Competition and Concentration in the New European Banking Landscape

Natassa Koutsomanoli-Fillipaki
Christos Staikouras*

Department of Accounting and Finance, Athens University of Economics and Business,
76 Patission Str., 104 34, Athens, Greece

Abstract

This paper measures the degree of concentration and competition in the new enlarged European Union (EU) banking environment and investigate competitive conditions in the major European banking markets over the period 1998-2002. We describe the patterns of consolidation and concentration using traditional indicators of market structure. The econometric study is based on a non-structural estimation technique to evaluate the elasticity of total interest revenues with respect to changes in banks' input prices (Panzar-Rosse test). The empirical results confirm that European banks were operating under conditions of monopolistic competition. Moreover, econometric estimates suggest that bank interest revenues in the 10 new EU markets were earned in conditions of higher competition than those existed for the old EU countries. Finally, large banks earned their interest revenues in a relatively more competitive environment compared with smaller banks, something that is not observed for the other sources of income.

JEL Classification: G21, L13; L10

Keywords: Banking; Competition; Panzar-Rosse; Market Structure

* Corresponding Author: Department of Accounting and Finance, Athens University of Economics and Business, 76 Patission Street, 104 34, Athens, Greece, Tel.: (+30) 210 82 03 459, Fax: (+30) 210 82 28 816, e-mail: cstaik@aueb.gr (C. Staikouras)

1. Introduction

In the past two decades, European banking markets have been subjected to structural changes, which were caused by modifications occurred in the external environment especially as a consequence of the increasing monetary and financial integration. The gradual liberalization of capital flows, the prospect of the European common market, the rapid pace of developments in information technology, the product/service innovation in financial markets, the internationalisation of banking activities, the phenomenon of disintermediation (the deterioration of the role of banks as financial intermediaries), and the concern for the competitive pressure from foreign rivals are undoubtedly some of the prominent structural features of the European banking sector. These forces have altered banking behavior and market structure. The main result of the reorganization of the credit system has been a sharp growth in the number of concentration processes in EU countries with vast implications for **competition** and **concentration** in the banking and financial sector: the enhanced competition has forced banks to look for a bigger size (in order to exploit potential economies of scale and/or scope) as well as better managerial capacity [X-efficiency] (in order to improve their overall efficiency). This has pushed banks to search for more efficient organizational solutions, greater variety of the offered services and stronger exploitation of scale economies.

Moreover, the EU enlargement with countries from Central and Eastern Europe will influence the banking structure in the new EU financial landscape. The main features of the financial structure in these countries are a relatively low level of financial intermediation, a strong dominance of the banking system within the financial sector owing to the particular underdevelopment of capital markets in most countries, and a high degree of foreign involvement in most sector segments (Caviglia et.al., 2002). The banking sectors of the 10 new EU countries have been restructured and recapitalised, with clear implications on their competition status.

As a consequence, a reduction in the number of operating banks occurred in most old (EU-15) and new EU country during the last five years. Mergers and acquisitions, failures and entry of new financial institutions have resulted in a decline in the number of banks operating in EU-15 and the 10 new EU countries of about 16% and 44% respectively in that time period (European Central Bank Reports, 2002, 2003).

The above mentioned changes in banking industry structure have fueled a large literature on banking competition and concentration. The degree of banking competition and its association with market concentration, always a subject of some controversy, is a more relevant issue now than in earlier times and of vital importance for welfare-related public policy toward market

structure and conduct in the banking industry (Shaffer, 2004). These two tendencies (**competition and concentration**) seem to contrast each other, if we accept the theoretical proposition according to which a more concentrated market implies a lower degree of competition due to undesirable exercise of market power by banks. Other theories (e.g. contestability theory) maintain that, under particular conditions, competition and concentration can coexist. The theory of contestability (Baumol, 1982; Baumol et.al., 1982) assumes that firms can enter or leave rapidly any market without losing their capital and that potential competitors possess the same cost functions as firms that already serve in the market. These characteristics imply that in the contestable market the threat of potential entry constrains firms to price their products competitively. If these conditions are met, then external conditions will dominate internal conditions and guarantee non-collusive behaviour within that market. Moreover, others, like Jansen and De Haan (2003), suggest that there is no connection between concentration and market competition.

There are also more general reasons why the market conditions in the banking industry deserve particular attention. The soundness and stability of the financial sector may in various ways be influenced by the degree of competition and concentration (Yeyati and Micco, 2003). From a theoretical point of view, competition may have a deleterious impact on stability if it causes banks' charter value to drop, thus reducing the incentives for prudent risk-taking behavior. According to this view, the promise of extraordinary profits associated with the presence of market power reduces the agency problem of limited liability banks (namely, their propensity to gamble). Stiffer competition, instead, could lead to more aggressive risk taking, as documented in some empirical studies (Keeley, 1990; Cerasi and Daltung, 2000). On the other hand, a more concentrated system, inasmuch as it implies the presence of a few relatively large banks, is more likely to display a "too big to fail" problem by which large banks increase their risk exposure anticipating the unwillingness of the regulator to let the bank fail in the event of insolvency problems (Hughes and Mester, 1998).

Moreover, competition in the banking industry, given the dominant role of banks in most countries, may have an impact on the likely effectiveness of monetary policy. A more monopolistic banking sector is able to obtain larger interest rate margins. Monopolistic pricing by banks will not transmit changes of central bank interest rates as fully as pure competitive pricing will do. This probably hampers monetary policy at least to some extent (Lensink and Sterken, 2002). Moreover, Kashyap and Stein (1997) and Cecchetti (1999) argue that the banking system's concentration and health are essential to the analysis of the effectiveness of monetary policy. These authors illustrate that within the European Monetary Union (EMU) there are substantial

differences in banking structures, which are likely to accentuate the differential impact of monetary policy across EMU members. According to these authors smaller banks are more likely to reduce lending in case of a monetary contraction, due to their weaker balance sheet structure and poorer ability to attract reasonably priced external funds. Countries with a high concentration ratio (a relatively large fraction of bigger banks) would be affected less by the credit channel.

To judge the implications of those developments, it is necessary to assess the current market structure of the banking industry, to record the degree of competition, and to investigate the impact of consolidation on the market structure and the behavior of banks. This paper seeks to measure the degree of concentration and competition in the new enlarged European banking landscape and investigate competitive conditions in the major European banking markets over the period 1998-2002. We describe the patterns of consolidation and concentration using traditional indicators of market structure. As these indicators rely on the indirect inferences of market concentration and market power, we conduct an empirical analysis based on the method developed by Panzar and Rosse (1977, 1987) to assess changes in the competitive structure in EU markets (aggregate and major individual) following the consolidation process in the examined period. Panzar and Rosse show that the sum of the elasticities of a firm's revenue with respect to the firm's input prices (the so-called H statistic) can be used to identify the nature of the market structure in which the firm operates. Moreover we assess results separately for large, medium-size and small banks, which may face different competitive conditions.

This paper extends previous studies on competition and concentration in European banking in several respects. While a number of studies have examined the effects of bank consolidation on competitive conditions in the EU banking industry, hardly any systematic research has been carried out for the after-EMU period, covering the new European economies. Moreover, in the empirical analysis, competitive conditions are estimated in terms of interest revenues, and total operating revenues. This is considered to be highly relevant since as market conditions have become tougher and more competitive, the focus of profitability management has tended to shift away from interest earnings towards fees and other income[1]. This evolution was a result of both increasing non-interest income and the ongoing reduction in interest income. However, banks' income streams (other than traditional retail) have suffered, due to the significant stock market correction that began in nearly 2000[2]. Therefore, it is very important to

[1] In 2002 the non-interest income source represented around 40% of the total operating income of EU banks, compared with only 30% in 1995 (ECB, 2004).
[2] By the end of 2002, stock prices had dropped to levels that were last seen in the aftermath of the financial crisis of autumn 1998 (ECB, 2004).

examine competition in terms of organic income (interest income and fee and commission income), since these are the most stable income sources presented in the banks' financial reports.

The structure of the paper is organized as follows. Section 2 displays two formal concentration indices and applies them to al the EU (old and new) countries. This section briefly discusses methodological and institutional issues regarding competition and concentration in the new European banking landscape. Section 3 reviews the literature and modern empirical methods (structural and non-structural) of measuring competition among banks. More specifically, we illustrate the Panzar and Rosse test used to assess competitive conditions in the banking system, with particular reference to the theoretical framework, the empirical implications and the existing studies employing this methodology. Section 4 presents the empirical model used in our econometric examination and describes the data used in our research. Section 5 provides an analysis of the data with the descriptive statistics of the variables. Section 6 contains the estimation results, and discusses the empirical evidence of testing the Panzar and Rosse model. Some conclusions are offered in the final section.

2. Indicators of market structure

The EU banking sector is still very fragmented in terms of national and sometimes even local characteristics. In some countries a large part of the banking activity is in the hands of a few nationwide banks, while in some others the market share of banks that operate on a nationwide basis is rather small. This section covers developments in the structure of the banking industry in the new EU banking environment.

There are several common indicators of market structure, including the **number of banks in each country**, the **k-bank concentration ratios (CR_k)** and the **Herfindahl-Hirschman Index (HHI)**. It is theoretically not clear whether a concentration ratio or the HHI is the most appropriate measure for market concentration (Sander and Kleimeier, 2004). The importance of the latest two concentration ratios[3] arises from their ability to capture structural features of a market.

Due to its simplicity and limited data requirement, the CR_k[4] concentration ratio is one of the most commonly used concentration indexes in empirical literature, which sums the market

[3] There are also other measures of competition (see Davies [1979] for an overview), but the CR_k and the HHI are the most commonly measures used in the literature.

[4] Summing only over the market shares of the *k* largest banks in the market, the *k*-bank concentration ratio takes the form:

shares of the k largest banks allocating equal weighting to each bank. This measure belongs to the class of discrete measures (Bikker and Haaf, 2000b). Supporters of these measures maintain the view that the behaviour of a market dominated by a small number of banks is very unlikely to be influenced by the total number of firms operating in the market.

However, Phillips (1976), along with many others, has criticized the concentration ratio because it ignores size inequalities within the leading group of firms (which itself is arbitrarily defined) and emphasizes only the leading group and all other firms. Similarly, he claims the relationship between the concentration ratio and firm numbers is variable and ambiguous. The competitive behaviour of the smaller market players might force the larger players to act competitively as well. Thus, for example, it fails to reflect the impact of shifts in the positions of market leader banks (as it attaches equal weighting to the k largest banks) and completely ignores smaller ones. Moreover, there are no rules for defining the appropriate value of k; accordingly, such values are arbitrarily established.

The HHI[5], which is the sum of the squared market shares of the individual banks, is the most widely used measure of concentration. Its advantage is that it makes full use of the information obtainable from the distribution of market positions[6]. Owing to the manner in which it is calculated, it attaches greater weighting to larger banks and allows usage of all banks. By construction, the HHI has an upper value of 10,000 in the case of a monopolist firm with a 100% share of the market; the index tends to zero in the case of a large number of firms with very small market shares for each one of them[7]. Federal Reserve and the Department of Justice (DOJ) use HHI derived from deposit shares as an initial screen to determine the possible effects of a bank merger[8].

$$CR_k = \sum_{i=1}^{k} s_i$$

giving equal emphasis to the *k* leading banks, but neglecting the many small banks in the market.

[5] The HHI takes the form:

$$HI = \sum_{i=1}^{n} s_i^2$$

[6] For that reason, this index is often called the "full information" index.

[7] Davies (1979) analyses the sensitivity of the HHI to its two constituent parts, i.e. the number of banks in the market and the inequality in market shares among the different banks and finds that the index becomes less sensitive to changes in the number of banks the larger the number of banks in the industry.

[8] The DOJ divides the spectrum of market concentration into three roughly delineated categories that can be broadly characterized as unconcentrated (HHI below 1,000), moderately concentrated (HHI 1,000-1,800), and highly concentrated (HHI above 1,800). With respect to bank mergers, the DOJ's merger guidelines say that if the change in the HHI in any local market could be greater than 200 and the post-merger market would have an HHI of at least 1,800, then the merger could create or enhance market power or facilitate its

In our analysis we present the indicators of the market structure for all the twenty-five EU banking systems. Our concentration measures (5-firm concentration ratio [CR_5] and HHI) are derived from deposits, because it is assumed that the level of a bank's deposits in a market is an indication of the level of its other banking services in that same market[9].

The simplest measure of market concentration is the number of credit institutions in the market. This measure simply conveys the number of choices available to consumers. The trend of consolidation that has been observed over several years in the banking industry continued in most countries, and was mostly apparent in the declining number of credit institutions. From 1998 to 2002, the number of financial institutions in the old EU banking landscape reduced by about 16 percent, from 9,260 in 1998 to 7,756 in 2002 (Table 1). This broad decline in the number of institutions is consistent with the notion that bank consolidation is proceeding at fast pace (at lower pace than in the 90s). The decline in the number of credit institutions reflects mergers rather than closures of existing institutions. The largest reduction in the number of institutions has taken place among the smaller savings and co-operative banks. Similarly, the number of banks in seven of the new EU countries dropped significantly by 44 percent, from 1,557 in 1997 to 872 in 2001[10] (Table 1), mainly due to banking sector restructuring (e.g. liquidations, acquisitions, rapid improvements in the legal and regulatory infrastructure).

At the country level (Table 1), the pace of consolidation greatly varied, with large countries showing the most substantial decrease in the total number of institutions. Major reductions in the number of institutions occurred in Germany (-27%), and France (-17%). The number of banks remained almost constant in Greece, while Sweden conversely reported a substantial increase. Regarding the major new EU country, Poland, the decrease in the number of banks (-48%) has been the result of consolidations, mergers, takeovers and liquidations. External factors such as mergers of foreign or regional banks have also affected the concentration of the Polish banking sector, leading to the merger of their subsidiaries operating in that country.

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exercise. Changes smaller than 200 points are deemed to be, in general, of little economic significance (Jayaratne and Hall, 1996; Laderman, 2003).

[9] The concentration ratios using total assets are available upon request.

[10] There is some historic and market unavailability on data for all the new EU countries.

Table 1: Number of credit institutions							
Country	**1998**	**2002**	**Change**	**Country**	**1997**	**2001**	**Change**
Austria	898	823	-8.4%	Czech Rep.	50	38	-24.0%
Belgium	120	111	-7.5%	Estonia	22	14	-36.4%
Denmark	212	178	-16.0%	Hungary	45	41	-8.9%
Finland	348	369	+6.0%	Lithuania	22	32	+45.6%
France	1,226	1,011	-17.5%	Poland	1,378	713	-48.3%
Germany	3,238	2,363	-27.0%	Slovakia	29	21	-27.6%
Greece	59	61	+3.4%	Malta	11	13	+18.2%
Ireland	78	85	+9.0%	**7 New EU**	**1,557**	**872**	**-44.0%**
Italy	934	822	-12.0%				
Luxembourg	212	177	-16.5%				
Netherlands	634	539	-15.0%				
Portugal	227	202	-11.0%				
Spain	402	359	-10.7%				
Sweden	148	216	+45.9%				
UK	521	440	-15.5%				
EU-15	**9,260**	**7,756**	**-16.2%**				

Source: Czech National Bank (CNB), Bank of Lithuania (BoL), National Bank of Poland, Central Bank of Malta, Bank of Estonia, European Central Bank (July 2002, November 2003).

As we can observe from Table 2, the banking concentration ratio seems to be reduced in the EU-15 region, on aggregate and in most of the countries in the period 1998-2002. The HHI stands at 83 in 2002, compared with 99 in 1998. Despite large-scale privatization and more liberal public policy towards the elimination of entry barriers, the banking sectors of the 10 new EU countries remained much more concentrated throughout the sample period than those of the EU-15 countries. The HHI for deposits stands at 262 in 2002, Furthermore, what is observed is a slight reduction in concentration in the 10 new EU countries. This means that while the number of banks has fallen in these countries, this decline has not systematically resulted in an increase in concentration. A number of explanations can be presented, mentioned also by Gelos and Roldos (2004). First, there was the legacy from the pre-market-reform era, namely large state-owned banks concentrating a large share of deposits. Second, all these countries pursued liberal entry policies and a large number of banks entered the markets. Third, the state-owned banks suffered a sharp reduction in market share, partly as a result of clean-up operations before their privatization to strategic (and mostly foreign) investors. A consolidation trend has only recently begun to take hold in the region, being driven by stronger banks being forced to absorb weaker ones to ensure continued stability, by shareholders deciding to exit the market, and by mergers of the parent companies of foreign banks present in the region.

Table 2: Concentration measures

Country	Year	CR_5	HHI	Country	CR_5	HHI	Country	CR	HHI
Austria	1998	66.50	1,779	Luxembourg	36.01	434	Lithuania	99.35	3,505
	1999	61.62	1,627		35.76	413		98.96	3,697
	2000	64.34	1,313		35.06	408		96.46	3,225
	2001	61.37	1,116		35.60	438		94.94	2,883
	2002	62.39	1,132		38.36	405		80.54	2,632
Belgium	1998	89.27	2,432	Netherlands	90.11	2,610	Malta	99.61	4,245
	1999	89.57	2,548		88.91	2,402		99.17	4,171
	2000	88.21	2,266		89.87	2,474		95.82	3,532
	2001	89.96	2,228		89.75	2,455		96.28	3,075
	2002	90.30	2,293		90.01	2,437		98.99	3,655
Denmark	1998	81.61	2,441	Portugal	79.15	1,568	Poland	75.31	1,691
	1999	82.59	2,489		77.67	1,547		66.60	1,359
	2000	84.23	2,859		80.37	1,605		64.44	1,162
	2001	82.77	2,782		75.11	1,385		61.13	1,046
	2002	82.83	2,947		72.61	1,301		60.51	1,047
Finland	1998	n.a.	5,488	Spain	60.99	1,147	Slovakia	78.40	1,943
	1999	n.a.	5,170		61.30	1,159		79.04	2,051
	2000	98.89	5,244		61.68	1,220		73.55	1,842
	2001	97.40	5,136		58.09	1,113		71.66	1,533
	2002	96.99	5,056		54.28	911		77.12	1,707
France	1998	50.55	644	Cyprus	92.97	2,776	Slovenia	77.82	2,061
	1999	44.35	513		90.92	2,684		76.72	2,026
	2000	42.45	475		88.03	2,067		75.93	2,030
	2001	42.83	479		85.67	2,092		76.82	2,250
	2002	41.23	468		88.54	2,447		75.51	2,145
Germany	1998	37.92	385	Sweden	93.46	2,471	Czech Rp.	88.01	2,406
	1999	34.74	315		87.08	2,056		83.94	2,065
	2000	44.55	463		86.81	2,073		80.88	1,884
	2001	42.27	416		84.09	1,935		79.07	1,725
	2002	40.67	387		85.98	2,056		76.47	1,609
Greece	1998	96.70	2,820	UK	42.28	483	Estonia	n.a.	4,781
	1999	83.26	1,881		40.26	453		n.a.	5,052
	2000	81.52	1,804		37.01	430		n.a.	5,381
	2001	80.23	1,754		37.48	442		n.a.	5,841
	2002	84.18	1,843		37.90	464		n.a.	5,844
Ireland	1998	65.55	1,551	Hungary	70.97	1,569	**EU-15**	12.94	99
	1999	64.16	1,431		69.64	1,492		12.50	92
	2000	61.81	1,318		63.55	1,204		12.75	92
	2001	60.63	1,202		64.11	1,170		12.19	89
	2002	64.64	1,145		63.83	1,222		11.49	83
Italy	1998	55.41	796	Latvia	78.15	2,026	**new EU**	36.10	384
	1999	53.40	739		65.23	1,335		32.26	332
	2000	48.26	624		69.50	1,446		30.69	316
	2001	46.75	561		70.47	1,259		29.24	291
	2002	40.80	441		68.66	1,244		27.31	262

Source: FitchIBCA's Bankscope database and own estimations.

Germany has the lowest HHI (standing at 387 in 2002), followed by Luxembourg, Italy, the UK and France, countries that also exhibit relatively low concentration ratios. On the other hand Finland has the highest level of concentration among all 15 EU countries (HHI stands at 5,056 in 2002)[11]. These statistics suggest that some of the smaller European countries' banking markets, at least those which continue to be purely national, are highly concentrated.

