"Relationship between bank competition and stability: the case of the UK"

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RELATIONSHIP BETWEEN BANK COMPETITION AND STABILITY: THE CASE OF THE UK

Abstract

There is no consensus in theoretical and empirical studies about the relationship between bank competition and stability. This research aims to investigate the relationship between bank competition and stability in the UK. The analysis has been done on a large sample of UK banks for the period 2004–2014. There is quite contrasting evidence on the bank competition and bank soundness relationship. A unified framework has been developed to assess how different factors may make it more likely that the data favor one theory over another. The results suggest that in some cases a U-shaped relationship exists between bank competition and stability. Therefore the conclusion is that in order to protect the bank from different risk exposures a moderate level of bank competition is needed.

Keywords   banks, competition, analysis, relationship, stability

JEL Classification   G21, G14

INTRODUCTION

In recent decades there has been a remarkable increase in the number of financial institutions in the UK banking sector which has led to competition-stability relationship becoming a pivotal issue. Competition and stability relationship has implications for the allocation of resources, availability of choice, and stability in the economy. This issue is not only interesting but important for the UK banking as long as policy makers proposed to establish stable financial market with sufficient level of competition in the banking industry. It is hard to judge what bank competition level is appropriate for the country and in this area there is a lot of concern about how ongoing financial processes affect competition and stability relationship. The belief that market power is needed to some extent to obtain stability makes academics and policy-makers focus on financial stability rather than on competition.

The purpose of this research is to analyze the relationship between bank competition and stability in the UK by underlining the importance of bank competitiveness for the UK banking sector. This will be achieved by looking at the issue in periods from 2004 to 2016: before the financial crisis, prior to the crisis and after the crisis; particularly research will highlight competition in the UK banking sector. The uniqueness of the work is that it looks only at the competition-stability relationship in the UK banking sector which is different from any other European banking. The difference is its internationality and it follows an Anglo-Saxon banking model that makes competitiveness of the market very important for effective bank performance. Also, a competitive environment in which banks operate might be changed because of the well-developed stock market in the UK. Consequently,

on capital markets, enterprises may increase funds and these funds are close substitutes for bank loans. So, the enterprises are given an opportunity to raise funds directly rather than obtaining funds from banks by a highly developed stock market.

This research work has been focused on a specific measure of bank competition. The index, which can be used as an indicator of competition at the country level is the HHI. However, this research focuses on a bank-level indicator of stability rather than indicators of systemic distress. It is important to highlight, therefore, that the research is not based on the competition stability debate, but nevertheless it shows the significance of both theories and it is necessary to consider regulatory and other policies when considering how stability of the bank is affected by competition in the banking market. Thirdly, this research investigates the relationship between competition and stability, which has been issued by many researches. However, it focuses on the impact of competition-stability trade-off in the bank industry in the UK. The effects of the competition are controlled for by including the time-varying effect, which implies only working with the country year information.

1. LITERATURE REVIEW AND RESEARCH QUESTIONS

The proposed research aims to analyze theoretically and empirically the relationship between competition and stability in the UK banking industry. It will consider the factors which have possibly affected competition-stability relationship in banking market during recent decades, including financial crisis, deregulation and innovations in the banking industry. It will also clarify the roles of the competition within the UK banking industry for recovery after the crisis and will analyze the main trends, such as net margin and return on assets in the UK banking sector via the latest survey data.

Previous research focusing on bank competition and bank stability relationship has a long empirical tradition. For assessing whether there was any correlation between industry conditions and bank performance work has been adopted by Structure Conduct Performance paradigm. However, this approach has been criticized by many researchers in terms of the markets power through which banks are able to earn high profits, or as a consequence of high level efficiency, or by collusion. There is never been sufficient resolution in the empirical literature (Berger, 1995; Goddard et al., 2001, 2007; Casu & Girardone, 2006, 2009b; Degryse & Ongena, 2008; Tregenna, 2009; Dick & Hannan, 2010). Two views are posited in the literature. The first, known as the competition-fragility view, argues that in less competitive markets resulting in higher profits banks earn capital ratios, and charter values, monopoly rents. This may

give them a better position to withstand demand or supply-side shocks which in its turn deter excessive risk-taking (Allen & Gale, 2004; Carletti, 2008). The second view is known as the competition-stability view, and posits that competition leads to less fragility. The possibility of the non-repayments and the default risk of bank portfolios make the financial system less stable (Boyd & De Nicolo, 2005). Empirical banking research in this area has found differences in the condition of the competition through whole banking sectors from the 1980s to the present (Molyneux et al., 1994). It should be noted that the two views are not necessarily opposing each other.

Many economists are willing to demonstrate that bank competition in the financial sector has a positive influence on the whole economy and can produce economic growth (Berger, 2009). It is notable that macroeconomic performance is affected through raising capital accumulation when enhanced competition in the banking sector contributed to a rise in deposit rates. A number of academics (Jayaratne & Strahan, 1996) have argued that competition is restricted and allocative efficiency is reduced by regulation of the banking industry which imposed higher barriers to entry. In the case of the UK, an examination of the current banking sector shows that methods of curtailing the implicit government guarantee accepted by major banks and the responsibility of these banks for risk taking is beneficial for both competition and stability. According to Vickers (2013), competitiveness of the banking sector is crucial particularly for recovering after crisis and he is concerned about it in

the UK retail banking market. Therefore, Vickers (2013) has recommended that the UK government does not deviate from competitive rules and rationales immediately and to work firmly but pragmatically to secure that actions are appropriate and relevant, but within the competitive principles.

H1A. There is a positive effect of competition on stability.

