Competition and efficiency in EU27 banking systems

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Abstract

In our study, we investigate competition in the banking systems of the EU27 as a whole, but also in both old EU member states and new EU member states, in the context of European Union integration and enlargement. Specifically, we construct 2 measures of competition, the Lerner Index and H-statistics, using bank-level data for a panel of 923 commercial banks from the 27 countries that are member states of the EU. The results show a significant increase in competition in new EU members between 2001 and 2006, while in old member states we see a notable decrease in competition between 2005 and 2007. As a whole, competition in the EU27 increases comparatively with 2001, and we consider adoption of the euro and continuing European integration to be the main factors for this issue. Additionally, empirical results provide evidence of convergence in terms of banking competition among the member states of the EU.

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1. Introduction

Recent turmoil in the global financial system has impacted severely on the banking sector, with many banks suffering large losses and being forced to raise additional capital privately or through their national governments. Failure by investors, depositors, and supervisors to appropriately discipline banks has led academics and policy-makers to reconsider the links

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among bank performance, risk and changes in the competitive environment. Moreover, in recent years, indicators of banking competition have been used by researchers to explain performance and risk differentials across banks.

Intensified competition is one expected benefit of economic integration in the European Union. Competition is generally accepted as a positive influence in most industries, in that it is supposed to have a positive impact on an industry's efficiency. In 1957, the Treaty of Rome set a Single European Market for all goods and services. All discrimination based on nationality was to disappear. The 1992 Maastricht Treaty consolidated the single-market programme. A single European financial market implies that in any of the member states a financial institution of a European Union country is able to function on the basis of the functioning authorization issued by its own country. The First Banking Directive removed obstacles to providing services and establishing branches across the borders of EU member states, harmonized rules for bank licensing and established EU-wide supervisory arrangements. Later, in 1989, the Second Banking Directive on coordination of laws, regulations and administrative provisions dealt with the start-up and development of activity by credit institutions and aimed to create a single banking market by establishing the principle of mutual recognition of banking permits. The main advantages of the single market are: a) reduced prices for banking and financial services as a consequence of the increase of concurrency among financial institutions; b) general growth of economic efficiency as a result of reduction of the cost for banking and financial services used by companies; c) increase of access to larger categories of markets, instruments and services under the conditions of portfolio diversification and better risk monitoring; and d) greater efficiency of use of capital flows due to free movement. In other words, the single European market would produce many dynamic gains in the form of economies of scale, increased competition resulting in reduction in X-inefficiency and international price discrimination, and an increase in the variety of products available across the market (Howells and Bain, 2007).

Besides, in recent years the reform of banking systems due to European Union accession and the transition phenomenon from centralized economy to market-based economy in Central and Eastern European countries has involved ample liberalization, privatization and recapitalization of the banking sector. This has resulted in giving much consideration to analysis of competition in banking sectors.

In our study, we investigate competition in banking systems in the EU27 as a whole, but also in both old EU member states and new EU member states, in the context of European Union integration and enlargement. Since 2004, total EU membership has increased twice: in 2004, 10 new member states (Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia) joined the EU, while in 2007, another 2 (Bulgaria and Romania) entered. The originality of this study consists in assessing competition not only for the EU27 banking systems as a whole, but also for old members' banking systems compared with new members' banking systems. We also take into consideration some effects of the present international financial crisis during the period 2008-2009.

After that, we test for convergence on non-structural measures of bank competition. We also assess the relationship between competition and efficiency in EU banking systems using Granger-type causality tests in a comparative manner: old EU members versus new EU members.

The rest of the paper is organized as follows: Section 2 reviews previous literature on banking competition and the relationship between banks' efficiency and competition. In Section 3 we explain the methodology we have used in our analysis and discuss data and variable selection. Section 4 presents and discusses the results of the empirical analysis. Section 5 presents the main conclusions.

2. Literature review

The literature includes some empirical approaches concerning evaluation of competition, the most well-known being "the Structure-Conduct-Performance Hypothesis" (SCP) and the "Efficient Structure Hypothesis" (ESH). The structural approach, as the name suggests, assesses bank competition by examining measures of market structure such as concentration ratios (the share of assets held by the top 3 or 5 institutions) or indices (e.g., the Herfindhal-Hirschman Index) and supposes that higher concentration in the banking market causes less competitive bank conduct, leading to higher bank profitability. The SCP model was originally developed by Bain (1956).