Regarding the 10 new EU countries, Estonia exhibits the highest concentration ratios (the HHI is 5,844 in 2002), while the largest banking market, Poland, presents the lowest one (HHI stands at 1,047 in 2002). In the majority of the new EU countries we can observe a decline in concentration, though it remains in relatively high levels. In Czech Republic, despite the high level of concentration, the market share of the largest banks has been steadily declining. Particularly apparent is the growing significance of medium-sized banks, which mainly comprise foreign bank subsidiaries. These indicators show that banking sectors in new EU countries appear to have a high and decreasing (in most cases) degree of concentration, while in the EU-15 countries the banking sectors are on average less concentrated.

However, these standard measures of market concentration can only serve as crude indicators of competitive conditions in the banking sector. Moreover, these are inherently static measures, describing the situation at one point of time, and tell us nothing about the actuality of any collusive behaviour by market participants. Therefore, the next section moves beyond the largely descriptive approach followed so far and uses, both theoretically and practically, an econometric method to assess changes in competitive conditions.

3. Review of literature and techniques

The literature approach on the measurement of competition can be divided into two major streams: **structural** and **non-structural**. The structural approach embraces the **structure-conduct-performance (SCP)** and the **efficiency hypothesis**, as well as a number of formal approaches with roots in industrial organisation theory. These two models investigate, respectively, whether a highly concentrated market causes collusive behaviour among the larger banks resulting in superior market performance, or whether it is the efficiency of larger banks that enhances their performance. These hypothesis although lacking formal back-up in micro-economic theory, have frequently been tested in the banking industry and provide policy makers measures of market structure and performance as well as their interrelationship.

[11] Similar are the results if we use the CR_3 and CR_5.

However, due to several deficiencies arising from the application of the structural approach, developments in industrial organization, as well as the recognition of the need to endogenise the market structure, many empirical studies follow a new course. This novel approach to competition evaluation has emerged under the impulse of the New Empirical Industrial Organisation (NEIO) approach. This approach, pioneered by Iwata (1974) and strongly enhanced by the papers of Bresnahan (1982, 1989), Lau (1982) and Panzar and Rosse (1989), tests competition and the use of market power, and stresses the analysis of banks' competitive conduct in the absence of structural measures.

3.1. The SCP and the efficiency hypotheses

We begin with a brief review of the SCP and the efficiency literature – both theoretical and empirical – as it relates to the banking industry. Many studies in the banking literature and in the more general industrial organisation find a positive relationship between profitability and measures of market structure – either concentration or market share.

The SCP hypothesis is a general statement on the determinants of market performance. This relationship in banking markets, as noted by Gilbert (1984), "*…was initiated in the 1960s, when the federal bank regulatory agencies began responding to new legal requirement concerning the effects of bank mergers on competition*". The SCP hypothesis asserts that banks are able to extract monopolistic rents in concentrated markets by their ability to offer lower deposit rates and charge higher loan rates. This finding reflects the setting of prices less favourable to consumers in more concentrated markets as a result of collusion or other forms of non-competitive behaviour. The more concentrated the market, the less the degree of competition. The smaller the number of firms and the more concentrated the market structure, the greater is the probability that firms in the market will achieve a joint price-output configuration that approaches the monopolistic solution. Empirically, the SCP relationship is usually tested by examining the relationship between profitability and market concentration with a positive relationship indicating non-competitive behaviour in concentrated markets. A related theory is the relative-market-power hypothesis (RMP) which asserts that only firms with large market shares and well-differentiated products are able to exercise market power in pricing these products and earn supernormal profits (Berger, 1995).

There have been many empirical studies of the SCP hypothesis in the banking industry (an extensive literature review is covered by Rhoades (1977), Gilbert (1984), Molyneux et.al. (1996) and Staikouras (2001)). Rhoades (1977), for example, in his survey of 39 studies from the period 1961-1977, determined that 30 of these studies had been successful in finding support for

the basic validity of the SCP hypothesis. Among others, Short (1979), Bourke (1989), and Molyneux and Thornton (1992) are using several independent variables related to characteristics both internal and external to bank's operations, in order to explain bank profitability either at an international or European level. For example, Bourke (1989), in the context of an international comparison of banks' profitability, devote a part of it to apply the methodology to a sample of seventeen French banks over the period 1972 to 1981. In the European field, Molyneux and Forbes (1993) tested the SCP hypothesis using annual banking data for the period 1986-1989. The main finding was a significantly positive concentration ratio. Lloyd-Williams et.al. (1994) found support for the SCP hypothesis in the case of Spanish banks for the period 1986-1988.

A challenge to the SCP hypothesis interpretation is the efficient hypothesis (Gilbert, 1984). Market concentration is not a random event but rather the result in industries where some firms possess superior efficiency. This hypothesis states that efficient firms increase in size and market share because of their ability to generate higher profits, which usually leads to higher market concentration. In principle, firms in markets with a large dispersion of efficiencies could be either more or less efficient on average than firms in other markets. However, proponents of the efficiency hypothesis usually assume (explicitly or implicitly) that the dispersion of efficiencies within markets that creates high levels of concentration also results in greater than average efficiency in these markets, yielding a positive profit-concentration relationship.

Evidence supporting the efficient hypothesis have been found for studies of the US banking system [Brozen (1982), Smirlock (1985), Evanoff and Fortier (1988) etc.]. Ravenscraft (1983) found a positive profit-market share relationship. This may reflects higher product quality and lower unit costs in relatively large business units. Smirlock (1985) models bank profitability as a function of market share, concentration, and an interaction term between market share and concentration (as well as several control variables) for over 2,700 unit state banks and he provides evidence in favour of the efficient hypothesis. Peristiani (1997) shows that acquiring banks achieve moderate improvements in scale efficiency. This moderate rise in scale efficiency may partly be attributed to the fact that smaller target markets are on average less scale-efficient than their acquirers.

However, generally speaking, the banking studies have not found a positive relationship as consistently as has been found in the inter-industry studies (among others Rhoades and Rutz (1981), Schuster (1984), and Moore (1998)). Gilbert (1984), in a survey article, find thirty-two out of forty-four studies have produced some evidence of significant association between market structure and measures of performance, with the direction of influence as indicated by the structure-performance hypothesis. In seven of those thirty-two studies the coefficients on

measures of market structure are not statistically significant in most of the reported equations. In two papers the coefficients on market concentration are significant but have signs that are opposite from those indicated by the traditional SCP hypothesis theory.

A serious problem applying this approach has been the interpretation of the positive relationship between profitability and concentration (when it can be found) and whether it supports the SCP or the efficiency hypothesis (Berger and Hannan, 1989; Hannan, 1991). Furthermore, Kaufman (1965) notes that market structure and performance may not be related linearly. It may reasonably be expected that the impact of a change in structure on performance becomes greater the closer structure approaches total concentration. Simultaneously, Clark (1986) notes that the failure to identify a more consistently strong, positive, and statistically significant direct relationship between market concentration and commercial bank profitability may be due in part to problems with the methodology employed. Much of the criticism is related to the one-way causality – from market structure to market performance – inherent in the original model as it is still being applied in many banking studies, and to the failure by recent studies to incorporate new developments in the theory of industrial organisations.

3.2. The New Empirical Industrial Organisation (NEIO) approach

Due to these deficiencies of the structural approach, and the developments in industrial organization a new approach capturing the field of competition evaluation has emerged under the impulse of the New Empirical Industrial Organisation (NEIO) approach. The first model, the Iwata model, allows the estimation of conjectural variation values for individual banks supplying a homogeneous product in an oligopolistic market (Iwata, 1974). This measure, to the best of our knowledge, has been applied to the banking industry only once, from Shaffer and DiSalvo (1994), in a two banks' market.

The second method, applied in the banking sector, is based in the procedure first suggested by Bresnahan (1982) and Lau (1982). It requires the estimation of a simultaneous-equation model where a parameter representing the degree of market power of firms is included. The key parameter in this test is interpreted as the extent to which the average firm's perceived marginal revenue schedule deviates from the demand schedule, and thus represents the degree of market power actually exercises by the firms in the sample. A distinguishing feature of this technique is that it does not require firm-specific data, but utilises aggregate industry data.

Bresnahan's approach (1982) was first developed for banking by Shaffer (1989 and 1993) for, respectively, the US loan markets and the Canadian banking industry. Suominen (1994) extends the model and applies it to the evaluation of banking competition in Finland for the

period 1960-1984 during which the interest rates applied by banks were tightly regulated. Based on the same methodology, Neven and Roller (1999) estimates a structural model for the loan market with data from six European countries between 1981 and 1989, while Bikker and Haaf (2000a) examines competition in the markets for deposits and loans in nine countries in the 1990s. Angelini and Cetorelli (2000) evaluates competition in Italian banking, while Toolsema (2002) analyses the consumer credit market in the Netherlands in the period 1993-1999. Uchida and Tsutsui (2004) investigate competition in the Japanese banking sector, and Canhoto (2004) estimates the model by using data from Portuguese banking in the period 1990-1995.

In addition, based also in the NEIO approach, a third, alternative, approach has been created for competition evaluation. The Panzar and Rosse[12] (1977 and 1987) approach for testing market power relies on the premise that banks will employ different pricing strategies in response to a change in input costs depending on the market structure in which they operate. In other words, market power is measured by the extent to which changes in factor prices (unit price of funds, capital and labor) are reflected in revenues (interest or total revenues). The test is derived from a general banking market model, which determines equilibrium output and the equilibrium number of banks by maximizing profits at both the bank level and the industry level. This test often has a clear interpretation when applied to the study of markets, given that H represents the percentage variation of the equilibrium revenue derived from the unit percent increase in the price of all factors used by the firm. Panzar and Rosse define a measure of competition, the "H-statistic", as the sum of the elasticities of the reduced-form revenue function with respect to factor prices. They show that this statistic can reflect the structure and conduct of the market to which the firm belongs.

Concerning the value of H, Panzar and Rosse assert that H is negative when the competitive structure is a monopoly, a perfectly colluding oligopoly, or a conjectural variations short-run oligopoly. Under these conditions, an increase in input prices will increase marginal costs, reduce equilibrium output and subsequently reduce total revenues. Under perfect competition, the H-statistic is unity[13]. In this case, an increase in input prices raises both marginal and average costs without altering the optimal output of any individual firm under certain conditions. Exit of some firms increase the demand faced by each of the remaining firms, thereby leading to an increase in prices and total revenues by the same amount as the rise in costs (i.e.

[12] The first application of this test has been made by Rosse and Panzar (1977), who employed a cross-section of data in order to estimate the H-statistic for the newspaper firms in the local media markets.
[13] Shaffer (1982) shows that the H statistic is also unity for a natural monopoly operating in a perfectly contestable market and also for a sales-maximizing firm that is subject to breakeven constraints.

demand is perfectly elastic). If H is between zero and unity, the market structure is characterised by monopolistic competition. Under monopolistic competition where potential entry leads to a contestable markets equilibrium, revenues will increase less than proportionally to the input prices, as the demand for banking products facing individual banks is inelastic. Table 3 summarises these findings, as have also been expensively presented by other authors).

A critical feature of the H-statistic is that the tests must be undertaken on observations that are in long-run equilibrium. The empirical test for equilibrium is justified on the grounds that competitive capital markets will equalize risk-adjusted rate of returns across banks such that, in equilibrium, rates of return should not be correlated statistically with input prices. Therefore, to test for equilibrium one can calculate the Panzar and Rosse H statistic using the return on assets as the dependent variable in place of the total revenue (or the interest income) in the regression equation. A value of $H<0$ would show non-equilibrium, whereas $H=0$ would prove equilibrium (Table 3). However, if the sample is not in long-run equilibrium, it is true that $H<0$ no longer proves monopoly, but it remains true that $H>0$ disproves monopoly or conjectural variation short-run oligopoly (Shaffer, 1985).

Table 3: Interpretations of the H-statistic

H statistics	**Competitive environment test**
$H\leq 0$	Monopoly equilibrium
	Perfect colluding oligopoly
	Conjectural variations short-rum oligopoly
$0<H<1$	Monopolistic competition free entry equilibrium
$H=1$	Perfect competition
	Natural monopoly in a perfectly contestable market
	Sales maximizing firms subject to breakeven constraints
H statistics	**Equilibrium test**
$H<0$	Disequilibrium
$H=0$	Equilibrium

Source: Rosse and Panzar (1977), Panzar and Rosse (1982, 1987), Shaffer (1982, 1983), Nathan and Neave (1989), Molyneux et. al. (1994), Hondroyiannis et.al. (1999).

When applying the Panzar and Rosse technique to assess banks' market conduct, various assumptions about banks' production activity have to be made. Firstly, the extension of the Panzar and Rosse methodology to the banking industry requires to assume that banks are treated

as single product firms, producing intermediation services by using labor, physical capital, and financial capital as inputs (traditional intermediation approach). Secondly, one needs to assume that higher input prices are not associated with higher quality services that generate higher revenues, since such a correlation may bias the computed H statistic. This means, however, that if one rejects the hypothesis of a contestable competitive market, this bias cannot be too large (Molyneux et al., 1996). Among other underlying assumptions we can mention that: (a) banks are profit maximization firms; (b) the performance of these banks needs to be influenced by the actions of other market participants; (c) cost structure is homogenous; and (d) the price elasticity of demand is greater than unity (see also De Bandt and Davis, 2000).

Despite these assumptions, equilibrium tests and other limitations (see Hempell, 2002) the model's special advantages make it a valuable tool in assessing market conditions. Particularly, an important advantage of the method is that, because revenues are estimated (and not output prices), data availability becomes much less of a constraint, since revenues are more likely to be observable than output prices and quantities or actual cost data. Also, the fact that the Panzar and Rosse model uses bank-level data allows for bank-specific differences in production function and type of operation (e.g. large vs. small, foreign vs. domestic, commercial vs. other types of financial institutions). Moreover, the estimation of the reduced-form revenue equations is often possible even though the structural equations cannot be estimated. This is of special importance in the case of the structural supply equation due to the often encountered lack of data for the supply side. Also, by not requiring a locational market definition a priori, the Panzar and Rosse framework avoids the potential bias caused by the misspecification of market boundaries; hence the H statistic will reflect the average of the bank's conduct in each market for a bank that operates in more than one market (this remark holds in particular for large universal banks with sizeable foreign activities). Finally, unlike the SCP or the efficiency hypothesis, the Panzar and Rosse methodology analyzes directly the competitive conduct of banks, based on the comparative static properties of the reduced form revenue equations, without employing any structural measures.

3.3. The Panzar and Rosse methodology studies in banking

Only a limited number of studies have applied the Panzar-Rosse methodology for the banking industry, and as far as we are aware, only one study has provided an extensive literature review capturing this issue (Shaffer, 2004). In this context, the following subsection provides an extensive review of the studies that applied the Panzar and Rosse methodology in the banking industry. To compare our results from the model implementation in the new European banking

landscape with those in the literature, Annex 1 summarises the results of other studies applying the Panzar-Rosse model. Most of them indicate that banks earn revenues (interest income or total revenues) as if they are under conditions of monopolistic competition.

One of the first applications of the Panzar and Rosse methodology to banking was a series of cross-sectional studies by Shaffer (1981a, b and 1982) which examined the competitive position for a sample of unit banks in New York. He concludes that banks behave neither as monopolists nor as perfectly competitive firms in long-run equilibrium. Nathan and Neave (1989) use an approach similar to Shaffer to study data for Canadian banks, trust companies and mortgage companies between 1982 and 1984. They estimated the H-statistic at 0.680 and 0.729 for 1983 and 1984 respectively, values that are significantly different from both zero and unity. However, for 1982 the perfect competition hypothesis could not be rejected, since the H-statistic was estimated at 1.058. Their results for trust and mortgage institutions were rather similar.

Bikker and Haaf (2000a,b) applied the methodology in the banking sectors of 23 industrialised countries over the period 1988-1998, and found evidence of monopolistic competition. If distinction is made between various banking sizes, in order to capture different geographic markets, perfect collusion cannot be excluded for small banks or local markets in Australia and Greece, whereas, for a number of markets of various banking sizes in other countries perfect competition can not be excluded. Competition is stronger for large banks (which operate more in international markets) and weaker for small banks (which operate more on local markets), which is consistent with the results presented by De Bandt and Davis (2000). Furthermore, competition seems to be weaker in non-European countries. Claessens and Laeven (2003), using bank-level data, estimated the competitive conditions of the banking systems in 50 countries. The H-statistic varies generally between 0.60 to 0.80, suggesting that monopolistic competition is the best description of the degree of competition. There does not appear to be any strong pattern among the countries, although it is interesting that some of the largest countries (in terms of number of banks and general size of their economy) have relatively low values for the H-statistics.

A substantial part of the literature has focused on Asian banking systems. Lloyd-Williams et.al. (1991) test for evidence of contestability on a sample of 72 Japanese commercial banks for 1986 and 1988. They find that the 1996 values of H range between -0.004 and -0.006, making them unable to reject the monopoly or conjectural variations short-run oligopoly hypotheses. However, for 1988 the values of H range between 0.245 and 0.423, suggesting that Japanese commercial banking revenues behaved as if earned under monopolistic competition. The results are consistent with the lack of entry by domestic institutions into commercial banking

being a result of incumbent firms acting in a contestable manner. According to Jiang et.al. (2004), the banking industry in Hong Kong can be characterized by close to perfect competition during the period 1992-2002. Smith and Tripe (2001) assesses competitive conditions in the New Zealand banking market in the period 1996-1999; he found that total bank revenues appear to have been earned under conditions of monopolistic competition.

The Panzar and Rosse methodology has been extensively applied to European banking both on multi-country studies and single-country studies. Their results suggest that, in general, monopolistic competition is the proper characterisation of the conditions under which European banks have been operating.

The first category (multi-country approach) includes studies presented by Molyneux et al. (1994), De Bandt and Davis (2000), Bikker and Groeneveld (2000), Bikker and Haaf (2000a,b), and Boutillier et al. (2004). Particularly, Molyneux et al. (1994) tested a sample of French, German, Italian, Spanish and British firms for the period 1986-1989. The results suggest that banks in Germany (except for 1987), the United Kingdom, France and Spain earned revenues as if under conditions of monopolistic competition in the examined period. Actually, the authors apply the same model to four separate years and find rather unstable results. For example, the market structure faced by banks in the UK shifted from monopoly to almost perfect competition and backward. In the case of German banks, the H-statistic switched sign between 1986 and 1989 (-0.0363 in 1986; 0.4697 in 1989). The H-statistic for Italy during 1987-1989 is negative and significantly different from zero (-0.2578 and -0.8945 for 1987 and 1989 respectively). We are, therefore, unable to reject the monopoly or conjectural variations short-run oligopoly hypotheses for Italian commercial banks in these two years (the 1988 results for Italy also suggest this conclusion, although the data does not represent long-run equilibrium values)[14]. Finally, long-run equilibrium tests illustrate that for the majority of the regressions the data are in long-run equilibrium and, therefore, the H-statistics can be meaningfully interpreted.

De Bandt and Davis (2000) also estimated the H-statistic for France, Germany, and Italy, but for a later period (1992-1996), while they also included US in their sample for comparative purposes. Moreover, they estimated the H-statistic within groups of large and small banks in each country. Their econometric estimates indicate that the US exhibits a higher level of competition than the EU banking markets, though the hypothesis of perfect competition for the US market is still rejected. Within the EU, whereas Germany and France tend to show monopolistic competition for large banks and monopoly for small ones, in Italy there is evidence of

[14] However, Coccorese (1998) evaluated the degree of competition in the Italian banking sector and obtained quite non-negative and significant values for H, except in 1992 and 1994.

monopolistic competition for both small and large banks. Furthermore, the behavior of large banks was not fully competitive as compared to the US. The authors do not find a clear trend in the competitive conditions in the economies studied.

