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Does Competition Lead to Efficiency? The Case of EU Commercial Banks

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Abstract

Using bank level balance sheet data for commercial banks in the major EU banking markets, this paper aims to shed some light on the recent developments in competition, concentration and bank-specific efficiency levels. Furthermore, using Granger-type causality test estimations, this study investigates the relationship between competition and efficiency. Results indicate that the main EU banking markets are becoming progressively more concentrated and less cost efficient. On average, banks seem to have reduced their marginal costs faster than price falls; this led to an increase in the Lerner index thus suggesting greater market power. However, our findings do not support Hick's *quiet life* hypothesis as they indicate that an increase in banks' monopoly power does not translate into a decrease in cost efficiency. On the other hand, results of the reverse causality tests provide no evidence that increases in efficiency precede increases in market power.

JEL classification: G21; D24

Keywords: Competition; Efficiency; Market Power; Granger Causality; EU banking.

1. Introduction

Competition is generally accepted as a positive force in most industries; it is supposed to have a positive impact on an industry's efficiency, quality of provision, innovation and international competitiveness. The past twenty years saw a process of liberalisation, deregulation and unprecedented financial sector reform both in developing and developed countries. In the European Union, the aim of regulatory developments, which include movements towards the creation of a single market for financial services, was to foster competition in order to improve the productivity, efficiency and profitability of the banking systems and also to increase both national and international competitiveness. The European Commission (EC), in its recent White Paper on Financial Services Policy (2005-2010) has stated that its principal objectives include: "*To consolidate dynamically towards an integrated, open, inclusive, competitive, and economically efficient EU financial market and to remove the remaining economically significant barriers so financial services can be provided and capital can circulate freely throughout the EU at the lowest possible cost…*" (SEC(2005) 1574). The EC is also keen to further enhance competition, to encourage additional consolidation and to boost the efficiency of pan-European financial markets.

Banks responded to the new operating environment by adapting their strategies, seeking new distribution channels and changing their organisational structures. Increased competition has also been considered the main driving force behind the acceleration in the recent consolidation process which is raising concerns about increased concentration in the banking sector and its potential implications for public policy. The aggregate number of credit institutions in the EU continued declining, often as a result of merger and acquisition (M&A) operations, confirming the trend of market consolidation. As a consequence, the degree of concentration of EU banking systems continued to rise: in the period 2000-2005 the five largest credit institutions increased their share of total assets from 37.8% to 42.3% in the EU (from 39.1% to 43% in the euro area) (ECB, 2006).

The impact of increased concentration on banking sector efficiency and competition has recently raised great interest among academics, policy-makers and anti-trust authorities. However, their relationship remains controversial (see Amel et al., 2004) and existing studies are usually treating these as separate issues. On the contrary, they are highly interrelated and often intertwined and, given the unique role of banks in the economy and the potential non-trivial implications for welfare, they deserve special attention.

To contribute to the existing literature, this paper investigates the evolution of market structure as well as the dynamics of both competition and efficiency in the largest five EU banking markets since the year 2000. Focusing on the commercial banking sector of France, Germany, Italy, Spain and the UK, we calculate concentration measures using the Herfindahl-Hirshman index and the 5-firm concentration ratio and estimate cost efficiency employing both parametric (Stochastic Frontier Analysis) and non-parametric (Data Envelopment Analysis) approaches. We also test the degree of competition by using the Lerner index of monopoly power, which measures the ability of a bank to set prices above marginal cost. Finally, using dynamic panel data Granger-type causality test estimations, this study aims to further the existing literature by directly investigating the relationship between competition and efficiency in banking markets. Whereas a positive relationship between competition and efficiency is often assumed, the specific characteristics of banking markets (i.e. entry barriers, sunk costs, information asymmetries) may lead to excessive market power of efficient banks, therefore reducing competition.

Results indicate that the main EU banking markets are becoming progressively more concentrated and less cost efficient. On average, banks seem to have reduced their marginal costs faster than price falls; this led to an increase in the Lerner index thus suggesting greater market power. However, our findings do not support Hick's *quiet life* hypothesis as they indicate that an increase in banks' market power does not translate into a decrease in cost efficiency. Indeed, increased monopoly power may have a positive effect on efficiency if it enables banks to operate at lower costs. These considerations however do not account for the welfare loss deriving from market power. On the other hand, results of the reverse causality tests provide no evidence that increases in efficiency precede increases in market power.

The remainder of the paper is structured as follows. Section 2 reviews the main literature on competition and efficiency in banking. Section 3 describes data and empirical methods used. Section 4 discusses the results and Section 5 concludes.

2. The Relationship between Competition and Efficiency

The study of competition in the banking sector and its relationship with bank efficiency is of great relevance in a period of renewed regulatory efforts to remove the remaining barriers to the integration of EU banking sectors and of increased domestic and cross-border M&As. Policymakers commonly expected that increased competition would in turn foster efficiency by providing incentives to managers to cut costs in order to remain profitable. Recent research has however indicated that the relationship between competition and banking system performance is more complex and that the view that competition is unambiguously good is more naïve in banking than in other industries (Claessen and Leaven, 2004).

The standard economic argument for the positive influence of competition on firms' performance is that the existence of monopoly rents gives managers the potential of capturing some of them in the form of slack or inefficiency (see Nickell et al., 1997). Competition (or lack of it) is normally proxied by increased concentration, which leads to producers' surplus and non-competitive pricing. The existence of a link between market structure and efficiency was first proposed by Hicks (1935) and the *quiet life* hypothesis. Hicks (1935) argued that monopoly power allows managers a *quiet life* free from competition and therefore increased concentration should bring about a decrease in efficiency. Leibenstein (1966) argued that inefficiencies are reduced by increased competition as managers respond to the challenge. However, these explanations assume that the traditional

Structure-Conduct-Performance (SCP) paradigm holds, at least partially. Yet, several banking studies suggest that concentration does not substantially increase bank profitability as predicted by the SCP hypothesis (Berger, 1995). To explain these contradictory findings, Berger and Hannan (1998) argue that banks in more concentrated markets may take advantage of market power in pricing not for earning higher profits but to allow costs to rise as a consequence of slack management. Increased concentration, if it leads to increased marked power, has therefore a negative impact on bank efficiency.

