)	0.0200 (0.60)	-.0096 (-0.24)
Ln*PK*	0.0008 (0.04)	0.0319 (1.58)	0.0417 (1.29)	0.0542 (1.56)
ln*PF*	0.5794*** (22.94)	0.4487*** (9.67)	0.6889*** (10.02)	0.6580*** (6.53)
DUM92	-	-	-.5700** (-2.41)	-.2375 (-0.25)
ln*PL*DUM92*	-	-	-.0281 (-0.82)	-.0045 (-0.11)
ln*PK*DUM92*	-	-	-.0630 (-1.53)	-.0510 (-1.22)
ln*PF*DUM92*	-	-	-.1573** (-2.16)	-.2478** (-2.39)
ln*RISKASS*	3.1061** (2.37)	2.8200* (1.80)	3.0907** (2.35)	2.6922* (1.71)
ln*ASSET*	-.0571*** (-3.40)	-.0150 (-0.65)	-.0601*** (-3.19)	-.0050 (-0.21)
ln*BR*	-.0486** (-2.78)	-.0592*** (-3.17)	-.0592** (-2.72)	-.0515** (-2.10)
GROWTH	-.0082* (-1.89)	-.2805* (-1.83)	-.0040 (-0.87)	-.1619 (-1.01)
Lloyds-TSB DUM	0.0310 (0.74)	0.0504 (1.24)	0.0399 (0.95)	0.0585 (1.38)
Barclays DUM	-.0002 (0.00)	0.1171 (1.23)	-.0177 (-0.19)	0.1089 (1.16)
R^2 within	0.9211	0.9401	0.9257	0.9438
H	0.5718	0.4697	0.5022	0.3993
H0: H = 0	F(1,198) = 228.0 Reject ***	F(1,174) = 87.6 Reject ***	F(1,194) = 13.5 Reject ***	F(1,170) = 54.2 Reject ***
H0: H = 1	F(1,198) = 127.9 Reject ***	F(1,174) = 111.6 Reject ***	F(1,194) = 133.0 Reject ***	F(1,170) = 122.6 Reject ***
H0: ΣSlope DUM92 = 0	-	-	F(1,194) =8.3 Reject ***	F(1,170) = 7.0 Reject ***
H0: $\mu_i = 0$	F(11,198) = 21.4 Reject ***	F(11,174) = 16.2 Reject ***	F(11,194) = 19.8 Reject ***	F(11,170) = 16.2 Reject ***
H0: $\lambda_t = 0$	-	F(1,173) = 2.8 Accept	-	F(1,170) = 1.8 Accept

*** significant at 1%, ** significant at 5%, * significant at 10%

Table 5
Dependent Variable ln *INTREV*; t values in parenthesis

Variable	1-way FE	2-way FE	1-way FE	2-way FE
Intercept	-.3384 (-1.51)	-1.3904*** (-3.74)	-.3555 (-0.96)	-1.5172** (-2.37)
ln*PL*	-.0543*** -(2.60)	-.0420* (-1.87)	-.0322 (-0.82)	-.0328 (-0.68)
ln*PK*	-.0078 (0.35)	0.0032 (0.14)	0.0010 (0.03)	-.0064 (-0.15)
ln*PF*	0.7027*** (24.33)	0.6036*** (11.20)	0.6822*** (8.46)	0.6584*** (5.49)
DUM92	-	-	-.1078 (-0.39)	0.5743 (0.51)
ln*PL*DUM92*	-	-	-.0167 (-0.42)	-.0119 (-0.25)
ln*PK*DUM92*	-	-	-.0090 (-0.19)	0.0095 (0.19)
ln*PF*DUM92*	-	-	-.0002 (-0.00)	-.0596 (-0.48)
ln*RISKASS*	2.5519* (1.70)	3.2812* (1.80)	2.3283 (1.51)	3.1613* (1.68)
ln*ASSET*	-.0488** (-2.54)	.01565 (0.59)	-.0458** (-2.07)	0.0134 (0.48)
ln*BR*	-.0321* (-1.65)	-.05579** (-2.55)	-.0454* (-1.78)	-.0581** (-1.99)
GROWTH	-.0072 (-1.51)	-.0996*** (-3.53)	-.0073 (-1.36)	-.2500 (-1.31)
Lloyds-TSB DUM	0.0340 (0.71)	0.0712 (1.52)	0.0413 (0.84)	0.0786 (1.56)
Barclays DUM	-.0176 (-.16)	.1529 (1.40)	-.0321 (-0.29)	0.1591 (1.43)
R^2 within	0.9283	0.9444	0.9290	0.9447
H	0.6405	0.5648	0.6250	0.5573
H0: H = 0	F(1,198) = 218.8 Reject ***	F(1,174) = 93.0 Reject ***	F(1,194) = 152.7 Reject ***	F(1,170) = 74.6 Reject ***
H0: H = 1	F(1,198) = 69.0 Reject ***	F(1,174) = 55.2 Reject ***	F(1,194) = 54.9 Reject ***	F(1,170) = 47.0 Reject ***
H0: ΣSlope DUM92 = 0	-	-	F(1,194) = 0.1 Accept	F(1,170) = 0.2 Accept
H0: $\mu_i = 0$	F(11,198) = 7.1 Reject ***	F(11,174) = 5.6 Reject ***	F(11,194) = 6.1 Reject ***	F(11,170) = 5.3 Reject ***
H0: $\lambda_t = 0$	-	F(1,174) = 12.4 Reject ***	-	F(1,170) = 2.4 Accept