In their study of the competitive structure of the European Union banking industry as a whole as well as for individual EU countries, Bikker and Groeneveld (2000) estimated the H-statistic and found that the European banking market as a whole is characterised by monopolistic competition. In spite of the deregulation and liberalisation of the EU bank market over the examined period (1989-1996), they found hardly any evidence of increasing competition over the years. Moreover, the hypothesis of a single European banking industry was strongly rejected. The authors also applied the analysis to the banking sectors of all individual EU countries separately, and found that H appears to be high, between two-third and one, in most countries. Only for two smaller countries (Denmark and Ireland) lower values for H are observed. The H=0 hypothesis is rejected for all countries. On the other hand, the hypothesis of perfect competition (H=1) cannot be rejected for two countries only, i.e. Belgium and Greece. Hence, the authors conclude that the banking industry market in separate EU countries can generally be classified as monopolistic competition, much closer to perfect competition than to monopoly.

In a more recent study, Boutillier et.al. (2004), aiming to estimate the impact of EMU on the European banking sectors' structure, analyse the degree of competition among bank firms of the four major European continental banking sectors (Germany, France, Italy and Spain) between 1993 and 2000. The implementation of the Panzar and Rosse model allows rejecting the monopolistic competition hypothesis for any of the represented sector for the examined period. On the whole, this index shows how the high degree of competition persists within the European Union during the concerned period.

The second category of studies at the European banking landscape includes the investigation of competitive conditions in individual EU countries (Vesala, 1995; Mooslechner and Schnitzer, 1995; Rime, 1999; Hondroyiannis et.al., 1999; Hempell, 2002, Coccorese, 1998, 2004). For example, Vesala (1995) assesses the levels of competition in Finnish banks between 1985 and 1992. A substantial increase in the level of contestability of Finnish banking was observable over the sample period, with the H statistic estimates rising from 0.182 in 1985 to 0.620 in 1992. Particularly, Vesala found monopolistic competition for the periods 1985-1988 and 1991-1992, and perfect competition for 1989-1990. This increase in contestability coincided with the substantial re-regulation of the Finnish banking sector in 1986.

Hondroyiannis et.al. (1999) examines the Greek banking system over the period 1993-1995. The results indicate that bank revenues appear to be earned in conditions of monopolistic

competition. Hempell (2002) investigated the German banking system for the period 1993-1998. He estimated the H-statistic separately for savings and cooperative banks and found that cooperative banks, which make up the largest part of the overall sample, attain the lowest H-statistic (0.53). He observed H-statistic of 0.64 for savings banks, 0.80 for credit banks and 0.83 for foreign banks.

Coccorese (2004) has tried to assess the competitive conditions in the Italian banking industry during the period 1997-1999, taking into account both the whole nation and its main macro-areas. The empirical results confirm that Italian banks earn revenues as if they were under conditions of monopolistic competition. They also show that there is a positive relationship between the local economic performance and the degree of competition among banks, given that they appear to behave as perfectly competitive firms where local macroeconomic data reveal lower unemployment rates, greater per capita GDP and lower market loan rates.

Finally, a growing part of the more recent literature has focused on emerging economies. Spiller and Favaro (1984) considered the form of competition that was present in the Uruguayan banking sector. The analysis suggested that banking firms do not have the same conjectures, or respond differently to actions of other banking firms within the same market. Gelfand and Spiller (1987) examined the same market between 1977-1980 and suggested that the removal of entry barriers for foreign banks reduced the degree of oligopolistic rivalty occurring between banks and eventually, leading to an increase in the level of competition in the domestic banking market. Barajas et.al. (2000) found monopolistic competition for the Colombian banking system in the period 1985-1998, with domestic banks exhibiting a considerably lower degree of competition (H=0.265) than established foreign banks (H=0.527).

Yildirim and Philippatos (2002) analyze the evolution of competitive conditions in the banking industries of fourteen Central and Eastern European transition economies for the period 1993-2000. The results suggest that the banking markets of these countries cannot be characterized by the bipolar cases of either perfect competition or monopoly except for FYR of Macedonia and Slovakia (for the overall sample, the mean levels of H values range from 0.46 to 0.58 depending on the model specification and are significantly different from both zero and unity). Furthermore, the cross-sectional analysis of competitive structure reveals initially a decreasing trend between 1993 and 1996 and a subsequent increasing trend in competitive conditions after 1996. Large banks in transition countries operate in a relatively more competitive environment compared to small banks, or in other words, competition is lower in local markets compared to national and international markets.

Drakos and Konstantinou (2003) have evaluated competitive conditions in banking markets for the period 1992-2000 and focused on a sample of banks from a group of Central and Eastern European countries or Former Soviet Union countries. They found overwhelming evidence against both the hypotheses of perfect competition and monopoly for all countries, except for Latvia, where the banking sector might even be consistent with a monopoly structure. Similarly, when pooling all available information in the panel, they noted that transition banking as a whole is consistent with a monopolistically competitive market structure.

Yeyati and Micco (2003) examine concentration and foreign penetration in eight Latin American banking sectors (those of Argentina, Brazil, Chile, Colombia, Costa Rica, El Salvador, Mexico and Peru) in the period 1993-2002. They conclude that the perfect competition (H=1) and monopoly (H=0) hypotheses are rejected at conventional levels for all countries. Moreover, their estimates of H for Latin American countries do not differ in range and cross-country variability for those found in more developed countries. Belaisch (2003) found that Brazilian banks operate under conditions of oligopoly over the period 1997-2000.

Finally, Gelos and Roldos (2004) investigated the competitive conditions of a sample of Latin America and Central and Eastern European countries over the period 1994-1999. The H-statistics are always between zero and one, indicating monopolistic competition for all but two countries, Argentina and Hungary, where the H statistic is compatible with either monopolistic or perfect competition. Over the examined period market structure changed in only one of the eight emerging markets examined (for Turkey, we cannot reject a decline in the H statistic, suggesting that competition has become less intense since 1998), with constancy of the H statistic in the other cases.

4. Empirical model

As we have already mentioned, traditional indicators of market structure rely on the indirect influences of market concentration and market power. Therefore we conduct an empirical analysis based on the Panzar and Rosse methodology to directly assess competitive conditions in the new EU banking system.

We rely on the intermediation approach of a bank[15], initially developed by Klein (1971) and Sealey and Lindley (1977). To derive the H statistic we use the following specification of the

[15] As discussed in Colwell and Davis (1992) there are two principal approaches to bank output measurement. In the "production approach" banks are treated as firms that use capital and labor to produce different categories of loan and deposit account. Output is measured by number of accounts or related transactions, and total costs are all operating costs used to produce these outputs. In the "intermediation

reduced-form revenue equation estimated to run on a panel data set of banks, similar to those presented in previous studies cited above:

$$\ln INTR = a + b \ln w_F + c \ln w_L + d \ln w_C + e \ln BSF + g \ln (OI/A) \qquad (1)$$

where INTR: the ratio of interest revenue (or total and organic revenue) to total assets[16], w_F: the unit price of funds, w_L: the unit price of labour, w_C: the unit price of capital, BSF: bank specific factors and OI/A: the ratio of other income to total assets.

Under the Panzar-Rosse framework, the H statistic is equal to the sum of the elasticities of the interest (or other) revenue with respect to the three input prices, i.e. H = b + c + d. In this paper, as does Bikker and Haaf (2000a,b), we interpret H as a continuous measure of the level of competition, in particular between 0 and 1, in the sense that higher values of H indicate stronger competition than lower values. This does not follow automatically from Panzar-Rosse (1987), which concentrates only on the testing of the hypotheses H=0 (or more precise (H≤0) and H=1. However, it can be shown that under stronger assumptions (in particular a constant price elasticity of demand across bank-size markets and countries) our continuous interpretation of H and the comparison between countries or bank-size markets is correct. The log specification may reduce possible simultaneity bias.

The nature of the estimation of the H-statistic means that we are especially interested in understanding how interest revenues (or organic and total revenues) react to variations in the cost figures. Since financial intermediation constitutes the core business in commercial banking, we first consider the ratio of interest revenues to total assets as the dependent variable. Although interest revenues still constitute the principal source of banks' earnings, recent studies on banking activities report an increasing share of non-interest income from fee-based products and services and off balance sheet credit substitutes in total revenues. Therefore we complement our analysis by using the ratio of total operating income to total assets (calculated as the interest revenue plus all the other non-interest income) as a dependent variable, which arguable makes it a more comprehensive measure of the overall degree of competition in banking services. In other words, in our approach banks are either seen as firms producing loans and investments (in the interest revenue approach) or loans, investments and other services (in the total revenue approach)[17]. Moreover, due to the fact that during the examined period banks increasingly focused on their traditional retail operations owing to the continued retrenchment of investors from equity markets

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approach", banks are viewed as intermediators of financial services rather than producers of loans and deposit account services, and the value of loans and investments are used as output measures; labor and capital are inputs to this process and hence operating costs plus interest costs are the relevant cost measure.

[16] The dependent variable is divided with total assets in order to abstract from size effects.

[17] From a comparative perspective, the existence of accounting differences across countries is an additional argument in favor of having a comprehensive view of bank revenues.

towards safer investments, we also use the ratio of organic income (interest income plus fee and commission income) to total assets as an alternative dependent variable. On the whole, in terms of dependent variables, we estimate three different models.

We assume that banks use three inputs (i.e. funds, labour, and capital), which is consistent with the intermediation approach. The ratio of interest expenses to total funds is used as a proxy for the price of funds, while the ratio of other expenses (operating costs minus those expenses related to funds and labour) to fixed assets is used as a proxy for the unit price of capital[18]. For the price of labour we use two alternative specifications: the ratio of personnel expenses to total assets (like Molyneux et.al., 1994; Bikker and Groeneveld, 2000; and Bikker and Haaf, 2000a,b), or, alternatively, the ratio of personnel expenses to the sum of loans and deposits[19]. The ratio of personnel expenses to the number of employees, which is a cleaner measure of unit labor costs, could also be a plausible alternative (Shaffer, 1982; Nathan and Neave, 1989; Hondroyiannis et.al., 1999; Coccorese, 2004). However, the former proxy is only available for a small subset of our sample of observations[20], and therefore we exclude this variable from the analysis.

As far as the independent variables are concerned (apart from the input prices), we include a set of bank-specific variables that reflect differences in risks, banks' production function, and deposit mix, to allow for bank heterogeneity. These variables, which should, at least theoretically, descend from the marginal revenue and cost functions underlying the empirical Panzar-Rosse equation, are the ratio of loans to total assets, the ratio of equity to total assets, the ratio of loan loss provisions to loans, and the ratio of bank deposits to customer and short-term funding**,** the latter to account for differences in deposit mix. All variables are expressed in logarithmic form. We also include the ratio of other income to total assets to account for the influence of the generation of other income on the model's underlying marginal revenue and cost functions[21].

A positive coefficient for loans to total assets is expected, as a higher fraction of loans on the total assets envisages greater revenue, whereas the coefficient for the other income to the total

[18] Nathan and Neave (1989) and Coccorese (1998) calculate this proxy dividing the general costs by the number of branches. However the database does not provide adequate figures regarding the number of branch of the European financial institutions.

[19] We assume that deposit collection and loan distribution are the most labour intensive operations, and therefore the ratio of personnel expenses to loans and deposits can provide a reasonable proxy for staff numbers. These results are not presented in the paper, but are available upon request from the authors.

[20] Moreover, empirical evidence have shown that results based on the ratio of personnel expenses to the number of employees are rather similar to those based on the ratio of personnel expenses to total assets (Hondroyiannis et.al., 1999; Coccorese, 2004).

[21] This ratio is used as an explanatory variable when the dependent variable is interest revenue (or organic income); not in the case of total operating revenues.

balance sheet ratio is probably negative as the generation of other income may be at the expense of interest income. The coefficient of the equity to total assets ratio will be negative or positive according to whether a higher level of risk capital leads to lower or higher bank revenues (Coccorese, 2004). Molyneux et.al. (1994) expect a negative coefficient for equity to total assets, because less equity implies more leverage and hence more interest income (see also Bikker and Groeneveld, 1998). However, on the other hand, capital requirements are higher, the riskier the loan and investment portfolios are, suggesting a positive coefficient. We expect the provisions to total assets ratio to be positively correlated to the dependent variables, since higher provisions should lead to higher bank revenue (Hondroyiannis et.al., 1999).

Equation (1) is estimated for EU-15 and new EU countries on aggregate and separately to investigate whether there are differences in competitive conditions between old and new EU countries. Additionally, we apply the Panzar and Rosse approach in the major EU countries, i.e. Germany, France, the UK, Italy and Spain, as well as for different size classes (at least for the old EU banking system, since large banks do not exist in the new EU banking sectors).

Banks were divided into three size-classes according to the size of their balance sheet. The threshold differentiating medium-sized from large banks is set at 50 billion euros, while the threshold between small and medium-sized banks is set at 5 billion euros[22]. A bank is classified as large if it has total assets above 50 billion euros for the majority of the five-year sample period (1998-2002), as medium-sized if it has assets between 5 and 50 billion euros (for at least three years out of the five-year period), and as small if it has assets below 5 billion euros. The large bank sample is relatively small to ensure that only truly large banks are included. Large banks represent almost 3% of all banks in the EU-15 as a whole, while no financial institution with total assets above 50 billion euros is operating in any of the new EU countries. Medium-sized banks represent 10% and 7% in EU-15 and new EU countries respectively, while the majority of banks is classified as small (87% for EU-15 and 93% for new EU countries). It should be noted, however, that in order to derive an accurate estimate of H-statistic for each size-category, we need a reasonable number of bank-year observations. Hence, as the number of medium-sized banks in the ten new EU countries is very small (and we have only 37 observations), we restrict our analysis of competition between different size-classes only to the old EU-15 countries. We expect smaller banks to operate in a less competitive environment than larger banks, or, put

[22] Bikker and Haaf (2000a,b) split their sample based on total assets of the banks: the smallest 50% of all banks of the world-wide sample constitute the small-banks' sample, the largest 10% of all banks constitute the large-bank sample, whereas remainders form the medium-sized sample.

differently, local markets to be less competitive than national and international markets (like Bikker and Haaf, 2000b).

Finally, as noted earlier, one critical assumption of the Panzar-Rosse approach is that banking systems operate in their long-run equilibrium, and therefore in order to confirm that the H-statistic we have estimated provides useful results, we need to verify that this conditions holds. As suggested by different authors (Shaffer, 1982; Molyneux et.al., 1994; Cocorrese, 2004 et.al.), one should verify that input prices are not correlated with industry returns. The empirical test for the market equilibrium is justified on the grounds that competitive capital markets will equalize risk-adjusted rate of returns across banks such that, in equilibrium, rates of return should not be correlated statistically with input prices. However, if the market is in disequilibrium, an increase (decrease) in factor prices would be reflected in a temporary decline (increase) in the rate of return. This is especially important for the cases of perfect competition and monopolistic competition (H>0), while the rejection of the monopoly hypothesis remains valid even if the sample is not in long-run equilibrium (Shaffer 1995, 2004). The long-run equilibrium test for the value of H is performed by running the same equation (1), however, using the return on assets (ROA) [or the return on equity (ROE)] as the dependent variable instead of revenues. In that framework, H=0 indicates that banking systems are in equilibrium. However, it should be noticed that equilibrium does not mean that competitive conditions are not allowed to change rather that changes in banking are taken as gradual.

5. Data analysis and descriptive statistics

Bank-level data were obtained from the BankScope database provided by Fitch-IBCA, a London-based rating agency for all the twenty-five EU countries. Accounting information are from the full spreadsheet and raw data files. This source provides consolidated data for the period 1996-2002. However, since the availability of data for early years (i.e. 1996 and 1997) is short, we work with an unbalanced sample covering all the EU banking industries during the period 1998-2002. The main objective in choosing the particular sample period and their respective data is to utilise the most recent year-end financial data that are available in the new European economic and monetary environment that has been created. One advantage of the Fitch IBCA database is that it offers annual balance sheet and income statement data that are reasonably comparable across countries and therefore suitable for cross-country comparisons.

However, a feature of the Fitch IBCA database that can be considered as a shortcoming is that coverage has expanded over time and therefore it does not provide a complete historical

panel of banks over time (also mentioned by Gelos and Roldos, 2004). This becomes even more apparent in the case of mergers, as only the largest of the merged banks is typically kept in the database, as well as in the case of bank failures, since exiting banks are fully deleted from the database (De Bandt and Davis, 2000). Another possible source of bias stems from the fact that only the more prominent banks are included in the database, excluding smaller ones which potentially might have more market power in local markets. The latter bias is more pronounced for small banks since the coverage of medium and large banks is relatively satisfactory in the database. This is a problem that we, as other authors, cannot address. Finally, some of the banks that are recorded in the database report only partial information and there are frequently missing observations for some variables, such as the number of bank employees.

The data were reviewed for reporting errors and other inconsistencies. In some cases observations were dropped from the sample. Starting from a large dataset of banks, we arrive, after removal of outliers, at an unbalanced sample of 3,031 banks in 1998 for all the countries under investigation, 3,032 in 1999, 3,230 in 2000, 3,334 in 2001 and 3,166 in 2002, which comprises a very large portion of the banking industries in these countries (in terms of balance sheet aggregates). In the database, year 2001 presents the highest financial institutions' coverage. The sample covers 2,886 banks from the old EU countries in 1998 (EU-15 countries), 2,891 in 1999, 3,090 in 2000, 3,187 in 2001 and 3,046 in 2002 (the aggregate figures for the 10 new EU countries are 145, 141, 140, 147, and 120 respectively). Table 4 lists the number of banks in the sample by country and financial year.

Table 4: Number of banks in the sample

	Year				
Country	**1998**	**1999**	**2000**	**2001**	**2002**
Austria	21	136	163	178	36
Belgium	45	42	42	45	32
Denmark	84	79	83	81	79
Finland	7	6	6	9	5
France	250	253	246	246	250
Germany	1,435	1,308	1,477	1,500	1,513
Greece	11	16	15	17	19
Ireland	36	40	36	38	33
Italy	558	579	589	576	595
Luxembourg	67	51	60	50	45
Netherlands	47	46	36	42	42
Portugal	23	25	28	30	26
Spain	104	112	110	104	111
Sweden	13	18	20	94	90
UK	185	180	179	177	170
EU-15	**2,886**	**2,891**	**3,090**	**3,187**	**3,046**

Cyprus	17	14	13	14	13
Czech Republic	17	16	18	17	11
Estonia	5	5	5	5	3
Hungary	23	25	21	22	22
Latvia	13	15	14	17	9
Lithuania	7	9	8	9	7
Malta	6	7	6	7	4
Poland	29	28	32	31	28
Slovakia	13	8	9	10	8
Slovenia	15	14	14	15	15
new EU countries	**145**	**141**	**140**	**147**	**120**
EU-25	**3,031**	**3,032**	**3,230**	**3,334**	**3,166**

Source: Fitch-IBCA database and own estimations.

Annex 2 provides some summary statistics for the 25 banking sectors under investigation for the whole period 1998-2002. It shows that on average, the financial institution in Finland is the largest one among all the EU countries, while at the other end stands Italy. For the 10 new EU countries, the average bank in Czech Republic is the largest, and the smallest is located in Latvia, whereas the largest and the smallest banks are operating in Poland. Generally, the banking sectors in the old 15 EU countries are dominated by larger financial institutions than those of the new EU countries.

Loans dominate the aggregate balance sheet figures on the assets' size of the financial reports. For the 15 EU countries, the average ratio is the highest in the case of Sweden (73%) and the lowest in Luxembourg (28%). On the other hand, for the 10 new EU countries, Slovenia has the highest average ratio (53%), while Czech Republic has the lowest (37%). Moreover, it is worth mentioning that in half of the 10 new EU countries (Latvia, Lithuania, Malta, Slovakia and Czech Republic) the average level of this ratio stands at levels below 50%, something that occurs only in three of the old EU countries (Belgium, Greece, and Luxembourg). On average, the loan to assets ratio is higher in the EU-15 banking sector (59%) than in the 10 new EU countries (48%)[23].

The average ratio of equity to total assets in the EU-15 countries ranges from 6 to 10% for the majority of the countries, except of Germany (5.3%) and Denmark, Italy, Sweden and Greece (with ratios of 13.6%, 12.3%, 11.7%, and 11.4% respectively). On the other hand, this ratio is much higher for the 10 new EU countries; it ranges, on average, from 7.8% in Czech Republic to 13.3% in Lithuania. This should be expected considering the ongoing restructuring process of these banking sectors, and the crises some of them have experienced recently.