The second approach, ESH, developed by Demsetz (1973) and Peltzmann (1977), suggests that the superior performance of the market leaders determines market structure, implying that higher efficiency produces both higher concentration and greater profitability. "Non-structural models" do not infer competitive conduct of banks through analysis of market structure. Rather, the New Empirical Industrial Organization approach recognizes that banks behave differently depending on the market structure in which they operate. Non-structural indicators of competition are mainly based on the measures of monopoly power developed by Lerner (1934). The Lerner Index suggests the mark-up of price over marginal cost: the higher the mark-up, the greater the realized market power. A broad range of studies use the Lerner Index such as Angelini and Cetorelli (1999), Padoa-Schioppa (2001), Carbó et al (2003), Maudos and Perez (2003), Toolsema (2003), Fernandez de Guevara and Maudos (2004), Carbó et al (2005), Carbó et al (2006), Humphrey et al (2006), Fernandez de Guevara et al (2007), Carbó and Rodriguez (2007), Maudos and Fernandez de Guevara (2007), and Carbó et al (2009). A number of studies have used the Lerner Index in order to try to determine the trend in competitive behavior over time.

An alternative non-structural indicator of the degree of market competition is the Panzar and Rosse (1987) H-statistic. The H-statistic measures the extent to which changes in banking costs are reflected in changes in banking revenues. It is calculated as the sum of the ratios of the percentage change in total revenue (from all sources) to the percentage change in the three input prices (funding, labor and capital costs), holding constant total banking output (total assets), leverage, and two balance-sheet composition variables (loans-to-assets and deposits-

to-total liabilities). Various studies use H-statistic measures. Some of them examine competition in European countries such as those of Shaffer (1993), Molyneux et al (1994), Bikker and Groeneveld (1998), De Bandt and Davis (2000), Koutsomanoli-Fillipaki and Staikouras (2004) and Carbó et al (2009). Claessens and Laeven (2004) and Bikker and Haaf (2002) assessed competition using the H-statistic for a sample of different countries, including European ones. Individual country studies are also available: for Germany - Hempell (2002) and Gischer and Stiele (2008); for Italy - Coccorese (2004); for Greece - Hondroyiannis et al (1999) and Coccorese (2005); for Spain - Maudos and Perez (2003) and Carbó et al (2003); and for Finland - Vesala (1995).

Fewer studies focus on banking-sector competition in developing countries. These include: Gelos and Roldós (2004), who analyze bank competition in Argentina, Brazil, Chile, the Czech Republic, Hungary, Mexico, Poland, and Turkey; Mkrtchyan (2005), who investigates bank competition in Armenia; Prasad and Ghosh (2005), who focus on the case of India; Levy-Yeyati and Micco (2007), who examine banking competition in Latin America; and Anzoategui et al (2010) who focus on competition in the Middle East and North Africa regions. Competition in the Central and Eastern European banking market has rarely been investigated. Yildirim and Philippatos (2003) assessed competition for 14 CEE countries between 1993 and 2000, using the H-statistic. Mamatzakis et al (2005) measure the degree of concentration and competition in 7 South Eastern European banking sectors, using the H-statistic, over the period 1998-2002. Drakos and Konstantinou (2005) examine competition in the banking sector with the same non-structural indicator for 10 CEE countries for the period 1992-1998. Delis (2010) applies the same indicator for a sample of 22 CEE countries over the period 1999-2006. Anzoategui et al (2010) analyze bank competition in Russia during 2002-2008, examining indicators of concentration and contestability, and computing non-structural measures of competition.

Previous research that focuses on the link between competition and bank performance has a long empirical tradition. Some studies assess the influence of banks' market power on efficiency. Hicks (1935) first argued the evidence of a negative relationship between market power and efficiency as a consequence of managers' 'quiet life'. This 'quiet life' hypothesis (QLH) considers that monopoly power allows managers to enjoy a share of monopoly rents in the form of discretionary expenses or a reduction of their effort, which generates inefficiencies. Thus, this slack management determines that firms with greater market power are more inefficient. Berger and Hannan (1998) first demonstrated that banks operating in more concentrated markets exhibit lower cost efficiency as a consequence of slack management. They tested this hypothesis on a sample of about 5000 US banks for the years from 1980 to 1989, using the Herfindahl-Hirschman Index (HHI) as a proxy for market power. Other studies replaced the Herfindahl-Hirschman Index (HHI) with the Lerner Index or H-statistics as a proxy for market power. Some of them support the QLH (Tu and Chen 2000, for Taiwan; Casu and Girardone 2009, for European countries; Koetter and Vins 2008, for Germany; Schaeck and Čihák 2008, for European countries and USA; Delis and Tsionas 2009, for European countries; and Coccorese and Pellecchia 2010, for Italy). Others reject the QLH (Weill 2004 and Maudos and Fernandez de Guevara 2007, for European countries; Koetter et

al 2008, for the USA; Pruteanu-Podpiera et al 2008, for the Czech Republic; Andries 2011, for Central and Eastern European countries; Al-Muharrami and Matthews 2009, for the Arab Gulf; and Fu and Heffernan 2009, for China). Others have both results (support and rejection), such as Solis and Maudos (2008) for Mexico: analysis of the Deposit market rejects the QLH and analysis of the Loans market supports the QLH; Turk Ariss (2010) for his sample of developing countries using cost efficiency, finds that the results support the QLH, but for Profit efficiency the QLH is rejected; and Färe et al (2010) for the Spanish banking system show that the relationship *varies* according to the level of market power, the component of efficiency evaluated (cost, technical or allocative) and the type of banking firm (commercial bank or savings bank), suggesting that the 'quiet life' might be a reality only for some banks. Comparatively with previous studies on EU countries, we use both non-structural indicators (Lerner Index and H-statistics) across new European Union members and old European Union members over 2001-2009, as well as for the whole EU. Additionally, we go forward and analyze the convergence of banking-competition levels across the EU member states. Finally, we assess the influence of banks' market power on EU banks' efficiency in terms of cost efficiency, testing which hypothesis is confirmed.