Despite the foregoing evidence that competitiveness in the banking industry has a positive economic effect on the entire economy, there is a view that market power of the banking industry is vital for financial stability (Keeley, 1990). Banking competition leads to higher pressure to maintain profit and may reflect on banks stability (Keeley, 1990). In an environment of high competition in the market, banks may invest in riskier projects in order to attract clients, which to some extent increase the risk of default or probability of failure. The assessment of the degree of competition in an industry from its structural features has been done by the Structure-Conduct-Performance hypothesis. The concentration in the market generates market power by its suggestion, allowing banks to earn monopolistic profits where they may offer lower deposit rates and charge higher loan rates. The Efficiency Structure Hypothesis, from another point of view, proposes that the positive relationship between market concentration and profitability is not a result of market power but because of the outstanding efficiency of firms with larger market share (Demsetz, 1973). Competition and stability relationship can be considered as a key issue in the banking industry as it has an impact through the economy. Allen and Gale (2004) developed a simple model of competition and risk taking to illustrate the agency problem. When firms are debt-financed, managers acting in the shareholders' interests have an incentive to take excessive risks, because the debt holders bear the downside risk while the shareholders benefit from the upside potential. The cost of such outcomes is considerably higher under competition because of the fact that banks with market power have stimulus to deduct the settlement of deposit investments to achieve an appropriate level of their profitability (Schaeck, 2007). For instance, banks loan portfolio can be impaired by the lower acceptance criteria set up by a bank, which may attract financially weak applicants. It seems that there is a need for the regu-

lations of the banking sector because it is sensitive to risks, which could be a reason for a bank's failure. According to the Office of Fair Trading a prudential regulation needs to preserve stability, without relaxing competition policy. Specifically the emerging market structures post-crisis will require an evaluation to secure that they are pro-competitive and present the best results for costumers. Particular attention is required to be paid to how governments withdraw support from the banking sector and to ensure that any new entry can be a credible threat to existing players (OECD, 2010).

H1B. There is a negative effect of competition on stability.

Both policy makers and academics agree that the variation of the relationship between competition and market stability should be studied further. As previously mentioned, no conclusion could be drawn from academic debates relating to the effects of competition on the stability of financial institutions. However, available publications in this field exploring the behaviors of oligopolies have already confirmed the likelihood of aggressive competition among banks, when they are active in a concentrated market. As a result, these institutions are obliged to identify the strategic moves of the competition. The major sources about competition in the banking sector (Berger, 1995) are mostly issuing the profit and cost efficiency in the banks.

2. DATA AND METHODOLOGY

The research strategy to be used in the study involves raw financial data collection with respect to UK banks and empirical analysis of the impact of competition in banking on risk-taking using Z-score as financial stability index and using the Lerner index and HHI index as a measure of the competition. Due to the nature of the study, financial data will be collected from database Bankscope and World Bank databases, where empirical analysis is carried out using Eviews software. A filtered search will be conducted over the period 2004 to 2014 with certain criterion restriction.

Bank-level financial data have been retrieved for the years 2004–2014 from the Bankscope database provided by Bureau Van Duk. Our initial sample

includes approximately 477 banks located in the UK. A number of filtering rules are applied to get rid of non-representative data, reducing our analysis sample from 539 to 477 banks operating in the UK. In order to take advantage of the panel dimension of the data decision was taken not to drop bank-year observations but to drop banks in order to maintain and take advantage of the panel dimension of the data.

The study as stability indices uses Z-score measure to quantify banking-sector stability. Using the example set out by Berger et al. (2009) the Z-score is used as a main stability measure. Other independent variables, which have been included in the research are control variables of the non-performing loans to gross loans (NPL) ratio and Return on Average Assets (ROAA) to measure financial stability. The ratio of non-performing loans to total loans is a key indicator for measuring the overall stability of the banking system in any given country. The Z-score is an inverse proxy variable of the failure probability of firms as well as a direct measure of stability. This was used for the first time by Roy (1952) and later in other empirical banking studies by Berger et al. (2009). A higher bank capitalization or stability is associated with a higher Z-score, while unstable earnings are characterized by a lower Z-score. Thus it can be concluded that a higher Z-score is an indicator for increased stability whereas a lower Z-score indicates instability.

The Z-score indicates the number of standard deviations below the mean by which the profits of the bank would have to fall in order to totally consume equity capital (Boyd et al., 2005).

It is a measure of a bank's distance from insolvency and is formally defined as:

$$Z = \frac{ROA + \dfrac{E}{A}}{\sigma ROA},$$

where Z is the inverse probability of failing (the Z-score), ROA is the returns on assets for bank, E/A is the equity to total assets for bank, and σROA is standard deviation on the returns to assets for bank.

In the data as competition indices the Lerner index is used which was calculated using the total cost, total revenue, and total-assets data. All data required for the construction of the Lerner index were obtained from the bank statements in the Bankscope.

In this research, the Lerner index is constructed by using the following formula:

$$Lerner = \frac{(Pit - MC)}{Pit},$$

where Pit operating income/total assets, MC – marginal cost.

$$MC = Cit / \big[2Qit(\alpha 1 + 2\alpha 2 \ln Qit + \\ + \sum \overline{y} \ln(w1, w2, w3)a) \big],$$

where Cit – total operating cost, Qit – total assets, $w1$ – price of funds, $w2$ – price of labor, and $w3$ – physical capital.

Marginal cost was constructed following the intermediation approach by Sealey and Lindley (1977) in specifying the input prices and the outputs of the cost function. In order to produce three outputs, namely deposits, other earning assets and loans, three inputs, namely labor, funds and physical capital are used. The three key groups of inputs relating to the bank production process have thus been reflected through the three inputs mentioned previously. These are for the provision of bank services which needs a management in banking and personal expertise, funds collected on the liabilities side and offices or branches (physical capital). About the price of labor, Bankscope does not provide direct data and there is no information on the number of employees to enable it, as the unit price of labor the construction of the ratio of personnel expenses to the number of employees. As a result, a ratio of personnel expenses over total assets has been used, that is a popular method in banking research based on Bankscope (Yildrim & Philippates, 2002). The construction of the price of funds has been done as the ratio of interest expense over funding. Moreover, the physical capital price might not be taken directly from Bankscope and was constructed as depreciation over fixed assets. However, depreciation ratio has been neglected because the data are not available on Bankscope database.

