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The Impact of Banking Market Structure on Bank's Profitability: Evidence from the OECD Economic Countries

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Περίληψη

Επηρεάζει η δομή της αγοράς την οικονομική απόδοση της τράπεζας; Για να απαντήσω σε αυτήν την ερώτηση, εξετάζω 7,035 εμπορικές, αποταμιευτιές και συνεταιριστικές τράπεζες από 35 χώρες μέλη του οργανισμού του ΟΟΣΑ από το έτος 2002 έως το 2015. Χρησιμοποιώ ένα δυναμικό πάνελ για να εκτιμήσω τον αντίκτυπο της δομής της αγοράς, όπως οι δείκτες HHI, CR5 και Lerner σχετικά με την κερδοφορία της Τράπεζας, όπως το ROA. Λαμβάνοντας υπόψη τόσο την παρατηρούμενη (control variables) όσο και την μη παρατηρημένη (fixed effects) ετερογένεια, βρίσκω στοιχεία για μη γραμμικότητες στη δομή της αγοράς. Πιο συγκεκριμένα, η συγκέντρωση έως ένα συγκεκριμένο όριο μειώνει την κερδοφορία και πάνω από αυτό το όριο αυξάνει την κερδοφορία. Επιπλέον, διερευνώ τους όρους αλληλεπίδρασης μεταξύ της δομής της αγοράς και των χαρακτηριστικών της τράπεζας που μπορούν να βελτιώσουν ή να μειώσουν την κερδοφορία της τράπεζας

Summary

Does market structure affect bank's performance? To answer this question, I examine 7,035 commercial, saving and co-operative banks from 35 member countries of OECD organization during the year 2002 until 2015. I employ a panel analysis with cross-sectional regressions to estimate the impact of market structure, for instance HHI, CR5 and Lerner index on Bank's profitability, for instance ROA. Accounting for both observed (control variables) and unobserved (fixed effects) heterogeneity, I find evidence for nonlinearities in the market structure. More precisely, concentration up to a specific threshold reduces the profitability and above that threshold increases the profitability. In addition, I investigate interaction terms between market structure and bank's characteristics that can enhance or mitigate bank's profitability.

1) Introduction

The relationship between market structure and banks profitability has a very controversial role and there have been many opinions about it. First, the relationship between market structure and performance has been studied extensively for American banking, European banking and other European organizations. In my thesis, I will try to focus on the impact of the Organization for Economic Co-operation and Development (hence after OECD) countries on co-operative, commercial and saving banks in order to have a symmetric data set in terms of countries similarities.

The OECD organization contains 35 member countries namely, Austria, Belgium, Canada, Denmark, France, West Germany, Greece, Iceland, Ireland, Italy, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States. More precisely, OECD countries includes the worlds most advanced economies with main target to create an organization dedicated to economic development. Therefore, in the OECD countries, banks are forced to generate new products and seek new customers. This strategy reflects the continued diversification across geographical areas and business lines (Pasiouras and Kosmidou 2006). Banks with cross-border shareholdings are on average larger, more profitable and based in countries with a more highly developed banking market (Focarelli and Pozzolo 2001). Therefore, many banks have been intrinsically forced to increase in size in order to compete in the enlarged European market and the banking industry experienced an unprecedented level of consolidation through mergers and acquisitions (Pasiouras and Kosmidou 2006).

Concerning the former, Berger (2000) and Goddard, Molyneux and Wilson (2004) suggest that information opacity, networking, and relationship lending, all of which impede competition, might characterize even developed banking markets. These elements cause persistence in the cost structure, profitability, and market power of banks. Therefore, all these changes in the bank business sector have affected considerable the impact on their performance. Adequate earnings are required in order for banks to maintain solvency and prosper in a suitable environment (Golin 2001). Therefore, correlations between market concentration and profitability could be estimated by the 'structure performance hypothesis' or 'efficient structure hypothesis'. These are the two competing hypotheses in the structure conduct performance (SCP) paradigm. Berger and Hannan (1989) used price information collected by the Federal Reserve System on banking institutions to examined price-concentration relationships instead of the profit concentration relationship in order to eliminate the efficient structure hypothesis as an alternative explanation of the results. The results of this analysis support the structure performance hypothesis. In this thesis, I use the structure performance hypothesis in order to assert the relationship between the degree of market structure and the degree of performance among banks in the OECD economic countries.