3. Methodology and data

In this section we discuss the empirical model used to assess the level and convergence of competition and we investigate the relationship between competition and efficiency in EU banking systems.

3.1. Competition measures

The purpose of this study is to analyze, comparatively, competitive conditions in the banking sectors of European Union countries, both old member countries and new member countries, in light of the reforms implemented in these countries and the tremendous changes in their banking systems using bank-level data.

In the first empirical part of this paper, we estimate the non-structural indicators of competition in order to examine the evolution and level of competition and market power of banks across member states of the European Union for the period 2001-2009. In particular, we measure competition using the Lerner Index and the H-statistic, indicators that are estimated using bank-level data. In the second part of the paper we will assess the convergence of banking competition at the European Union level.

In order to estimate the degree of bank market power we use bank-level data, the approach followed being similar to that of Maudos and Fernandez de Guevara (2007) and Delis and Tsionas (2009) who defined the Lerner Index as:

$$L_{it} = \frac{(p_{it} - mc_{it})}{p_{it}}, \qquad (1)$$

where p is the price of total assets computed as the ratio of total revenue to total assets, mc is the marginal cost of total assets, and subscripts i and t denote bank and time, respectively. To calculate the Lerner Index, we first estimate the following translog cost function with one output (total assets), three input factors (labor, deposits, and capital), and three netputs (fixed assets, loan loss provisions, equity capital) (Schaeck and Čihák 2008).

$$\begin{aligned}\ln C_{it} &= \alpha_0 + \alpha_1 \ln Y_{it} + \frac{1}{2}\alpha_2 \ln Y_{it}^{\,2} + \sum_{k=1}^{2}\beta_k W_{k,it} + \sum_{h=1}^{2}\mu_h \ln E_{h,it} \\ &+ \frac{1}{2}\sum_{k=1}^{2}\sum_{m=1}^{2}\gamma_{km} \ln W_{k,it} \ln W_{m,it} + \sum_{k=1}^{2}\rho_k \ln Y_{it} \ln W_{k,it} + \sum_{h=1}^{2}\varepsilon_h \ln Y_{it} \ln E_{h,it} \\ &+ \sum_{k=1}^{2}\sum_{h=1}^{2}\lambda_{kh} \ln W_{k,it} \ln E_{h,it} + \frac{1}{2}\sum_{h=1}^{2}\sum_{n=1}^{2}\psi \ln E_{h,it} \ln E_{n,it} + \varepsilon_{it},\end{aligned} \tag{2}$$

where C denotes total cost, and Y is total assets. W is the vector of inputs (labor, funding, and other costs), and E is the vector of netputs (fixed assets, loan loss provisions, and equity capital).

To obtain marginal cost, we differentiate Eq. (2) with respect to Y as follows:

$$mc_{it} = \frac{\partial C_{it}}{\partial Y_{it}} = \left[\alpha_0 + \alpha_2 \ln Y_{it} + \rho_1 \ln W_{1,it} + \rho_2 \ln W_{2,it} + \varepsilon_1 \ln E_{1,it} + \varepsilon_2 \ln E_{2,it}\right]\frac{C_{it}}{Y_{it}}. \tag{3}$$

To impose standard homogeneity conditions, we scale all profits and input prices by labor costs, and adjust for heteroskedasticity and scale biases by scaling by equity capital. In the case of perfect competition, L=0; under pure monopoly, L = 1; for monopolistic competition L ranges between 0 and 1; and L < 0, implies pricing below marginal cost and could result, for example, in non-optimizing behavior of banks.

Following the empirical strategy pursued by Claessens and Laeven (2004) and Anzoategui et al (2010), we obtain the H-statistic by estimating the equation

$$\ln TR_{it} = \alpha_0 + \beta_1 \ln W_{1,it} + \beta_2 \ln W_{2,it} + \beta_3 \ln W_{3,it} + \gamma \ln Z_{it} + \delta D_t + \varepsilon_{it}, \tag{4}$$

where TR is total revenue over total assets, W_k is the unit price of input k, Z is a matrix of controls, D is a matrix of year dummies, α_0 denotes bank-level fixed effects, and i and t denote bank and time, respectively.

$$H = \beta_1 + \beta_2 + \beta_3. \tag{5}$$

Panzar and Rosse (1987) showed that the H-statistic indicates the nature of market structure under the following assumptions: a) banks are profit maximizing; b) banks produce revenue using labor, capital and intermediated funds as inputs; and c) higher input prices are not associated with higher quality services that generate higher revenue.