This study intends to estimate the relationship between the competition index and the stability index. In order to account for variances across banks, the study incorporates control variables suggested by Berger et al. (2009). The control variables include the non-performing loans to gross loans, total assets, and the net interest margin and return on average assets. These variables are bank-specific control variables and one data point is taken per bank over the eleven years. There are no control variables accounting for country-specific effects because only one country sample and its features in a country's banking sector have been studied. However, the control variable, GDP per capita, has been collected from the World Bank's Indicators database in order to evaluate macroeconomic factors. To consider endogeneity of market power and heterogeneity across the banking industry in the UK, the Generalized Method of Moments (GMM) by using instrumental variables is applied. The econometric methodology used here is taken from Berger et al. (2009) but uses some financial ratios and country rank, shareholders value, bank size, as instrumental variables. The data for the instrumental variables was collected from the Bankscope database and the World Bank database. The model was estimated on a panel of 477 banks in the UK between 2004 and 2014. GMM models were used because of working with a large number of cross-sections.

The generic form of GMM models is as follows:

$$Stability = f(\,BCit, Bit, BSjt, Mit\,),$$

where the subscripts i, j, t denote bank i, specific variables j and year t; $BCit$ – banking competition; Bit – bank-specific variables; $BSjt$ – banking system specific variables; Mjt – macroeconomic variables.

Furthermore, our main results are not motivated by bank-specific conditions. Martinez-Miera and Repullo's (2010) theoretical model suggests an inverse U-shaped relationship between market power and bank soundness. The researchers run the regression with quadratic term of the HHI and Lerner index in order to gain empirical support for the model above. By means of a significant and suggesting negative coefficient on the squared term, there should be a non-linear, inverse

U-shaped relationship. In our case from the point of market power HHI deposits' quadratic term does turn negative. Then the control variables are considered, where a robustness check has been carried out by using different types of tests. The tests of the validity of the instruments have been used, and rejection implies that the instruments are valid. Namely, one period lagged (minus one period lags) tests are obtained for the relevance of the instrumental variables, where rejecting the null hypothesis implies that the variables are not exogenous. Because in the research GMM methods have been used it is not necessary to check for heteroscedasticity. As there were estimated GMM regressions with robust standard errors clustered at the bank level, to correct for correlation, the test for the presence of heteroscedasticity in our data set is not required. The GMM model by itself captures heteroscedasticity.

3. EMPIRICAL RESULTS

As hypothesized at the beginning there exist Z-score for stability, HHI index for competition which is modelled as a function of specific factors. The regression runs to acquire insight in the potential drivers of heterogeneity. There is an interest in the variables that directly shows the impact of different variable characteristics on the competition-stability relationship. In line with Berger et al. (2009), competition in banks is measured by constructing the Herfindahl-Hirschman Index (HHI). This measure accounts for share of the each bank in total deposits or in loans among the banks. HHI deposits for banks are calculated as:

$$HHI = \left(\frac{sum\ of\ deposits\ for\ each\ bank}{total\ sum\ of\ deposits}\right)^{2}.$$

The equation may be interpreted as follows: a rise in the HHI shows an increase in the market power concentration and less competition. This process of the construction of HHI deposits is repeated for the construction of HHI loans:

$$HHI = \left(\frac{sum\ of\ loans\ for\ each\ bank}{total\ sum\ of\ loans}\right)^{2}.$$

Higher values of both HHI deposits and HHI loans indicate greater concentration. In this research, in

order to construct the HHI, data has been collected from individual banks for a period of 14 years in the UK. HHI deposits and HHI loans have then been calculated for banks for the 14-year period.

Table 1. Competition and stability measures for the UK banks (total number of banks from the sample equal to 477)

Source: Calculated by author.

	Competition indicators		Stability indicator
Years	HHI deposits	HHI loans	Z-score
2004	0.301	2.94E-11	2.2000
2005	0.186	2.32E-11	2.6962
2006	0.391	3.80E-11	2.7057
2007	0.181	1.91E-11	3.9289
2008	0.496	2.35E-11	2.3446
2009	0.236	2.51E-11	2.0288
2010	0.274	2.82E-11	1.8118
2011	0.279	3.35E-11	3.8602
2012	0.274	2.71E-11	4.4988
2013	0.255	2.18E-11	3.8198
2014	0.123	1.27E-11	4.1258
2015	0.122	1.26E-11	4.1123
2016	0.233	2.01E-11	3.7234

In the table above samples for 2004–2014 were listed, and it can be seen that indices varied during the period of crisis 2007–2009 and during the periods after and prior to the crisis. The sample period assigned to computing the standard deviation of the ROA in order to allow for time variation in the denominator of the Z-score comprised 11 years. Reviews calculation reveals a fluctuation from 1.8118 to 4.4988 of the Z-score. For the UK's whole banking system the Z-score measure of the risk or stability was relatively higher in the years 2011–2014, between 3.8602 and 4.1258. This may be because the banking system was artificially injected by capital from the government. In the years after the crisis, this ratio gradually decreased, 2.3446 to 1.8118, but from 2011 the Z-score increased again, being equal to 3.8602. This also may be seen as a result of the economic growth and considered as a natural financial phenomenon associated with the emerging market. However, one should note that it also indicated a relatively financially stable banking market.

If we compare all the banks, a difference in numbers for large and medium banks, as well as for small banks, should be noted. The HHI deposits index in the following table was greater for medium banks in 2013, being equal to 2.45 than in other bank groups. For the groups of small banks they reached the highest number equal to 0.008724 in 2005, and for large groups of banks it was 0.000 in 2013. A lower concentration has been indicated with respect to HHI deposits for large and medium groups of banks in 2007 and 2004. For large banks this number was equal to 6.63204E–05 in 2007 and 0.002 in 2014, for small banks it was equal to 5.44078E-20 in 2010, and then for medium banks it was equal to 0 in 2004 and in 2007 the number was equal to 0.967. HHI deposits index for large banks is highest and equal to 0.000229 in 2014, which can be interpreted that in the years after the crisis in the deposit market large banks have different attitudes in terms of market power. This may be because of the economic growth and emerging market prospects. In recent years market power is relatively low. For medium size banks in 2014 it equals 1.7320; for small banks it equals 2.46764E–05. This can be explained by diversification of the market and different participants entering the market after the crisis.