The aim of my dissertation is to extent earlier work on the determinants of profitability of banks in the OECD economic countries and examine to what extent the performance of commercial, savings and co-operative banks in OECD countries is influenced. These permit

comparisons between the present results and those of the previous literature on the determinants of bank performance.

Fitch Connect has been used to comprise the bank-level data. This data base provides an innovative, robust and comprehensive credit analytics platform and an international data set of balance sheet items on individual banks, where all the main information on assets, liabilities and revenues is reported according to a common, comparable standard. The rest of my thesis is organized as follow. Section 2 reviews the theoretical and empirical relationship between market structure and performance literature. Section 3 describes the specification of the bank market structure and performances equation, and discusses the relationship between the present model and specifications used elsewhere in the literature. Section 4 describes the OECD banking sample and present the estimation results. Section 5 concludes.

2) Literature Review

In the literature, many studies find a positive and statistical relationship between profitability and measures of market structure (concentration or market share). The link between market concentration and bank performances received considerable attention especially during the late 80's after a number of deregulatory changes that took place in the banking industry. Most studies have simply postulated a relationship between one or more performance measures (financial ratios) and the degree of competition within a geographic market, certain economic characteristics of the market, and, in some cases, hank costs and/or portfolio mix. (Duane, Graddy and Kyle 1979). More precisely, Berger (1995) finds that there are two possible explanations of that positive relationship.

The first explanation is that by adding the X-efficiency variable of the efficient-structure hypothesis (ESH) was resulted to the fact that firms with superior management and technology have lower costs and therefore higher profits. These firms are also gain large market shares resulting in high levels of concentration. The second explanation of Berger (1995) is that by adding the efficient-structure hypothesis (ESH) variable, which is the bank-specific scale economies measure, firms have essentially equal good management and technology but more efficient scales than others. Therefore, these firms have lower costs and higher profits, large market shares and high levels of concentration. Some researchers argue that increased concentration is not the result of managerial efficiency, but rather reflects increasing deviations from competitive market structure. Therefore, concentration should positively relate to bank profitability (Bourke,1989; and Molyneux and Thornton, 1992).

It is well known that competition and market power have opposite results. In the recent literature on the SCP hypothesis, alternative indicators of the degree of competition in banking are provided by the estimation of the Lerner and the Rosse-Panzar indices, which are usually

referred to as non-structural measures of competition (Athanasoglou, Brissimis and Delis 2005). Market concentration measures, such as the Herfindahl-Hirschman index, have been considered in the past as measures of competition (Cetorelli and Strahan 2006). Other studies argue that there is no need to include efficient-structure hypothesis (ESH) variable (Gale and Branch 1982; Smirlock, Gilligan and Marshall 1984; Stevens 1990), so that market share may pick up correlation with excluded scale efficiencies.

On the other hand, other papers like Lawrence, Rai (1995) do not find a positive and significant relationship between concentration and profitability. Lawrence and Rai (1995) use the test developed in Berger and Hannan (1993) to examine the relationship between performance and market structure for 11 European countries. A substantial body of early research was SCP based, and sought to resolve the "collusion-versus-efficiency" debate on empirical criteria (Rhoades 1985; Smirlock 1985; Evanoff and Fortier 1988; Berger and Hannan 1989, Bourke 1989, Jackson 1992). Lawrence, Rai. (1995) support the ESH version of the efficient-structure hypothesis for the banks located in low concentration countries.

Berger (1995) advocates two hypotheses from the relationship between market structure and banks performance. Mirzaei, Moore, Liu (2013) analyzes these two hypotheses from such a relationship. The first hypothesis is the structure-conduct-performance (SCP) paradigm, where, in highly concentrated markets, firms set prices that are less favorable to consumers resulting to imperfect competitive markets. In principle, SCP paradigm is used as an analytical framework to make relations amongst market structure, market conduct and market performance (Edwards, Allen and Shaik 2006). The structure performance hypothesis states that the degree of market concentration is inversely related to the degree of competition. This is because market concentration encourages firms to collude resulting to an anti-competitive behavior and excess profits. The second hypothesis is the relative-market-power (RMP) paradigm, where, firms increase market share and exercise their market power in pricing products. Therefore, firms earn higher profits. More precisely, RMP hypothesis suggests that only firms with large market shares and well differentiated products are able to exercise market power and earn non-competitive profits (Berger, 1995). Thus, the difference between SCP and RMP is that the latter need not occur in concentrated markets (Goldberg and Rai 1995). From the above discussion we can conclude the following hypotheses:

Hypothesis 1: Higher concentration will reduce profitability

Hypothesis 2: Higher market power will reduce profitability

3) Model specification and Data

The empirical model that I will use to study the relationship between market structure and profitability is of the following form:

$$TR_{itc} = \delta_0 + \delta_1 BS_{itc} + \delta_2 B_{itc} + \delta_3 X_{itc} + \varepsilon_{itc} \quad (1)$$

In equation (1), the bank profitability (Return On Assets), labelled TR (Total Revenue), of bank i at year t country c is regressed on the banking structure (BS) at the bank level such as a three firm deposits concentration ratio, a vector of bank characteristics (B) like deposits, equity, size and total volume of loans and a vector of variables observed at the country level (X) like the net inflow of foreign direct investment (FDI) and the share of the manufacturing sector relative to GDP. The final data set includes bank-level data for 35 member countries during the period 2002-2015. The rest of the section discusses the measures of bank profitability, measures of concentration, measures of efficiency, control variables used in my study and measures of market power. Endogeneity can arise from reverse causality or from the omitted variable bias. Reverse causality could emerge from the structure of the banking market to allow for high markups that can generate higher profits (Athanasoglou, Brissimis and Delis 2008). To alleviate these concerns all the right hand side variables are lagged once and I use fixed effects at the bank, year, country and specialization level.

In Table 1, I provide definitions for the variables used to estimate equation (1) and in Table 2 I report summary statistics for these variables. Table 3, presents the ccorrelation matrix. In Table 4, I present the number of Banks in the sample of the OECD countries. It shows that during the years 2005 and 2007 the number of banks was much higher compare to the other years. This is because in 2005 and 2007. Moreover, the data indicate that there was a gradual increase in the number of Banks from 2002 until 2007. However, in 2009 the number of Banks started to decline. This happens due to the financial crisis 2007-2008, where many banks collapse because they lose money on mortgage defaults, interbank lending to freeze, and credit to consumers and businesses to dry up. More precisely, banks were able to create too much money, too quickly and used it to push up houses prices and speculate on financial markets. Furthermore, as it can be seen from the Table 4 from the year 2011 until 2015 there was a sharp decline in the number of banks where the lowest number of banks was in 2015 at 3.304 thousand Banks. A sustained economic downturn invariably leads for a consolidation of systemic institutions. Therefore banks whose business models are no longer viable had forced to rearrange businesses and move towards consolidation. According to the paper of Pasiouras and Kosmidou (2006) banks have been forced to increase in size in order to compete in the enlarged European market and the banking industry experienced an unprecedented level of consolidation through mergers and acquisitions. However, consolidation should not be seen from the sole perspective of creating larger sized banks. While there is an emerging consensus on creating a few large size banks, it is more important to ensure that this is a well calibrated process. Finally, the consolidation of banks has led to an increase in the market share of the largest banks, and at the same time, the price of credit has declined (

Jayaratne and Strahan, 1998). These are the main results and from the Table 4.

In Table 5, I report the averages values of the HHI by country and year. As is common in the literature, I obtain these market-level measures by taking the mean of the HHI per country and year. The HHI ranges from 0.002 to almost 1. HHI suggest that Ireland and New Zealand are the most concentrated countries in 2002 while Belgium Denmark, France, Germany, Japan and United Stated are the least for the same year. In total, I observe that Finland, France, Italy and the United States have the lost concentration throughout the sample.

In Table 6, I report the average values of the Lerner index by country and year. I generate these market values by taking the weighted mean of the individual measures, with market shares as the weights. The weighted mean value is 0.258. The Lerner index suggest that tat Belgium (0.129) and Switzerland (0.156) have the most competitive banking systems, while Estonia (0.401) and Slovak republic (0.318) the least competitive ones. The result in Tables 5 and 6 indicate that the degree of competition varies considerably across countries and years.

3.1 Determinants of bank profitability

There is a variety of indicators that can measure the Bank's performance. In my view, the profitability variables are represented by tow alternative measures which are the profits to equity ratio (Return on Equity) and the ratio of profits to assets (Return on Assets). Therefore, in order to elaborate the level of profitability and market structure, I measure return on assets for X selected banks located in 35 member countries of the OECD organization. In principle, Return on Assets (ROA) =Net Income/Total Assets which implies how profitable an institution is relative to its total assets. In detail, Return on Assets reflects the ability of a bank's management to generate profits from the bank's assets. Therefore, according to (Guru et.al, 1999), ROA is the ratio of net income to total assets which measures how profitable and efficient a banks' management is. Table 10 shows the sensitivity test of return on assets (ROA) during the period 2002-2015. Furthermore, in my sample I use the natural logarithm of bank's income from loans (Ln(il)) as the depended variable. Return on Equity (ROE=Net Income/Shareholder Equity) is probably the most popular measure of profitability which indicates the return to shareholder on their equity.