For accurate identification of the H-statistic using an estimated revenue equation based on a static equilibrium model, it is necessary to assume that markets are in a long-run equilibrium at each point in time when the data are observed. Accordingly, the equilibrium profit rate should be uncorrelated with factor input prices. To test the market equilibrium assumption we estimated the following equation:

$$\ln(1+R_{it}) = \alpha_0 + \beta_1 \ln W_{1,it} + \beta_2 \ln W_{2,it} + \beta_3 \ln W_{3,it} + \gamma \ln Z_{it} + \delta D_t + \varepsilon_{it}, \quad (6)$$

where R_{it} is the return on assets of bank i in year t, and because it can take on negative values, we compute the dependent variable as $\ln(1+R_{it})$.

The log specification is used to improve the regression's goodness of fit and to reduce possible simultaneity bias (De Bandt and Davis 2000).

The estimated value of the H-statistic ranges between -∞ and 1. The H-statistic is smaller than 0 if the underlying market is a monopoly; it ranges between 0 and 1 for monopolistic competition; and an H-statistic of unity indicates perfect competition.

3.2. Convergence measures

In order to analyze the convergence of banking-competition levels across the EU member states over the 2001-2009 period, we used the concepts of β-convergence and σ-convergence proposed by Barro and Sala-i-Martin (1991). The seminal papers by Barro and Sala-i-Martin (1992) and Mankiw et al (1992) have triggered a huge amount of literature attempting to empirically detect and measure convergence in various contexts.

While β-convergence focuses on detecting possible catching-up processes, σ-convergence simply refers to a reduction of disparities among regions in time. The two concepts are, of course, closely related. β-convergence is necessary but not sufficient for σ-convergence.
Recently, a number of studies have emerged examining convergence of bank performance (see Fung 2006; Fernandez de Guevara et al 2007; Mamatzakis et al 2008; Evans et al 2008; Weill 2009; Casu and Girardone 2010; Matthews and Zhang 2010).

In the case of European countries, studies check whether financial integration takes place in the EU banking markets and whether, as a result, it improves banking sector performance. The studies also check whether convergence is occurring in the banking sector. Fernandez de Guevara et al (2007) analyze both the evolution of convergence in interest rates and the level of competition and its inequalities among the European banking systems for the period 1993-2001. Using β-convergence and σ-convergence, Weill (2009) investigates convergence in banking efficiency for 10 European countries between 1994 and 2005. By applying dynamic panel-data models to the concepts of β-convergence and σ-convergence, Casu and Girardone (2010) assess the speed at which EU-15 area banking markets integrated between 1997 and 2003. Mamatzakis et al (2008), using β- and σ-convergence, examine convergence in cost and profit efficiency across the banking systems of the ten new European Union member states

over the period 1998-2003. Evans et al (2008) investigate whether a deregulatory process was associated with increasing similarity, or convergence, of banking industries across the European Union.
To estimate unconditional β-convergence, we use the following equation:

$$\Delta \ln LERNER_{j,t} = \alpha + \beta \ln LERNER_{j,t-1} + \gamma(\Delta \ln LERNER_{j,t-1}) + \varepsilon_{j,t}$$
$$\Delta \ln LERNER_{j,t} = \ln LERNER_{j,t} - \ln LERNER_{j,t-1}, \quad (7)$$

where $LERNER_{j,t}$ is the mean level of competition, measured using the Lerner Index, in country j in year t; $LERNER_{j,t-1}$ is the level of competition in country j in year t-1; j = 1,2,...,27 and t = 1,2,...,9; α, β and γ are the parameters to be estimated; and $\varepsilon_{j,t}$ is the error term. Then, there is β-convergence if the coefficient β is negative: the higher the coefficient in relative terms, the greater the tendency for convergence.
σ-convergence is investigated through estimation of the following equation:

$$\Delta W_{j,t} = \alpha + \sigma W_{j,t-1} + \gamma(\Delta W_{j,t-1}) + \varepsilon_{j,t}$$
$$W_{j,t} = \ln LERNER_{j,t} - \ln \overline{LERNER}_t \quad (8)$$
$$\Delta W_{j,t} = W_{j,t} - W_{j,t-1},$$

where, estimated using the Lerner Index, $\overline{LERNER}_t$ is the mean level of competition of the banking systems from the European Union at time t; α, σ and γ are parameters to be estimated; and $\varepsilon_{j,t}$ is the error term. A negative value for σ parameter implies convergence of $LERNER_{j,t}$ toward to $\overline{LERNER}_t$.

The empirical models specified in equations (1) – (8) are estimated using the panel least square fixed-effect methodology.