The highest number of the HHI loans for large and medium banks was seen in the years 2004, 2005, 2007 and 2008 and this amounted to 0.105616 for large banks and 0.144441 for medium banks in 2007. However, in the case of small banks it fluctuated throughout the period, with an average of 2.22E–04. Therefore, taking into account all the information mentioned above, one may infer that a greater amount of HHI gives more market power to any group of banks during the years 2004 to 2008. The HHI loan shows that large banks have relatively more market power during the post-crisis period, thus justifying the common sense of too big to fail banks in the UK similarly to all over the world. It should be noted that the banking system in the UK displayed more market power in the years after the crisis, but recently the coefficients of market power were smaller particularly for the small and large groups of banks. In terms of HHI loan any groups of banks have relatively lower HHI loan index. One example of that in 2013 for medium banks, a greater concentration equal to 0.153949 was noted.

The Lerner index in small group of banks is negative during most of the period. However, there is still a positive sign for large banks and medium banks during the sample period, the highest number of which amounted to 0.737038 for large banks in 2014. For medium banks its highest amount was equal to 0.794145 in 2014 and the smallest amount was equal to 0.468462 in 2007, whereas in the case of small banks its highest amount was 0.847126 in 2005. The positive sign of the Lerner index was observed in the years before the financial crisis, which can be an indicator of the market power associated with single bank in the entire banking system. In addition, this would be because of the financial manipulations in the economy which was massively indicated before the time of financial crisis. Nevertheless, in the particular period from 2004 to 2014, there was observed a negative sign of the index in small bank groups, with the exception of those listed above. Therefore, a negative sign of the Lerner index for the small banks implies that there is a less or no market power associated with the bank, which in turn means that the market can be considered fully competitive.

The Z-score is used in this research as a measure of risk and bank safeness. It is positive for all the banks in the sample, which implies a relatively high degree of stability for them. There are relatively smaller amount for the years before the crisis for the group of small banks in 2004 – 0.76438, in 0.4766 – 2005 and in 2006 – 0.34919 preceding the crisis. For medium banks, it has a positive sign and the number is large compared to any groups of banks. During the sample period, it shows greater numbers than in any other groups of banks, which implied more stability in this section. Therefore, it can be interpreted that small banks are exposed to more risks and are less stable. This may be due to the nature of their operations and the facilities they provide. Medium banks are more prone to risks according to empirical analysis and have a greater number in the bank Z-score than other groups of banks. Large banks are more stable than small ones, but although they are not as stable as medium, they are still exposed to certain risks.

As a conclusion for this section, one may infer that some bank groups had greater market power during the crisis. This may be because they were injected by capital from the authorities with the pur-

pose of stabilizing the whole economy throughout the UK. However, it is important to take into account the reduced market power and the more competitive environment occurring in the period after the crisis in the UK, which shows decrease in the market power indicators in period after the crisis.

In the next section the empirical model used to test the implication of banking competition on the financial stability of banks is discussed. All regressions include the Lerner index, the HHI deposits index, or the HHI loans index as a measure of industry competition, and are instrumented with indicators. In all cases, higher values of the Lerner index, the HHI-deposit index, and the HHI-loan index imply higher degrees of market power and hence a less competitive environment. The models of assessment are as follows:

1) *Stability = f(NIM, Total assets, GDP, NPL, ROAA).*

2) *Stability = f(NIM, Total assets, GDP, NPL, ROAA)+HHI deposits.*

3) *Stability = f(NIM, Total assets, GDP, NPL, ROAA)+HHI loans.*

4) *Stability = f(NIM, Total assets, GDP, NPL, ROAA)+Lerner.*

5) *Stability = f(NIM, Total assets, GDP, NPL, ROAA)+HHI deposits +HHI loans +Lerner.*

The dependent variable Z-score has been used to represent financial stability. In Table 2, financial ratios are measured to keep competition in the banking market. In the first model we only used control variables without adding market power indices (Table 2). From this model these coefficients of the GDP and ROAA can be interpreted positively in relation to the risk and are equal to 0.000145 and 0.284629. It should be noted that the NIM banking system indicator is inversely related to the risk, with a mean of –1.28869; the coefficient of risk is negative as well, namely –3.057156. Results of the Model 2 and Model 3 regressions show the samples chosen from the particular period between 2004 and 2014, when the HHI deposits and the HHI loans are used as a proxy mea-

Table 2. Models' regression outcomes

Dependent variable Z-score	Model 1	Model 2 HHI deposits	Model 3 HHI loans	Model 4 Lerner index	Full model	
c degree of market power	–	0.004844***	4.189064***	1.18E–05***	HHI deposits	–0.684289***
					HHI loans	3.513921***
					Lerner	–0.002712***
C degree of market power squared	–	–0.038470***	4.758150***	5.71E–08***	–	
NIM	–1.288694***	–0.331096***	–1.366856***	–1.047250***	–23.32486***	
ROAA	2.284630***	2.420376***	2.217311***	2.208212***	–10.00760	
NPLs	0.424474***	0.387245***	0.365243***	0.405150	3.008385	
Total assets	–3.61E–10***	5.08E–10***	–2.74E–10***	–1.89E–10	–2.78E–08	
GDP	0.000145***	0.000144***	0.000126***	0.000143	0.001439	
C	–3.057156***	–6.758001***	–2.059218***	–3.702943	51.98049	
J statistics	4.65E–10	1.83E–09	3.83E–11	6.38E–11	1.47E–05	
R square	0.859309	0.832169	0.385586	0.849999	0.523076	
Adjusted R square	0.859175	0.831957	0.384627	0.849827	0.522438	
Number of observations	5247	4770	4850	5247	5200	
Number of banks: 477						

Notes: *** statistical significance at 1% level, ** statistical significance at 5% level, * statistical significance at 10% level.

sure. A positive relationship is found between the Z-score and the HHI deposit, equal to 0.004844, the HHI loan has a positive sign, 4.189064. This means that a higher degree of market power and stability in the loan market positively influenced the banks' financial condition. Furthermore, we noted a negative relationship between the NIM (bank system specific variable) and the Z-score in every model in analyzing the market power, which means that risk will rise within the banking system when the profitability is increased. Therefore, profitability in the banking market can be associated with less stability. However, more market power in the loans' market positively correlated with risks, which may imply that competition could erode the loan portfolio, thus affecting the whole market.

