



Competitive conditions among the major British banks

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Abstract

This paper reports an empirical assessment of competitive conditions among the major British banks, during a period of major structural change. Specifically, estimates of the Rosse–Panzar H -statistic are reported for a panel of 12 banks for the period 1980–2004. The sample banks correspond closely to the major British banking groups specified by the British Banking Association. The robustness of the results of the Rosse–Panzar methodology is tested by estimating the ratio of Lerner indices obtained from interest rate setting equations. The results confirm the consensus finding that competition in British banking is most accurately characterised by the theoretical model of monopolistic competition. There is evidence that the intensity of competition in the core market for bank lending remained approximately unchanged throughout the 1980s and 1990s. However, competition appears to have become less intense in the non-core (off-balance sheet) business of British banks.

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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. The abolition of exchange controls in 1979 and the abolition of the last of the quantitative controls on bank lending heralded a period of rapid deregulation and increased competition in British banking during the 1980s. The Corset was abolished in 1980, required reserves were abolished in 1981 and Hire Purchase controls, which had restricted consumer borrowing, were abolished in 1982. Furthermore, the Building Societies Act of 1986 enabled the Building Societies to compete directly in the retail banking market. The 1980s saw a number of mergers of Building Societies. Several of the larger Societies de-mutualised and converted into banks. Against such a background of far-reaching structural change, this study poses the question: How have competitive conditions in the UK retail banking sector changed since the deregulatory period of the 1980s? To answer this question, we use econometric techniques to examine the nature of competitive conditions in the markets of the major British banks during the period 1980–2004.

We apply the Rosse–Panzar methodology in order to measure the intensity of competition in the banking sector. We report separate estimates of the Rosse–Panzar H statistic using data relating to 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.

The remainder of the paper is structured as follows. The next section details developments in British banking during 1980–2004. Section 3 presents the theory, data and empirical model. The estimation and results are reported in Section 4. Section 5 concludes.

2. British banking during 1980–2004

While the introduction of Competition and Credit Control (CCC) in 1971 signalled the beginning of the process of deregulation, it is widely recognized that the 1979 Banking Act represented the starting point for 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 rapid growth of bank credit and the secondary banking crisis. The 1970s witnessed several shifts of emphasis through the imposition and relaxation of quantitative controls, in the form of restrictions on 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.¹

¹ The 1987 Act effectively removed the distinction. Since the legislation, the conversion from licensed deposit-taker to retail bank has been increasing; 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).

A further important concession to clearing bank 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. Henceforth, time deposits paid 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 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 by acquiring stock broking and jobbing firms. Non-banking financial institutions, such as insurers, retailers and building societies, challenged the banks on their traditional balance sheet activity.

The period from 1987 to 2003 saw a number of demutualizations and mergers and acquisitions that affected the banking sector. There were also trends towards consolidation and diversification. 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 Midlands by Halifax). In 1995 Lloyds and TSB merged to form the Lloyds-TSB group. Barclays acquired Woolwich in 2000, and Royal Bank of Scotland acquired National Westminster in the same year. In 2001 Bank of Scotland and Halifax merged to form the HBOS group.

Table 1 presents concentration and Herfindahl–Hirschman Indices (HHI) for the sample period. The number of mergers, consolidations and acquisitions that occurred during the 1990s and in the new century might suggest an increase in concentration and a reduction in the intensity of competition. However, the evidence presented in this paper would suggest otherwise. Moreover, market structure indicators including the asset-based 2-bank concentration ratio, 5-bank concentration ratio and HHI² show a modest decline in the second half of the 1990s (see Table 1). It is important not to read too much into aggregate concentration measures, because contestability may dictate that banks in highly concentrated markets still behave competitively. Nevertheless, it can be seen that market concentration did not alter appreciably over the sample period.

There have been remarkably few studies of competition of UK banks relating to the last two decades of the 20th century. A notable exception is Heffernan (1993, 2002) who examines 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 using estimated interest rate equations based on monthly panel data. The results indicate an increase in competition in the mortgage market and low interest checking accounts, but there is evidence

² The US Department of Justice considers a market with a result of less than 1000 to be a competitive marketplace; a result of 1000–1800 to be a moderately concentrated marketplace; and a result of 1800 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.

Table 1

Concentration ratios and HHI for the biggest two and biggest five banks (assets-based)

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

Source: British Bankers Association.

of price discrimination behavior in other products. The findings suggest that the retail banking sector in Britain is best characterised by the model of monopolistic competition, 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.