3.3. Cost Efficiency measures

In the analysis of the efficiency of the banks in EU member states we used the SFA Method (Stochastic Frontier Analysis). According to the SFA, total cost takes the following specification:

$$TC_{it} = f(P_{it}, Y_{it}) + \upsilon_{it} + u_{it}, \quad (9)$$

where TC_{it} denotes observed total cost for bank i at year t, P is a vector of input prices and Y is a vector of outputs. This approach disentangles the error term into two components. The first, υ_{it}, corresponds to random fluctuations and the second, u_{it}, accounts for the firm's inefficiency.

For the cost-efficiency function, we apply a translog specification. Restrictions regarding the function of the stochastic frontier are more flexible when a functional form of the translog-type production function is applied than when a functional Cobb-Douglas-type form is applied. The translog form does not impose the hypothesis regarding constant elasticity of the production function or of elasticity of substitution between inputs. Another advantage of the translog form is that it allows data to indicate the real value of the curvature of the function rather than impose prior hypotheses regarding its value.

In order to calculate the level of cost efficiency we apply the following equation:

$$\ln(C_{it}/W_{1,it}) = \alpha + \sum_{n=1}^{3}\beta_n \ln Y_{n,it} + \sum_{m=2}^{3}\beta_m \ln(W_{m,it}/W_{1,it}) + v_{it} + u_{it} \quad , \tag{10}$$

where: C is total cost, Y is outputs, and W is price of inputs.
The cost-efficiency level is given by the ratio between the minimum cost and the cost registered by the decisional unit and is calculated as:

$$EFF_{it} = \exp(-u_{it}). \tag{11}$$

The SFA method assumes that the inefficiency component of the error term is positive and thus high costs are associated with a high level of inefficiency.

3.4. Methodology used to test the relationship and causality between competition and efficiency

In a similar vein to Schaeck and Čihák (2008) and Casu and Girardone (2009) we analyze the link between competition and efficiency in the European banking systems in a Granger-causality manner, formally specified in equation (12) as follows:

$$\begin{aligned} EFF_{i,t} &= c + \alpha_1 LERNER_{i,t-1} + \alpha_2 LERNER_{i,t-2} + \beta_1 EFF_{i,t-1} + \beta_2 EFF_{i,t-2} + \theta_t + \vartheta_i + \varepsilon_{i,t} \\ LERNER_{i,t} &= c + \alpha_1 EFF_{i,t-1} + \alpha_2 EFF_{i,t-2} + \beta_1 LERNER_{i,t-1} + \beta_2 LERNER_{i,t-2} + \theta_t + \vartheta_i + \varepsilon_{i,t} \end{aligned} \tag{12}$$

where EFF_{it} is the level of cost efficiency for bank i in year t, $LERNER_{it}$ represents the measure of the Lerner Index. c is the intercept, α and β are parameters to be estimated, θ is a common time effect, υ is an individual bank specific effect, and e is a disturbance term.

3.5. Data

The model is estimated on a panel of 923 commercial banks from the 27 member states of the European Union for the period 2001-2009. In our sample we included only active banks with information available for at least 5 years, and we excluded those banks with missing, negative or zero values for inputs or outputs used in estimation of cost efficiency. In order to estimate non-structural indicators of competition we used the following data set: a) inputs: personnel expenses (PE), fixed assets (FA) and financial capital (sum of total deposits (TD), total money market and short term funding (TMMSTF), and equity (EQ); b) input prices: total personnel expenses over total assets (w1), other operating expenses over fixed assets (w2) and interest expenses over financial capital (w3); c) control microeconomic variables: total capital ratio

(TCR), equity to total assets ratio (EQ_TA), credit risk measured as the ratio of loan-loss provisions to total loans (CRISK), liquidity risk measured as the ratio of liquid assets to total deposits and short term funds (LA_DSTF); and d) control macroeconomic variables: GDP growth rate – growth in real GDP in per cent, inflation rate – change in annual average retail/consumer price level in per cent (IR), and level of financial intermediation – domestic credit provided by banking sector percentage of GDP (FINT).

Table 1 shows the country averages of the variables used for estimating competition and efficiency measures.