[23] This is consistent with the ECB Report (July, 2002) mentioning the relatively low level of financial intermediation in the 10 new EU countries (at that point of time accession countries).

Annex 2 shows that the bank in Denmark relies much more heavily, on average, on interest income (as presented by the interest income to total assets ratio [interest margin ratio] which stands at 6.8%), while Finland is at the other end of the spectrum (at 3.7%). The average ratio for EU-15 banking sector as a whole is 5.8%. Regarding the new EU countries, Poland has the highest and Malta the lowest interest margin ratio. On average, the examined ratio ranges from 6 to 11% in the new countries, and is much higher than that of the old EU countries (on average it stands at 8.7%). This indicates that banks in new EU countries relay more on interest income than other sources of income such as fee or commission income (maybe because capital markets are less developed in those countries), compared with the old EU countries. Similar is the picture we obtain when we examine the ratio of total revenue to assets.

On average, the financial institution in EU-15 countries presents lower personnel expenses to assets (1.4%) compared with the new countries (1.7%). Denmark and Ireland are at the two edges of the personnel costs' range (high and low) regarding the EU-15 countries, while Lithuania and Slovakia are those respectively among the 10 new EU countries.

6. Empirical Results

Following the empirical literature on banking competition, we estimate the reduced-form revenue equation (Equation (1)) on a panel data framework, which effectively utilizes information both from the cross-section of banks as well as their time series behavior[24]. The regression models are estimated using the fixed effects estimator in order to control for unobserved heterogeneity, which is especially important since the regressions are otherwise likely to suffer from omitted variable problems. Our choice of the fixed effects estimators versus the random effects model is confirmed by the implementation of the Hausman test -and is further supported by the vast majority of the literature- which indicated that the p-value of chi-square obtained is very low and therefore the hypothesis of no correlation between the error and the regressors (under which, the random effects model is applicable) is rejected. We introduce therefore in Equation (1) different intercepts ($\alpha=\alpha_i$, i = 1,… N) in order to capture all bank-specific, non time-varying determinants of revenues not explicitly addressed in the regression specification, as well as time dummies to take into account time effects (Annex 3). However, when we performed a modified Wald statistic for groupwise heteroscedasticity in the residuals of the fixed effects model (following Greene, 2000: p. 598), the null hypothesis of homoscedasticity

[24] For the advantages of utilizing panel data see De Bandt and Davis (2000).

was firmly rejected[25]. Therefore, in order to correct for heteroscedasticity, the regression models are re-estimated by implementing the ordinary least squares (OLS) method using panel corrected standard errors. Country dummies were added in the estimations to take into account country-specific characteristics that were omitted from the regression specification, while we also included time dummies. These constitute our core results and will be presented in the following section.

Overall, the point estimate of the H-statistic is significantly positive in every instance, independently of the dependent variable we use (i.e. interest revenue, organic income or total operating income), rejecting the hypotheses of monopoly or consistent conjectural variations short-run oligopoly. At the same time, it is significantly less than unity, rejecting the hypothesis of perfect competition. Hence, our evidence indicate the existence of a certain degree of monopolistic competition in the new European banking landscape, which is consistent with the findings of previous studies applying the same methodology.

a) Results for EU-15 and new EU countries

Tables 5 to 7 report pooled regression results for the old EU (EU-15) and the new EU countries over the sample period 1998-2002. With interest income as the dependent variable (Table 5), the H-statistic is estimated at 0.54 and 0.78 for old and new EU countries respectively. The Wald tests reveal that H differs significantly from both 0 and 1, and therefore reject the hypotheses of both monopoly and perfect competition for EU-15 as well as for new EU countries at the 1% significance level, leading us to conclude that interest revenue appear to be earned under conditions of monopolistic competition during the sample periods. As we already mentioned in the specification of the model, under strong assumptions (and particularly by assuming a constant elasticity of demand across markets) the comparison of H between countries is correct (Vesala, 1995; Bikker and Haaf, 2000b; and Coccorese, 2004). Hence, we can conclude that, on aggregate, the banking systems in the new EU countries operate in a more competitive environment that those of the old EU countries. Lower barriers to entry in the examined period, such as allowing increased participation of foreign banks in the new EU banking sectors, appear

[25] For the interest income equation, the values of the modified Wald statistic for group-wise heteroscedasticity (it follows the chi-distribution) are (the number in parentheses are the p-values): for EU-15=$4.4e^{+33}$ (0.000), for new EU = $2.7e^{+30}$ (0.000), for France = $2.0e^{+32}$ (0.000), for Germany = $1.7e^{+33}$ (0.000), for Italy = $2.2e^{+32}$(0.000), for Spain = $5.2e^{+30}$ (0.000), and for the UK = $2.3e^{+31}$ (0.000). For the organic income equation, the values are: for EU-15 = $6.2e^{+33}$ (0.000), for new EU = $5.2e^{+30}$ (0.000), for France = $4.2e^{+33}$ (0.000), for Germany = $2.5e^{+33}$ (0.000), for Italy = $1.1e^{+35}$ (0.000), for Spain = $1.3e^{+32}$ (0.000), and for the UK = $1.6e^{+32}$ (0.000). For the total operating revenues equation, the values are: for EU-15 = $3.5e^{+34}$ (0.000), for new EU = $5.6e^{+31}$ (0.000), for France = $1.3e^{+32}$ (0.000), for Germany = $2.9e^{+33}$ (0.000), for Italy = $5.7e^{+31}$ (0.000), for Spain = $1.2e^{+33}$ (0.000), and for the UK = 37650.40 (0.000).

to have prevented a decline in competitive pressures at least in the main income source, i.e. the interest income[26]. (see also Gelos and Roldos, 2004).

The higher competition facing the new EU countries can be further confirmed when looking at the estimation results with organic income as the dependent variable (Table 6). The H-statistic for EU-15 banking systems is estimated at 0.65, while the respective statistic for new EU countries is at 0.73. Formal tests reveal again that H differs significantly from both 0 and 1, providing evidence that a certain degree of monopolistic competition in these banking markets is present. However, it seems that the difference in the H-statistic between the two examined regions is reduced, since the competition for products and services gaining fee and commission income is higher in the old EU-15 countries. Confirming this trend, in our third specification, which uses the ratio of total operating revenues as the dependent variable (Table 7), our findings are reversed due mainly to the corresponding underdevelopment of capital markets in the new EU countries. EU-15 countries appear to have a higher H-statistic (estimated at 0.61) compared with the new EU countries (H is estimated at 0.46). Overall, our results for the EU-15 and the 10 new EU countries indicate that banks operate under conditions of monopolistic competition. Moreover, the point estimates of H obtained from the third specification were consistently lower than those of the first two specifications in the case of the new EU countries.

As regards the overall pattern of signs, results (Tables 5-7) indicate that for both EU-15 and new EU countries the price of labour is always positive and statistically significant, either when measured as the ratio of personnel expenses to total assets or as the ratio of personnel expenses to loans and deposits[27]. This is consistent with the findings of previous studies (i.e. Molyneux et al., 1994; Bikker and Groeneveld, 1998; Hondroyiannis et al., 1999; Bikker and Haaf, 2000b; Yeyati and Micco, 2002; Gelos and Roldos, 2004; Coccorese, 2004). Moreover, its coefficient becomes higher and more significant as we move from the measurement of interest income to total operating revenues. The coefficient of the price of funds is positive and statistically significant when we use as a dependent variable either interest or organic income. However, when the ratio of total operating income to the balance sheet aggregates is used as the dependent variable, the coefficient becomes negative for EU-15 countries (and significant at the 5% level), while it remain positive but statistically insignificant for the new EU countries. In particular, an interesting result is that, in contrast to the unit price of labour, which follows the exact opposite pattern, the elasticity of the price of funds is reduced both in magnitude as well as

[26] In the descriptive statistics we mentioned the high level of interest income that these 10 new countries present in the examined period.
[27] Results available from the authors upon request.

in statistical importance, as we move from interest (or organic) income to the use of total operating income. Overall, in our first two specifications (with interest and organic income), the price of funds contributes the most to the explanation of bank revenue (which is hardly surprising given the fact that funding is the main factor in the production function of banks), followed by the price of labour. However, in the case of total operating income results are reversed. Nevertheless, in any case, the effect of the price of capital on the overall elasticity appears to be minimal compared to other input prices, while its sign is always positive. Our results are consistent with other studies that find that the sign of the coefficient on the unit price of capital varies by economies and, in most cases, is negligible in the overall factor price elasticity (Jiang et.al., 2004).

As far as the other control variables is concerned, the ratio of loans to total assets always has the expected positive and significant sign, and is the most important bank-specific factor, both in terms of occurrence and level of significance. Moreover, the ratio of bank deposits to customer and short-term funding is consistently negative and significant (except of the case when we use total operating revenues when it becomes insignificant). The ratio of loan loss provisions to total loans is always positive, and statistically significant for the EU-15 and new EU countries. Finally, as far as the sign of the ratio of equity to total assets is concerned, results are mixed; the coefficient is always positive and significant in the old EU countries and negative and, most of the times, significant, in the new EU countries. As we have mentioned, Molyneux et.al. (1994) expect a negative coefficient for equity to total assets, because less equity implies more leverage and hence more interest income (see also Bikker and Groeneveld, 1998). However, on the other hand, capital requirements are higher, the riskier the loan and investment portfolios are, suggesting a positive coefficient. Moreover, the negative coefficient in the case of new EU countries may reflect the payoff of other expenses, such as costs on rationalisation of branch networks and information technology, something that can only be effective in improving efficiency and in turn increasing revenue in the longer term. Finally, the sign of the coefficient of other income to total assets is always negative and significant, as expected.

As elaborated in the literature, a critical feature of the H-statistic is that the test must be undertaken on observations that are in a long-run equilibrium. An equilibrium test is provided for all three models, after replacement of the dependent variable by the rate of return on average assets (ROA) or equity (ROE). Using both alternative specifications (ROA and ROE), we find that the hypothesis of equilibrium (H=0) is confirmed for both EU-15 and new EU countries. The Wald tests performed could not reject the hypothesis of equilibrium at conventional statistical levels, which means that our analysis is well established (Annex 4).

b) Results for individual countries

Tables 8 to 10 examine the competitive conditions in the five largest European banking markets (France, Germany, Italy, Spain and the UK). For Germany, with the ratio of interest income to total assets as the dependent variable, all three input prices are positive and statistically significant, with the price of funds contributing more to the explanation of banks' interest revenues. The H-statistic is estimated at 0.394 and is statistically different from both zero and unity, indicating the existence of monopolistic competition. When we use organic income as the dependent variable, our results concerning the signs and the significance of coefficients do not change substantially, but the H-statistic is calculated at higher levels (at 0.597); again the German banking market is characterized by monopolistic competition. As far as the third specification is concerned, the price of labour has the highest coefficient followed by the price of capital, while the price of funds becomes negative, but remains statistically significant (as also reported for the whole EU-15 banking industry). The H-statistic is estimated at 0.520. Overall, our results for Germany are consistent with previous studies conducted for that country[28]. All other bank specific variables are also statistically significant, with the expected sign.

For France, as in Germany, the three input coefficients are positive and statistically significant, with the funding price having the higher coefficient among all input prices (with the exception of the specification with total revenues regarding the price of funds). The H-statistic, when the dependent variable is interest income, is estimated at 0.701, while when it is organic income or total revenues it is estimated at 0.826 and 0.829 respectively. In all cases both the hypotheses of monopoly and perfect competition are rejected. For the third specification, as is the case in all other countries, the price of labour contributes the most to the explanation of total operating income, followed by the price of capital, while the price of funds is negative but not statistically significant. The explanatory variables have the expected signs. Our results for France are consistent with previous research on that country (e.g. Glassens and Laeven, 2003).

For the United Kingdom, the H-statistic, when we use interest income as the dependent variable, is estimated at 0.670. The hypotheses of both monopoly and perfect competition are rejected, indicating that banks earn their interest revenues under conditions of monopolistic competition. When we use organic income, the H-statistic improves slightly, standing at 0.740, while, with total operating income, the H-statistic is estimated at somewhat lower levels, compared with the previous two specifications (0.604). Among input prices, the price of capital is

[28] More specifically, Hempell (2002) estimated H-statistic at 0.68, De Bandt and Davis (2000) estimated H at 0.54 and 0.63, Bikker and Haaf (2000a,b) at 0.60 and 0.63, and Glassens and Laeven (2003) found that H ranges from 0.39 to 0.69 according to the model specification.

positive but insignificant in all specifications. Our results are consistent with previous studies, i.e. Bikker and Haaf (2000b) estimated H at 0.61 and 0.64 depending on model specification.

For the Spanish banking system, in all specifications the price of capital is not significant, while the other two variables have positive and significant signs (except of the price of funds in the third specification). The H-statistic, when the dependent variable is interest income, is estimated at 0.509, while when it is organic income or total revenues it is estimated at 0.619 and 0.429 respectively. In all cases both the hypotheses of monopoly and perfect competition are rejected. The price of funds contributes the most to the explanation of interest revenues, while among the other explanatory variables, the equity to assets ratio has a negative sign (something that is not observed in the other EU countries). Finally, we present the results for the Italian banking system. The H-statistic, with interest income as the dependent variable, is estimated at 0.665, while when organic income or total revenues is used, it is estimated at 0.781 and 0.561 respectively.

Comparing the countries, it seems that France is the most competitive major European banking market, regardless of the dependent variable we use in the model. Germany is the least competitive market in the first two specifications, and Spain in the last one.

As a final point, an important issue remains to be examined, and particularly, whether the banking systems we have investigated are in equilibrium. Using both alternative specifications (ROA and ROE), we find that the hypothesis of equilibrium (H=0) is confirmed for all the major EU countries. The Wald tests performed could not reject the hypothesis of equilibrium at conventional statistical levels, which means that our analysis is well established (Annex 4).

c) Results for different size-classes

Next, we investigate whether the wide size dispersion of the banks considered in the sample has a significant impact on their competitive behavior (Tables 11 to 13). The purpose of this decomposition is to investigate whether differences in conduct patterns can be expected to arise with the size of the institutions.

Some arguments can, a priori, be delivered favoring the case of lower conduct parameters for larger banks, evidencing stronger competition (Canhoro, 2004). This result is confirmed when interest revenue is used as the dependent variable. The H-statistic for large banks is 0.540, while for medium-sized and small the respective figures stand at 0.462 and 0.519. This may be due to the fact that smaller banks that operate in local markets experience a certain degree of market power in interest pricing (and thus should face less competition). However, in all cases, both hypotheses of monopoly and perfect competition are rejected, indicating that banks of all size-

categories earn their interest revenues under conditions of monopolistic competition. In contrast to the first model, in the other two specifications (using organic income and total operating revenues), the H-statistic is higher for smaller banks. This finding may be attributed to the fierce competition these banks have to face in the field of commission generation and capital market related activities.

As regards the signs of coefficients, the price of funds (as in our previous findings) contributes the most to the explanation of interest and organic income, followed by the price of labour. However, in the third specification (with total operating income as the dependent variable), the coefficient of the unit price of funds becomes negative for all size-classes of banks and remains significant only for large banks. On the other hand, the price of labour follows the opposite pattern. The ratio of loans to total assets is consistently positive and statistically significant.

As a final point, we need to examine whether our data are in equilibrium. Using both alternative specifications (ROA and ROE), we find that the hypothesis of equilibrium (H=0) is confirmed for small and large banks at conventional statistical levels. However, the Wald test for medium-sized banks indicated that H is significantly different from zero (and particularly negative), and therefore the hypothesis of equilibrium was rejected at 1% level of significance. (Annex 4). The implication of a negative H (in equilibrium test) is that an exogenous increase in input prices reduces the bank's ROA, which means that the bank is unable to pass along its higher costs fully to its borrowers without losing some patronage (Shaffer, 2004). According to Shaffer (2004), the main inference of these disequilibrium findings is that the rejection of H=1 might be spurious for medium-sized banks. However, the rejection of H=0 in the revenue equations remains valid even if the sample is not in long-run equilibrium.

7. Conclusion

There are many different views on the desirability of different banking structures in which banks operate. Competitive conditions in the banking industry and their evolution over time are of interest to policy makers responsible for monetary and financial stability. While competition could lower financial intermediation costs and contribute to improvement in economic efficiency, it could reduce market power and profitability of banks, weakening their ability to withstand adverse developments.

In this paper we try to assess the current market structure of the banking industry in the new EU landscape, and to record the degree of competition. The paper measures the degree of concentration and competition in the new enlarged European banking environment and

investigate competitive conditions in the major European banking markets over the period 1998-2002. We describe the patterns of consolidation and concentration using traditional indicators of market structure. As these indicators rely on the indirect inferences of market concentration and market power, we conduct an empirical analysis based on the method developed by Panzar and Rosse to assess changes in the competitive structure in EU markets (aggregate and major individual) following the consolidation process in the examined period. In the Panzar and Rosse methodology the key point is that a monopolist's output and total revenue decline when his marginal cost curve shifts upward. On the contrary, in a perfectly competitive sector, an increase in marginal costs would be fully reflected in prices, thus increasing total revenues one-to-one for the sector as a whole. In between these two extremes is the case of oligopolistic structure: as the marginal cost curve shifts upward, total revenues increase by less than one-to-one with the increase in costs.

The trend of consolidation that has been observed over several years in the banking industry continued in most countries, and was mostly apparent in the declining number of credit institutions. At the country level, the pace of consolidation greatly varied, with large countries showing the most substantial decrease in the total number of institutions. Despite large-scale privatization and more liberal public policy towards the elimination of entry barriers, the banking sectors of the 10 new EU countries remained much more concentrated throughout the sample period than those of the EU-15 countries. Furthermore, what is observed is a slight reduction in concentration in the 10 new EU countries. This means that while the number of banks has fallen in these countries, this decline has not systematically resulted in an increase in concentration.

The empirical study based on the Panzar-Rosse approach suggests that the point estimate of the H-statistic is significantly positive in every instance, independently of the dependent variable we use (i.e. interest revenue, organic income or total operating income), rejecting the hypotheses of monopoly or consistent conjectural variations short-run oligopoly. At the same time, it is significantly less than unity, rejecting the hypothesis of perfect competition. Hence, our evidence indicate the existence of a certain degree of monopolistic competition in the new European banking landscape (old EU-15 countries, major EU countries and 10 new countries), which is consistent with the findings of previous studies applying the same methodology. It should, however, be stressed that, as competition is dynamic in nature, conditions that observed over a certain period might not be indicative for another. Moreover, we can conclude that, on aggregate, the banking system in the new EU countries operate in a more competitive environment that that of the old EU countries at least when evaluating main income source, i.e. the interest income. When the dependent variable is total revenues, it seems that the old EU-15

banking system is more competitive than the respective of the 10 new countries. Although the coefficients of control variables are of secondary interest, the results are in conformity with our expectations and the results of the previous literature.

The long-run equilibrium test for the value of H is performed; the data appear to be in long-run equilibrium, and the Panzar and Rosse test can be meaningfully interpreted.

The foreseen structural changes require the need for adjustment to be taken seriously by all participants in the financial system. This adjustment appears to have intensified in recent years, as there has been an increase in merger activity, an establishment of alliances and an introduction of new products and services, often based on modern information technology. The process of structural change embodies an element of risk, but if these risks are identified early and analysed carefully, then they can be duly taken into account.