*** significant at 1%, ** significant at 5%, * significant at 10%

Alternatively, a higher level of provisions indicates a more risky loan portfolio and consequently a higher level of compensating return and therefore a positive effect on revenue. The effect of BR on total revenue suggests that the increased cost of maintaining a higher branch network dominates the positive effects of maintaining market share.

A formal test for the time-specific error component in the 2-way error-component regression is decisively rejected. We can therefore concentrate on the parameter estimates of columns 2 and 4 of Table 4. The results indicate strong support for the one-way error component model against that of a pure 'pooled' regression model. A significance test on the sum of the input price elasticities show that the 'H' statistic lies between zero and unity. The slope dummies are jointly significant indicating a value for the H statistic that is significantly lower in the second half of the period than in the first.

Table 5 presents the results for the case of interest revenue. At the outset, we can reject the possibility of a difference in the estimated value of the 'H' statistic in both halves of the sample. An F test for the joint significance of the slope dummies on the input price elasticities was decisively rejected, which means that we may concentrate on the estimates shown in columns 2 and 3. In contrast to the results in Table 4, we were unable to reject the two-way error component regression model. The estimated 'H' statistic lies between zero and unity and was constant throughout the full sample period.

The common elements in Tables 4 and 5 is the relative explanatory power of the price of funds and the proportion of branches in the sample. The effect of size on interest revenue was less robust than in the case of total revenue. However, the main result is that using interest revenue as the dependent variable, our findings suggests that despite the many changes to the banking system in Britain, competitiveness and contestability had not changed significantly over the period 1980-2004.

We may summarise the findings of the Rosse-Panzar method by comparing our results for estimates of the H statistic with other studies that have examined the UK. Table 6 summarises.

Table 6
H Statistics

Author	Variable	Period	Banks/FI	H statistic
Molyneux et. al. (1994)	Interest revenue	1986 1989	109 171	0.6282 0.8525
Bikker and Haaf (2002)	Interest revenue	1991 1997	213	0.6100 0.64
Claessens and Laeven (2004)	Interest revenue	1994-2001	106	0.74
Casu&Girardone (2005)	Total revenue	1997-2003	63	0.307 - 0.327
This study	Total revenue	1980-1991 1992-2004	10 12	0.7506 0.5022
This study	Interest revenue	1980-2004	10-12	0.5648

The unanimous verdict of all these studies is that the British banking system can be described as one of monopolistic competition. However, if the H statistic can be interpreted as a continuous variable we may infer that a high value for the statistic implies a higher level of competitiveness than a lower level.

From Table 6 we can see that Molyneux et. al. (1994) and Bikker and Haaf (2002) suggest that competitiveness has improved during the 1980s and between the beginning and the end of the 1990s. Claessens and Laeven (2004) suggest that competitiveness has been relative strong during the 1990s. In contrast Casu and Girardone (2005) estimate a relatively low level of competitiveness. The results of this paper confirm the mainstream finding that the British banking market is one of monopolistic competition.