A government enquiry into competition in UK banking (Cruikshank, 2000) concluded that while the market for personal retail banking was consistent with monopolistic competition, as evidenced by sustained abnormal returns, 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. Although they may form part of a larger banking group, entrants often specialize in products such as mortgages, unsecured loans and credit cards. This entry activity tends to increase the intensity of competition in these niche markets.

Other studies have examined competition in the UK banking sector as part of a wider investigation of competition in the banking sectors of many countries, using the Rosse–Panzar methodology that is adopted in this paper.³ These studies typically use panel data sets obtained from Fitch/Bankscope. Large numbers of banks are typically included, irrespective of specialist practice. An advantage of this approach is that it deals with the aggregate of banking activity in a country, and provides a snapshot of competitive conditions in totality. A disadvantage, as Llewellyn (2005) notes, is that aggregate studies fail to distinguish between banking sub-sectors that are highly competitive, and those that are not. This distinction can only be revealed by micro-level studies of specific banking markets. The application of the Rosse–Panzar methodology to aggregated data provides evidence about the nature of competitive conditions for a complete package of banking services, rather than for specific banking products.

The focus on British rather than European banking in this study is interesting, because the British experience of evolution in market structure and the regulatory environment since the 1970s differs markedly from that of other European countries. Deregulation in France, Spain, and Italy took place later than in the UK, and was typically carried out at a more controlled and slower pace. In contrast, the British experience is often characterised as 'big bang'. The implication is that the UK banking market may have evolved

³ For example Molyneux et al. (1994), Bikker and Haaf (2002), Claessens and Laeven (2004) and, most recently, Casu and Girardone (2005).

more rapidly than its continental counterparts, increasing the possibility of transitional disequilibrium. This possibility is explored in Section 4 of the paper.

3. Theory, methodology and data

Many early studies of market structure in banking were based on the structure-conduct-performance (SCP) paradigm. Typically, these studies assumed the market structure was exogenous, and regressed profitability on the concentration ratio and a number of control variables. Results, which showed a positive relationship between profitability and the concentration ratio, were interpreted as evidence that banks in concentrated markets exercised market power. In contrast to the SCP paradigm, the efficient-structure hypothesis (ESH) suggests that large banks tend to outperform small banks in terms of profitability because they are often more efficient. However, the available evidence does not resolve the debate, because neither SCP nor ESH variables are of great importance in explaining bank profitability (Berger, 1995; Berger and Humphrey, 1997). Moreover, both approaches focus on profitability, rather than the deviation of output price from marginal cost, which is the correct theoretical basis for analyzing competitive conditions (Paul, 1999).

The shortcomings of the SCP and ESH approaches are addressed by the *new empirical industrial organization* (NEIO), which assesses the strength of market power by examining deviations between observed and marginal cost pricing, without explicitly using any market structure indicator. The Rosse and Panzar (1977) reduced-form revenue model and the Bresnahan (1982) and Lau (1982) mark-up model are the two most popular approaches in this strand of literature. Both are derived from profit-maximizing equilibrium assumptions. The Rosse–Panzar approach works well with firm-specific data on revenues and factor prices, and does not require information about equilibrium output prices and quantities for the firm and/or industry. In addition, the Rosse–Panzar approach is robust in small samples, while the Bresnahan–Lau model tends to exhibit an anticompetitive bias in small samples (Shaffer, 2004).

Rosse and Panzar (1977) and Panzar and Rosse (1982, 1987), together with applications to banking by Nathan and Neave (1989) and Perrakis (1991), assume that firms can enter or leave any market rapidly, without losing their capital, and that potential competitors operate on the same cost functions as established firms. The key argument is that if the market is contestable, the threat of entry with price-cutting by potential competitors enforces marginal cost pricing by incumbents. In equilibrium, the latter do not realize excess profits, and no entry occurs. The test for the nature of competitive conditions is based on the properties of a reduced form log-linear revenue equation as follows:

$$\ln R_{it} = \alpha_0 + \sum_{j=1}^J \alpha_j \ln w_{jit} + \sum_{k=1}^K \beta_k \ln X_{kit} + \sum_{n=1}^N \gamma_n \ln Z_{nt} + \varepsilon_{it}, \quad (1)$$

where R represents the revenue of bank i at time t ; w_j are the input prices; the terms in X are bank-specific variables that affect the bank's revenue and cost functions; the terms in Z are macro variables that affect the banking market as a whole; and ε is a stochastic disturbance term. The Rosse–Panzar H -statistic is calculated from the reduced form revenue equation. H is the sum of elasticities of total revenue of with respect to each of the bank's J input prices. In Eq. (1), $H = \sum_{j=1}^J \alpha_j$.