Differently phrazed, it is a measure of the amount of net income taxes earned for

each dollar of equity capital contributed by the shareholders of the bank (Saunders & Marcia, 2011). Often, banks with higher equity (lower leverage) result to higher ROA and lower ROE. Therefore, a high percentage of leverage means that that the institution has more debt than equity on their balance sheet. Finally, last measure of profitability is Net Interest Margin as a proxy for the pricing ability of banks (NIM=Net Interest Margin/Total Assets). By this I mean that NIM could capture the pricing ability of banks for both deposit rates and loan rates leading to a full picture. This is because banks could operate competitively with one rate and behave non-competitively with the other. It is simply It is usually expressed as a percentage of what the financial institution earns on loans in a time period and other assets minus the interest paid on borrowed funds divided by the average amount of the assets on which it earned income in that time period (the average earning assets). Finally, in my research I mainly use the Return on Assets (ROA) as the measure of bank profitability because it is heavily used in the literature and also variation at the bank level.

3.2 Measure of concentration

According to Athanasoglou, Brissimis and Delis (2008), the measurement of market concentration has received much attention in the economics literature since the importance of the competition was first recognized in the 1930s. Concentration is the proportion of an industry's total assets controlled by its largest firms (Pasiouras and Kosmidou 2006). According to the structure-conduct performance (SCP) hypothesis, banks in highly concentrated markets tend to collude and therefore earn monopoly profits (Gilbert, 1984; Molyneux 1996).

I measure concentration using the "Herfindahl-Hirschman (H-H) index". According to the literature tow are the most widely used measures of concentration, the five-bank concentration ratio and the Herfindahl-Hirschman (H-H) index. HHI is the most popular measure of concentration and often regarded as a benchmark for the assessment of other concentration indices (Claessens and Laeven, 2004; Delis, Kokas and Ongena, 2016). The HHI is defined as the sum of squared market shares of deposits of all the banks in each country. Herfindahl-Hirschman (H-H) index has the following form: HHI =$\sum_{i=1}^{N}$ s, where "i" is the market share of bank i. In order to calculate the bank level HHI then I will use the following formula: HHI=$\frac{si}{\sum_{i=1}^{N} si}$. Second measure of concentration and also widely used is the three-bank concentration ratio (CR3). CR=$\sum_{i=1}^{N}$ s · w, where si is the market share of bank i, wi is the weight attached to market share and n is the number of banks in the

market. In principle, concentration ratio is the percentage of market share owned by the largest *m* firms in an industry, CRm, where *m* is a specified number of firms sometimes a larger or smaller number analysis, (Edwards, Allen and Shaik, 2006). The Concentration ratio is calculated at the country level and is more suitable for cross-country analysis. Usually, researches calculate the concentration ratio for the top 3 or 5 or 7 banks in the economy (Casu, Girardone and Molyneux ; 2015). In my study I used the 5-bank concentration ratio. The concentration ratio can be expressed as: $CR_{\mathrm{m}} = s_1 + s_2 + s_3 + \cdots + s_m$, where s_i= market share of the ith firm.

3.3 Measures of efficiency

In the efficiency/productivity literature there is an increase on the use of efficiency as a measure to examine the economies of scale, economies of scope and both economies of scale and scope, accounting for risk and policy implications. In my view, first measure of efficiency is the X-efficiency variable (X-EFF) which provides a measure of how effectively banks are using their inputs to produce a given level of output. The basic model that many researchers used like Mester (1993), Cebenoyan (1993) and. Goldberg, Rai (1995) is $\ln tc = f(yi, pi) + \varepsilon i$. The above model assumes that total cost deviates from the efficient cost frontier by a random noise, vi, and an inefficiency component, ui (Goldberg, Rai 1995). Therefore $\varepsilon i = ui + vi$ and yi is the output i of each bank, pi is the cost or price of input i, vi is statistical noise distributed normal (0,σ_2), and ui is one-sided inefficiency measure. Second measure of efficiency is the Scale efficiency (SCALE). Scale efficiency shows whether banks with similar production and management technology are operating at optimal economies of scale (Goldberg, Rai (1995)). In principal if SCALE1< 1 then banks are operating below the optimal scale levels and have lower costs by increasing output. If SCALE > 1 then banks are required to downsize in order to achieve the optimal input combinations. In conclusion, both X-efficiency variable (X-EFF) and Scale efficiency (SCALE) are the most important measures of efficiency. As it can be observe from the literature, efficiency affect in plenty ways the relationship between market structure and bank profitability. In my study I do not include the measures of direct efficiency because I use the SCP approach and indirectly proxy for the market structure.