We interpret the results of this paper in the following way. Competitiveness has remained unchanged over the full time period if banking performance is measured with respect to their core business. However, if non-interest income is included in the assessment, then banking competitiveness has significantly worsened in the 1990s. An alternative empirical test evaluates the robustness of the results and confirms our conclusion relating to the core area of banking.

Following Ho and Saunders (1981), we decompose the rate of interest charged on loans into cost of funds, real resource costs and risk. We estimate the following interest rate equations for the sample of banks:

$$R_{Lit} = \gamma_0 + \gamma_1 PF_{it} + \gamma_2 MC_{it} + \gamma_3 RISKASS_{it} + \varsigma_{it} \qquad (10)$$

R_{Lit} is the average loan rate for bank *i* at time *t*; PF_{it} is the average cost of funds for bank *i* at time *t*; MC_{it} is a measure of the marginal cost of servicing deposits and loans of bank *i* at time *t*; $RISKASS_{it}$ is a measure of risk defined as above; and ς_{it} is a random term. The parameter γ_1 is the ratio of the Lerner indices for deposits and loans and is a measure of market power.

$$\gamma_1 = \frac{\left(1 + \frac{\vartheta}{e_D}\right)}{\left(1 + \frac{\theta}{e_L}\right)} \qquad (12)$$

where e_D is the interest elasticity of demand for deposits; e_L is the aggregate interest elasticity of demand for loans; ϑ is the average share of the bank deposit market b the banks; and θ is the average share of the bank loan market by the banks.

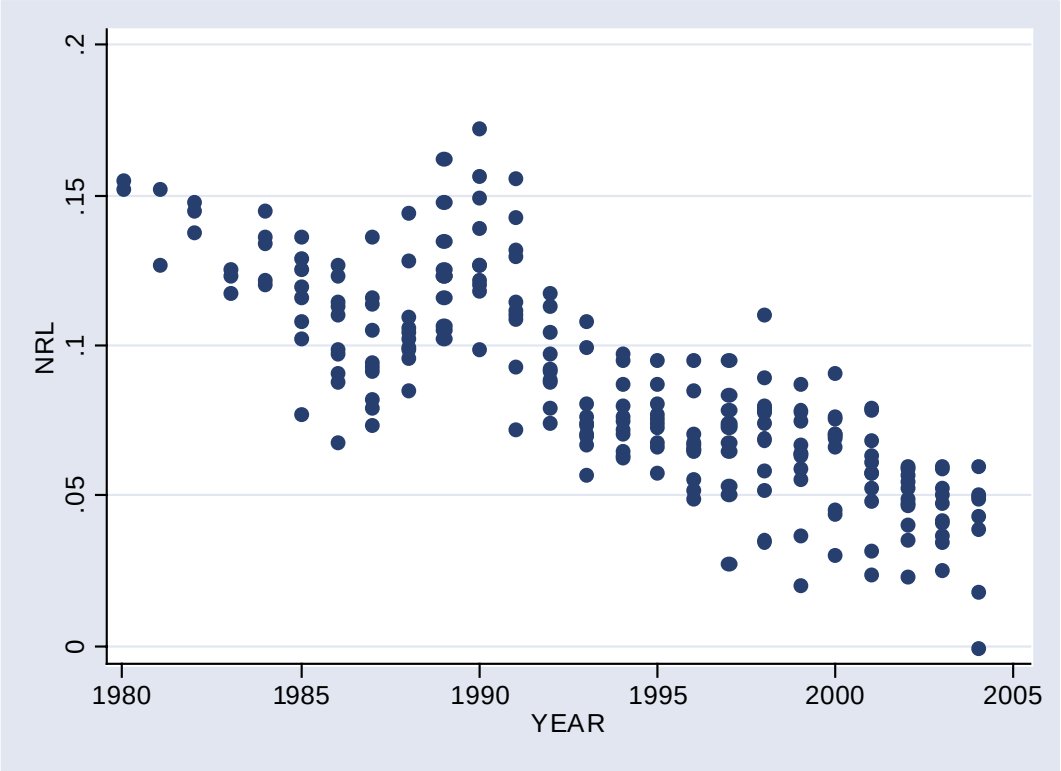
If the number of banks increases and the average shares in the deposit and loan market decline or if the elasticities of deposits and loans get larger through an increase in competition and substitution possibilities, the ratio of Lerner indices will tend to unity. In the extreme, if either the number of banks increases to infinity or the interest elasticity of loans and deposits becomes infinite, γ_1=1. Under monopolistic competition, γ_1 is strictly greater than unity. Vesala (1995) shows that in the case of monopolistic competition, H is an increasing function of *eL*, so that the less market power exercised by banks (higher is γ_1), the lower is H.