Rosse and Panzar (1977), Panzar and Rosse (1982, 1987) show that when the H -statistic is negative ($H < 0$) the structure of the market is monopolistic. This case includes oligopoly with collusion, and may include a conjectural variation short-run oligopoly. In such cases, an increase in input prices will increase marginal costs, reduce equilibrium output and reduce total revenue. An H -statistic of one ($H = 1$) is associated with perfect competition, as any increase in input prices increases both marginal and average costs, without altering the optimal output of any individual firm. This case also includes a natural monopoly operating in a perfectly contestable market, and a sales-maximising firm subject to break-even constraints. Finally, $0 < H < 1$, is associated with monopolistic competition.

An important limitation of the H -statistic is that the tests must be undertaken on data that represents the market 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 return should be uncorrelated with input prices. The equilibrium test is based on a regression in which the dependent variable total revenue in Eq. (1) is replaced with pre-tax profit to total assets, as shown in the following equation:

$$\ln \pi_{it} = \alpha'_0 + \sum_{j=1}^J \alpha'_j \ln w_{jit} + \sum_{k=1}^K \beta'_k \ln X_{kit} + \sum_{n=1}^N \gamma'_n \ln Z_{nt} + u_{it}, \quad (2)$$

$E = \sum_{j=1}^J \alpha'_j = 0$ indicates long-run equilibrium, while $E < 0$ reflects disequilibrium. Table 2 summarises these theoretical underpinnings of the theory for measuring competitive conditions in the banking market, including the tests for equilibrium conditions.

Stylized bank-specific [X] variables which have been used previously by researchers include RISKASS = the ratio of provisions to total assets,⁴ a measure of the riskiness of the bank's overall portfolio; ASSET = total assets, a proxy for size; and BR = the ratio of the number of branches of each bank to the total number of branches for all banks. Branching has been viewed as a means for maintaining market share by providing consumers with close-quarter access to financial services, mitigating to some extent price competition.⁵

The data source is the Annual Reports of individual banks and Annual Abstract of Banking Statistics (British Bankers Association). The data sample broadly corresponds to the British Banking Association (BBA) Major British Banking Groups (MBBG), covering seven of the total nine banking groups in MBBG⁶ plus Standard Chartered Plc,⁷ but excluding Bradford & Bingley and Northern Rock Plc. Specifically, the sample comprises Abbey National Plc (1985–2004), Alliance & Leicester Plc (1994–2004), Barclays Plc (1985–2004), Woolwich Plc (1996–2002), Halifax Plc (1986–2004), Bank of Scotland

⁴ 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. Alternatively, a higher level of provisions indicates a more risky loan portfolio and therefore a higher level of compensating return.

⁵ See Northcott (2004). In addition, branching has cost implications, so there is a trade-off between maintaining market share and increasing cost of branch maintenance.

⁶ The total nine 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 Standard Chartered Group was a component of the MBBG before 1997 and has been actively operating in the banking market whereas Bradford & Bingley and Northern Rock Plc demutualized late in the sample period. Furthermore, the sum of total assets of Bradford & Bingley and Northern Rock Plc is less than that of Standard Chartered. Therefore, the inclusion of Standard Chartered would be more representative for the dynamics of the competition condition in the retailing banking during the past two decades.

Table 2
The theory and interpretation of the H -statistic

<i>Equilibrium test</i>	
$E = 0$	Equilibrium
$E < 0$	Disequilibrium
<i>Competitive conditions</i>	
$H \leq 0$	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

(1986–2004), Midland Bank Plc (1980–2004), Lloyds-TSB bank Plc (1982–2004).⁸ 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 seven groups, and 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. This dominant shareholder role motivates our use of consolidated annual data for these banks. Consequently, the data provides an overall picture of the seven groups. One exception is the Royal Bank of Scotland acquisition of National Westminster in 2000. To avoid double counting, we utilised unconsolidated data for Royal Bank of Scotland during the period of 2001–2003, and consolidated data for National Westminster. In sum, our data set is an unbalanced panel comprising 12 banks and 219 bank-year observations for the period 1980–2004.