When using only the Lerner index as competition proxy, a positive relation is found between the Lerner index and the Z-score, the meaning of which equals 1.18E-05. This means that increasing competition leads at a certain bank level to eroding stability. In other words, competition at the bank level may have a negative impact on the financial stability of the whole system. Nevertheless, one should note that its value is very small, so market power at the bank level in the UK banking industry seems not notable. Therefore, these findings confirm the competition fragility view pres-

ent even in analyzing the sample; however, following results confirm the competition stability view for the UK.

In the full model it is worth noting the negative relationship between Z-core and the NIM, total assets, ROAA and Lerner and HHI deposits. The negative relationship between Z-score and HHI deposits in a full model samples –0.684289 implies that risks will rise when market power in the deposit market increases or increased market power can lead to reduced stability in this area. The negative relationship with other variables can be interpreted as stability eroding assets' quality, which is the key source of profit for banks, and assets associated with risks for the banks, for example loan portfolio. Also in a full sample model we can see the HHI deposits equal to –0.684289, HHI loans 3.513921 and the Lerner index –0.002712, which have opposing conclusion, HHI deposits and the Lerner index suggest that market power erodes financial stability and makes the market more vulnerable to financial shocks in the economy. However, an HHI loan shows positive relationship. In overall as it is shown in the table, the HHI deposit and the Lerner index separately in their own models have a positive relationship with the Z-score (Table 2). The Lerner index whose measure of the single bank competition level is positive, sug-

Table 3. Market power regression results for HHI deposits

Variables	Coefficients	Standard Error	t-Statistic	P value
NIM	1.88488	1.3024	1.44723	0.0079
ROAA	1.79712	0.1761	10.1999	0.0000
NPLS	0.34416	0.0414	8.30946	0.0000
TOTAL ASSETS	1.70528	8.9657	1.90199	0.0572
GDP	0.00012	1.6658	7.54122	0.0000
CONSTANT	−12.596	3.7656	−3.34499	0.0008
HHI deposit	0.53837	0.2039	2.639224	0.0083
HHI deposit2	−0.0384	0.0144	−2.654643	0.0080
R-squared	0.07442			
Adjusted R-squared	0.07306			
Number of observations: 4747				
Number of banks: 477				

gests that single banks are not more sensitive to risks when the competition is rising but rather that the whole banking industry is vulnerable. There exists a direct link between market power and financial stability; in the loan market it has a positive signs.

This result is also consistent with the results of other authors. In Table 3 overall bank risk and market power are measured with the Z-score and bank competition measures which is HHI index respectively. For the U-shaped relationship between market power and bank soundness empirical support is obtained for the model by means of a significant and negative coefficient on the squared term of HHI deposit, suggesting a non-linear, inverse U-shaped relationship.

Model 2:

Stability = f(NIM, Total assets, GDP, ROAA, NLPs) + HHI deposits + (HHI deposits)².

This result is also consistent with the results of Berger (2009). However, the market power-stability relationship does not turn negative in terms of HHI loans as it is shown in the Table 2. Again, it is still found that banks operating in the UK with higher liquid stock exchanges, higher activity restrictions and more systemic stability react more strongly to a change in competition. In order to test results the findings are subject to further tests. In the Appendix 5, one can see results using quadratic terms of the Lerner index and HHI index as our measure for bank competition.

The economic significance of the result is important as HHI deposits are positive and equal to 0.53837, while the quadratic term of HHI deposit is negative and equal to −0.0384. For HHI loans the opposite is to be observed, as HHI loans are equal to −0.017415, having a positive quadratic term equal to 4.758150[1]. All the terms are statistically significant at any level. Once more, foregoing facts suggest that there is a U-shaped relationship between stability and competition. Also, all the profitability measures such as the NIM and the total assets have a positive relationship with Z-score, which could imply that increased profitability leads to more stability, an increase in their terms by one sample would increase the bank total revenue by one to one. Contrary to expectation, the coefficient of the risk constant term is negative and statistically significant in the model. This illustrates that the more independent stability coefficient also depends on the profitability or risk activities associated with banks. This may be because individual banks are more sensitive to the regulatory compliance in the banking sector which they tried to avoid in pursuing profit behavior. That is to say, under continuous and close monitoring by regulators, banks act more conservatively in order to avoid more lawsuits in case of any default. The HHI deposit, which indicates low and negative sign, is an important indicator for the banks as deposits are the major source of funding of banks' activities. The coefficients on other bank characteristics in our study suggest the positive and negative impact of the different bank financial ratios on financial stability.

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1 For details see appendix 5

CONCLUSION

For bank stability, determination of the competition in the financial sector and the condition of the economy is likely to play a key role. Researchers in their studies have mainly tended to carry out their assessment by using cross country variables at the international level. In this study research has been provided for banks within the country where the mode of competition and market services are organized at a national level. The examination of the relationship between stability and competition, and their subsequent impact on bank stability in the UK banking industry is important. The study is significant for the banking sector because of the nature of bank models and the economic environment of the UK. Also the results of our study suggest a non-linear relationship between bank competition and stability.