The *efficient structure* hypothesis (Demsetz, 1973) on the other hand, posits a reverse causality between competition and efficiency: more efficient firms have lower costs, which in turn lead to higher profits. Therefore, the most efficient firms are able to increase their market share, resulting in higher concentration. If higher market concentration lowers competition, there should be an inverse relationship between competition and efficiency, thus reversing the causality running from efficiency to competition in the SCP paradigm. One drawback of these studies is that they proxy competition with concentration measures, such as the Herfindahl-Hirshman index (HH) or concentration ratios. The New Empirical Industrial Organisation (NEIO) literature, on the other hand, argues that factors other than market structure and concentration may affect competitive behaviour, such as entry/exit barriers and the general contestability of the market (Baumol et al., 1982). These studies measure the degree of competition in banking markets by using different indicators: the Lerner index (Lerner, 1934); the Panzar and Rosse's (1987) H-statistics; Bresnanhan's (1989) mark-up test and conjectural variation approaches (for a review of recent studies, see Berger et al., 2004; Dick and Hannan, 2009).

The literature relating the concepts of competition and efficiency usually refers to inefficiency as costs deriving from slack management. This corresponds well to the concept of x-efficiency, which involves avoiding waste by achieving the maximum possible output from a given set of inputs or by minimising the inputs given an achievable set of outputs. There is a vast literature on the measurement of cost structure and efficiency in banking (see the reviews by Goddard et al., 2001 and 2007; Berger, 2007). The early bank efficiency literature shows that before deregulation EU banking markets were often characterised by the presence of many institutions operating at a non-optimal scale with relatively high excess capacity.

Only a handful of studies directly address the issue of the relationship between the intensity of competition and efficiency. Based on European banking data, Casu and Girardone (2006) and Weill (2004) find an inverse relationship between competition (proxied by the Rosse- Panzar H-statistic) and efficiency. They find little evidence that banking system concentration negatively relates to competitiveness but suggest that the most efficient banking systems are also the least competitive. More recent studies extend the analysis of the relationship between competition and efficiency to include the evaluation of both measures at the firm level. Maudos and Fernandez de Guevara (2007) examine the relationship between market power (proxied by the Lerner index) and cost efficiency by estimating the determinants of cost efficiency in a logit regression model. Their results indicate the existence of a negative relationship between competition and cost efficiency (that is, a positive effect of market power on efficiency) in the European banking sectors, thus rejecting the *quiet life* hypothesis. Using data relative to the Czech banking system, Pruteanu-Podpiera et al. (2008) investigate the effect and evolution of banking competition and the relationship with cost efficiency. Their results, based on Granger causality techniques, also reject the *quiet life* hypothesis. This is also similar to the findings reported by Koetter et al. (2008). Finally, Schaeck and Čihák (2008)'s study on the relationship between efficiency, competition and soundness in EU and US banking also finds evidence that increases in market power precede increases in cost efficiency.

3. Methodology and Data

3.1 Data

The data on EU commercial banks are derived from BankScope, a global database published by Bureau Van Dijk. The data are collected for an unbalanced sample of 2,701 commercial bank observations operating in France, Germany, Italy, Spain and the United Kingdom between 2000 and 2005. We restricted the investigation to commercial banks as there are still significant differences in the retail market structure among EU countries and in some countries the saving banking sector is still partially benefiting from state help.[1] The choice of an unbalanced panel is justified mainly to account for mergers and acquisitions, entry and exit during the period. We use data from consolidated accounts, where available, to avoid double-counting. The data were analysed for inconsistencies, reporting errors, missing values and outliers. The final sample is shown in Table 1, which lists the total and average number of banks in the sample by country and year as well as the size of the average bank (by total assets) over the period.

<Insert Table 1 around here>

It is interesting to note that Italian commercial banks have an average size that is roughly half that of the French, German and Spanish ones. Moreover, UK commercial banks have an average size of almost five times that of Italian banks. The number of banks in the sample is decreasing over time (with the exception of Italy[2]) as the banking sector consolidates further.

3.2 Input and Output Specification

The approach to output definition used in this study is a variation of the *intermediation approach*, which was originally developed by Sealey and Lindley (1977) and posits that total loans and

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[1] For example, until 2005 the German Landesbanks benefited state guarantees that have secured the high ratings and have given them access to cheap funding.

[2] In Italy a relatively small number of savings and co-operating banks converted into commercial bank status in the period under analysis and this explains the slight increase in bank numbers.

securities are outputs, whereas deposits along with labour and physical capital are inputs.[3] Specifically, we choose two output specifications, both for the parametric and non-parametric approaches: the traditional lending activity of banks (total loans) and the growing non-lending activities (other earning assets).[4] The input specification is slightly different between the two approaches. In the stochastic frontier (Section 3.3.1) we use the price of deposits measured as total interest expenses over total deposits; the price of labour is calculated as total personnel expenses over total assets; and finally, the price of capital is measured as other administrative expenses over total fixed assets. In the non-parametric approach (Section 3.3.2) we aggregate the cost expenditure into a single input.[5] Specifically, we define total costs as the sum of personnel expenses, other administrative expenses, interest paid and non-interest expenses. A benefit of this specification is that the single total cost input in DEA is more readily comparable with the cost frontier estimated by SFA. Table 2 reports the descriptive statistics of the input/output variables.

<Insert Table 2 around here>

[3] There are two main approaches in the banking literature to describe the production process of banks: the production approach (Benston, 1965) and the intermediation approach (Sealey and Lindley, 1977). They mainly differ on the treatment of deposits. The production approach sees deposits as an output whereas the intermediation approach sees deposits as an input factor. The modern banking literature mainly follows the latter (see for example, the reviews by Goddard et al., 2001 and 2007; Berger, 2007).