The income statements of the banks do not separate interest revenue between interest earned on loans and interest earned from other earning assets. Thus the ratio of interest received to the sum of loans and other earning assets is a weighted average of the average return on loans and the average return on other earning assets (R_O). We take the yearly average of the 3-month interbank rate (R_B) as a measure of the average return on other earning assets (*OEA*) and define the dependent variable (R_L) as follows:

$$R_L = \left(\frac{loans + OEA}{loans}\right)\left(\frac{Interest}{loans + OEA} - \left(\frac{OEA}{loans + OEA}\right)R_B\right)$$

$$= \left(\frac{loans + OEA}{loans}\right)\left(\left(\frac{loans}{loans + OEA}\right)R_L + \left(\frac{OEA}{loan + OEA}\right)R_O - \left(\frac{OEA}{loans + OEA}\right)R_B\right)$$

Figure 2:
Scatter Plot of Estimated Average Interest on Loans



If R_B is a good proxy for R_O, then R_L will be measured with a non-systematic error, which will be absorbed into the general error in the regression equation and therefore result in unbiased estimates. Figure 2 shows the calculated series for the full sample.

Three points emerge from an examination of Figure 2. First, there is a clear downward trend in the average rate on loans. Second, there are a number of outliers in the data. Third, the downward trend in the second half of the period is less pronounced than in the first. The 1990s, particularly the second half, has been a period of low interest rates and consequently less downward adjustment. We allow for these empirical features in the estimation.

Table 7
Interest rate functions: GLS Panel estimation, 't' values in parenthesis

Variable	Level	Level	Level AR1	Differenced	Differenced	Differenced AR1(12)
Intercept	4.889*** (7.44)	4.938*** (8.07)	4.18*** (5.93)	-.005*** (-4.15)	-.005*** (-4.33)	-.005*** (-4.01)
PF	1.209*** (9.78)	1.204*** (27.55)	1.121*** (26.78)	1.128*** (20.14)	1.083*** (29.09)	1.093*** (29.79)
MC	0.636*** (9.78)	0.628*** (10.52)	0.584*** (7.75)	0.564*** (4.75)	0.538*** (4.64)	0.576*** (5.16)
RISKASS	-.016 (-0.16)	-	-	0.250*** (2.83)	0.271*** (3.11)	0.220*** (2.61)
YEAR	-.002*** (-7.43)	-.002*** (-8.07)	-.002*** (-5.93)	-	-	-
DUM92	-5.24*** (-6.80)	-5.22*** (-7.05)	-4.10*** (-4.81)	0.004*** (3.45)	0.004*** (3.71)	0.004*** (3.49)
*PF*DUM92*	.001 (0.01)	-	-	-.089 (-1.20)	-	-
*YEAR*DUM92*	0.002*** (6.80)	0.003*** (8.07)	.002*** (4.81)	-	-	-
Log Likelihood	745.2	746.0	780.2	741.7	740.6	749.0
H0: AR = 0			$\chi^2_1 = 68.5$ Reject			$\chi^2_{12} = 16.8$ Reject

*** significant at the 1%, ** significant at the 5%, * significant at the 10%

The measure of the marginal cost of servicing loans and deposits is taken to be the ratio of *operating costs to total assets*[21]. Table 7 presents some results. Pre-testing of the specification rejected the error components regression model. Table 7 presents the results from panel GLS estimation with heteroskedasctic adjustment of the standard errors. Columns 2-4 report the results from estimation using levels.