The theories of competition-fragility or competition-stability have both received some empirical support using different measures of bank risk and the degree of competition or market power. There have been tested the theories by regressing measures of bank stability and bank competition on several measures of market power, by using bank-level data for 477 banks in the UK. In some cases our results supported the traditional "competition-fragility" view, that banks with a greater degree of market power also enjoy more stability in the market. However, from the empirical results and analysis there is some support for "competition-stability" view that competition between banks enhanced stability in the UK banking industry. So, theoretical models and empirical results for the UK are offering controversial evidence.

This study provides important new evidence about the relationship between banks' specific factors such as net interest margin, total assets and competition, productivity change and stability in the UK banking sector. Specifically, by utilizing a panel data sample of banks one is able to acquire valuable insights into the banks' financial products and services. One is also able to analyze the implications of banks' competition, and thus changes in banking environment, on the relative financial operations of the participants. One of the most important findings from the study is that different banks' financial ratios are significant when determining the financial stability. Furthermore, the competitive environment and financial developments themselves can have a powerful impact, both on the banks themselves, and also on the remaining financial institutions. Increasing competition has a stronger impact in the UK as it has more revenue herding, more widen deposit insurance and liquid stock markets. The results also confirmed that banks have considerable latitude in respect of their own resources and can impact the market by themselves, and that UK banks used this latitude to differentiate between objectives. In contrast, the large banks in the UK from the sample seem to behave more consistently in a non-profit increasing fashion. The results also indicate that stability of the bank in the market can influence competition in the banking industry. As evidence of this there exists a U-shaped relationship between HHI deposits competition measure and Z-score bank stability measure.

In the first part of the sample period, for example, the small UK banks seem to have greater market power, this may be because they are at the forefront of technological change and innovations, shift all exhibiting technological regress. In contrast, in the last part of the sample period, the medium banks also began to demonstrate positive levels of competition, which may be due to technological changes and development. Consequently, tests of the competitive structure using the Lerner index revealed the UK medium banks to be more competitive at the end of sample period. Somewhat surprisingly, tests conducted for other banks using Lerner index suggest that this market in some cases has become less, rather than more, competitive in recent years. In turn, this suggests that, to date, the impact of the conversion process, in respect of reducing the degree of competition, has tended to out-weigh the combined effects of new entrants, new technology and deregulation. Moreover, although the bank institutions' specific variables were still not at the forefront of market power, they appeared to have exhibited considerable relative impact from a relatively low base.

In summary, in terms of the relationship between competition and stability, two strands of the literature do not oppose each other. The overall risk to the bank does not necessarily increase when there is a high risk in the loan or deposit market. Even banks that have an ambiguous strategy to charge higher rates for loans and have a risky loan portfolio, may still have lower overall risks because they use different risk management instruments for example, hedging techniques. Given the evidence of a non-linear relationship between bank competition and stability, there is a need of implications from outsight regulators or authorities in the country. In an environment where regulation is consistently shaped by the economy, competition will not decrease stability. Considering the evidence mentioned above, one may conclude that elements of the regulatory framework impacting either competition or stability, are necessary in order to avoid negative consequences of competition for stability. Stability can be enhanced by changes in regulation. Competition needs to be kept at a moderate level. Too low level or too high level competition can both lead to higher bank risks, therefore bigger financial instability in the banking sector.

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APPENDICES

Appendix 1. Descriptive statistics for whole banking system from the Bankscope database

Group of banks	Total assets (th USD)				Net income (th USD)				Net interest margin (%)				Operating income (th USD)				ROAA (%)				NPLs/Gross loans (%)			
	Average	Median	Std. deviation	Number of banks	Average	Median	Std. deviation	Number of banks	Average	Median	Std. deviation	Number of banks	Average	Median	Std. deviation	Number of banks	Average	Median	Std. deviation	Number of banks	Average	Median	Std. deviation	Number of banks
2014	90,096,989	1,969,409	323,296,581	284	214,071	9,99	1,129,883	282	2.87	1.42	12.98	268	1,587,885	67,482	6,108,234	282	1.38	0.52	7.05	282	4.94	2.64	8.52	91
2013	620,918,366	1,064,559	268,546,814	461	49,515	5,825	1,414,339	455	3.50	1.32	16.00	418	1,162,747	46,937	5,456,108	454	1.97	0.48	8.32	455	7.60	3.41	14.25	128
2012	61,673,123	1,047,814	282,364,494	469	39,605	3,372	1,036,245	459	3.09	1.27	26.12	420	1,126,158	43,075	5.585,642	458	1.34	0.38	10.98	459	8.01	3.80	13.40	129
2011	63,758,142	1,112,324	291,641,530	462	71,830	2,724	1,187,084	457	4.44	1.25	25.03	413	1,176,180	29,930	5,921,109	452	2.03	0.31	18.88	457	6.57	3.62	9.06	128
2010	650,076,281	1,085,316	290,367,222	435	96,708	4,853	1,054,971	431	3.94	1.20	25.46	388	1,373,507	41,036	6,511,947	423	1.38	0.39	10.62	430	7.25	4.08	11.42	117
2009	69,900,302	1,223,949	305,514,891	398	97,109	3,563	1,884,684	396	3.14	1.25	25.58	361	1,398,904	41,231	6,545,290	390	0.55	0.31	15.67	396	7.05	4.25	11.36	102
2008	78,865,114	1,309,824	368,447237	394	-191,085	2,172	3,120,660	382	3.46	1.50	51.75	354	952,877	26,687	5,267,119	373	-0.51	0.21	12.29	382	4.01	2.60	5.69	95
2007	80,008889	2,003,688	351,344,402	362	373,770	12,022	2,116,677	361	3.54	1.50	28.10	332	1,574,225	72,030	7,137,364	352	1.52	0.66	12.86	361	2.80	1.31	5.43	85
2006	64,314,315	2,318,303	250,890,772	341	388,700	19,630	1,694,321	339	4.75	1.38	80.80	316	1,541,146	73,908	6,558,890	330	2.04	0.75	11.25	339	2.48	1.32	3.95	62
2005	50,639,515	1,856,188	203,006,605	326	324,253	11,301	1,390,700	324	4.24	1.44	81.26	295	1,291,829	56,134	5,438,977	311	2.76	0.61	10.75	323	1.72	1.13	1.83	46
2004	48,001,999	1,260,788	188,165,968	244	321,203	5,601	1,543,553	239	3.36	1.44	65.58	216	1,302,161	35,581	5,811,524	231	1.63	0.59	8.44	239	3.23	1.91	3.42	24