[4] Since the mid-1990s, a number of studies (e.g. Berg et al. 1992; Mester, 1996) have included some measures of risk and/or output quality in the evaluation of the bank production process. Other studies have taken a two-step approach to investigate the impact of risk and other environmental variables on efficiency. In a parametric framework, see for example the studies by Berger and DeYoung, (1997); Dietsch and Lozano-Vivas (2000) and Girardone et al. (2004). In a non-parametric context, see among others Bos and Kool (2006) and Drake et al. (2006). Although risk and environmental factors are of importance when estimating bank efficiency, in this study we have abstracted from these considerations. The literature trying to specify the relevance of different measures of risk reports mixed results (Shaffer and DiSalvo, 1994; Berg and Kim, 1998). The most important issue relates to the treatment of risk as either an exogenous variable (as through the business cycle) or as an endogenous variable determined by management behaviour (Berger and DeYoung, 1997; Williams, 2004). Similarly, the literature investigating the relationship between risk and competition yields mixed results. For instance, Boyd and De Nicolo (2005) and Boyd et al. (2007) document that increases in competition are consistent with improved stability and therefore a reduction of risk. On the other hand, Beck et al. (2006) among others, find that increases in competition bring about greater risk. The ambiguity of both the relationships between risk and efficiency on one hand and risk and competition on the other, motivates our choice to abstract from risk considerations in the present study.

[5] The different treatment on the input side is due to the well-known dimensionality problem associated with DEA (Smith, 1997).

3.3 Frontier Efficiency Analysis

The literature on the measurement of efficiency frontiers can be divided into two main streams: parametric techniques, such as the Stochastic Frontier Analysis (SFA) and non-parametric techniques such as Data Envelopment Analysis (DEA).

3.3.1 Stochastic Frontier Analysis

The standard SFA generates estimates of x-efficiencies for each banking institution along the lines first suggested by Aigner et al. (1977). Specifically, x-efficiency scores are estimated using the Battese and Coelli's (1992) time-varying stochastic frontier approach for panel data with firm effects which are assumed to be distributed as truncated normal random variables and are also permitted to vary systematically with time (see also Battese and Coelli, 1993; and Coelli et al., 2005). The chosen functional form for the cost function is the translog with three inputs, two outputs (total loans and total securities) and a time trend. The final specification is as follows:

$$\begin{aligned}\ln TC_{it} &= \alpha_0 + \sum_{i=1}^{2}\alpha_1 \ln Q_i + \sum_{j=1}^{3}\beta_j \ln P_j + \frac{1}{2}[\sum_{i=1}^{2}\sum_{j=1}^{3}\delta_{ij}\ln Q_i \ln Q_j + \sum_{j=1}^{3}\sum_{i=1}^{3}\gamma_{ij}\ln P_j \ln P_i] + \\ &+ \sum_{i=1}^{2}\sum_{j=1}^{3}\rho_{ij}\ln Q_i \ln P_j + t_1 T + \frac{1}{2}t_{11}T^2 + \sum_{i=1}^{2}\theta_{ti} T \ln Q_i + \sum_{j=1}^{3}\psi_{tj} T \ln P_j + \varepsilon_{it}\end{aligned} \tag{1}$$

The single-equation stochastic cost model is represented by $\ln TC_{it} = \ln TC^{*}(Q_{it}, P_{jt}; B) + \varepsilon_{it}$ where TC is total costs (financial and operating costs); Q_1 is total loans; Q_2 is total other earning assets; P_1 is the price of labour (personnel expenses/total assets); P_2 is the price of deposits (interest expenses /customer and short term funding) and P_3 is the price of capital (total capital expenses/total fixed assets); T is a time trend; B is a vector of unknown parameters to be estimated: α, β, δ, γ, ρ, t, θ, ψ.[6] Finally ε_{it} is a two-components error term that for the i-th firm can be written as follows: $\varepsilon_{it} = u_{it} + v_{it}$ where v_{it} is a two-sided error term capturing the effects of statistical noise, assumed to

[6] We apply the common restrictions of standard symmetry and homogeneity in prices to the translog functional form.

be independently and identically normal distributed with zero mean and variance σ_v^2 and independent of the $u_{it} = \{u_i \exp[-n(t-T)]\}$ where u_i is a one-sided error term capturing the effects of inefficiency and assumed to be half normally distributed with mean zero and variance σ_u^2; n is an unknown parameter to be estimated capturing the effect of inefficiency change over time.

3.3.2 Data Envelopment Analysis

DEA is a mathematical linear programming technique developed by Charnes, Cooper and Rhodes in 1978 (CCR) which identifies the efficient frontier from the linear combination of those units/observations that (in a production space) use comparatively less inputs to produce comparatively more outputs. The CCR model assumes constant returns to scale (CRS), which is the optimal scale in the long-run. Banker, Charnes and Cooper (1984) (or BCC model) include an additional convexity constraint (λ) to allow for variable returns to scale (VRS). The BCC model is used in this paper since several factors such as imperfect competition and regulatory requirements may cause a unit not to be operating at the optimal scale.[7]

In particular, if at any time t there are N firms that use a vector of inputs $X = (x_1, x_2, ..., x_k)$ to produce a vector of outputs $Y = (y_1, y_2, ..., y_m)$, the input-oriented BCC measure of efficiency of a particular firm is calculated as:

[7] For an introduction to DEA methodology see, among others, Thanassoulis (2001); Coelli et al. (2005). See Thanassoulis et al. (2008) for an extensive review of this literature.

$$
\begin{aligned}
&\min_{\theta,\lambda} \theta_i \\
&s.t. \quad \sum_{r=1}^{N} y^t{}_{mr} \lambda^t{}_r \geq y^t{}_{mi} \\
&\qquad\ \ \sum_{r=1}^{N} x^t{}_{kr} \lambda^t{}_r \leq \theta_i x^t{}_{ki} \\
&\qquad\ \ \lambda^t{}_r \geq 0 \\
&\sum_{r=1}^{N} \lambda = 1
\end{aligned}
\tag{2}
$$

where $\theta_i \leq 1$ is the scalar efficiency score for the i-th unit. If θ_i =1 the i-th firm is efficient as it lies on the frontier, whereas if θ_i < 1 the firm is inefficient and needs a (1-θ_i) reduction in the inputs levels to reach the frontier.