Table 1 Means of variables used

Country	No of banks	Total assets	Total cost	Total income	Cost of Labor	Cost of Physical Capital	Cost of Funds
Austria	62	5508.614	270.059	142.783	0.023	5.592	0.059
Belgium	24	40507.970	3087.668	641.338	0.011	3.704	0.039
Bulgaria	14	686.455	39.906	38.736	0.013	1.171	0.047
Cyprus	7	8168.755	396.392	275.995	0.016	0.756	0.053
Czech Republic	14	6464.830	272.503	273.291	0.008	2.415	0.064
Denmark	44	14935.950	539.051	232.880	0.018	5.915	0.058
Estonia	4	967.617	41.835	34.751	0.020	1.613	0.030
Finland	6	36758.010	1203.630	685.663	0.013	3.694	0.048
France	113	40090.510	1526.593	717.482	0.018	8.906	0.026
Germany	157	12143.040	517.082	238.017	0.028	10.501	0.054
Greece	15	20747.040	1138.161	808.022	0.014	1.127	0.033
Hungary	14	5020.972	398.592	315.449	0.017	4.198	0.056
Ireland	20	40562.640	1437.369	558.336	0.002	14.046	0.051
Italy	88	25228.910	1002.469	724.985	0.014	6.439	0.035
Latvia	18	1082.915	54.042	46.606	0.014	1.811	0.025
Lithuania	9	1709.636	76.537	60.317	0.015	1.361	0.028
Luxembourg	52	7521.229	377.874	110.532	0.007	5.964	0.054
Malta	8	2203.565	80.837	58.109	0.007	3.953	0.031
Netherlands	22	81754.950	3253.605	1251.428	0.008	5.916	0.061
Poland	26	4429.315	262.759	227.427	0.014	5.187	0.044
Portugal	16	11907.830	650.445	354.636	0.010	3.051	0.061
Romania	17	1776.378	148.381	118.250	0.027	1.219	0.057
Slovakia	11	3364.041	163.722	142.008	0.011	1.661	0.031
Slovenia	15	2560.603	132.974	98.026	0.011	1.163	0.040
Spain	27	86225.470	3232.884	2631.003	0.010	2.449	0.032
Sweden	16	17815.200	619.540	321.277	0.013	10.510	0.026
United Kingdom	104	55101.910	1759.921	1163.685	0.019	18.382	0.046
All	923	23751.540	927.075	503.315	0.018	7.689	0.047

All bank-level data used are obtained from the BankScope database and are reported in millions of euro while data regarding banking system characteristics and macroeconomic variables have been taken from the EBRD, the World Bank and ECB reports.

In order to estimate cost-efficiency scores, bank inputs and outputs are defined according to the value-added approach: a) Outputs: loans (Q1), other earning assets (Q2) and demand deposits (Q3); b) Inputs: personnel expenses (PE), fixed assets (FA) and financial capital (FC); c) Input prices: Cost of Labor (W1), calculated by dividing Personnel Expenses by Total Assets, and Cost of Physical Capital (W2), calculated by dividing other operating expenses by fixed assets; and d) Cost of Funds (W3), calculated as the ratio of interest expenses over financial capital.

4. Empirical results

4.1. Competition results

The Lerner Index – the mark-up of price over marginal cost – is used as an indicator of banking competition and varies considerably across European countries. Table 2 shows the means of the Lerner Index – the mark-up of price over marginal cost – across new European Union members and old European Union members over 2001-2009, as well as for the whole EU. Significant cross-country differences exist in these competition measures.

Table 2 Mean values of Lerner Index for European Union members over 2001-2009

Period	Lerner Index		
	EU members	Old EU members	New EU members
2001	0.8101	0.7797	0.8445
2002	0.6921	0.7074	0.7423
2003	0.6967	0.7332	0.6208
2004	0.7288	0.7692	0.5093
2005	0.7121	0.7504	0.5581
2006	0.7699	0.8196	0.4893
2007	0.7750	0.8315	0.5181
2008	0.6729	0.7134	0.4862
2009	0.7252	0.7376	0.6619
Average	0.7314	0.7602	0.6034

Based on the Lerner Index, we observe a significant increase of competition in new EU members between 2001 and 2006, while in old EU members we see a marked decrease of competition between 2005 and 2007. Old EU members have a higher value of the Lerner Index (0.7602) than new EU members (0.6034). Taking into account the initial level of the Lerner Index in 2001 for all EU member states during the period analyzed, we observed a general reduction of market power across European banking systems, which means an improvement in competition.

Table 3 Mean values of Lerner Index for European countries over 2001-2009

Country	Lerner Index	Country	Lerner Index	Country	Lerner Index
Austria	0.8373	Germany	0.9233	Netherlands	0.5751
Belgium	0.6496	Greece	0.8906	Poland	0.6470
Bulgaria	0.6000	Hungary	0.8571	Portugal	0.4255
Cyprus	0.9640	Ireland	0.1575	Romania	0.4793
Czech Republic	0.4707	Italy	0.6578	Slovak Republic	0.4994
Denmark	0.7858	Latvia	0.6991	Slovenia	0.4485
Estonia	0.7585	Lithuania	0.3624	Spain	0.8367
Finland	0.8265	Luxembourg	0.6419	Sweden	0.6132
France	0.7154	Malta	0.7081	United Kingdom	0.8358

The results presented in Table 3 show the existence of important inequalities in the level of competition or market power among the banking sectors of the European Union. Cyprus (0.9640) and Germany (0.9233) have the highest values of market power, while Ireland (0.1575) and Lithuania (0.3624) have the lowest values, which suggest a monopolistic competition structure in most cases. These results can be explained by the increase of competition between 2001 and 2006, due to introduction of the euro and the process of EU accession of the present new member states (there were two accession waves: in 2004 and 2007).