Variables used for calculation of HHI index in Table 1 from the Bankscope database

Years	All the banks' deposits	Large banks' deposits	HHI deposit large	Medium banks' deposits	HHI deposit medium	Small banks' deposits	Small banks' deposits/All deposits	HHI deposit small
2004	2,654,001,666	33,718,036	0.000161407	1,778,692,311	0	50,792,302	0.019138007	0.000366263
2005	2,681,911,830	31,740,953	0.000140072	3,025,502,753	1.272641593	250,505,724	0.093405652	0.008724616
2006	3,450,571,681	41,839,449	0.000147025	4,564,368,139	1.749762976	309,602,488	0.089724984	0.008050573
2007	5,241,106,953	42,682,182	6.63204E-05	5,154,746,856	0.967316599	144,339,339	0.027539858	0.000758444
2008	4,260,088,434	51,391,052	0.000145525	4,999,831,672	1.377442686	124,852,235	0.029307428	0.000858925
2009	4,469,689,248	48,413,529	0.000117322	6,189,862,288	1.91781766	152,103,706	0.03403004	0.001158044
2010	4,572,659,844	49,160,081	0.000115581	6,162,045,524	1.815983981	50,770,596	2.33255E–10	5.44078E–20
2011	4,455,501,839	46,252,352	0.000107764	6,537,333,401	2.152821461	35,028,043	0.00786175	6.18071E–05
2012	4,690,838,416	47,834,365	0.000103987	6,930,935,618	2.183146012	32,513,594	0.006931297	4.80429E–05
2013	4,665,392,799	50,496,342	0.00011715	7,316,917,873	2.459687485	34,195,213	0.007329546	5.37223E–05
2014	4,201,717,796	63,629,162	0.000229329	5,529,711,711	1.73201329	20,872,199	0.004967539	2.46764E–05

Years	Large banks' loans	All the banks' loans	Large banks' loans divided by all loans	HHI loan large	Medium banks' loans	Large banks' loans divided by all loans	HHI loan medium	Small banks' loans	Small banks' loans divided by all loans	HHI loan small
2004	2,110,060,773	5,463,944,797	0.386179006	0.149134225	1,266,996,639	0.231883133	0.053769787	30,185,214	0.005524436	3.05194E-05
2005	2,225,593,037	6,978,881,261	0.318903984	0.101699751	2,316,908,879	0.33198858	0.110216417	226,586,552	0.032467461	0.001054136
2006	2,712,049,596	9,227,951,943	0.293895071	0.086374313	3,461,822,931	0.375145314	0.140734007	297,404,085	0.032228612	0.001038683
2007	3,755,465,142	11,555,790,097	0.32498558	0.105615627	4,391,826,931	0.380054232	0.144441219	112,185,378	0.009708153	9.42482E-05
2008	3,235,114,391	9,912,640,575	0.326362523	0.106512497	3,619,142,993	0.365103825	0.133300803	98,818,713	0.00996896	9.93802E-05
2009	3,153,539,690	10,774,768,500	0.292678185	0.08566052	3,876,798,576	0.359803422	0.129458502	106,510,273	0.009885157	9.77163E-05
2010	3,454,125,204	10,935,859,259	0.315853114	0.09976319	3,898,161,596	0.356456818	0.127061463	36,740,544	0.003359639	1.12872E-05
2011	3,213,593,790	10,603,292,064	0.303075099	0.091854516	3,914,344,314	0.369163114	0.136281405	23,438,669	0.002210509	4.88635E-06
2012	3,118,774,478	10,458,606,866	0.298201713	0.088924261	3,888,709,911	0.371819111	0.138249452	22,453,446	0.002146887	4.60912E-06
2013	3,162,533,732	10,742,969,987	0.294381697	0.086660583	4,215,150,813	0.39236364	0.153949226	22,982,619	0.002139317	4.57668E-06
2014	2,909,378,327	9,626,874,232	0.302214224	0.091333437	3,604,697,112	0.374441072	0.140206117	13,519,192	0.001404318	1.97211E-06

Appendix 3. Variables used for calculation of Z-score from the Bankscope database

For large banks

Years	ROAA	Equity/assets	Std. deviation ROAA
2004	0.800000	4.760000	0.230000
2005	0.810000	4.590000	0.240000
2006	0.810000	4.430000	0.170000
2007	0.740000	4.240000	0.240000
2008	-0.200000	2.910000	0.810000
2009	0.050000	4.490000	0.430000
2010	0.200000	5.130000	0.280000
2011	0.190000	5.230000	0.340000
2012	0.010000	5.280000	0.360000
2013	0.000000	5.650000	0.490000
2014	0.140000	5.990000	0.290000

For medium banks

Years	ROAA	Equity/assets	Std. deviation ROAA
2004	105.0000	4.190000	5.180000
2005	157.0000	3.980000	8.700000
2006	164.0000	3.590000	5.380000
2007	170.0000	3.480000	5.790000
2008	173.0000	2.580000	12.69000
2009	177.0000	3.480000	7.930000
2010	187.0000	3.880000	4.720000
2011	203.0000	4.020000	3.000000
2012	207.0000	4.300000	4.180000
2013	208.0000	4.740000	4.190000
2014	133.0000	5.250000	4.230000