3.4 The Lerner Index of Monopoly Power

The Lerner Index of monopoly power is an indicator of the degree of market power and it is a well established measure of competition in the banking literature. It represents the extent to which market power allows firms to fix a price above marginal cost (MC). MC is calculated from the estimation of a translog cost function as specified in equation (1) above with three inputs (labour, physical capital and deposits) and a single output (proxied by total assets[8]) as follows:

$$MC_{it} = \frac{TC_{it}}{Q_{it}} \left(\alpha_1 + \delta \ln Q_{it} + \rho_j \ln Q_{it} + \theta_t T + \varepsilon_{it} \right) \tag{3}$$

Marginal costs derived from equation (3) are used to calculate the Lerner index:

$$LERNER = \frac{p_{it} - MC_{it}}{p_{it}} \tag{4}$$

[8] Following the established literature (Shaffer, 1993; Berg and Kim, 1994; Angelini and Cetorelli, 2003; and Fernandez de Guevara et al., 2005) we use a single indicator of banking activity because of problems in the empirical estimations of separate prices for bank output using Bankscope data. The assumption is that the flow of banking goods and services produced by a bank is proportional to its total assets.

where p is the price of output Q and is calculated as total revenue (interest plus non-interest income) divided by total assets. LERNER=0 it indicates perfect competition, while LERNER=1 indicates monopoly.[9]

3.5 Dynamic Panel Data Granger-Type Causality Estimation

To investigate the relationship between efficiency (as estimated following the methodologies described in Section 3.3) and competition (proxied by the Lerner index as discussed in Section 3.4), we apply a Granger type causality test. Granger testing is a common method of investigating causal relationships (Granger, 1969) by estimating an equation in which a dependent variable y is regressed on lagged values of y and the lagged values of an additional variable x.[10] The null hypothesis is that x does not Granger-cause y. If one or more of the lagged values of x is significant, we are able to reject the null hypothesis and we can conclude that x Granger causes y.

The test was originally designed for pairs of lengthy time series; however, econometricians have recently begun to modify Granger tests to incorporate panel dynamics. The extension of the original Granger methodology to panel data has the potential to improve upon the conventional Granger analysis for all of the reasons that panel analysis is generally preferable to cross-sectional or traditional time series analysis (see Greene, 2003).

In this study, we employ dynamic panel data methods and the 'system' (or 'combined') Generalised Method of Moments (GMM) procedures developed by Holtz-Eakin et al. (1988), Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). These methods are useful for panels characterised by a relatively low number of years and a large number of cross-sections

[9] The interpretation of the Lerner index as an indicator of market power may incur some problems: a) it is influenced by the criteria followed in the definition of revenue and costs; b) it is general practice not to consider the cost of risk, despites its relevance on bank costs and revenues; c) banking output is usually proxied by the total assets of each firm mainly because of data problems; finally, d) the Lerner index may not be an appropriate measure of market power when a firm solves a dynamic problem (Pindyck, 1985 and Perloff et al., 2007).

[10] Please note that in this section the notations y and x do not refer to inputs and outputs as defined in Section 3.3.2.

per year (Roodman, 2006) and they help deal with possible problems of endogeneity and measurement error (see in the growth literature e.g. Bond et al., 2001).[11]

The single equation to be estimated is an autoregressive (AR) distributed linear specification as follows:

$$y_{it} = \alpha_0 + \sum_{j=1}^{n} \alpha_j y_{i(t-j)} + \sum_{j=1}^{n} \beta_j x_{i(t-j)} + \theta_t + \eta_i + \upsilon_{it} \tag{5}$$

where y_{it} is the dependent variable, α_0 is the intercept, $y_{i(t-j)}$ is *j*th lag of the dependent variable, $x_{i(t-j)}$ is *j*th lag of an explanatory variable of interest, α_j and β_j are parameters to be estimated, θ_t is a common time effect, η_i is an individual bank specific effect, and υ_{it} is a disturbance term. To avoid cross-sectional dependence, the disturbances are assumed to be orthogonal to each other. Specifically, the following AR(2) model has been used in this application:

$$y_{it} = \alpha_0 + \alpha_1 y_{i,t-1} + \alpha_2 y_{i,t-2} + \beta_1 x_{i,t-1} + \beta_2 x_{i,t-2} + \theta_t + \eta_i + \upsilon_{it} \tag{6}$$

The estimation of an AR(2) model allows us to test the Granger causality joint hypothesis alternatively by a measure of competition (the Lerner index of monopoly power) and a measure of bank cost efficiency (estimated using parametric and non-parametric methods). This allows us to investigate, in a six-year dataset for five EU countries, whether changes in competition patterns precede (Granger-cause) changes in bank efficiency, and/or vice-versa whether changes in efficiency Granger-cause changes in competition.