Table 4 Mean values of H-statistics for European Union members over 2001-2009

Period	H-statistics		
	Old EU members	New EU members	EU members
2001	0.5393	0.9968	0.6634
2002	0.5833	0.8433	0.5969
2003	0.6853	0.8754	0.7042
2004	0.9080	0.7492	0.8869
2005	0.6403	0.7293	0.6812
2006	0.7437	0.6246	0.7231
2007	0.5174	0.9063	0.6049
2008	0.5840	0.7122	0.6233
2009	0.6654	0.7573	0.6879
Average	0.6519	0.7994	0.6858

As we can see in Table 4, for new EU members the mean level of H-statistics (0.7994) is higher than for old EU members (0.6519) in the period 2001-2009. But perhaps the *trend* of competition at the level of these two groups of countries is more important: During the period analyzed we observed a significant decrease of competition in new EU members and an increase of competition in old EU members. The higher scores of H-statistics of new EU members in the first part of the period assessed (2001 - 2003) could be explained by reforms of the transition process of these banking systems from a centralized economy to a market-based economy, as well as by the process of EU accession. These reforms (2001-2003) implied higher changes in banking revenues due to changes in banking costs than after 2004. As a whole, the H-statistics for EU27 members do not have a coherent trend. Similar

to the findings of previous studies (see, e.g., Delis 2010), the H-statistic varies widely between countries, with Greece presenting the lowest score (0.1538) and Hungary the highest (0.9345). These values indicate, similar to the Lerner Index, a monopolistic competition in most of the countries.

4.2. Evaluating convergence of competition

In this section we provide information relating to convergence of competition scores (values of the Lerner Index) across the 27 countries that were member states of the European Union over the 2001-2009 period. In our analysis, we use two major indicators of convergence, namely σ- and β-convergence. The results provide evidence of β-convergence in terms of banking competition among the member states of the European Union, as the β-coefficient is negative and significant. That means the countries with the lowest level of competition in 2001 had experienced a higher increase of competition than countries with the highest level of competition during the period 2001-2009.

Table 5 Convergence of competition levels across European countries

β-convergence		σ-convergence	
α	-0.0068	α	-0.0116
	(0.0068)		(0.0068)
β	-0.7890***	β	-0.8140***
	(0.0278)		(0.0282)
γ	0.1892***	γ	0.1762***
	(0.0221)		(0.0222)

Note: Standard deviations are presented in parentheses.
*, **, *** indicates significance levels at 10%, 5% and 1%

A similar result is obtained in the case of σ-convergence, meaning that dispersion of mean competition scores between member states of the European Union was reduced during the 2001-2009 period. σ-convergence indicates how rapidly each country's competition levels are converting to the sample mean.

The results of convergence tests for both groups, old EU members and new EU members, presented in Table 6, validate and reinforce our main conclusion concerning β-convergence and σ-convergence in banking competition across member states of the European Union, and show that β-convergence and σ-convergence was higher in new EU members from Central and Eastern Europe.

Table 6 Tests of convergence of competition level across Old and New EU members

Old EU members			
β-convergence		σ-convergence	
α	-0.0091***	α	-0.0144*
	(0.0080)		(0.0080)
β	-0.7651***	β	-0.7831***
	(0.0316)		(0.0319)
γ	0.1874***	γ	0.1715***
	(0.0249)		(0.0249)
New EU members			
β-convergence		σ-convergence	
α	-0.0004	α	-0.0036***
	(0.0116)		(0.0117)
β	-0.9298***	β	-0.9971***
	(0.0572)		(0.0593)
γ	0.1887***	γ	0.1968
	(0.0482)		(0.0493)

Note: Standard deviations are presented in parentheses.
*, **, *** indicates significance levels at 10%, 5% and 1%

Table 7 Granger-causality tests

i) Dependent Variable: LERNER INDEX			
Model	**1-EU**	**2 – Old members**	**3 – New members**
C	1.2278***	1.3009***	1.1940***
	(0.1919)	(0.2171)	(0.4078)
LERNER(-1)	-0.0306	-0.1098***	0.0029
	(0.0211)	(0.0313)	(0.0258)
LERNER(-2)	0.0613***	0.0910***	0.0253
	(0.0173)	(0.0215)	(0.0250)
EFF(-1)	-0.5942***	-0.5469**	-0.7644**
	(0.1742)	(0.1964)	(0.3942)
EFF(-2)	0.2473*	0.1725*	0.4446*
	(0.1856)	(0.2102)	(0.4232)
SEFF	-0.3469	-0.3744	-0.3198
R-squared	0.6830	0.7003	0.5452
Adjusted R-squared	0.5575	0.5778	0.3663
S.E. of regression	0.6319	0.6768	0.4284
Sum squared resid	561.8443	492.0094	59.2911
Log likelihood	-1558.102	-1297.395	-182.4003
F-statistic	5.4435	5.7176	3.0488
Prob(F-statistic)	0.0000	0.0000	0.0000
Method		Panel Least Squares	