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Table 5: Results (EU-15 vs. 10 new EU Countries) (Interest Income/Assets)

Linear regression Model, with heteroskedastic panels corrected standard errors
Dependent Variable: Interest Income/ Total Assets

	EU-15				***New EU Countries***			
Variable	**Coefficient**	**Std. Err.**	**z**	**Prob>z**	**Coefficient**	**Std. Err.**	**z**	**Prob>z**
Ln w_L	0.134031**	0.011471	11.68	0.000	0.153340**	0.025897	5.92	0.000
Ln w_F	0.388709**	0.018370	21.16	0.000	0.572464**	0.040310	14.20	0.000
Ln w_C	0.013843**	0.003972	3.49	0.000	0.051457**	0.017301	2.97	0.003
Ln E/A	0.033287**	0.004279	7.78	0.000	-0.041507*	0.017107	-2.43	0.015
Ln LLP/L	0.048170**	0.002948	16.34	0.000	0.027949**	0.008005	3.49	0.000
Ln L/A	0.178215**	0.010810	16.49	0.000	0.150449**	0.046849	3.21	0.001
Ln D/CCTF	-0.023531**	0.002445	-9.62	0.000	-0.037751**	0.008983	-4.20	0.000
Ln OI/A	-0.022103**	0.002293	-9.64	0.000	-0.060753**	0.010931	-5.56	0.000
year1998	0.107361**	0.006499	16.52	0.000	0.112233**	0.032393	3.46	0.001
year1999	0.059721**	0.005826	10.25	0.000	0.030468	0.031067	0.98	0.327
year2000	0.053001**	0.005834	9.08	0.000	0.038777	0.030040	1.29	0.197
year2001	0.035419**	0.005540	6.39	0.000	-0.021576	0.027625	-0.78	0.435
+ country dummies included								
_cons	0.962457**	0.067076	14.35	0.000	1.104243**	0.193614	5.70	0.000
R-sq	0.558				0.8293			
	Wald chi2 (26) =2749.23 (0.0000)				Wald chi2(21)=2069.87 (0.0000)			
H-*statistic*	**0.536582**	0.028473	18.85	0.000	**0.777260**	0.049581	15.68	0.000
Wald test for H=1	chi2(1) =264.89 (0.0000)				chi2(1) =20.18 (0.0000)			
Wald test for H=0	chi2(1) =355.14 (0.0000)				chi2(1) = 245.76 (0.0000)			

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. p-values in parentheses.
**Significant at the 1% level of significance.
*Significant at the 5% level of significance.

Table 6: Results (EU-15 vs. 10 new EU Countries) (Organic Income/Assets)

Linear regression Model, with heteroskedastic panels corrected standard errors
Dependent Variable: Organic Income/ Total Assets

	EU-15				***New EU Countries***			
Variable	**Coefficient**	**Std. Err.**	**z**	**Prob>z**	**Coefficient**	**Std. Err.**	**z**	**Prob>z**
Ln w_L	0.24946**	0.01114	22.40	0.000	0.18945**	0.02824	6.71	0.000
Ln w_F	0.35292**	0.01718	20.54	0.000	0.47927**	0.04085	11.73	0.000
Ln w_C	0.04486**	0.00394	11.40	0.000	0.06226**	0.01732	3.59	0.000
Ln E/A	0.02167**	0.00426	5.09	0.000	-0.05718**	0.01892	-3.02	0.003
Ln LLP/L	0.03838**	0.00270	14.23	0.000	0.03800**	0.00857	4.44	0.000
Ln L/A	0.08695**	0.01105	7.87	0.000	0.08251	0.04368	1.89	0.059
Ln D/CCTF	-0.00739**	0.00256	-2.88	0.004	-0.02724**	0.00915	-2.98	0.003
Ln OI/A	-0.02074**	0.00246	-8.43	0.000	-0.06617**	0.01097	-6.03	0.000
year1998	0.07953**	0.00606	13.13	0.000	0.11475**	0.03303	3.47	0.001
year1999	0.05648**	0.00551	10.25	0.000	0.04441	0.03088	1.44	0.150
year2000	0.05645**	0.00553	10.21	0.000	0.03476	0.03095	1.12	0.261
year2001	0.02471**	0.00520	4.75	0.000	-0.02219	0.02840	-0.78	0.435
+ country dummies included								
_cons	1.83983**	0.06622	27.79	0.000	1.78402**	0.20250	8.81	0.000
R-sq	0.5808				0.7889			
	Wald chi2(26)=3216.50 (0.0000)				Wald chi2(21)=1621.50 (0.0000)			
H-*statistic*	**0.64723**	0.02668	24.26	0.000	**0.73098**	0.05292	13.81	0.000
Wald test for H=1	chi2(1) = 174.83 (0.0000)				chi2(1) =25.84 (0.0000)			
Wald test for H=0	chi2(1) = 588.52 (0.0000)				chi2(1) =190.79 (0.0000)			

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. p-values in parentheses.
**Significant at the 1% level of significance.
*Significant at the 5% level of significance.

Table 7: Results (EU-15 vs. 10 new EU Countries) (Total Revenues/Assets)

Linear regression Model, with heteroskedastic panels corrected standard errors
Dependent Variable: Total Operating Income/ Total Assets

	EU-15				***New EU Countries***			
Variable	**Coefficient**	**Std. Err.**	**z**	**Prob>z**	**Coefficient**	**Std. Err.**	**z**	**Prob>z**
Ln w_L	0.58238**	0.01145	50.84	0.000	0.34134**	0.05294	6.45	0.000
Ln w_F	-0.03879*	0.01615	-2.40	0.016	0.05550	0.05894	0.94	0.346
Ln w_C	0.06523**	0.00530	12.31	0.000	0.06265*	0.02541	2.47	0.014
Ln E/A	0.01996**	0.00640	3.12	0.002	-0.02581	0.03629	-0.71	0.477
Ln LLP/L	0.08009**	0.00367	21.82	0.000	0.04969**	0.01561	3.18	0.001
Ln L/A	0.15186**	0.01158	13.12	0.000	0.12716*	0.05567	2.28	0.022
Ln D/CCTF	-0.00245	0.00348	-0.71	0.481	-0.02489	0.01665	-1.50	0.135
year1998	0.09666**	0.00755	12.80	0.000	-0.05122	0.05834	-0.88	0.380
year1999	0.06523**	0.00714	9.14	0.000	0.09591	0.05113	1.88	0.061
year2000	0.05390**	0.00677	7.96	0.000	0.08314	0.05047	1.65	0.100
year2001	0.01271*	0.00641	1.98	0.048	-0.01364	0.04864	-0.28	0.779
+ country dummies included								
_cons	2.80720	0.07677	36.57	0.000	2.46418	0.34510	7.14	0.000
R-sq	0.7644				0.5218			
	Wald chi2(25)=17485.91 (0.0000)				Wald chi2(20)=473.07 (0.0000)			
H-*statistic*	**0.60882**	0.02565	23.73	0.000	**0.45948**	0.08657	5.31	0.000
Wald test for H=1	chi2(1) = 232.55 (0.0000)				chi2(1) =38.98 (0.0000)			
Wald test for H=0	chi2(1) = 563.31 (0.0000)				chi2(1) = 28.17 (0.0000)			

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. p-values in parentheses.
**Significant at the 1% level of significance.
*Significant at the 5% level of significance.

Table 8: Results for the Major EU Countries (Interest Income/Assets)

Linear regression Model, with heteroskedastic panels corrected standard errors: Dependent Variable: Interest Income/ Total Assets

	FRANCE			*GERMANY*			*ITALY*			*SPAIN*			*UK*		
Variable	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**
ln w_L	0.158549	5.30	0.000	0.123663	9.34	0.000	0.184552	4.36	0.000	0.100004	2.78	0.005	0.192886	6.80	0.000
	0.029942			*0.013245*			*0.042377*			*0.035935*			*0.028367*		
ln w_F	0.476742	21.64	0.000	0.261938	10.71	0.000	0.442232	7.93	0.000	0.414836	9.88	0.000	0.457358	9.26	0.000
	0.022031			*0.024457*			*0.055774*			*0.041979*			*0.049407*		
ln w_C	0.065349	3.85	0.000	0.008133	1.77	0.077	0.038236	3.08	0.002	-0.005159	-0.29	0.770	0.020158	1.16	0.245
	0.016975			*0.004603*			*0.012415*			*0.017619*			*0.017327*		
ln E/A	0.055648	5.62	0.000	0.020150	3.99	0.000	0.026107	2.07	0.038	-0.015064	-1.14	0.253	0.039513	3.34	0.001
	0.009897			*0.005054*			*0.012613*			*0.013185*			*0.011835*		
ln LLP/L	0.020955	2.42	0.016	0.029904	10.63	0.000	0.035663	2.57	0.010	0.047752	3.38	0.001	0.048918	4.24	0.000
	0.008667			*0.002813*			*0.013878*			*0.014131*			*0.011545*		
ln L/A	0.163096	4.29	0.000	0.156707	8.66	0.000	0.106701	3.09	0.002	0.362821	9.28	0.000	0.282679	8.35	0.000
	0.038025			*0.018106*			*0.034533*			*0.039101*			*0.033839*		
ln D/CCTF	-0.021467	-2.84	0.004	-0.020410	-5.00	0.000	-0.034406	-7.65	0.000	-0.017959	-2.44	0.015	-0.001320	-0.16	0.874
	0.007552			*0.004080*			*0.004495*			*0.007375*			*0.008324*		
ln OI/A	-0.010546	-1.94	0.052	-0.020789	-7.75	0.000	-0.028908	-4.22	0.000	-0.027745	-2.73	0.006	-0.005919	-0.59	0.556
	0.005437			*0.002682*			*0.006853*			*0.010146*			*0.010048*		
Year1998	0.087515	3.87	0.000	0.083420	14.69	0.000	0.156677	4.33	0.000	0.189273	6.03	0.000	0.129143	2.96	0.003
	0.022588			*0.005677*			*0.036183*			*0.031392*			*0.043679*		
Year1999	0.044025	2.26	0.024	0.046755	8.68	0.000	0.083464	4.52	0.000	0.097879	3.36	0.001	0.084807	2.25	0.024
	0.019495			*0.005386*			*0.018468*			*0.029144*			*0.037622*		
Year2000	0.046713	2.47	0.014	0.038931	7.25	0.000	0.087567	4.95	0.000	0.054422	1.86	0.062	0.089056	2.20	0.028
	0.018948			*0.005368*			*0.017693*			*0.029194*			*0.040554*		
Year2001	0.029597	1.68	0.094	0.027147	5.17	0.000	0.062678	3.51	0.000	0.059669	2.11	0.035	0.052843	1.40	0.163
	0.017661			*0.005254*			*0.017836*			*0.028300*			*0.037870*		
constant	0.734993	3.47	0.001	1.213981	12.52	0.000	1.163353	5.49	0.000	0.143777	0.54	0.592	0.719420	3.48	0.001
	0.211693			*0.096966*			*0.211718*			*0.268454*			*0.206764*		
R-sq	0.7234			0.4078			0.6967			0.5791			0.8004		
	Wald chi2(12)=996.52 (0.0000)			Wald chi2(12) = 957.38 (0.0000)			Wald chi2(12)=959.34 (0.0000)			Wald chi2(12) =419.58 (0.0000)			Wald chi2(12) =450.28 (0.0000)		
H-*statistic*	**0.7006395**	15.00	0.000	**0.3937345**	11.09	0.000	**0.6650204**	6.8	0.000	**0.5096811**	7.74	0.000	**0.6704021**	10.96	0.000
	0.0467095			*0.0355082*			*0.0978576*			*0.0658417*			*0.0611876*		
Wald test for H=1	chi2(1) =41.08 (0.0000)			chi2(1) =291.52 (0.0000)			chi2(1) =11.72 (0.0000)			chi2(1) = 55.46 (0.0000)			chi2(1) =29.02 (0.0000)		
Wald test for H=0	chi2(1) =225.00 (0.0000)			chi2(1) = 122.96 (0.0000)			chi2(1) =46.18 (0.0000)			chi2(1) =59.92 (0.0000)			chi2(1) =120.04 (0.0000)		

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Standard errors in italics.Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

Table 9: Results for the Major EU Countries (Organic Income/Assets)

Linear regression Model, with heteroskedastic panels corrected standard errors: Dependent Variable: Organic Income/ Total Assets

	FRANCE			***GERMANY***			***ITALY***			***SPAIN***			***UK***		
Variable	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**
ln w_L	0.338682	10.01	0.000	0.244927	17.96	0.000	0.316375	7.82	0.000	0.223470	7.52	0.000	0.356246	9.80	0.000
	0.033824			*0.013635*			*0.040475*			*0.029725*			*0.036355*		
ln w_F	0.391516	17.77	0.000	0.310118	13.53	0.000	0.394443	7.67	0.000	0.375316	9.74	0.000	0.347368	5.06	0.000
	0.022033			*0.022922*			*0.051424*			*0.038529*			*0.068619*		
ln w_C	0.095996	5.13	0.000	0.042202	9.65	0.000	0.069777	6.72	0.000	0.020263	1.38	0.167	0.036448	1.60	0.109
	0.018727			*0.004372*			*0.010376*			*0.014661*			*0.022754*		
ln E/A	0.033428	4.28	0.000	0.010586	2.26	0.024	0.004491	0.36	0.718	-0.021176	-1.62	0.106	0.035460	2.18	0.030
	0.007810			*0.004689*			*0.012445*			*0.013104*			*0.016297*		
ln LLP/L	0.019931	2.35	0.019	0.030628	11.82	0.000	-0.009369	-0.87	0.386	0.031046	2.36	0.018	0.027352	1.51	0.131
	0.008471			*0.002591*			*0.010816*			*0.013156*			*0.018103*		
ln L/A	0.049394	1.24	0.217	0.051131	2.44	0.015	0.066032	2.10	0.036	0.137425	4.64	0.000	0.215162	5.06	0.000
	0.039969			*0.020919*			*0.031492*			*0.029625*			*0.042554*		
ln D/CCTF	-0.014678	-1.69	0.091	-0.020971	-4.14	0.000	0.002630	0.66	0.506	-0.009201	-1.63	0.103	0.021590	1.93	0.053
	0.008682			*0.005071*			*0.003957*			*0.005644*			*0.011166*		
ln OI/A	0.000189	0.04	0.969	-0.021375	-7.10	0.000	-0.015972	-2.63	0.009	-0.014431	-1.82	0.069	-0.024523	-1.35	0.178
	0.004869			*0.003009*			*0.006080*			*0.007933*			*0.018187*		
year1998	0.021746	1.02	0.306	0.062305	11.91	0.000	0.107972	3.24	0.001	0.106079	3.68	0.000	0.148708	2.73	0.006
	0.021230			*0.005232*			*0.033344*			*0.028814*			*0.054431*		
year1999	0.008149	0.44	0.661	0.049216	9.52	0.000	0.088363	5.30	0.000	0.071160	2.63	0.008	0.119183	2.42	0.016
	0.018559			*0.005172*			*0.016670*			*0.027009*			*0.049302*		
year2000	0.031046	1.68	0.092	0.041822	8.11	0.000	0.105567	6.53	0.000	0.055769	2.19	0.029	0.113624	2.38	0.017
	0.018449			*0.005156*			*0.016158*			*0.025488*			*0.047795*		
year2001	0.014918	0.87	0.384	0.016127	3.24	0.001	0.048828	2.94	0.003	0.031567	1.28	0.201	0.064964	1.52	0.128
	0.017132			*0.004984*			*0.016604*			*0.024677*			*0.042661*		
constant	2.194804	10.06	0.000	2.095707	19.13	0.000	1.958820	9.63	0.000	1.737448	8.60	0.000	1.883676	6.53	0.000
	0.218205			*0.109538*			*0.203305*			*0.201939*			*0.288397*		
R-sq	0.7070			0.4757			0.7201			0.5811			0.7759		
	Wald chi2(12)=1013.06 (0.0000)			Wald chi2(12)=1041.06 (0.0000)			Wald chi2(12)=758.89 (0.0000)			Wald chi2(12)=350.27 (0.0000)			Wald chi2(12) = 561.74 (0.000)		
H-*statistic*	**0.826193**	17.65	0.000	**0.597248**	17.59	0.000	**0.780595**	8.54	0.000	**0.619049**	10.85	0.000	**0.740061**	10.70	0.000
	0.046803			*0.033953*			*0.091400*			*0.057031*			*0.069196*		
Wald test for H=1	chi2(1)=13.79 (0.0000)			chi2(1) =140.71 (0.0000)			chi2(1) =5.76 (0.0000)			chi2(1) =44.62 (0.0000)			chi2(1) =14.11 (0.0000)		
Wald test for H=0	chi2(1) =311.61 (0.0000)			chi2(1) =309.42 (0.0000)			chi2(1) =72.94 (0.0000)			chi2(1) =117.82 (0.0000)			chi2(1) =114.39 (0.0000)		

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Standard errors in italics.Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

Table 10: Results for the Major EU Countries (Total Revenue /Assets)

Linear regression Model, with heteroskedastic panels corrected standard errors: Dependent Variable: Total Operating Income/ Total Assets

	FRANCE			***GERMANY***			***ITALY***			***SPAIN***			***UK***		
Variable	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**
ln w_L	0.676560	19.79	0.000	0.581392	41.46	0.000	0.528053	10.53	0.000	0.469977	10.26	0.000	0.747530	19.58	0.000
	0.034194			*0.014024*			*0.050142*			*0.045821*			*0.038170*		
ln w_F	-0.009335	-0.44	0.656	-0.124953	-5.25	0.000	-0.005881	-0.11	0.910	-0.023618	-0.47	0.639	-0.165155	-1.81	0.071
	0.020988			*0.023781*			*0.052283*			*0.050380*			*0.091445*		
ln w_C	0.161851	10.55	0.000	0.063164	10.29	0.000	0.038931	3.57	0.000	-0.017166	-0.71	0.476	0.021824	0.68	0.494
	0.015335			*0.006137*			*0.010902*			*0.024083*			*0.031879*		
ln E/A	0.011676	1.01	0.313	0.005292	0.89	0.375	0.001808	0.13	0.900	-0.039559	-2.04	0.041	0.030285	1.30	0.192
	0.011565			*0.005961*			*0.014316*			*0.019386*			*0.023231*		
ln LLP/L	0.070167	6.37	0.000	0.070538	20.93	0.000	0.028813	2.40	0.016	0.053651	2.47	0.014	0.121334	5.16	0.000
	0.011010			*0.003370*			*0.012013*			*0.021754*			*0.023492*		
ln L/A	0.193650	6.28	0.000	0.073768	4.70	0.000	0.199413	5.78	0.000	0.160003	3.76	0.000	0.462661	8.35	0.000
	0.030841			*0.015711*			*0.034497*			*0.042501*			*0.055428*		
ln D/CCTF	-0.011387	-1.17	0.243	-0.020306	-3.37	0.001	-0.005935	-1.41	0.159	-0.013159	-1.43	0.151	0.090793	3.16	0.002
	0.009763			*0.006027*			*0.004214*			*0.009171*			*0.028776*		
year1998	-0.054226	-2.08	0.037	0.094298	13.40	0.000	0.193101	6.10	0.000	0.134492	3.01	0.003	0.099294	1.31	0.189
	0.026043			*0.007035*			*0.031646*			*0.044622*			*0.075642*		
year1999	-0.019807	-0.82	0.414	0.086877	13.32	0.000	0.053419	3.51	0.000	0.094761	2.48	0.013	0.043966	0.64	0.523
	0.024260			*0.006523*			*0.015203*			*0.038181*			*0.068820*		
year2000	-0.004135	-0.19	0.849	0.042416	6.84	0.000	0.119168	8.42	0.000	0.046707	1.29	0.197	0.110494	1.58	0.114
	0.021729			*0.006198*			*0.014157*			*0.036213*			*0.069983*		
year2001	-0.003674	-0.17	0.865	0.003936	0.65	0.517	0.062455	4.17	0.000	0.045864	1.15	0.252	0.076797	1.22	0.223
	0.021544			*0.006081*			*0.014988*			*0.040024*			*0.062970*		
constant	2.726000	13.49	0.000	3.315520	35.66	0.000	2.566640	10.55	0.000	2.860073	9.24	0.000	2.811100	7.71	0.000
	0.202066			*0.092971*			*0.243266*			*0.309618*			*0.364388*		
R-sq	0.8257			0.8135			0.6298			0.6529			0.7897		
	Wald chi2(11)=3244.88 (0.0000)			Wald chi2(11)=7658.02 (0.0000)			Wald chi2(11)=862.45 (0.0000)			Wald chi2(11)=316.88 (0.0000)			Wald chi2(11) =1864.80 (0.0000)		
H-*statistic*	**0.8290756**	17.02	0.000	**0.5196035**	14.42	0.000	**0.5611029**	5.54	0.000	**0.4291941**	5.32	0.000	**0.6041993**	6.64	0.000
	0.0487239			*0.0360219*			*0.1012586*			*0.0806075*			*0.0909942*		
Wald test for H=1	chi2(1) =12.31 (0.0000)			chi2(1) =177.85 (0.0000)			chi2(1) =18.79 (0.0000)			chi2(1) =50.14 (0.0000)			chi2(1) =18.92 (0.0000)		
Wald test for H=0	chi2(1) =289.54 (0.0000)			chi2(1) =208.07 (0.0000)			chi2(1) = 30.71 (0.0000)			chi2(1) =28.35 (0.0000)			chi2(1) =44.09 (0.0000)		