With the AR(2) model described in equation (6), Granger causality can be measured with a joint test of the two lags of *x* and is distributed as χ^2 with two degrees of freedom. The null hypothesis is that $\beta_1 = \beta_2 = 0$: if the probability is <0.10 then the null hypothesis is rejected at the 10% significance level. The sign of the causal relationship is determined by the sum of the jointly

[11] Recent banking studies (e.g. Berger and DeYoung, 1997, and Williams, 2004) use standard OLS techniques to test the Granger causality between estimated bank efficiency levels, problem loans and capitalisation. While our method should be more reliable than using standard OLS, the generated regressors problem may still affect our results that should then be interpreted with care.

significant coefficients. A positive (negative) sum implies that the causal relationship is also positive (negative), that is an increase (decrease) in x in the past increased (decreased) the y in the present.[12] This model assumes an additional set of restrictions for it to be valid: serial correlation in the first order errors; no second-order GMM residual serial correlation; and a p-value >0.05 for the Sargan/Hansen test statistics of overidentifying restrictions (also known as Hansen's J) to test the validity of the instrumental variables. Finally the estimated models are also subjected to a test that measures the stability over time (or 'long-run effect') of the x over the y. The extant literature suggests the use of a test of the restriction $\beta_1 + \beta_2 = 0$ that should be interpreted as follows: a rejection of the restriction implies that there is evidence for a long-run effect of x on y. Else, y will depend on the change in x rather than on its level (Bond and Windmeijer, 2005).

4. Empirical Results

4.1 Competition Patterns in European Banking

Table 3 shows the means of the structural indicators of market concentration across our sample of EU countries over the period 2000-2005. The Herfindahl-Hirshman index (HH) represents the market share (in terms of total assets, total loans and total deposits) of every firm in the market whereas the CR-5 indicates the market share of the five largest firms in the market. We also calculated the HH for the sub-sample of commercial banks on total loans, total deposits as well as total assets.

The data show that national conditions still vary considerably across countries and this is reflected in the different market structures of the retail banking industry in general and of the commercial banking industry in particular. Against the EU average (in 2005, the HH was 601 and the CR-5 was

[12] While the Granger causality test is a useful tool to denote whether a variable is correlated with the lagged values of the other – after controlling for its own lags, some caution should be used in interpreting the results. Among the main limitations of the Granger are that it is contingent on the choice of variables included in the equations and the number of lags. Moreover, if the sample is unbalanced (as in our case) by increasing the number of lags, the number of observations will be reduced significantly and this may affect the consistency of the results.

43% for the EU-25), concentration levels remain relatively low in Germany, Italy and the UK. Most countries, however, show an increase in concentration during the period of analysis. In the UK alone, in the six years period from 2000, concentration (measured as the market share of the five largest banks) increased by 28.57%. Looking at the separate information for commercial banks, they seem to operate in more concentrated markets.

<Insert Table 3 around here>

Measuring market power is fundamental to the analysis of bank competition: the lower the competition faced by a bank (or any other firm), the greater its market power, reflected by its ability to set price above marginal costs. In the analysis that follows we will refer either to competition or market power as related but opposite concepts.

Figure 1 shows the evolution of marginal costs and the Lerner index of monopoly power over the sample period and country differences are also apparent. The commercial banking sectors in the UK and Germany seem to enjoy the highest relative margin and Spain the lowest. These results are broadly in line with those of Fernandez de Guevara and Maudos (2005). It is necessary however to bear in mind that most previous studies consider the whole banking sector whereas we concentrate on commercial banks only.

<Insert Figure 1 around here>

Marginal costs decreased in all countries (with the exception of France) over the sample period, showing an increase in 2005. Italy and Spain, which display the highest average marginal costs, also display the biggest decrease, possibly because of the reduction of both financial and operating costs. Despite the decrease in marginal costs, Italy and Spain report the highest increase in the Lerner index, thereby indicating that the decrease in marginal cost was smaller than the decrease in the average price of assets. On average, banks seem to have reduced their MC faster than price falls; this will increase the Lerner index thus suggesting greater market power and less competition. In all countries (apart from the UK) the Lerner index is higher in 2004 than in 2000, thus suggesting less competitive conditions. Comparing our results with averages for the whole banking system (see Fernandez de Guevara and Maudos, 2005), it is possible to notice that, despite being more concentrated, commercial banks enjoy a lower market power compared to saving banks. This reinforces our decision to concentrate this analysis on the commercial banking sector because of the potential distortions still existing in the EU savings banking sector.

4.2 The Evolution of Bank Efficiency: SFA and DEA Analysis

The yearly SFA and DEA results for the countries in our sample, as well as the average efficiency over the period are shown in Table 4.[13]

The average overall efficiency score for the five EU banking industries over the whole sample period is 75.43% for SFA and 71.23% for DEA, thus indicating a 24.57% and 28.77% respectively average potential reduction in inputs utilisation. The results for the different EU countries in 2005 vary between 74.51% in Germany and 62.04% in Italy in the DEA estimations and between 80.47% in Italy and 68.88% in Spain for the SFA estimations.

<Insert Table 4 around here>

Both methodologies indicate average inefficiency scores of about 30%, a result that is broadly in line with the main literature on bank efficiency (see Goddard et al., 2007). Differently from most studies analysing bank efficiency during the 1990s, which find improvements in resources utilisation, the yearly results seem to indicate, for most countries, an increase in input wastage from 2000-2001 onwards resulting in lower average efficiencies (see Figure 2).[14] This trend could be explained by the fact that the initial effort towards cutting costs fostered by deregulation and increased competition was followed by a wave of mergers and acquisitions that might have imposed

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[13] Efficiency scores were estimated both with reference to single country frontiers and to a common EU-5 frontier. Results are not statistically different. The results reported are derived from country-specific frontiers.

[14] Given the use of an unbalanced panel to account for entry and exit and M&As, it is not possible in a DEA framework to compare directly the yearly results as the observations composing the sample might differ from year to year. It is however possible to note the decreasing average yearly results, which are consistent with the econometric estimations.

higher costs on banks, thereby decreasing their cost efficiency. However, decreases in bank efficiency can also be a signal that bank consolidation is allowing managers to exploit increased market power.

<Insert Figure 2 around here>

The analysis so far has highlighted that the main EU banking markets are becoming progressively more concentrated and less efficient. Further, there is no evidence of an overall increase of competitive pressure over the period. The next section will investigate the relationship between efficiency and competition; particularly we study the direction of the causal relationship (if any) between the two variables.