To allow for heterogeneity across the banks, we use an error-component model, with the bank- and time-specific error components estimated as fixed effects. Most previous studies that have employed the Rosse–Panzar methodology have used data sets containing large numbers of banks and small numbers of time periods. In contrast, the present sample contains a small number of banks, which nevertheless account for a large proportion of the total assets of the British banking sector, and a long time period. The period 1980–2004 covers two recessions, in 1980–1981 and 1991–1992. 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 invariably coincide with the turning point of the recession, so bank performance may lead or lag the business cycle.⁹ Hence, the final equations to be estimated also include a pure time series variable, real GDP growth rate (GROWTH), as described by Eqs. (3) and (5)¹⁰

⁸ Woolwich was acquired by Barclays in 2000. The last annual report is 2003. The annual data for Lloyds Bank Plc is from 1982 to 1994, while the annual data for TSB Bank Plc is from 1984 to 2004. In 1995, the two banks merged to form Lloyds TSB Bank Plc.

⁹ See Cruikshank (2000), Appendix C. Theoretical models suggest both counter-cyclical and pro-cyclical mark-ups (Rotemberg and Saloner, 1986 and Green and Porter, 1984). Empirical support for the counter-cyclical mark-up is found by Mandelman (2006) in a large cross-country study, while support for the pro-cyclical mark-up is found by De Guevara et al. (2005) for EU banks.

¹⁰ Coccoresse (2004) recognises the role of macroeconomic indicators in assessing bank competition in Italy.

$$\begin{aligned} \ln \text{REV}_{it} = & \alpha_0 + \alpha_1 \ln \text{PL}_{it} + \alpha_2 \ln \text{PK}_{it} + \alpha_3 \ln \text{PF}_{it} + \beta_1 \ln \text{RISKASS}_{it} \\ & + \beta_2 \ln \text{ASSET}_{it} + \beta_3 \ln \text{BR}_{it} + \gamma_1 \text{GROWTH}_t + \varepsilon_{it}, \end{aligned} \quad (3)$$

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 i -subscript denotes banks ($i = 1, \dots, N$); and the t -subscript denotes time ($t = 1, \dots, T$). The model assumes a one-way error component as described by

$$\varepsilon_{it} = \mu_i + v_{it}, \quad (4)$$

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 given by $H = \alpha_1 + \alpha_2 + \alpha_3$. Similarly the equilibrium condition is modelled as

$$\begin{aligned} \ln \text{ROA}_{it} = & \alpha'_0 + \alpha'_1 \ln \text{PL}_{it} + \alpha'_2 \ln \text{PK}_{it} + \alpha'_3 \ln \text{PF}_{it} + \beta'_1 \ln \text{RISKASS}_{it} \\ & + \beta'_2 \ln \text{ASSET}_{it} + \beta'_3 \ln \text{BR}_{it} + \gamma'_1 \text{GROWTH}_t + u_{it}, \end{aligned} \quad (5)$$

$$u_{it} = \eta_i + v_{it}, \quad (6)$$

where ROA is the return on assets, η_i is the bank-specific effect and v_{it} is an IID random error. The banking market is deemed to be in equilibrium if $E = \alpha'_1 + \alpha'_2 + \alpha'_3 = 0$.

The Rosse–Panzar methodology is only one of a number of ways of measuring the nature of competitive conditions.¹¹ 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 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.¹² The robustness of the findings from the Rosse–Panzar methodology is tested by estimating the ratio of Lerner indices obtained from loan interest rate setting equations.¹³ The next section presents the empirical results and examines possible changes in competitive conditions during the 1980s and 1990s, focussing separately on the traditional and non-traditional lines of banking business activity.

4. Empirical analysis and results

The reduced form functions have, as the dependent variable, both the logarithm of total revenue and interest revenue as a percentage of total assets, respectively. The inclusion of non-interest revenue recognises the importance of non-interest income and fee earnings to bank profitability.¹⁴ Our starting point is to test if the British banking market is in long-

¹¹ See also Bresnahan (1982, 1997) and Lau (1982).

¹² See Freixas and Rochet (2002) for a formal derivation.

¹³ Ho and Saunders (1981) pioneered the estimation of interest margins as a function of competition and interest rate risk, with extensions by Allen (1988), Angbazo (1997) and Maudos and De Guevara (2004) for different sources and types of risk.

¹⁴ A number of studies use total bank revenue; for example, De Bandt and Davis (2000) and Casu and Girardone (2005) but interest revenue is used by Molyneux et al. (1994) and Bikker and Haaf (2002).