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Standard errors in italics.Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

Table 11: Results (Large vs. Small Banks) (Interest Income/Assets)

Linear regression Model, with heteroskedastic panels corrected standard errors
Dependent Variable: Interest Income/ Total Assets

	Large			***Medium-sized***			***Small***		
Variable	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**
ln w_L	0.131295**	6.29	0.000	0.075584**	4.86	0.000	0.112116**	7.53	0.000
	0.020890			*0.015564*			*0.014898*		
ln w_F	0.401017**	9.79	0.000	0.368121**	13.5	0.000	0.385157**	16.35	0.000
	0.040941			*0.027274*			*0.023561*		
ln w_C	0.007620	0.35	0.729	0.018337	1.67	0.096	0.021292**	5.72	0.000
	0.022012			*0.011012*			*0.003721*		
ln E/A	-0.012728	-0.78	0.434	0.027516**	2.86	0.004	0.016822**	3.27	0.001
	0.016262			*0.009610*			*0.005151*		
ln LLP/L	0.001047	0.09	0.931	0.056039**	6.62	0.000	0.041946**	13.55	0.000
	0.012124			*0.008461*			*0.003096*		
ln L/A	0.137024**	3.89	0.000	0.100436**	4.75	0.000	0.170072**	13.89	0.000
	0.035263			*0.021161*			*0.012240*		
ln D/CCTF	-0.074619**	-4.51	0.000	-0.023594**	-4.01	0.000	-0.013965**	-5.88	0.000
	0.016530			*0.005887*			*0.002374*		
ln OI/A	0.019683	1.48	0.138	-0.008990	-1.39	0.163	-0.011956**	-4.62	0.000
	0.013256			*0.006448*			*0.002589*		
year1998	0.139714**	4.14	0.000	0.117574**	5.32	0.000	0.089282**	11.52	0.000
	0.033752			*0.022088*			*0.007749*		
year1999	0.077510**	2.82	0.005	0.052151*	2.43	0.015	0.049337**	7.70	0.000
	0.027529			*0.021490*			*0.006404*		
year2000	0.079927**	2.73	0.006	0.069949**	3.42	0.001	0.045565**	6.89	0.000
	0.029326			*0.020433*			*0.006610*		
year2001	0.044463	1.55	0.122	0.047743*	2.31	0.021	0.027414**	4.45	0.000
	0.028751			*0.020694*			*0.006164*		
constant	1.273328**	5.06	0.000	1.045673**	8.68	0.000	0.911039**	10.72	0.000
	0.251737			*0.120489*			*0.084995*		
R-sq	0.5725			0.467			0.5104		
	Wald chi2(12)=302.29 (0.0000)			Wald chi2(12)=376.02 (0.0000)			Wald chi2(12)=1461.50 (0.0000)		
H-*statistic*	**0.539932**	9.97	0.000	**0.462041**	12.05	0.000	**0.518565**	14.45	0.000
	0.0541483			*0.0383515*			*0.0358834*		
Wald test for H=1	chi2(1) =72.19 (0.0000)			chi2(1) =196.76 (0.0000)			chi2(1) = 180.01 (0.0000)		
Wald test for H=0	chi2(1) =99.43(0.0000)			chi2(1) =145.14 (0.0000)			chi2(1) = 208.84 (0.0000)		

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Standard errors in italics.Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

Table 12: Results (Large vs. Small Banks) (Organic Income/Assets)

Linear regression Model, with heteroskedastic panels corrected standard errors
Dependent Variable: Organic Income/ Total Assets

	Large			***Medium-sized***			***Small***		
Variable	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**
ln w_L	0.176657**	8.94	0.000	0.161826**	10.37	0.000	0.249273**	16.52	0.000
	0.019759			*0.015607*			*0.015088*		
ln w_F	0.354531**	9.96	0.000	0.341097**	13.65	0.000	0.338998**	15.45	0.000
	0.035599			*0.024980*			*0.021942*		
ln w_C	0.005088	0.26	0.792	0.043643**	4.16	0.000	0.061036**	16.05	0.000
	0.019277			*0.010500*			*0.003803*		
ln E/A	-0.008933	-0.61	0.539	0.053450**	4.68	0.000	0.013738**	2.75	0.006
	0.014549			*0.011427*			*0.004991*		
ln LLP/L	0.010376	0.86	0.388	0.038597**	4.80	0.000	0.025362**	9.14	0.000
	0.012016			*0.008045*			*0.002775*		
ln L/A	0.169032**	5.63	0.000	0.038188	1.94	0.052	0.060970**	4.74	0.000
	0.030034			*0.019635*			*0.012858*		
ln D/CCTF	-0.070554**	-5.41	0.000	0.000020	0.00	0.997	-0.003524	-1.40	0.162
	0.013031			*0.006346*			*0.002518*		
ln OI/A	0.020624	1.66	0.096	-0.006064	-0.91	0.364	-0.008951**	-3.25	0.001
	0.012399			*0.006686*			*0.002756*		
year1998	0.115045**	3.75	0.000	0.094477**	4.37	0.000	0.057079**	8.02	0.000
	0.030675			*0.021614*			*0.007120*		
year1999	0.071080**	2.82	0.005	0.046074*	2.14	0.033	0.043656**	7.21	0.000
	0.025211			*0.021555*			*0.006055*		
year2000	0.087861**	3.25	0.001	0.066311**	3.19	0.001	0.047565**	7.68	0.000
	0.027063			*0.020781*			*0.006193*		
year2001	0.043377	1.63	0.103	0.039714	1.89	0.059	0.015791**	2.72	0.006
	0.026610			*0.021014*			*0.005796*		
constant	1.588365**	7.02	0.000	1.649929**	15.14	0.000	1.944919**	21.49	0.000
	0.226155			*0.108974*			*0.090516*		
R-sq	0.5993			0.4655			0.5302		
	Wald chi2(12)=428.83 (0.0000)			Wald chi2(12)=428.45 (0.0000)			Wald chi2(12)=1370.76 (0.0000)		
H-*statistic*	**0.536276**	11.37	0.000	**0.546566**	15.01	0.000	**0.649307**	19.35	0.000
	0.047176			*0.036402*			*0.033551*		
Wald test for H=1	chi2(1) =96.62 (0.0000)			chi2(1) =155.16 (0.0000)			chi2(1) =109.26 (0.0000)		
Wald test for H=0	chi2(1) =129.22 (0.0000)			chi2(1) = 225.44 (0.0000)			chi2(1) =374.54 (0.0000)		

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Standard errors in italics.Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

Table 13: Results (Large vs. Small Banks) (Total Revenues/Assets)

Linear regression Model, with heteroskedastic panels corrected standard errors
Dependent Variable: Total Operating Income/ Total Assets

	Large			***Medium-sized***			***Small***		
Variable	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**	**Coefficient**	**z**	**Prob>z**
ln w_L	0.540869**	16.63	0.000	0.566986**	30.31	0.000	0.549582**	33.58	0.000
	0.032525			*0.018709*			*0.016365*		
ln w_F	-0.131784**	-3.93	0.000	-0.042349	-1.59	0.113	-0.025727	-1.24	0.214
	0.033497			*0.026708*			*0.020705*		
ln w_C	0.011592	0.49	0.626	0.085926**	5.13	0.000	0.087757**	16.97	0.000
	0.023806			*0.016764*			*0.005171*		
ln E/A	-0.002912	-0.12	0.905	0.056308**	3.18	0.001	0.080788**	12.66	0.000
	0.024446			*0.017717*			*0.006381*		
ln LLP/L	0.064615**	3.29	0.001	0.073651**	6.62	0.000	0.060523**	15.48	0.000
	0.019614			*0.011119*			*0.003909*		
ln L/A	0.366136**	9.49	0.000	0.212420**	7.92	0.000	0.107788**	8.00	0.000
	0.038575			*0.026812*			*0.013471*		
ln D/CCTF	-0.133204**	-5.19	0.000	0.016121	0.95	0.340	-0.019196**	-6.82	0.000
	0.025657			*0.016888*			*0.002816*		
year1998	0.087788*	2.45	0.014	0.084205**	2.73	0.006	0.086436**	10.08	0.000
	0.035871			*0.030897*			*0.008577*		
year1999	0.071084*	2.06	0.039	0.062133*	2.04	0.042	0.056669**	7.44	0.000
	0.034516			*0.030524*			*0.007614*		
year2000	0.105257**	2.83	0.005	0.059562*	2.12	0.034	0.040989**	5.51	0.000
	0.037251			*0.028046*			*0.007433*		
year2001	0.061326	1.74	0.082	0.009742	0.38	0.707	0.007264	1.01	0.314
	0.035280			*0.025919*			*0.007221*		
constant	2.668306**	10.73	0.000	2.414342**	13.04	0.000	2.719929**	26.87	0.000
	0.248785			*0.185176*			*0.101242*		
R-sq	0.9091			0.771			0.6689		
	Wald chi2(11)=1432.59 (0.0000)			Wald chi2(11)=2623.20 (0.0000)			Wald chi2(11)=5367.88 (0.000)		
H-*statistic*	**0.420677**	6.79	0.000	**0.610563**	15.26	0.000	**0.611611**	18.43	0.000
	0.061937			*0.040015*			*0.033181*		
Wald test for H=1	chi2(1) = 87.49 (0.0000)			chi2(1)=94.72 (0.0000)			chi2(1) =137.01 (0.0000)		
Wald test for H=0	chi2(1) =46.13 (0.0000)			chi2(1) =232.82 (0.0000)			chi2(1) =339.77 (0.0000)		

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Standard errors in italics.Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

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Annex 2: Summary of Literature on Measuring Bank Competition Using Panzar-Rosse Methodology

Authors	Countries considered	Period	Results
Shaffer (1982)	New York	1979	monopolistic competition
Gelfand & Spiller (1987)	Uruguay	1977-1980	monopolistic competition
Nathan & Neave (1989)	Canada	1982-1984	monopolistic competition (1983-84) perfect competition (1982)
Lloyd-Williams et.al. (1991)	Japan	1986-1988	Monopoly
Molyneux et. al. (1994)	France, Germany, Italy, Spain, UK	1986-1989	monopolistic competition monopoly for Italy (1987-89)
Vesala (1995)	Finland	1985-1992	monopolistic competition (1985-88 / 1991-92) perfect competition (1989-90)
Molyneux et.al. (1996)	Japan	1986-1988	monopoly (1986), monopolistic competition (1988)
Coccorese (1998)	Italy	1988-1996	monopolistic competition (perfect competition in 1992 / 1994)
Hondroyiannis et.al. (1999)	Greece	1993-1995	monopolistic competition
Barajas et.al. (2000)	Colombia	1985-1998	monopolistic competition
Bikker & Haaf (2000b)	23 Industrialised Countries	1988-1998	monopolistic competition
Bikker & Groeneveld (2000)	15 EU Countries	1989-1996	monopolistic competition
De Bandt & Davis (2000)	France, Germany, Italy, US	1992-1996	monopolistic competition
Smith & Tripe (2001)	New Zealand	1996-1999	monopolistic competition (but monopoly for 1997)
Yildirim & Philippatos (2002)	14 Central and Eastern European Countries	1993-2000	monopolistic competition (except for FYR of Macedonia and Slovakia)
Hempell (2002)	Germany	1993-1998	monopolistic competition
Belaisch (2003)	Brazil	1997-2000	oligopoly
Yeyati & Micco (2003)	8 Latin American Countries	1993-2002	monopolistic competition
Claessens & Laeven (2003)	50 countries	1994-2001	monopolistic competition
Drakos & Konstantinou (2003)	10 Central and Eastern European Countries	1992-2000	monopolistic competition (monopoly for Latvia)
Coccorese (2004)	Italy	1997-1999	monopolistic competition
Gelos & Roldos (2004)	8 Latin American and Eastern European Countries	1994-1999	monopolistic competition (exc. Argentina and Hungary)
Boutillier et.al. (2004)	Germany, France, Italy, Spain	1993-2000	monopolistic competition
Jiang et.al. (2004)	Hong Kong	1992-2002	perfect competition

Annex 2: Descriptive Statistics

Country	TA	IR/A	TR/A	L/A	E/A	PE/A	IE/F	OE/FA	LLP/L
Austria	4,510	5.293	3.673	58.628	6.708	1.339	4.002	94.852	0.638
	(17,700)	*(1.396)*	*(1.977)*	*(17.729)*	*(4.082)*	*(0.606)*	*(3.258)*	*(125.687)*	*(0.409)*
Belgium	21,200	5.742	2.793	43.034	7.070	0.949	4.415	194.799	0.820
	(64,700)	*(1.541)*	*(2.211)*	*(20.498)*	*(5.008)*	*(0.740)*	*(1.736)*	*(213.227)*	*(0.949)*
Denmark	3,734	6.837	5.657	57.592	13.594	2.090	3.040	146.113	1.123
	(21,000)	*(1.339)*	*(1.816)*	*(13.017)*	*(5.544)*	*(0.847)*	*(0.923)*	*(189.068)*	*(0.758)*
Finland	39,200	3.688	4.796	66.599	6.769	0.836	3.596	253.402	0.119
	(64,000)	*(1.784)*	*(4.909)*	*(8.785)*	*(3.649)*	*(0.342)*	*(2.884)*	*(460.090)*	*(0.167)*
France	21,400	6.264	3.977	58.623	7.776	1.544	5.238	180.300	0.772
	(78,400)	*(3.253)*	*(2.566)*	*(22.144)*	*(5.771)*	*(0.931)*	*(4.881)*	*(190.781)*	*(1.219)*
Germany	3,545	5.766	3.393	61.696	5.336	1.418	3.850	84.470	0.954
	(31,500)	*(0.922)*	*(1.408)*	*(13.354)*	*(2.841)*	*(0.567)*	*(2.460)*	*(113.189)*	*(0.859)*
Greece	12,400	6.706	4.762	46.595	11.392	1.781	5.248	80.744	1.029
	(15,500)	*(2.700)*	*(2.027)*	*(15.237)*	*(6.709)*	*(0.854)*	*(2.982)*	*(128.590)*	*(1.184)*
Ireland	11,700	5.052	2.542	51.833	9.478	0.504	5.624	282.591	0.464
	(36,000)	*(1.930)*	*(2.740)*	*(22.139)*	*(7.854)*	*(0.716)*	*(4.246)*	*(304.291)*	*(0.893)*
Italy	3,273	5.615	4.248	54.890	12.343	1.662	3.842	133.567	0.731
	(18,200)	*(1.601)*	*(1.641)*	*(14.540)*	*(4.868)*	*(0.721)*	*(2.796)*	*(159.991)*	*(0.701)*
Luxembourg	11,600	5.796	2.283	28.481	6.256	0.660	6.344	306.803	0.647
	(52,100)	*(2.899)*	*(2.050)*	*(14.975)*	*(6.306)*	*(0.754)*	*(4.918)*	*(349.148)*	*(0.953)*
Netherlands	31,800	5.973	3.048	61.790	6.490	0.985	7.527	163.938	0.570
	(9,560)	*(2.892)*	*(3.369)*	*(23.062)*	*(4.127)*	*(1.095)*	*(5.919)*	*(174.365)*	*(0.931)*
Portugal	16,800	5.959	3.763	54.973	8.824	1.092	6.118	128.956	0.872
	(4,690)	*(4.170)*	*(2.872)*	*(21.907)*	*(7.606)*	*(0.560)*	*(6.307)*	*(176.874)*	*(1.275)*
Spain	11,600	5.122	3.774	63.524	9.017	1.394	3.061	91.682	0.556
	(3,720)	*(1.390)*	*(1.461)*	*(18.869)*	*(6.294)*	*(0.832)*	*(2.183)*	*(132.300)*	*(0.529)*
Sweden	30,000	5.652	4.617	73.387	11.665	1.531	4.010	296.542	0.432
	(7,930)	*(0.798)*	*(2.307)*	*(17.805)*	*(5.201)*	*(1.139)*	*(5.900)*	*(307.069)*	*(0.703)*
UK	21,200	6.078	3.770	57.033	9.075	1.206	5.150	243.164	0.679
	(62,200)	*(3.006)*	*(4.421)*	*(27.616)*	*(7.749)*	*(1.635)*	*(3.012)*	*(317.146)*	*(1.016)*
EU-15	**7,574**	**5.779**	**3.697**	**58.891**	**7.719**	**1.445**	**4.123**	**123.227**	**0.852**
	(41,500)	***(1.734)***	***(2.057)***	***(17.295)***	***(5.365)***	***(0.785)***	***(3.165)***	***(174.297)***	***(0.878)***

Note: TA: Total Assets; IR/A: Interest Revenue/Total Assets; TR/A: Total Revenue/Total Assets; L/A: Net Loans/Total Assets; E/A: Equity/Total Assets; PE/A: Personnel Expenses/Assets; IE/F: Interest Expenses/Funds; OE/FA: Other Operating Costs/Fixed Assets; LLP/L: Loan Loss Provisions/Loans. Figures are means (*in million of € for TA and percentage for all other variables*) for the period 1998-2002. Standard errors are given in the parentheses. Further descriptive statistics can be provided upon requested.

Country	TA	IR/A	TR/A	L/A	E/A	PE/A	IE/F	OE/FA	LLP/L
Cyprus	2,055	9.778	4.268	51.810	9.752	1.390	8.806	123.266	1.184
	(3,538)	*(7.872)*	*(2.994)*	*(19.464)*	*(6.420)*	*(0.678)*	*(7.627)*	*(180.531)*	*(1.384)*
Czech	3,058	7.071	4.167	37.290	7.782	1.125	5.831	159.204	2.446
	(5,065)	*(3.958)*	*(2.422)*	*(18.036)*	*(4.240)*	*(0.990)*	*(4.902)*	*(152.423)*	*(2.990)*
Estonia	1,850	7.131	6.261	51.998	10.138	2.004	4.527	55.337	3.031
	(2,662)	*(1.818)*	*(2.041)*	*(14.318)*	*(3.252)*	*(1.082)*	*(1.486)*	*(26.872)*	*(2.391)*
Hungary	1,110	10.683	6.799	50.670	9.986	1.790	8.875	268.579	0.972
	(1,527)	*(4.399)*	*(3.341)*	*(17.033)*	*(4.473)*	*(1.860)*	*(5.526)*	*(336.772)*	*(0.910)*
Latvia	0,237	6.501	6.378	41.342	12.014	1.990	3.395	124.921	2.684
	(0,350)	*(2.466)*	*(2.096)*	*(21.554)*	*(6.646)*	*(1.375)*	*(2.110)*	*(99.213)*	*(2.539)*
Lithuania	0,645	6.272	7.113	45.775	13.320	3.087	3.647	41.078	2.498
	(0,991)	*(1.567)*	*(1.838)*	*(12.964)*	*(7.194)*	*(1.440)*	*(1.275)*	*(20.085)*	*(2.755)*
Malta	2,210	5.461	3.291	40.707	11.534	0.952	4.432	156.278	0.679
	(3,766)	*(1.660)*	*(1.470)*	*(13.767)*	*(9.771)*	*(0.728)*	*(2.139)*	*(224.295)*	*(0.475)*
Poland	2,805	10.847	7.152	51.936	11.796	2.018	8.806	178.688	2.129
	(4,409)	*(3.271)*	*(2.443)*	*(15.915)*	*(6.163)*	*(1.232)*	*(3.500)*	*(248.596)*	*(1.622)*
Slovakia	0,817	9.093	5.343	44.354	10.256	0.933	7.721	109.311	3.010
	(1,174)	(4.527)	(2.718)	(14.344)	(5.715)	(0.342)	(4.730)	(159.574)	2.753
Slovenia	0,809	7.402	5.385	52.598	10.206	1.323	5.101	90.531	2.007
	(1,096)	(1.959)	(1.463)	(8.228)	(3.471)	(0.230)	(1.405)	(104.351)	(1.717)
10 new EU	**1,664**	**8.716**	**5.876**	**47.805**	**10.579**	**1.660**	**6.802**	**152.561**	**2.058**
	(3,220)	***(4.386)***	***(2.768)***	***(17.086)***	***(5.849)***	***(0.966)***	***(4.753)***	***(217.510)***	***(2.133)***

Note: TA: Total Assets; IR/A: Interest Revenue/Total Assets; TR/A: Total Revenue/Total Assets; L/A: Net Loans/Total Assets; E/A: Equity/Total Assets; PE/A: Personnel Expenses/Assets; IE/F: Interest Expenses/Funds; OE/FA: Other Operating Costs/Fixed Assets; LLP/L: Loan Loss Provisions/Loans. Figures are means (*in million of € for TA and percentage for all other variables*) for the period 1998-2002. Standard errors are given in the parentheses. Further descriptive statistics can be provided upon requested.