4.3 The Relationship and Causality between Competition and Efficiency

Tables 5 and 6 report the results of our empirical analysis on the relationship and causality between competition and efficiency for the five EU banking markets in our sample. These are derived from the estimation of the two-step SYS-GMM model. Our specification (equation 7) includes two lags of the dependent and explanatory variables. Estimations are carried out twice using as alternative measures of cost efficiency, the parametric SFA and the non-parametric DEA (results are reported in panels (a) and (b) respectively).[15]

Table 5 shows the results of the Granger causality test when the dependent variable is cost efficiency. The significance of the coefficients for the first and second lags of efficiency seems to suggest that efficiency is affected significantly by previous years' efficiency (and in some cases the inefficiency as noted by the negative and significant sign of the second lag in panel a). Granger causality is assessed as the joint test of the two lags of x as follows: $\beta_1 = \beta_2 = 0$. A p-value <0.10

[15] Robustness tests have been carried out using OLS and fixed effects models as well as the difference GMM (DIF-GMM) and results are broadly in line with those presented in this section.

rejects at the 10% significance level the null hypothesis of no causality running from competition to efficiency. The results show that increases in market power, proxied by the Lerner index, precede increases in cost efficiency (estimated both from a parametric and a non-parametric frontier) with a positive sign. Since the sum of the lagged coefficients is mostly positive and significant, we can reject the null hypothesis of no causality.[16] These results are consistent with the rejection of the *quiet life* hypothesis, in line with recent literature (e.g. Maudos and Fernandez de Guevara, 2007; Pruteanu-Podpiera et al., 2008; Schaeck and Čihák, 2008; Koetter et al., 2008).

<Insert Table 5 around here>

The findings presented in Section 4.1 have shown that the increase in the Lerner index was driven by a reduction in marginal costs rather than an increase in prices. This suggests that the worsening of competitive conditions did not result in uncompetitive pricing policies. Rather, banks seem to have exploited increased monopoly power possibly by negotiating lower factor input prices, which are in turn driving decreases in marginal costs. The positive causal relationship between market power and efficiency could thus be attributed to the lower financial and operating costs enjoyed by banks with higher monopoly power. It appears that these banks do not necessarily allow costs to rise as a consequence of slack management (i.e. inefficiency), as the *quiet life* hypothesis suggests. Increased monopoly power may have a positive effect on efficiency if it enables banks to operate at lower costs. These considerations do not account for the welfare loss deriving from market power.

In Table 6 we test the causality running from efficiency to competition. Looking at the results, the first lag of competition is usually positive and significantly different from zero at the one per cent level in both panels (a) and (b). This indicates that competition at time t is influenced by the previous year's competition. Our findings suggest that when the Lerner index is the dependent variable, in the majority of cases the sum of the lagged coefficients is not significant; therefore we

[16] Even though our results provide some evidence of a positive relationship between market power and efficiency for our sample of European commercial banks, these results should be interpreted cautiously because for some countries not all of the additional Arellano and Bond (1991)'s conditions are met.

cannot reject the null hypothesis of no causality. In other words changes in cost efficiency, do not precede changes in market power either with a positive or negative sign.

<Insert Table 6 around here>

Our results are robust across alternative measures of efficiency. In the case of Germany, where the null hypothesis of no causality can be rejected and the relationship is positive, one of three additional conditions, i.e. serial correlation in the first order errors, is however not met.

Overall, our evidence in Tables 5-6 implies that higher Lerner margins (i.e. an increase of banks' monopoly power) do not necessarily translate into "slack" management (i.e. a decrease in cost efficiency). On the other hand, increases in efficiency do not seem to lead to greater market power of efficient banks. In addition to the evidence provided by previous studies, such as Maudos and Fernandez de Guevara (2007) our results also indicate that the existence of a positive relationship or correlation between monopoly power and efficiency does not necessarily imply a causal relation between the two variables. However, even though Granger causality tests may constitute an improvement on the methodology commonly used in the literature, they only indicate that changes in market power precede changes in efficiency with a positive sign rather than establishing causation in the traditional sense of the word.

5. Conclusions

Competition is generally considered as a positive force, often associated with increased efficiency and enhanced consumers' welfare. However, in the banking sector it is a more controversial issue. The acceleration in the recent consolidation process is raising concerns about increased concentration in the banking sector and the potential implications for public policy deriving from increased market power of banks. Policymakers are faced with the contrasting issues as to whether competitive forces are positively impacting on bank performance and efficiency or whether the consolidation wave poses a threat to competition in the sector.

Using bank level balance sheet data for the major EU commercial banking markets, this paper aims to shed some light on these issues by investigating the relationship between measures of competition, concentration and bank-specific efficiency levels. Our study further contributes to the existing literature by directly investigating the dynamics of the relationship between competition and efficiency using system GMM models to test Granger causality.

The analysis has highlighted that the main EU banking markets are becoming progressively more concentrated and less cost efficient. Further, there is no evidence of an overall increase in competitive pressure over the period and there is substantial variability in the indicators across countries. On average, banks seem to have reduced their marginal costs faster than price falls; this led to an increase in the Lerner index thus suggesting greater market power. The Granger causality running from market power to efficiency is positive. Therefore, our findings do not support Hick's *quiet life* hypothesis as they indicate that an increase in banks' monopoly power does not translate into a decrease in cost efficiency. In contrast, it may have a positive effect on efficiency if it enables banks to operate at lower costs. These considerations however do not account for the welfare loss deriving from market power. These results are consistent with the recent literature (Schaeck and Čihák, 2008, and Podpiera et al., 2008). However, differently from Maudos and Fernandez de Guevara, (2007) and Koetter et al. (2008) we cannot conclude that a rejection of the *quiet life* hypothesis translates into support for the *efficient structure* paradigm of Demsetz (1973) and others. Indeed our results of the reverse causality running from efficiency to competition are inconclusive and provide no evidence that increases in efficiency precede increases in market power.