Table 3
Tests of equilibrium (rolling sample) dependent variable lnROA

Period	ln PL	ln PK	ln PF	Sum	H0 Sum = 0
1980–2004	-0.0002	-0.0014	-0.0009	-0.0025	$F(1, 200) = 3.20^*$
1980–1989	-0.0024	-0.0035	-0.0012	-0.0071	$F(1, 46) = 0.81$
1981–1990	-0.0020	-0.0028	0.0023	-0.0025	$F(1, 54) = 0.14$
1982–1991	0.0050	-0.0024	-0.0036	-0.0010	$F(1, 62) = 0.02$
1983–1992	-0.0000	-0.0039	-0.0031	-0.0070	$F(1, 69) = 3.57^*$
1984–1993	0.0006	-0.0038	-0.0047	-0.0079	$F(1, 76) = 5.53^{**}$
1985–1994	0.0002	-0.0021	-0.0056	-0.0075	$F(1, 81) = 5.30^{**}$
1986–1995	0.0005	-0.0008	-0.0048	-0.0051	$F(1, 83) = 2.99^*$
1987–1996	0.0008	0.0005	-0.0033	-0.0020	$F(1, 83) = 0.61$
1988–1997	0.0003	-0.0019	-0.0013	-0.0029	$F(1, 84) = 1.94$
1989–1998	0.0001	-0.0015	-0.0005	-0.0019	$F(1, 85) = 0.85$
1990–1999	0.0005	-0.0019	0.0004	-0.0010	$F(1, 86) = 0.28$
1991–2000	0.0003	-0.0010	0.0006	-0.0001	$F(1, 87) = 0.00$
1992–2001	0.0007	-0.0012	0.0012	0.0007	$F(1, 88) = 0.12$
1993–2002	0.0002	-0.0021	0.0016	-0.0003	$F(1, 89) = 0.02$
1994–2003	-0.0006	-0.0024	-0.0001	-0.0031	$F(1, 89) = 2.07$
1995–2004	-0.0006	-0.0024	-0.0007	-0.0037	$F(1, 87) = 3.23^*$

t-Values in parenthesis.

* 10% Level of significance.

** 5% Level of significance.

run equilibrium. Given the dynamic changes within the British banking scene during this period it would be no surprise to find that market equilibrium may not have held over the full sample. We test for this by running a rolling regression of a 10-year window with the aim of identifying periods when the banking market was not in equilibrium. Table 3 presents the results for ln ROA as described by Eq. (5) for the full sample and for the rolling sub-samples. For reasons of space we show only the results for the sum of the elasticities for the test of equilibrium as described in Table 2.

Table 3 suggests that market equilibrium over the full sample period is questionable. The F statistic on the restriction of the sum of the elasticities rejects market equilibrium at the 10% level of significance but not the 5%. The rolling regression results show that in the sub-samples 1983–1992 through to 1986–1995 and again in 1995–2004 the banking market was not in equilibrium.¹⁵ A Chow test for parameter stability confirms the suggestion that the banking market has undergone a structural change. Table 4 shows the results for Eq. (5) and sub-samples 1980–1991 and 1992–2004. The sub-sample period was chosen both because it represented an approximate halfway point in the time dimension of the data but more so because mid-1991 was the turning point of the 1990–2 recession, so the first half of the period captures a full business cycle.

Table 4 shows that bank specific fixed effects were not significant in the first half of the period but were significant in the second half. Furthermore while there is a suggestion that the banking market was not in equilibrium in the full sample period, the restriction that $E = 0$ was not rejected for the sub-samples at any conventional level of significance. A

¹⁵ This finding would be damaging if we argued that the British banking market was perfectly competitive. Shafer (2004) argues that the restriction that $E = 0$ is necessary for the perfect competition case but not for the monopolistic competition case.

Table 4
Tests of equilibrium dependent variable lnROA

Variable	1980–2004	1980–1991	1992–2004
Intercept	0.0230*** (3.24)	0.1034* (1.87)	0.0252 (2.60)
ln PL	−0.0002 (0.27)	0.0059 (1.24)	0.0002 (0.37)
ln PK	−0.0014* (1.89)	−0.0020 (1.21)	−0.0016* (1.81)
ln PF	−0.0009 (1.03)	−0.0034 (1.01)	0.0005 (0.49)
ln RISKASS	−0.6471*** (13.56)	−0.5514*** (8.53)	−0.8343*** (5.91)
ln ASSET	−0.0016*** (2.69)	−0.0068** (2.07)	−0.0016** (2.07)
ln BR	−0.0012 (1.91)*	0.0017 (0.97)	−0.0025 (1.55)
GROWTH	0.0007*** (4.19)	0.0004 (1.54)	0.0006* (1.71)
R ² Within	0.5898	0.6159	0.4706
H0: $\eta_i = 0$	$F(11, 200) = 7.78^{***}$	$F(9, 66) = 1.50$	$F(11, 117) = 11.28^{***}$
H0: $E = 0$	$F(1, 200) = 3.20^*$	$F(1, 66) = 0.01$	$F(1, 117) = 0.28$
Chow stability test $F(19, 202) = 2.11^{***}$			

t-Values in parenthesis.