ii) Dependent Variable: COST EFFICIENCY LEVEL			
Model	**1-EU**	**2 – Old members**	**3 – New members**
C	0.8343***	0.8372***	0.7341***
	(0.0283)	(0.0323)	(0.0559)
	-0.0156	-0.0404	0.272170***
EFF(-1)	(0.0257)	(0.0292)	(0.0562)
	-0.1591***	-0.1555***	-0.2614***
EFF(-2)	(0.0272)	(0.0312)	(0.0570)
	0.0056*	0.0101**	-0.0014
LERNER(-1)	(0.0029)	(0.0041)	(0.0033)
	0.0031	0.0033	-0.0013
LERNER(-2)	(0.0024)	(0.0032)	(0.0032)
SLERNER	0.087	0.0134	-0.0027
R-squared	0.5660	0.0134	0.7152
Adjusted R-squared	0.3948	0.3554	0.6106
S.E. of regression	0.0988	0.1071	0.0619
Sum squared resid	15.0527	13.5088	1.3585
Log likelihood	2283.07	1645.317	737.1681
F-statistic	3.3059	2.8846	6.8384
Prob(F-statistic)	0.0000	0.0000	0.0000
Method		Panel Least Squares	

Note: Standard deviations are presented in parentheses.
*, **, *** indicates significance levels at 10%, 5% and 1%

Table 7 reports the results of Granger-causality tests. In the first set of estimations, competition, measured as the Lerner Index, is estimated as a function of lagged competition and lagged cost efficiency. The results show that efficiency negatively Granger-causes the Lerner Index – hence, efficiency positively Granger-causes competition – in all three models. Causality is stronger in the case of new member states where, in the equation explaining the Lerner Index, lags of efficiency are jointly different from zero and sum up to -0.31, significant at 5%. In these conditions, the evidence for all groups of countries rejects the efficient structure hypothesis.

The results from the second set of estimations show that the Lerner Index does not Granger-cause efficiency in all three models, lags of the Lerner Index are not jointly different from zero and their sum is not significant at 10%. Thus, we can conclude that the results of reverse causality running from competition to efficiency provide little or no evidence that increases/decreases in market power precede decreases/increases in efficiency. Taking into account this evidence, we can neither reject nor support the 'quiet life' hypothesis.

5. Conclusions

In our study, we investigate competition in banking systems in the EU27 as a whole, but also in both old EU member states and new EU member states, in the context of European Union

integration and enlargement. After that, we test for convergence on non-structural measures of bank competition. We also assess the relationship between competition and efficiency in EU banking systems using Granger-type causality tests in a comparative manner, old EU members versus new EU members.

Our results show that competition in the EU27 had higher scores in 2009 in comparison with 2001 but it does not have a coherent trend. The increase of competition in new members' banking systems could be explained by deregulation and entry of foreign banks through acquisitions or "greenfield" investments. On the other hand, the decrease of competition in old member states between 2005-2007 could be explained by a decrease of interest in the internal market (much more mature) of European multinational banks and their orientations to markets from Central and Eastern European markets, with many more possibilities to increase their profits.

Further proof of this that can be observed in the fact that in 2009 competition decreased in new member markets and, after 2008, it increased in the old member market. This could be explained by the effects of the international financial crisis that made banks from old member states reduce their exposure to new member markets. This evidence makes us draw the conclusion that competition in the EU is due to internationalization of European banks, while deregulation is not sufficient to increase competition. Thus, we could consider that competition in new-member markets is dependent on interest by parental undertakings in these markets. Both non-structural indicators, the Lerner Index and the H-statistic, demonstrate that most countries have monopolistic competition and higher competition in new member states than in old member states.

The results of convergence tests provide evidence of β-convergence and σ-convergence in terms of banking competition among the member states of the European Union and show that convergence was higher in new EU members from Central and Eastern Europe. By investigating the relationship between competition and efficiency in EU banking systems using Granger-type causality tests, we rejected the efficient structure hypothesis, but our findings provide little or no evidence to support or reject the 'quiet life' hypothesis.

From a policy perspective, our findings suggest that country-specific factors, the low market share of local banks and the decreasing interest of foreign banks (from old members or outside the EU) in maintaining their exposure could be the reason for decreasing competition in new member markets. This means that deregulation is not sufficient for continuously increasing competition and EU27 banking-market forces do not behave as a "single European market", even if there is progress. Taking into account the results of investigating the relationship between competition and efficiency in EU banking systems, we can also conclude that an increase in efficiency of banks fosters competition – causality is stronger in the case of new member states, but no evidence supports reverse causality. Under these conditions, policymakers should not count on fostering competition in order to improve banks' efficiency, but their measures should create an environment for improving efficiency of banks in order to increase competition and to take advantage of this phenomenon.

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