These findings imply that the relationship between competition and efficiency is not straightforward and that other factors (such as among others, risk incentives, regulatory framework, contestability and macroeconomic factors) may influence both the magnitude and the direction of the relationship and therefore should be accounted for in future research in this area.

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Table 1

Total Average Size of Sampled Banks and Number of Institutions

	France	*Germany*	*Italy*	*Spain*	*UK*	*Total by year*
2000	101	111	121	52	76	461
2001	105	107	130	56	70	468
2002	99	104	125	52	72	452
2003	93	104	144	47	78	466
2004	86	96	142	46	77	447
2005	77	89	135	39	67	407
Total number of banks	561	611	797	292	440	2,701
Total assets of the average bank by country[a]	22,708.0	24,657.5	11,690.6	22,938.6	49,947.2	

[a] Values are in million €.

Table 2

Summary Statistics of Input and Output Variables[a]

	Mean	*Median*	*St.dev.*	*Min*	*Max*
Total loans	11796.3	710.7	43868.3	0.3	612611.1
Other earning assets	10316.6	426.1	48031.0	0.2	807326.3
Total assets	24360.3	1420.4	96825.3	22.2	1348930.1
Total deposits	17264.1	1081.0	68482.7	2.2	944172.3
Interest expenses	713.8	31.2	3000.1	0.1	48103.0
Personnel expenses	233.9	19.3	935.7	0.1	13526.0
Total administrative expenses	203.8	15.3	752.4	0.1	9187.0
Fixed assets	256.1	13.7	1082.7	0.1	15772.4
Total cost	1029969.0	25700.0	4542554.7	3.4	70461000.0

Note: Values are in million €.

[a] Total loans and other earning assets are outputs to the production process of banks. The factor input prices in the parametric approach (SFA) are calculated as follows: price of deposits = total interest expenses/total deposits; price of labour = total personnel expenses/total assets; price of capital = other administrative expenses/total fixed assets. In the non-parametric (DEA) approach we aggregate the cost expenditure into a single input (total cost).

Table 3

Concentration Measures: Herfindahl-Hischman Index (HH) and CR-5

	2000	2001	2002	2003	2004	2005	2000-2005
HH Total Loans (Commercial banks)							
France	1373	1443	1282	1271	849	1371	-0.14%
Germany	1928	1956	1764	1635	2164	2010	4.27%
Italy	987	872	945	646	564	1137	15.22%
Spain	1890	2112	1606	2650	2309	3064	62.15%
UK	924	917	1027	1085	1122	1084	17.29%
HH Total Deposits (Commercial Banks)							
France	1374	1704	1427	1470	1417	1682	22.42%
Germany	1872	1827	1774	1953	2781	2826	50.97%
Italy	1138	992	974	742	730	1439	26.50%
Spain	2016	2321	1713	2870	2328	3326	64.95%
UK	935	955	1066	1116	1131	1327	41.88%
HH Total Assets (Commercial Banks)							
France	1511	1957	1603	1669	1386	1622	7.34%
Germany	1944	1933	1814	2019	2776	2833	45.72%
Italy	1038	915	977	707	675	1315	26.71%
Spain	2096	2466	1824	2992	2481	3459	65.02%
UK	940	952	1080	1139	1164	1293	37.65%
HH Total Assets (Banking Sector)							
France	587	606	551	597	623	758	29.13%
Germany	151	158	163	173	178	174	15.23%
Italy	190	260	270	240	230	230	21.05%
Spain	581	532	513	506	482	487	-16.18%
UK	264	282	307	347	376	399	51.14%
CR-5 (Banking Sector)							
France	47	47	45	47	50	53	12.77%
Germany	20	20	21	22	22	22	10.00%
Italy	23	29	31	28	26	27	17.39%
Spain	46	44	44	43	42	42	-8.70%
UK	28	29	30	33	35	36	28.57%

Source: Authors' calculations and ECB (2006).

Table 4

DEA and SFA Efficiency Scores by Year and Country

	Countries	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2000- 2005**
DEA Efficiency Scores	France	69.46	67.29	65.59	65.57	3.69	62.39	-10.17%
	Germany	72.29	73.33	69.45	68.73	70.50	74.51	3.07%
	Italy	76.33	83.71	65.31	63.81	77.49	62.04	-18.72%
	Spain	84.67	80.11	79.47	72.20	7520	78.64	-7.13%
	UK	72.12	76.28	62.78	69.62	66.71	67.63	-6.23%
	Average	*74.97*	*76.14*	*68.52*	*67.98*	*70.12*	*69.04*	*-7.91%*
SFA Efficiency Scores	France	74.10	73.83	71.17	71.86	70.23	69.75	-5.87%
	Germany	74.77	74.13	73.76	72.09	71.34	70.85	-5.25%
	Italy	84.13	83.35	81.42	81.17	80.57	80.47	-4.35%
	Spain	75.19	73.32	71.77	72.20	71.51	68.88	-8.40%
	UK	76.95	75.46	74.15	73.48	72.53	70.54	-8.33%
	Average	*77.03*	*76.02*	*74.45*	*74.16*	*73.23*	*72.10*	*-6.40%*

Table 5

Does Competition Granger-Cause Cost Efficiency?