* Significant at the 10%.

** Significant at the 5%.

*** Significant at the 1%.

Chow test for parameter stability confirms that there was a structural change in the estimating equation.¹⁶

Tables 5 and 6 present the results using the logarithm of total bank revenue as a fraction of total assets (lnREV) and the log of interest revenue as a fraction of total assets (lnINTREV) respectively. The Chow test results in Table 5 indicate strong evidence of parameter instability caused by a structural break.¹⁷ The positive effect of RISKASS, the riskiness of the bank's overall portfolio, supports the argument that higher risk commands a higher compensating return. 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, although this variable was not significant in the sub-samples. A significance test on the sum of the input price elasticities show that the '*H*' statistic lies between zero and unity. The estimate of the *H* statistic is significantly lower in the second half of the period than in the first, indicating a worsening of competitive conditions.

Table 6 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. The Chow test for parameter stability suggests no structural break over the full

¹⁶ A test for the time-specific error component in the 2-way error-component regression indicated no time-specific effect. However, it should be noted that the variable GROWTH would be expected to absorb all time-specific effects.

¹⁷ This finding is also supported by a joint-test for intercept and slope dummies on the unit factor prices (1992–2004 = 1; 0 otherwise) at the 1% level of significance.

Table 5
Tests of competitive conditions dependent variable lnREV

Variable	1980–2004	1980–1991	1992–2004
Intercept	−0.3083 (1.60)	1.1033** (2.06)	−0.5455 (1.57)
lnPL	−0.0098 (0.54)	0.164*** (3.57)	−0.0164 (0.64)
lnPK	0.0025 (0.13)	0.0026 (0.16)	−0.0289 (0.91)
lnPF	0.5788*** (23.12)	0.6119*** (18.97)	0.5096*** (12.72)
lnRISKASS	2.9886** (2.30)	1.4147** (2.26)	5.8986 (1.17)
lnASSET	−0.0551*** (3.34)	−0.0963*** (2.89)	−0.0676** (2.52)
lnBR	−0.0461*** (2.70)	0.0094 (0.57)	−0.0809 (1.43)
GROWTH	−0.0082* (1.91)	−0.0027 (1.17)	−0.0121 (1.00)
R^2 Within	0.9209	0.9181	0.8165
H0: $\eta_i = 0$	$F(11, 200) = 23.94$ ***	$F(9, 66) = 21.97$ ***	$F(11, 117) = 11.95$ ***
H0: H = 0	$F(1, 200) = 229.46$ ***	$F(1, 66) = 205.89$ ***	$F(1, 117) = 71.25$ ***
H1: H = 1	$F(1, 200) = 128.99$ ***	$F(1, 66) = 16.59$ ***	$F(1, 117) = 94.76$
H	0.5715	0.7785	0.4643
Chow stability test $F(19, 202) = 2.57$ ***			

t -Values in parenthesis.

* Significant at the 10%.

** Significant at the 5%.

*** Significant at the 1%.

sample. The estimated ' H ' statistic lies between zero and unity and is not significantly different in the sub-samples.¹⁸

The common elements in Tables 5 and 6 is the relative explanatory power of the price of funds and size. 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, competitive conditions had not changed significantly over the period 1980–2004.

In general, our results are consistent with previous studies, which use the Rosse–Panzar approach and include the UK in the sample. For example, Molyneux et al. (1994) and Biker and Haaf (2002) find improved competition in the 1980s and between the beginning and the end of the 1990s. Claessens and Laeven (2004) find relatively strong competition during the 1990s, while Casu and Girardone (2005) estimate a relatively low level of competition with an H -statistic of around 0.3.¹⁹ While the different estimates of H can be attributed to the variation of sample periods and sample size, the established view is that

¹⁸ This result was also supported by a joint-test for intercept and slope dummies on the unit factor prices (1992–2004 = 1) which rejected their inclusion at any conventional level of significance.