For small banks

Years	ROAA	Equity/assets	Std. deviation ROAA
2004	1.891000	8.220000	10.95000
2005	2.930000	5.310000	13.51000
2006	3.461000	5.160000	16.18000
2007	1.886000	7.950000	18.35000
2008	1.187000	8.330000	12.34000
2009	1.153000	8.770000	21.14000
2010	0.509000	14.47000	13.92000
2011	0.391000	23.74000	26.36000
2012	0.336000	27.26000	12.77000
2013	0.325000	29.93000	10.22000

Appendix 4. Variables used for the Lerner index construction from the Bankscope database

For large group of banks

Years	Fixed assets	Funds	Income	Personnel expenses	Total expenses	Total assets	Interest expenses	Labor
2004	59,827,880	0.015142516	35,574,827	39,859,064	131,466,234	4,560,667,853	58,320,549	0.0087397
2005	58,422,530	0.017747308	36,529,048	42,257,785	153,663,721	4,967,519,699	76,095,342	0.0085068
2006	56,232,017	0.020527366	45,870,646	53,113,874	205,425,760	6,206,089,911	111,146,837	0.0085583
2007	58,078,293	0.018032705	53,021,621	5,9124,023	255,365,172	9,330,112,754	149,134,230	0.0063369
2008	47,145,981	0.014139976	−34,974,658	49,376,340	222,001,920	9,657,327,628	126,146,631	0.0051128
2009	53,098,818	0.00912398	15,103,989	56,767,215	180,790,148	8,273,329,894	67,952,123	0.0068615
2010	53,322,815	0.009205401	18,580,480	62,190,414	188,872,837	8,641,830,437	70,688,595	0.0071964
2011	40,721,215	0.008978011	19,926,066	61,254,126	194,694,810	8,830,524,828	70,207,873	0.0069366
2012	41,784,150	0.0090198	4,148,896	59,829,805	192,790,318	8,615,717,869	68,321,464	0.0069443
2013	38,203,720	0.00848417	5,390,579	58,673,933	183,545,480	7,989,883,714	59,312,422	0.0073435
2014	35,293,980	0.006710026	14,720,608	53,521,924	159,262,699	7,747,146,780	44,732,910	0.0069086

For medium group of banks

Years	Total expenses	Total assets	Personnel expenses	Labor	Interest expenses	Income	Funds	Fixed assets
2004	1E+08	3.43E+09	17,174,833	0.005007	56,544,245	27,335,942	0.0232082	12,268,917
2005	1.98E+08	6.13E+09	32,353,446	0.005274	125,726,449	47,519,513	0.0266066	16,489,787
2006	3.06E+08	8.96E+09	45,235,864	0.005051	210,802,923	57,517,762	0.0299238	21,253,812
2007	4.18E+08	1.13E+10	54,198,184	0.004777	304,667,899	74,044,546	0.0340279	28,167,083
2008	3.5E+08	1.14E+10	38,038,872	0.003334	260,555,734	61,626,420	0.0272261	20,058,747
2009	2.13E+08	1.09E+10	47,625,693	0.004384	114,391,590	59,419,809	0.011816	32,606,805
2010	2.1E+08	1.1E+10	49,573,156	0.004492	91,323,054	70,160,605	0.0095028	32,729,813
2011	2.15E+08	1.16E+10	47,502,924	0.004089	98,809,524	70,478,706	0.0096659	31,171,049
2012	2.15E+08	1.16E+10	49,655,076	0.004296	95,547,631	66,274,783	0.0093115	31,502,513
2013	2.22E+08	1.19E+10	54,135,031	0.004565	89,784,391	81,282,783	0.0084995	33,288,530
2014	1.59E+08	9.8E+09	46,394,740	0.004733	62,628,242	71,283,472	0.0072141	22,021,880

For small group of banks

Years	Personnel expenses	Fixed assets	Funds	Labor	Interest expenses	Income	Total assets	Total expenses
2004	2,465,770	865,318	0.02143	0.01451	1,747,688	137,526	169,939,765	2,832,432
2005	3,021,467	1,164,173	0.03106	0.007513	9,396,919	3,177,718	402,182,305	5,369,915
2006	4,227,153	1,503,608	0.03018	0.008432	11,828,879	2,216,117	501,302,300	8,202,347
2007	4,620,318	1,519,855	0.05301	0.015494	12,882,945	3,017,706	298,208,396	13,572,262
2008	2,968,703	858,015	0.03286	0.014147	5,195,928	-354,569	209,841,517	21,774,609
2009	2,435,679	739,935	0.01249	0.011262	2,203,567	191,106	216,278,220	35,346,871
2010	2,144,396	652,608	0.03009	0.020204	2,150,417	535,782	106,135,057	57,121,480
2011	1,967,196	586,647	0.02886	0.023421	1,404,309	5,964,272	83,993,624	92,468,351
2012	2,005,677	540,958	0.02447	0.02725	1,010,175	479,808	73,602,814	1.5E+08
2013	2,068,012	523,982	0.01793	0.030206	715,999	1,296,332	68,462,582	2.42E+08
2014	1,147,830	265,510	0.01326	0.033214	294,949	905,407	34,558,651	3.92E+08

Appendix 5. Market power regression results when including the squared term

Dependent variable Z-score	Lerner	HHI deposits	HHI loans
Degree of market power	-0.000214**	0.53837***	-0.017415***
Degree of market power squared	5.71E-08***	-0.0384***	4.758150***
NIM	0.321226	1.88488	-2.162802***
ROAA	1.679739***	1.79712***	0.423100***
NPLs	0.400107***	0.34416***	2.016034***
Total assets	4.21E-10***	1.70528*	0.000142***
GDP	0.000157***	0.00012***	1.13E-09***
C	-7.897036***	-12.596***	0.208924*
J statistics	4.73E-12	3.55E-10	1.61E-11
R square	0.5230	0.07442	0.345258
Adjusted R square	0.5224	0.07306	0.344065
Number of observations:	5247	4770	3850

Note: *** statistical significance at 1% level, ** statistical significance at 5% level, * statistical significance at 10% level.