Annex 3: Fixed Effects Estimators

Fixed effects model with time dummies: Dependent variable: Interest Income/ Total Assets

	EU-15				*New EU Countries*			
Variable	**Coefficient**	**Std. Err.**	**t-statistic**	**Prob>t**	**Coefficient**	**Std. Err.**	**t-statistic**	**Prob>t**
ln w_L	0.151943**	0.006120	24.83	0.000	-0.014980	0.035849	-0.42	0.676
ln w_F	0.523061**	0.005163	101.31	0.000	0.590405**	0.024780	23.83	0.000
ln w_C	0.013462**	0.002687	5.01	0.000	0.022400	0.022325	1.00	0.317
ln E/A	0.008911*	0.004200	2.12	0.034	0.019766	0.015620	1.27	0.207
ln LLP/L	0.014267**	0.001164	12.26	0.000	0.005131	0.006665	0.77	0.442
ln L/A	0.129582**	0.007777	16.66	0.000	0.167258**	0.041234	4.06	0.000
ln D/CCTF	0.000037	0.001983	0.02	0.985	-0.014709	0.009171	-1.60	0.110
ln OI/A	-0.006033**	0.001032	-5.85	0.000	-0.017048*	0.007877	-2.16	0.032
year1998	0.046884**	0.002522	18.59	0.000	0.111227**	0.022231	5.00	0.000
year1999	0.029629**	0.002308	12.84	0.000	0.068353**	0.018201	3.76	0.000
year2000	0.017896**	0.002283	7.84	0.000	0.060823**	0.017712	3.43	0.001
year2001	0.005750**	0.002133	2.70	0.007	0.010295	0.016928	0.61	0.544
constant	1.088320**	0.046732	23.29	0.000	0.177641	0.270758	0.66	0.512
R-sq (overall)	0.4404				0.7138			
	F(12,5123) =1481.61		Prob > F = 0.0000		F(12,214) =92.35		Prob > F = 0.0000	
H-*statistic*	**0.688465**	0.007873	87.45	0.000	**0.597825**	0.048828	12.24	0.000
Wald test for H=1	F(1, 5123) = 1565.86		Prob > F = 0.0000		F(1, 214) = 67.84		Prob > F = 0.0000	
Wald test for H=0	F(1, 5123) = 7647.21		Prob > F = 0.0000		F(1, 214) = 149.91		Prob > F = 0.0000	
Hausman test: Ho= RE vs FE :			chi2(12)=520.72 (0.000)				chi2(12)=28.91 (0.0041)	

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. Hausman test rejects the random effects (RE) vs fixed effects (FE) hypothesis at 1% level of significance. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

Fixed effects model with time dummies: Dependent variable: Organic Income/ Total Assets

	EU-15				***New EU Countries***			
Variable	**Coefficient**	**Std. Err.**	**t-statistic**	**Prob>t**	**Coefficient**	**Std. Err.**	**t-statistic**	**Prob>t**
ln w_L	0.237997**	0.006423	37.06	0.000	0.032154	0.036514	0.88	0.380
ln w_F	0.443235**	0.005418	81.81	0.000	0.521364**	0.025240	20.66	0.000
ln w_C	0.021971**	0.002820	7.79	0.000	0.018751	0.022740	0.82	0.411
ln E/A	0.009548*	0.004407	2.17	0.030	0.021771	0.015910	1.37	0.173
ln LLP/L	0.014947**	0.001222	12.24	0.000	0.003822	0.006789	0.56	0.574
ln L/A	0.134272**	0.008161	16.45	0.000	0.155886**	0.042000	3.71	0.000
ln D/CCTF	-0.001992	0.002081	-0.96	0.339	-0.010750	0.009342	-1.15	0.251
ln OI/A	-0.007692**	0.001083	-7.10	0.000	-0.012952	0.008023	-1.61	0.108
year1998	0.042095**	0.002646	15.91	0.000	0.099691**	0.022644	4.40	0.000
year1999	0.037240**	0.002422	15.38	0.000	0.068369**	0.018539	3.69	0.000
year2000	0.034094**	0.002396	14.23	0.000	0.058513**	0.018041	3.24	0.001
year2001	0.008974**	0.002238	4.01	0.000	0.010506	0.017243	0.61	0.543
constant	1.640262**	0.049040	33.45	0.000	0.690745	0.275786	2.50	0.013
R-sq (overall)	0.4592				0.5914			
	F(12,5123)=1137.22		Prob > F = 0.0000		F(12,214)= 70.78		Prob > F = 0.0000	
H-*statistic*	**0.703203**	0.008262	85.12	0.000	**0.572269**	0.049734	11.51	0.000
Wald test for H=1	F(1, 5123) = 1836.88		Prob > F = 0.0000		F(1, 214) = 73.97		Prob > F = 0.0000	
Wald test for H=0	F(1, 5123) = 6743.99		Prob > F = 0.0000		F(1, 214) = 132.40		Prob > F = 0.0000	
Hausman test: Ho= RE vs FE :			chi2(12)=232.18 (0.000)				chi2(12)=80.88 (0.000)	

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. Hausman test rejects the random effects (RE) vs fixed effects (FE) hypothesis at 1% level of significance. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

Fixed effects model with time dummies: Dependent variable: Total operating Income/ Total Assets

	EU-15				***New EU Countries***			
Variable	**Coefficient**	**Std. Err.**	**t-statistic**	**Prob>t**	**Coefficient**	**Std. Err.**	**t-statistic**	**Prob>t**
ln w_L	0.4625704**	0.0105191	43.97	0.000	0.2613827**	0.0875258	2.99	0.003
ln w_F	0.0766146**	0.0089665	8.54	0.000	0.0428729	0.0610192	0.70	0.483
ln w_C	0.0508723**	0.0045849	11.10	0.000	-0.0622210	0.0539259	-1.15	0.250
ln E/A	0.0172980*	0.0075340	2.30	0.022	-0.0326115	0.0390034	-0.84	0.404
ln LLP/L	0.0398258**	0.0019624	20.29	0.000	0.0127674	0.0163333	0.78	0.435
ln L/A	0.1640840**	0.0134198	12.23	0.000	0.2073244*	0.0990329	2.09	0.037
ln D/CCTF	-0.0104939**	0.0032516	-3.23	0.001	0.0219732	0.0214616	1.02	0.307
year1998	0.0653931**	0.0042163	15.51	0.000	-0.0217956	0.0523361	-0.42	0.677
year1999	0.0522063**	0.0038269	13.64	0.000	0.0778583	0.0449172	1.73	0.084
year2000	0.0299830**	0.0037109	8.08	0.000	0.0913414	0.0437990	2.09	0.038
year2001	-0.0074380*	0.0035684	-2.08	0.037	-0.0287547	0.0422108	-0.68	0.496
constant	2.2351180**	0.0797665	28.02	0.000	2.1714620**	0.6636512	3.27	0.001
R-sq (overall)	0.3299				0.2743			
	F(11,7667) = 343.16		Prob > F = 0.0000		F(11,225) = 4.30		Prob > F = 0.0000	
H-*statistic*	**0.5900573**	0.0134526	43.86	0.000	**0.2420346**	0.1188146	2.04	0.043
Wald test for H=1	F(1, 7667) = 928.60		Prob > F = 0.0000		F(1, 225) = 40.70		Prob > F = 0.0000	
Wald test for H=0	F(1, 7667) = 1923.86		Prob > F = 0.0000		F(1, 225) = 4.15		Prob > F = 0.0000	

Hausman test: Ho= RE vs FE : chi2(11)=301.20 (0.000) chi2(11)== -25.40^^

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. Hausman test rejects the random effects (RE) vs fixed effects (FE) hypothesis at 1% level of significance. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

^^ indicates that model fitted on these data fails to meet the asymptotic assumptions of the Hausman test

Fixed effects model with time dummies: Dependent variable: Interest Income/ Total Assets

	Large			***Medium-sized***			***Small***		
Variable	**Coefficient**	**t-statistic**	**Prob>t**	**Coefficient**	**t-statistic**	**Prob>t**	**Coefficient**	**t-statistic**	**Prob>t**
ln w_L	0.181963	5.61	0.000	0.0694989	4.27	0.000	0.1790510	26.35	0.000
	0.032425			*0.0162922*			*0.0067941*		
ln w_F	0.568430	20.10	0.000	0.5106057	33.30	0.000	0.5216705	95.00	0.000
	0.028279			*0.0153330*			*0.0054914*		
ln w_C	0.002382	0.12	0.906	0.0228590	3.00	0.003	0.0130037	4.58	0.000
	0.020127			*0.0076284*			*0.0028373*		
ln E/A	0.041345	1.61	0.109	0.0137859	1.49	0.136	0.0042137	0.84	0.399
	0.025686			*0.0092436*			*0.0049941*		
ln LLP/L	0.005825	0.59	0.555	0.0085571	2.19	0.029	0.0148093	12.54	0.000
	0.009845			*0.0039147*			*0.0011806*		
ln L/A	0.127259	3.11	0.002	0.2074008	7.96	0.000	0.1134599	14.03	0.000
	0.040971			*0.0260465*			*0.0080873*		
ln D/CCTF	-0.014920	-1.06	0.289	0.0040997	0.59	0.554	0.0008944	0.45	0.656
	0.014030			*0.0069204*			*0.0020080*		
ln OI/A	-0.027587	-3.20	0.002	-0.0022549	-0.66	0.510	-0.0064897	-6.18	0.000
	0.008619			*0.0034175*			*0.0010510*		
year1998	0.074190	4.86	0.000	0.0771349	8.36	0.000	0.0421749	16.43	0.000
	0.015265			*0.0092270*			*0.0025668*		
year1999	0.037831	2.94	0.004	0.0385035	4.74	0.000	0.0283380	11.96	0.000
	0.012856			*0.0081228*			*0.0023688*		
year2000	0.032195	2.28	0.024	0.0346500	4.38	0.000	0.0142344	6.14	0.000
	0.014139			*0.0079155*			*0.0023199*		
year2001	0.024004	1.97	0.051	0.0257706	3.44	0.001	0.0016629	0.77	0.442
	0.012213			*0.0074890*			*0.0021612*		
Constant	1.005803	4.11	0.000	0.2732176	1.77	0.077	1.2969920	26.09	0.000
	0.244933			*0.1540730*			*0.0497177*		
R-sq (overall)	0.4381			0.3985			0.4736		
	F(12,179) = 103.45 (0.0000)			F(12,722) = 174.30 (0.0000)			F(12,4198) = 1282.64 (0.0000)		
H-*statistic*	**0.7527744**	17.52	0.000	**0.6029635**	28.29	0.000	**0.7137252**	82.85	0.000
	0.0429721			*0.0213100*			*0.0086142*		
Wald test for H=1	F(1,179) =33.10 (0.0000)			F(1,722) =347.13 (0.0000)			F(1,4198) =1104.41 (0.0000)		
Wald test for H=0	F(1,179) =306.87 (0.0000)			F(1, 722) =800.60 (0.0000)			F(1,4198) = 6864.79 (0.0000)		
Hausman test: Ho= RE vs FE :	chi2(12)=27.45 (0.0066)			chi2(12)=78.95 (0.000)			chi2(12)=420.29 (0.000)		

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Standard errors in italics. Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. Hausman test rejects the random effects (RE) vs fixed effects (FE) hypothesis at 1% level of significance. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

Fixed effects model with time dummies: Dependent variable: Organic Income/ Total Assets

	Large			***Medium-sized***			***Small***		
Variable	**Coefficient**	**t-statistic**	**Prob>t**	**Coefficient**	**t-statistic**	**Prob>t**	**Coefficient**	**t-statistic**	**Prob>t**
ln w_L	0.2356853**	7.26	0.000	0.1490530**	8.40	0.000	0.2697025**	38.24	0.000
	0.0324663			*0.0177383*			*0.0070528*		
ln w_F	0.4912553**	17.35	0.000	0.4505463**	26.99	0.000	0.4369523**	76.65	0.000
	0.0283151			*0.0166939*			*0.0057005*		
ln w_C	0.0033236	0.16	0.869	0.0325857**	3.92	0.000	0.0214066**	7.27	0.000
	0.0201521			*0.0083055*			*0.0029454*		
ln E/A	0.0484530	1.88	0.061	0.0187691	1.86	0.063	0.0027907	0.54	0.590
	0.0257191			*0.0100640*			*0.0051843*		
ln LLP/L	0.0053399	0.54	0.589	0.0100441*	2.36	0.019	0.0153129**	12.49	0.000
	0.0098572			*0.0042622*			*0.0012255*		
ln L/A	0.1235203**	3.01	0.003	0.1909227**	6.73	0.000	0.1219502**	14.53	0.000
	0.0410234			*0.0283582*			*0.0083952*		
ln D/CCTF	-0.0261394	-1.86	0.064	0.0048760	0.65	0.518	-0.0014686	-0.70	0.481
	0.0140482			*0.0075347*			*0.0020844*		
ln OI/A	-0.0222833*	-2.58	0.011	-0.0028923	-0.78	0.437	-0.0084896**	-7.78	0.000
	0.0086303			*0.0037208*			*0.0010910*		
year1998	0.0627281**	4.10	0.000	0.0682158**	6.79	0.000	0.0383347**	14.39	0.000
	0.0152844			*0.0100459*			*0.0026646*		
year1999	0.0391376**	3.04	0.003	0.0433961**	4.91	0.000	0.0364682**	14.83	0.000
	0.0128721			*0.0088438*			*0.0024590*		
year2000	0.0416677**	2.94	0.004	0.0431250**	5.00	0.000	0.0316929**	13.16	0.000
	0.0141571			*0.0086180*			*0.0024082*		
year2001	0.0227479	1.86	0.064	0.0289126**	3.55	0.000	0.0049882*	2.22	0.026
	0.0122281			*0.0081537*			*0.0022435*		
Constant	1.5771760**	6.43	0.000	0.8896286**	5.30	0.000	1.8505550**	35.86	0.000
	0.2452457			*0.1677480*			*0.0516110*		
R-sq (overall)	0.4678			0.3843			0.4863		
	F(12,179) = 87.00 (0.0000)			F(12,722) = 130.88 (0.0000)			F(12,4198) = 993.96 (0.0000)		
H-*statistic*	**0.7302643**	16.97	0.000	**0.6321851**	27.25	0.000	**0.7280614**	81.42	0.000
	0.0430269			*0.0232014*			*0.0089423*		
Wald test for H=1	F(1, 179) = 39.30 (0.0000)			F(1, 722) = 251.32 (0.0000)			F(1, 4198) = 924.79 (0.0000)		
Wald test for H=0	F(1, 179) = 288.06 (0.0000)			F(1, 722) = 742.44 (0.0000)			F(1, 4198) = 6628.85 (0.0000)		
Hausman test: Ho= RE vs FE :	chi2(12)=49.45 (0.0000)			chi2(12)=30.66 (0.0022)			chi2(12)=217.71 (0.0000)		

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Standard errors in italics. Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. Hausman test rejects the random effects (RE) vs fixed effects (FE) hypothesis at 1% level of significance. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

Fixed effects model with time dummies: Dependent variable: Total operating Income/ Total Assets

	Large			***Medium-sized***			***Small***		
Variable	**Coefficient**	**t-statistic**	**Prob>t**	**Coefficient**	**t-statistic**	**Prob>t**	**Coefficient**	**t-statistic**	**Prob>t**
ln w_L	0.6189125**	11.88	0.000	0.3951610**	11.10	0.000	0.4702832**	42.68	0.000
	0.0520895			*0.0356136*			*0.0110197*		
ln w_F	0.0267445	0.61	0.542	0.0909082**	2.81	0.005	0.0735346**	7.98	0.000
	0.0438215			*0.0323921*			*0.0092206*		
ln w_C	0.0061189	0.19	0.851	0.0599868**	3.74	0.000	0.0498122**	10.66	0.000
	0.0325903			*0.0160541*			*0.0046743*		
ln E/A	0.0093979	0.24	0.814	0.0208508	1.00	0.316	0.0158799	1.90	0.057
	0.0398491			*0.0207831*			*0.0083447*		
ln LLP/L	0.0250367	1.62	0.108	0.0449034**	5.62	0.000	0.0392857**	20.23	0.000
	0.0154971			*0.0079921*			*0.0019416*		
ln L/A	0.0404026	0.61	0.545	0.3835344**	7.36	0.000	0.1300867**	9.56	0.000
	0.0666272			*0.0520931*			*0.0136032*		
ln D/CCTF	-0.0924641**	-4.01	0.000	0.0112309	0.80	0.425	-0.0114457**	-3.58	0.000
	0.0230509			*0.0140791*			*0.0031930*		
year1998	0.0116209	0.49	0.627	0.0810954**	4.34	0.000	0.0667167**	16.02	0.000
	0.0238723			*0.0186670*			*0.0041653*		
year1999	0.0276540	1.36	0.177	0.0673235**	4.11	0.000	0.0523541**	13.77	0.000
	0.0203886			*0.0163920*			*0.0038032*		
year2000	0.0457168*	2.09	0.038	0.0382041*	2.37	0.018	0.0298296**	8.15	0.000
	0.0218574			*0.0160933*			*0.0036583*		
year2001	0.0277185	1.46	0.146	-0.0098601	-0.64	0.520	-0.0078136*	-2.22	0.027
	0.0189908			*0.0153216*			*0.0035218*		
Constant	3.9205720**	9.86	0.000	0.8655071**	2.72	0.007	2.4277210**	29.89	0.000
	0.3974459			*0.3177389*			*0.0812097*		
R-sq (overall)	0.8615			0.7056			0.6372		
	F(11,193)=24.75 (0.0000)			F(11,909)=32.34 (0.0000)			F(11,6543)=317.41 (0.0000)		
H-*statistic*	**0.6517758**	9.76	0.000	**0.5460559**	11.64	0.000	**0.593630**	42.64	0.000
	0.0667678			*0.0469056*			*0.013923*		
Wald test for H=1	F(1,193) =27.20 (0.0000)			F(1,909) =93.66 (0.0000)			F(1,6543) = 851.88 (0.0000)		
Wald test for H=0	F(1,193) = 95.29 (0.0000)			F(1,909) = 135.53 (0.0000)			F(1,6543) = 1817.89 (0.0000)		
Hausman test: Ho= RE vs FE :	chi2(11)=26.59 (0.0053)			chi2(11)=43.11 (0.0000)			chi2(11)=197.59 (0.0000)		

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Standard errors in italics. Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. Hausman test rejects the random effects (RE) vs fixed effects (FE) hypothesis at 1% level of significance. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

Fixed effects model with time dummies: Dependent variable: Interest Income/ Total Assets