¹⁹ Casu and Girardone (2005) obtain an estimate of H of around 0.3 whereas the estimates we obtain are in the region of 0.5–0.8. One possible reason for this difference is the panel of small T (7-years) and large N (63-banks) used by Casu and Girardone, which raises the prospect of 'aggregation bias' caused by incorrectly assuming parameter equality over all 63 banks.

Table 6
Tests of competitive conditions dependent variable lnINTREV

Variable	1980–2004	1980–1991	1992–2004
Intercept	–0.3604 (1.63)	0.8798 (1.26)	–0.5448 (1.28)
ln PL	–0.0560*** (2.70)	0.0950 (1.58)	–0.0521* (1.68)
ln PK	–0.0064 (0.29)	–0.0276 (1.31)	–0.0284 (0.73)
ln PF	0.7024*** (24.54)	0.6456*** (15.33)	0.6505*** (13.28)
ln RISKASS	2.4187 (1.63)	0.4113 (0.50)	3.8100 (0.62)
ln ASSET	–0.0465** (2.46)	–0.1019** (2.47)	–0.0567* (1.73)
ln BR	–0.0295 (1.51)	0.0269 (1.25)	–0.0737 (1.07)
GROWTH	–0.0073 (1.48)	–0.0068** (2.26)	–0.0113 (0.76)
R ² Within	0.9281	0.8723	0.8123
H0: $\eta_i = 0$	$F(11, 200) = 8.34^{***}$	$F(9, 66) = 9.66^{***}$	$F(11, 117) = 3.26^{***}$
H0: H = 0	$F(1, 200) = 220.22^{***}$	$F(1, 66) = 101.26^{***}$	$F(1, 117) = 71.77^{***}$
H1: H = 1	$F(1, 200) = 69.6^{***}$	$F(1, 66) = 16.42^{***}$	$F(1, 117) = 40.82^{***}$
H	0.6400	0.7130	0.5700
Chow Stability Test $F(19, 202) = 0.91$			

t-Values in parenthesis.

* Significant at the 10%.

** Significant at the 5%.

*** Significant at the 1%.

the British banking system can be described as one of monopolistic competition. Our results confirm this mainstream finding.

We interpret the results of this paper in the following way. Competition in banking 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 competition has significantly worsened in the 1990s. The implication is that there has been a weakening of competition in the non-interest element of banking services, which means that by altering the product-mix of banking services, British banks have been able to increase their collective market power.²⁰ Non-interest earnings amounted to between 30% and 35% of gross revenue for banks in 2004, which represents a significant source of income. How is it possible for competitive conditions 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 products. The

²⁰ Llewellyn (2005) also discusses the proposition that while the UK banking market may be competitive in general, it may be weak in sub-markets such as bank services to SMEs. In contrast de Young and Roland (2001) in an empirical study of US banks argue that the trend to off-balance sheet activity increases bank earnings volatility because of high competitive rivalry in these markets.

lack of competitive conditions 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 do not meet target ROE. Llewellyn (2005) argues that this is a deliberate strategy of Economic Value Added (EVA) by maximising shareholder value.

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.²¹ We estimate the following interest rate equations for the sample of banks:

$$R_{Lit} = \gamma_0 + \gamma_1 PF_{it} + \gamma_2 MC_{it} + \gamma_3 RISKASS_{it} + \zeta_{it}, \quad (7)$$

where 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 ζ_{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, $\gamma_1 = (1 + \vartheta/e_D)/(1 + \theta/e_L)$, 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 by 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, $\gamma_1 = 1$. 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 e_L , so that the less market power exercised by banks (lower is γ_1), the higher 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:

$$\begin{aligned} R_L &= \left(\frac{\text{loans} + \text{OEA}}{\text{loans}} \right) \left(\frac{\text{Interest}}{\text{loans} + \text{OEA}} - \left(\frac{\text{OEA}}{\text{loans} + \text{OEA}} \right) R_B \right) \\ &= \left(\frac{\text{loans} + \text{OEA}}{\text{loans}} \right) \left(\left(\frac{\text{loans}}{\text{loans} + \text{OEA}} \right) R_L + \left(\frac{\text{OEA}}{\text{loan} + \text{OEA}} \right) R_O - \left(\frac{\text{OEA}}{\text{loans} + \text{OEA}} \right) R_B \right). \end{aligned} \quad (8)$$

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.²²

²¹ See also Maudos and De Guevara (2004) for a more general estimation of interest margin models for EU countries, including the UK.

²² The calculated series for the full sample are available from the authors on request.