Dependent variable: *y*=COST EFF	Variables and tests	France	Germany	Italy	Spain	UK
Panel (a)	SFAEFF1	2.08632***	2.09213***	2.09443***	2.08969***	2.0889***
x= LERNER	SFAEFF2	-1.08845***	-1.09448***	-1.09685***	-1.0920***	-1.0911***
	LER1	.013193**	.002563	-.011403***	.026968***	.001281
	LER2	.009121*	-.001706	-.016388***	.002122	.001320
	Σ(LER)	.022315**	.000857**	-.027791***	.02909***	.002601
	χ^2 (2) (prob >χ^2)	5.49 (.0644)	4.98 (.0830)	61.70 (.0000)	14.46 (.0007)	2.50 (.2868)
	m1 p-value	.000	.000	.105	.09	.173
	m2 p-value	. 391	.386	.151	.990	.217
	Sargan/Hansen p-value	.512	.815	.167	.669	.234
	Test of $\beta_1+\beta_2=0$ p-value	.026	.778	.000	.000	.180
Panel (b)	DEAEFF1	-.08268***	.91629***	.2785***	.3672***	.57615***
x=LERNER	DEAEFF2	-.06978**	.25250**	.48713***	.52744***	.14663***
	LER1	1.50238***	.256391	.287726	1.16699**	.401289***
	LER2	.091814	.618766***	.735359***	.445637	-.19173
	Σ(LER)	1.5942***	.8752***	1.02309***	1.61263***	.209558**
	χ^2 (2) (prob >χ^2)	16.47 (.0003)	26.86 (.0000)	14.91 (.0006)	28.10 (.0000)	7.00 (.0302)
	m1 p-value	.050	.002	.065	.013	.262
	m2 p-value	.866	.251	.951	.133	.299
	Sargan/Hansen p-value	.271	.578	.360	.585	.252
	Test of $\beta_1+\beta_2=0$ p-value	.000	.000	.001	.000	.275

Notes: Year dummies are included in all models. SFAEFF= cost efficiency estimated using SFA. DEAEFF= cost efficiency estimated using DEA. *,**,*** indicates significance at the 10%, 5% and 1% levels. Asymptotic standard error in parentheses. The two-step estimates are Windmeijeier corrected (Windmeijer, 2005). m1 and m2 are tests for first-order and second-order serial correlation. Sargan/Hansen is a test of the over-identifying restrictions for the GMM estimators. All computations done using Stata.

Table 6

Does Cost Efficiency Granger-Cause Competition?

Dependent variable: *y*=LERNER	Variables and tests	France	Germany	Italy	Spain	UK
Panel (a) *x*=SFA COST EFFICIENCY	LER1	.82371***	1.01588***	.58034***	1.11288***	.68361***
	LER2	.23450*	.17272***	.38333***	.093210	-.01227
	SFAEFF1	-.000472	-.001884	.000731	-.00077	.000435
	SFAEFF2	.000484	.001910	-.000749	.00077	-.000417
	Σ(SFAEFF)	.000012	.0000255***	-.000018	.0000	.000018
	χ^2 (2) (prob $>\chi^2$)	1.26 (.5330)	9.78 (.0075)	0.75 (.6871)	4.56 (.1024)	3.88 (.1440)
	m1 p-value	.073	.488	.216	.061	.103
	m2 p-value	.775	.111	.765	.213	.956
	Sargan/Hansen p-value	.510	.343	.933	.545	.949
	Test of β_1+ β_2=0 p-value	.267	.556	.520	.967	.671
Panel (b) *x*= DEA COST EFFICIENCY	LER1	.52924***	.87146*	.28476**	1.0829***	1.02811***
	LER2	.39744***	.12738	.61990***	-.03013	-.05530
	DEAEFF1	.003103	.014397*	.013219*	.002927	.000479
	DEAEFF2	-.006722	.011034	-.006097	.002395	.006859
	Σ(DEAEFF)	-.00362	.0 25431**	.007122**	.005322	.007338
	χ^2 (2) (prob $>\chi^2$)	3.90 (.1422)	6.71 (.0350)	6.11 (.0470)	0.55 (.7592)	2.70 (.2598)
	m1 p-value	.214	.586	.431	.065	.113
	m2 p-value	.501	.118	.562	.357	.932
	Sargan/Hansen p-value	.920	.019	.434	.410	.898
	β_1+ β_2=0 p-value	.661	.014	.469	.498	.158

Notes: Year dummies are included in all models. SFAEFF= cost efficiency estimated using SFA. DEAEFF= cost efficiency estimated using DEA. *,**,*** indicates significance at the 10%, 5% and 1% levels. Asymptotic standard error in parentheses. The two-step estimates are Windmeijeier corrected (Windmeijer, 2005). m1 and m2 are tests for first-order and second-order serial correlation. Sargan/Hansen is a test of the over-identifying restrictions for the GMM estimators. All computations done using Stata.

Figure 1

Marginal Cost and Lerner Index of Monopoly Power

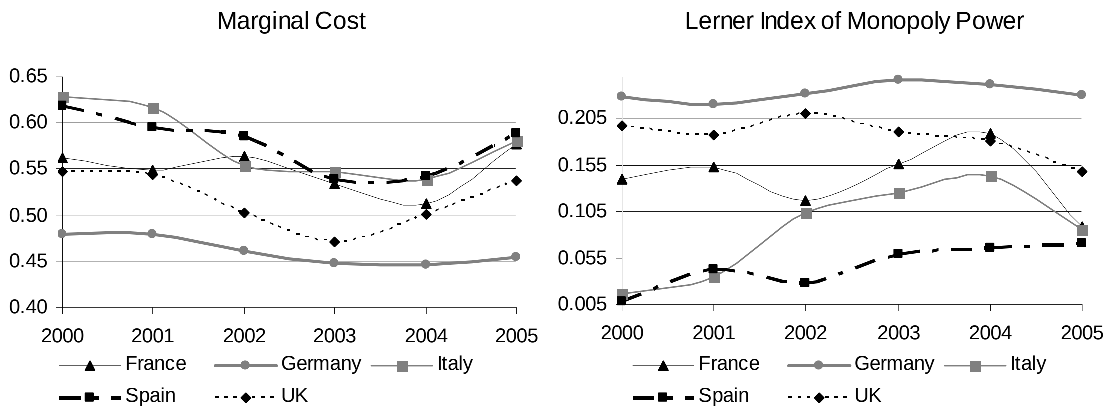

Figure 2

The Evolution of Bank Efficiency: Yearly Averages