Allowing for the possibility of unit roots in the variables we also estimate the functions in first differences shown in columns 5-7. The results for the levels show that there

[21] This assumes that marginal cost is proportional to average cost, which is consistent with CRS. However, this assumption is questionable given that the results of Table 4 imply diseconomies of scale.

was a discernible structural break in the 1990s in that there was a downward shift in interest rates and the negative trend in the 1980s was neutralised in the 1990s. The results show a value for γ_1 which is significantly different from unity confirming the findings of Table 5 that on the banks core business, the market could be described as monopolistic competition. However, there was no significant difference in the coefficient on PF in the 1990s, which means that there was no change in competitive conditions in the 1990s following the many mergers and acquisitions of that period. Allowing for the possibility of other missing variables or dynamic misspecification we also estimate the interest rate function with a common AR1 parameter. The null hypothesis that the first-order parameter is zero was decisively rejected on a Chi-Square with one-degree-of-freedom of 68.5.

The results from first differencing the variables basically confirm the findings from the levels, except that risk now appears as a significant variable and correctly signed. The specification rejected a common first-order autocorrelation adjustment but accepted a panel specific autocorrelation adjustment on a Chi-Square with 12 degrees of freedom of 16.8[22]. Again there was no evidence of a significant difference in the value of γ_1 between the two periods.

6. Summary and Conclusions

We have investigated the competitiveness and market contestability of the major British banks. The sample of banks bears a close correspondence to the major British Banking Groups specified by the British Banking Association. The period of investigation was 1980-2004 - a period that was punctuated with changes to legislation that affected banking business culminating in a series of Building Society conversions, and bank mergers and acquisitions.

Using the Rosse-Panzar methodology we find that the banking market in Britain is one of monopolistic competition. This result is of no surprise as it confirms the findings of a number of researchers. What is surprising is that following the number of mergers and acquisitions by banks and newly converted banks, our findings suggest that competitive conditions on the core business of banking (balance sheet business) has remained the same in the 1990s and 2000s as in the 1980s. This result is confirmed by estimating the ratio of the Lerner indices of deposits to loans. A ratio strictly greater than unity is symptomatic of monopoly or monopolistic competition. A ratio of unity is consistent with perfect competition. Our results confirm that there was no significant change in the ratio of the Lerner indices, indicating the continuing force of contestability. It is the credible threat of entry into the mainstream area of banking business that has deterred any increase in anti-competitive behaviour. Furthermore concentration has fallen moderately in the 1990s[23], suggesting that the mergers and acquisitions by the banks have been moderated by the new entrants from demutualization.

An examination of bank total revenue using the Rosse-Panzar methodology suggests that there was a significant worsening of competitiveness in the 1990s on the bank's non-core business. Non-interest earnings amounted to between 30 and 35 per cent of gross revenue for banks in 2004, which represents a significant source of income. How is it possible for competitiveness to be unchanged in some products but worsen in others? The answer according to Llewellyn (2005) is through the mechanism of 'bundling'. The purchase of one bank service may be conditional on the purchase of another, which may deter the customers from searching for the best individual product when in reality they purchase a bundle of

[22] It is very possible that the differencing operation induces panel specific autocorrelation by creating a moving average error process in the bank specific component of the error term.
[23] A feature also noted by Gondat-Larralde and Nier (2004) in their analysis of competition in the UK retail banking market.

products. The lack of competitiveness in the non-interest income segment of bank earnings has seen British banks making a strategic decision to develop capital-free business to raise ROE and the removal of assets from the balance sheet through securitization if they don't meet target ROE. Llewellyn (2005) argues that this is a deliberate strategy of Economic Value Added (EVA) by maximising shareholder value. Whatever the motivation, the re-focussing of British banks in the non-interest earnings capacity of their enterprise will eventually attract competition from new entrants or create the potential for the threat of entry.

Appendix I: Definitions of Variables

TREV = ratio of total bank revenue to total assets; *INTREV* = the ration of interest revenue to total assets; *PL* = the ratio of personnel expenses to employees (unit price of labour); *PK* = the ratio of capital expenses (the sum of depreciation on fixed assets and other operating expense) to fixed assets (unit price of capital); *PF* = ratio of annual interest expenses to total loanable funds (the sum of deposits and short term money market funding) - (unit price of funds); *RISKASS* = ratio of provisions for contingent liability and loan losses to total assets; *ASSET* = bank total assets; *BR* = ratio of number of branches of each bank to the total number of branches of the whole banking system; *ROA* = net pre-tax profits to total assets.

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