Table 7
Interest rate functions: GLS panel estimation

Variable	Level	Level	Level AR1	Differenced	Differenced	Differenced AR1(12)
Intercept	4.889*** (7.44)	4.938*** (8.07)	4.18*** (5.93)	−0.005*** (−4.15)	−0.005*** (−4.33)	−0.005*** (−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	−0.016 (−0.16)	−	−	0.250*** (2.83)	0.271*** (3.11)	0.220*** (2.61)
YEAR	−0.002*** (−7.43)	−0.002*** (−8.07)	−0.002*** (−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	0.001 (0.01)	−	−	−0.089 (−1.20)	−	−
YEAR*DUM92	0.002*** (6.80)	0.003*** (8.07)	0.002*** (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

t-Values in parenthesis.

* Significant at the 10%.

*** Significant at the 1%.

The measure of the marginal cost of servicing loans and deposits is taken to be the ratio of *operating costs to total assets*.²³ Pre-testing of the specification rejected the error components regression model. Table 7 presents the results from panel GLS estimation with heteroskedastic 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 was a discernible structural break in the 1990s in that there was a downward shift in interest rates and the negative trend (shown by the variable *YEAR*) in the 1980s was neutralised in the 1990s. The value of γ_1 is significantly different from unity, which confirms the findings of Table 6 that on the banks' core business, the market could be described as one of monopolistic competition. However, there was no significant difference in the coefficient on *PF* in the 1990s as revealed by a slope dummy (1992–2004 = 1), 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.²⁴

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 16.8.²⁵ Again there was no evidence of a significant difference in the value of γ_1 between the two periods.

5. Summary and conclusions

We measure the nature of competitive conditions among the major British banks during 1980–2004. Our study is central to understanding the evolution of banking in the UK because the sample of banks closely corresponds to the major British banking groups specified by the British Banking Association, while the sample period covers the era of key changes to legislation that affected banking business, culminating in a series of Building Society conversions, and bank mergers and acquisitions. In addition, the long time period used in our study differs from shorter periods in most previous studies.

We use the Rosse–Panzar methodology, and augment it with an analysis of Lerner indices derived from interest rate setting equations. The evidence from the Rosse–Panzar methodology suggests that UK banking is monopolistically competitive. However, we find that in the sub-samples 1983–1992 through to 1986–1995 and again in 1995–2004 the banking market was not in equilibrium. While the result of monopolistic competition is consistent with evidence from previous research, it is surprising 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) remained the same in the 1990s and 2000s as in the 1980s. This result is confirmed by estimating the

²³ This assumes that marginal cost is proportional to average cost.

²⁴ The null that the first order AR parameter is zero was rejected on a Chi-square (1 d.f.) of 68.5.

²⁵ 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.

ratio of the Lerner indices of deposits to loans. It is found that there was no significant change in the ratio of the Lerner indices, indicating the continuing force of competition. Furthermore concentration has fallen moderately in the 1990s,²⁶ suggesting that the mergers and acquisitions by the banks have been moderated by the new entrants from demutualization.

Results obtained from further application of the Rosse–Panzar methodology to examine bank total revenue suggest that there was a significant worsening of competitive conditions in the 1990s on the banks' non-core business. This result was further confirmed by estimating the '*H*' statistic over a moving sub-sample window of 10 years duration, which showed a secular decline in its value. The suggestion that the UK banking market is competitive in general but non-competitive in specific sub-markets has been recognised by the [Competition Commission \(2002\)](#) and the [Cruikshank \(2000\)](#) report. Even the conclusion that conditions of competition on the core business of the banks as an aggregate have not changed over the period needs to be qualified. [Heffernan \(2002\)](#) suggests that individual sub-markets have seen a deterioration of competition (credit cards, interest cheque accounts) while others have seen a strong improvement in competition (mortgages), which may have left the aggregate position unchanged. The implications for policy suggest a stronger focus on transparency of bank charges and fees, which in turn may eliminate consumer inertia that arises from the 'bundling' of bank services. However, it could be also argued that any such policy would be short term as the openness of the UK banking market suggests that non-competitive behavior in specific sub-markets would be eliminated by competitive pressure over the long period. 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.

An interesting avenue for further research might involve more in-depth analysis of how the price and non-price strategies of the banks sampled have changed during the sample period (see, for example, [Aysuo and Martinez, 2006](#)).

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²⁶ This feature is noted also by [Gondal-Larralde and Nier \(2004\)](#) in their analysis of competition in the UK retail banking market.

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