	FRANCE			***GERMANY***			***ITALY***			***SPAIN***			***UK***		
Variable	**Coefficient**	**t-stat**	**Prob>t**	**Coefficient**	**t-stat**	**Prob>t**	**Coefficient**	**t-stat**	**Prob>t**	**Coefficient**	**t-stat**	**Prob>t**	**Coefficient**	**t-stat**	**Prob>**
ln w_L	0.12834**	5.68	0.000	0.12917**	15.71	0.000	0.26445**	13.27	0.000	0.27604**	8.04	0.000	0.01208	0.47	0.(
	0.02260			*0.00822*			*0.01992*			*0.03433*			*0.02583*		
ln w_F	0.47099**	35.58	0.000	0.55156**	62.21	0.000	0.39564**	24.68	0.000	0.57294**	17.97	0.000	0.64537**	23.31	0.(
	0.01324			*0.00887*			*0.01603*			*0.03189*			*0.02768*		
ln w_C	0.04949**	5.45	0.000	0.02102**	6.25	0.000	0.00602	0.86	0.388	0.01597	1.2	0.232	0.01075	0.88	0.3
	0.00908			*0.00336*			*0.00698*			*0.01333*			*0.01223*		
ln E/A	-0.00441	-0.33	0.739	-0.01230	-1.72	0.086	0.00571	0.49	0.622	-0.01425	-0.93	0.355	-0.00403	-0.22	0.8
	0.01320			*0.00717*			*0.01157*			*0.01537*			*0.01852*		
ln LLP/L	0.00699	1.64	0.102	0.01363**	12.22	0.000	0.01624**	3.69	0.000	0.01972**	3.16	0.002	-0.00097	-0.13	0.8
	0.00427			*0.00112*			*0.00440*			*0.00623*			*0.00749*		
ln L/A	0.37233**	11.55	0.000	0.09791**	9.93	0.000	0.10716**	5.44	0.000	0.14419**	3.34	0.001	0.25396**	5.51	0.(
	0.03222			*0.00986*			*0.01969*			*0.04319*			*0.04609*		
ln D/CCTF	-0.01437	-1.59	0.113	-0.00854**	-2.96	0.003	0.00113	0.29	0.772	0.00976	1.31	0.190	0.00497	0.67	0.5
	0.00905			*0.00289*			*0.00392*			*0.00743*			*0.00739*		
ln OI/A	-0.02277**	-5.76	0.000	-0.00534**	-5.48	0.000	-0.00785**	-2.63	0.009	0.00388	0.7	0.484	-0.01959*	-2.19	0.(
	0.00396			*0.00098*			*0.00298*			*0.00554*			*0.00896*		
year1998	0.08130**	7.61	0.000	0.02374**	9.58	0.000	0.11988**	10.94	0.000	0.03204	1.86	0.065	0.01826	0.85	0.3
	0.01068			*0.00248*			*0.01096*			*0.01726*			*0.02138*		
year1999	0.03410**	3.71	0.000	0.01573**	6.94	0.000	0.03797**	4.66	0.000	0.04615**	3.03	0.003	0.02438	1.45	0.
	0.00919			*0.00227*			*0.00815*			*0.01522*			*0.01681*		
year2000	0.03029**	3.34	0.001	-0.00086	-0.38	0.702	0.05858**	8.54	0.000	-0.00463	-0.41	0.683	0.01371	0.76	0.4
	0.00906			*0.00225*			*0.00686*			*0.01132*			*0.01806*		
year2001	0.01448	1.74	0.083	-0.01182**	-5.55	0.000	0.04490**	6.87	0.000	-0.00477	-0.4	0.687	-0.00671	-0.43	0.(
	0.00835			*0.00213*			*0.00654*			*0.01183*			*0.01548*		
constant	-0.08623	-0.49	0.624	1.12997**	19.31	0.000	1.74242**	12.01	0.000	1.59129**	5.65	0.000	-0.23814	-0.89	0.3
	0.17592			*0.05853*			*0.14509*			*0.28169*			*0.26660*		
R-sq (overall)	0.6412			0.2414			0.6306			0.3211			0.5384		
	F(12,473) =162.37 (0.0000)			F(12,2994) = 589.44 (0.0000)			F(12,640) = 375.19 (0.0000)			F(12,216) = 101.65 (0.0000)			F(12,176) = 140.85 (0.0000)		
H-*statistic*	**0.648823**	21.84	0.000	**0.7017488**	59.33	0.000	**0.6661192**	29.15	0.000	**0.8649499**	19.92	0.000	**0.6682**	20.5	0.(

	0.0297138	*0.0118269*	*0.0228534*	*0.043427*	*0.032603*
Wald test for H=1	F(1, 473) =139.68 (0.0000)	F(1,2994) =635.94 (0.0000)	F(1,640) =213.44 (0.0000)	F(1,216)=9.67 (0.0000)	F(1,176) =103.57 (0.0000)
Wald test for H=0	F(1, 473) =476.80 (0.0000)	F(1,2994) =3520.61(0.0000)	F(1,640) = 849.58 (0.0000)	F(1,216) =396.70 (0.0000)	F(1,176) =420.05 (0.0000)
Hausman test: Ho= RE vs FE	chi2(12)=58.16 (0.000)	chi2(12)=1530.99 (0.000)	chi2(12)=44.07 (0.000)	chi2(12)== -23.16 ^^	chi2(12)=55.54 (0.000)

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Standard errors in italics. Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. Hausman test rejects the random effects (RE) vs fixed effects (FE) hypothesis at 1% level of significance. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

^^ indicates that model fitted on these data fails to meet the asymptotic assumptions of the Hausman test

Fixed effects model with time dummies: Dependent variable: Organic Income/ Total Assets

	FRANCE			*GERMANY*			*ITALY*			*SPAIN*			*UK*		
Variable	**Coefficient**	**t-stat**	**Prob>t**	**Coefficient**	**t-stat**	**Prob>t**	**Coefficient**	**t-stat**	**Prob>t**	**Coefficient**	**t-stat**	**Prob>t**	**Coefficient**	**t-stat**	**Prob>t**
ln w_L	0.187808**	8.28	0.000	0.167169**	20.04	0.000	0.419522**	20.66	0.000	0.340701**	9.23	0.000	0.075184**	2.60	0.010
	0.022689			*0.008342*			*0.020304*			*0.036909*			*0.028939*		
ln w_F	0.416273**	31.33	0.000	0.476644**	52.99	0.000	0.305720**	18.71	0.000	0.486091**	14.18	0.000	0.566209**	18.25	0.000
	0.013288			*0.008996*			*0.016338*			*0.034284*			*0.031022*		
ln w_C	0.060730**	6.66	0.000	0.020381**	5.98	0.000	0.019457**	2.74	0.006	0.009057	0.63	0.528	0.009332	0.68	0.497
	0.009118			*0.003411*			*0.007112*			*0.014337*			*0.013703*		
ln E/A	-0.006494	-0.49	0.624	-0.011984	-1.65	0.099	0.004460	0.38	0.705	-0.021646	-1.31	0.192	-0.008544	-0.41	0.681
	0.013247			*0.007272*			*0.011787*			*0.016526*			*0.020754*		
ln LLP/L	0.004582	1.07	0.286	0.013852**	12.24	0.000	0.020359**	4.54	0.000	0.029075**	4.34	0.000	-0.001937	-0.23	0.818
	0.004285			*0.001132*			*0.004486*			*0.006699*			*0.008395*		
ln L/A	0.365680**	11.31	0.000	0.106011**	10.60	0.000	0.107912**	5.38	0.000	0.109537*	2.36	0.019	0.291268**	5.64	0.000
	0.032344			*0.010003*			*0.020069*			*0.046440*			*0.051650*		
ln D/CCTF	-0.015275	-1.68	0.093	-0.006089*	-2.08	0.038	0.001238	0.31	0.757	0.000077	0.01	0.992	0.008147	0.98	0.326
	0.009080			*0.002931*			*0.003991*			*0.007993*			*0.008277*		
ln OI/A	-0.020971**	-5.28	0.000	-0.005941**	-6.00	0.000	-0.012527**	-4.12	0.000	0.000006	0.00	0.999	-0.005434	-0.54	0.589
	0.003971			*0.000989*			*0.003038*			*0.005953*			*0.010037*		
year1998	0.039529**	3.69	0.000	0.019075**	7.59	0.000	0.104544**	9.36	0.000	0.043266*	2.33	0.021	0.027438	1.15	0.254
	0.010718			*0.002513*			*0.011165*			*0.018553*			*0.023954*		
year1999	0.015598	1.69	0.092	0.021185**	9.21	0.000	0.042571**	5.13	0.000	0.066266**	4.05	0.000	0.043754*	2.32	0.021
	0.009227			*0.002301*			*0.008301*			*0.016367*			*0.018837*		
year2000	0.027765**	3.05	0.002	0.014128**	6.18	0.000	0.074496**	10.66	0.000	0.021275	1.75	0.082	0.030065	1.49	0.139
	0.009095			*0.002287*			*0.006989*			*0.012168*			*0.020236*		
year2001	0.012280	1.47	0.143	-0.009259**	-4.29	0.000	0.043777**	6.57	0.000	-0.000578	-0.05	0.964	0.005706	0.33	0.743
	0.008378			*0.002160*			*0.006662*			*0.012718*			*0.017351*		
constant	0.433345*	2.45	0.014	1.456107**	24.52	0.000	2.599192**	17.58	0.000	2.324627**	7.68	0.000	0.191945	0.64	0.521
	0.176581			*0.059387*			*0.147859*			*0.302871*			*0.298743*		
R-sq (overall)	0.5057			0.253			0.6216			0.5499			0.4094		

	F(12,473) = 132.42 (0.0000)			F(12,2994) = 464.34 (0.0000)			F(12,640) = 299.92 (0.0000)			F(12,216) = 73.59 (0.0000)			F(12,176) = 102.01 (0.0000)		
H-*statistic*	**0.664811**	22.29	0.000	**0.664194**	55.35	0.000	**0.744698**	31.98	0.000	**0.835849**	17.9	0.000	**0.650726**	17.81	0.000
	0.0298256			*0.012*			*0.0232898*			*0.0466921*			*0.0365335*		
Wald test for H=1	F(1, 473) =126.30 (0.0000)			F(1,2994) =783.09 (0.0000)			F(1,640) =120.16 (0.0000)			F(1,216) =12.36 (0.0000)			F(1,176) =91.40 (0.0000)		
Wald test for H=0	F(1, 473) =496.84 (0.0000)			F(1,2994) =3063.56 (0.0000)			F(1,640) =1022.42 (0.0000)			F(1,216) =320.46 (0.0000)			F(1,176) =317.26 (0.0000)		
Hausman test: Ho= RE vs FE :	chi2(12)=35.50 (0.0004)			chi2(12)= 565.27 (0.000)			chi2(12)= 19.57 (0.0757)			chi2(12)= 10.19 (0.5997)			chi2(12)= 117.10 (0.000)		

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Standard errors in italics. Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. Hausman test rejects the random effects (RE) vs fixed effects (FE) hypothesis at 1% level of significance, for all countries except from Italy and Spain. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

Fixed effects model with time dummies: Dependent variable: Total operating Income/ Total Assets

	FRANCE			***GERMANY***			***ITALY***			***SPAIN***			***UK***		
Variable	**Coefficient**	**t-stat**	**Prob>t**	**Coefficient**	**t-stat**	**Prob>t**	**Coefficient**	**t-stat**	**Prob>t**	**Coefficient**	**t-stat**	**Prob>t**	**Coefficient**	**t-stat**	**P**
ln w_L	0.570723**	20.94	0.000	0.485513**	31.98	0.000	0.491147**	17.57	0.000	0.404760**	7.01	0.000	0.338131**	5.68	
	0.027259			*0.015183*			*0.027953*			*0.057705*			*0.059500*		
ln w_F	0.011975	0.66	0.507	0.048426**	2.94	0.003	0.040257	1.77	0.076	0.049249	0.87	0.387	0.346982**	5.60	
	0.018024			*0.016485*			*0.022690*			*0.056834*			*0.061913*		
ln w_C	0.125589**	11.30	0.000	0.050919**	8.04	0.000	0.035206**	3.20	0.001	0.032852	1.46	0.145	0.011838	0.42	
	0.011111			*0.006337*			*0.010987*			*0.022473*			*0.028059*		
ln E/A	-0.006718	-0.46	0.646	-0.009679	-0.74	0.457	0.028441	1.30	0.193	-0.050093	-1.88	0.061	-0.032044	-0.73	
	0.014640			*0.013021*			*0.021843*			*0.026603*			*0.044142*		
ln LLP/L	0.020276**	3.70	0.000	0.039925**	20.03	0.000	0.034092**	4.95	0.000	0.032226**	2.84	0.005	0.059249**	3.43	
	0.005479			*0.001994*			*0.006883*			*0.011337*			*0.017298*		
ln L/A	0.132341**	3.40	0.001	0.185844**	9.99	0.000	0.131389**	3.99	0.000	0.148450	1.97	0.049	0.667814**	7.88	
	0.038887			*0.018612*			*0.032966*			*0.075193*			*0.084709*		
ln D/CCTF	0.006275	0.56	0.576	-0.020757**	-3.64	0.000	-0.013199*	-2.22	0.027	-0.032438*	-2.58	0.010	0.032956*	2.12	
	0.011224			*0.005695*			*0.005942*			*0.012586*			*0.015542*		
year1998	-0.022160	-1.65	0.099	0.050049**	11.12	0.000	0.160016**	10.20	0.000	0.139138**	4.97	0.000	-0.118727*	-2.52	
	0.013393			*0.004500*			*0.015682*			*0.027970*			*0.047158*		
year1999	-0.026191*	-2.24	0.025	0.059276**	14.37	0.000	0.043183**	3.67	0.000	0.125956**	4.61	0.000	-0.058351	-1.55	
	0.011668			*0.004126*			*0.011775*			*0.027341*			*0.037669*		
year2000	-0.007588	-0.66	0.510	0.007589	1.91	0.056	0.096227**	9.34	0.000	0.054912**	2.88	0.004	-0.062143	-1.50	
	0.011521			*0.003974*			*0.010307*			*0.019050*			*0.041378*		
year2001	-0.017099	-1.59	0.112	-0.024275**	-6.32	0.000	0.040325**	4.06	0.000	0.056872**	2.96	0.003	-0.065664	-1.88	
	0.010736			*0.003842*			*0.009929*			*0.019184*			*0.034988*		
constant	2.595368**	12.82	0.000	2.308461**	20.54	0.000	2.613163**	12.07	0.000	2.383077**	4.93	0.000	-0.446997	-0.85	
	0.202425			*0.112413*			*0.216573*			*0.483755*			*0.527400*		
R-sq (overall)	0.8156			0.7674			0.6211			0.6334			0.3965		
	F(11,592)=50.97 (0.0000)			F(11,4587)=204.06 (0.0000)			F(11,1237)=96.82 (0.0000)			F(11,271)=20.74 (0.0000)			F(11,230)=24.57 (0.0000)		

H-*statistic*	**0.708287**	19.44	0.000	**0.584858**	27.93	0.000	**0.566610**	16.53	0.000	**0.486860**	7.08	0.000	**0.696951**	10.57	
	0.036438			*0.0209426*			*0.0342816*			*0.068767*			*0.0659291*		
Wald test for H=1	F(1,592) =64.09 (0.0000)			F(1,4587) =392.94 (0.0000)			F(1,1237) =159.82 (0.0000)			F(1, 271)=55.68 (0.0000)			F(1, 230) =21.13 (0.0000)		
Wald test for H=0	F(1, 592) =377.84 (0.0000)			F(1,4587) = 779.90 (0.0000)			F(1,1237) =273.18 (0.0000)			F(1, 271)=50.12 (0.0000)			F(1,230) =111.75 (0.0000)		
Hausman test: Ho= RE vs FE :	chi2(11)=66.92 (0.000)			chi2(11)=246.15 (0.000)			chi2(11)=23.66 (0.0143)			chi2(11)=14.59 (0.2023)			chi2(11)=26.21 (0.0060)		

where: w_L=price of labour, w_F=price of funds, w_C=price of capital, E/A=equity/total assets, LLP/L=loss loan provisions/loans, L/A=loans/ total assets, D/CSTF= bank deposits/ customer & short-term funding, OI/A=other income/total assets. Standard errors in italics. Both the hypothesis for monopoly (H=0) and perfect competition (H=1) are rejected at 1% level of significance. Hausman test rejects the random effects (RE) vs fixed effects (FE) hypothesis at 1% level of significance, for all countries except from Italy and Spain. p-values in parentheses.

**Significant at the 1% level of significance.

*Significant at the 5% level of significance.

Annex 4: Equilibrium Tests

1998-2002	ROA			ROE		
	H-statistic	St. Err.	Wald test for H=0	H-statistic	St. Err.	Wald test for H=0
EU-15	-0.052057	0.046257	chi2(1) = 1.27 *(0.2604)*	-0.056469	0.048194	chi2(1)=1.37 *(0.2413)*
new EU countries	0.200728	0.193855	chi2(1) =1.07 *(0.3005)*	-0.058362	0.257305	chi2(1)=0.05 *(0.8206)*
France	-0.156045	0.127114	chi2(1)=1.51 *(0.2196)*	-0.140248	0.128196	chi2(1)=1.20 *(0.2740)*
Germany	-0.018826	0.085501	chi2(1) = 0.05 *(0.8257)*	-0.006325	0.088928	chi2(1) =0.01 *(0.9433)*
Italy	0.126044	0.122870	chi2(1) =1.05 *(0.3050)*	0.172332	0.122953	chi2(1) =1.96 *(0.1610)*
Spain	-0.126646	0.220013	chi2(1) =0.33 *(0.5649)*	-0.166290	0.219919	chi2(1) =0.57 *(0.4496)*
UK	0.008632	0.127137	chi2(1) =0.00 *(0.9459)*	-0.012141	0.129379	chi2(1) =0.01 *(0.9252)*
Large banks	-0.120647	0.206624	chi2(1) =0.34 *(0.5593)*	0.041330	0.372770	chi2(1) = 0.01 *(0.9117)*
Medium-sized banks	-0.243125**	0.077485	chi2(1) = 9.85 *(0.0017)*	-0.279303**	0.081048	chi2(1) =11.88 *(0.0006)*
Small banks	0.001748	0.056242	chi2(1) =0.00 *(09752)*	0.000401	0.057087	chi2(1) = 0.00 *(0.9944)*

Linear regressions on equation (1) with heteroscedastic panels corrected standard errors and time dummies. As dependent variables we use alternatively ROA and ROE. H<0 is disequilibrium while H=0 is equilibrium. Equilibrium is confirmed for all banking markets under investigation, except from medium-sized banks, where H is significantly different from zero at 1% level of significance. p-values in parentheses.

**H is significantly different from zero at 1%.

1998-2002	ROA			ROE		
	H-statistic	St. Err.	Wald test for H=0	H-statistic	St. Err.	Wald test for H=0
EU-15	0.065224	0.079028	F(1,4752)=0.68 (0.4092)	-0.012541	0.083215	F(1,4758) =0.02 (0.8802)
new EU countries	0.346312	0.497539	F(1,164) =0.48 (0.4874)	0.165383	0.601637	F(1,165) =0.08 (0.7837)
France	0.026762	0.213623	F(1,432) =0.02 (0.9004)	0.059586	0.234660	F(1,433) = 0.06 (0.7997)
Germany	-0.172358	0.158721	F(1,2777) =1.18 (0.2776)	-0.209222	0.166112	F(1,2780) =1.59 (0.2079)
Italy	0.657017**	0.239023	F(1,607) =7.56 (0.0062)	0.712389*	0.246463	F(1, 608) =8.35 (0.040)
Spain	0.050583	0.316225	F(1,207) =0.03 (0.8731)	0.031216	0.301644	F(1,207) = 0.01 (0.9177)
UK	0.174268	0.238722	F(1,144) = 0.53 (0.4666)	0.090134	0.249002	F(1,144) = 0.13 (0.7179)
Large banks	0.233588	0.377837	F(1, 162) =0.38 (0.5373)	-0.378856	0.658033	F(1, 165) = 0.33 (0.5656)
Medium-sized banks	0.192511	0.148667	F(1,667) = 1.68 (0.1958)	0.076527	0.164585	F(1, 669) = 0.22 (0.6421)
Small banks	-0.004295	0.095972	F(1,3899) = 0.00 (0.9643)	-0.033211	0.097294	F(1,3900) = 0.12 (0.7329)

Least square regressions on equation (1) with fixed efffects and time dummies. As dependent variables we use alternatively ROA and ROE. H<0 is disequilibrium while H=0 is equilibrium. Equilibrium is confirmed for all banking markets under investigation, except from the case of Italy, where H is significantly different from zero at 1% level of significance for ROA and at 5% level for ROE. p-values in parentheses.

** H is significantly different from zero at 1%.

* H is significantly different from zero at 5%.