3.4 Control Variables

As in many other researches, there have been several control variables that are drawn from the literature on the determinants of bank competition (Delis, Kokas and Ongena et al. 2015). Therefore the Bank Characteristics indicated as B_{itc} in equation (1) that includes total loans, equity and the natural logarithm of the off-balance sheet items. Furthermore, I present the Country characteristic as X_{itc} in equation (1). The country characteristics include the ratio of the number of foreign banks over the number of all banks, the sum of gross minus the value of intermediate inputs used in the production of manufacturing (%) and finally the real GDP.

Equity: Most of the academic papers present capital as a buffer against unexpected monetary and macroeconomic shocks (Calomiris and Hubbard 1995). The ratio of equity to total assets is employed as a measure of capital strength (Mirzaei, Moore and Liu 2013). In principle, all banks in my sample are subject to the Basel II capital adequacy regulations where capitalization is seen as the main source to cover loan losses. More precisely, capital is a resource available to the bank to protect itself against potential losses and to finance acquisition or expansion. Therefore, banks should have sufficient resources to bear losses incurred from bad loans or from other activities. This is very important due to the fact that banks can control the financial stability of a country, and consequently, the whole economy of a country.

Total Loans: Total loans is defined as all loans, claims and advances made to commercial, consumer and government borrowers including leases and mortgages, less reserves for credit losses and unearned income (Goldberg and Rai 1995).

Off-balance sheet items: The off-balance-sheet activities to total assets ratio is specified in the model. This variable is relatively recent in being recognized for its importance in affecting bank performance. The off-balance sheet items are produced using essentially the same inputs with the single-output model of the bank and, thus, the single-output model may be missing some important information (Delis, Kokas and Ongena 2015).

Foreign ownership>40: An institution is defined as a foreign bank if at least 50% of the bank's shares are held in foreign hands (Mirzaei, Moore and Liu (2013)). The number of consecutive years since when the foreign ownership variable reached a value of 40% or higher in a specific country (zero otherwise) (Delis, Kokas and Ongena 2015).

Manufacturing: The manufacturing value added as a percentage of the GDP. I include the manufacturing variable in order to control for banking lending intensity to countries with different level of manufacturing.

Size: The size variable which is the log of total assets (ln (Total Assets)), controls for cost differences related to bank size and for the greater ability of larger banks to diversify. Moreover, the bank size captures the effect of scale efficiency.

Real GDP: In principle, Real Gross Domestic Product (Real GDP) is

a macroeconomic measure of the value of economic output adjusted for price changes. More precisely, Real GDP is a measure of economic output that accounts for the effects of inflation or deflation.

3.5 Measures of Market power

The measurement of market power has received much attention in the economics literature since the importance of imperfectly competitive markets was first recognized in the 1930s. (Delis, Kokas and Ongena 2015). As I discussed later, a related hypothesis of the traditional SCP hypothesis is the relative market power hypothesis (RMP). The RMP hypothesis states that firms with large market shares are able to exercise market power to earn higher profits (Goldberga and Rai 1995). However, there is also some support for the SCP view that market power is a determinant of firm-level performance (Goddard, Molyneux and Wilson 2004). Moreover, is quite interesting that other researchers suggest that market power gained through concentration increases risk through the setting of higher interest rates. However, there is a large literature that banks rationally choose more risky portfolios when confronted with increase competition (Mirzaei, Moore and Liu, 2013) .The Lerner Index (1934) is the only measurable market power indicator, besides market share, that varies at the bank level. The Lerner index remains a very popular and credible measure of market power and competition because of its simplicity and transparency.

More precisely, Lerner Index is defined as $LI_{itc} = \frac{P_{itc} - MC_{itc}}{P_{itc}}$, where P and MC are the price of bank output at time t and the marginal cost of the production of the output at time t respectively. In principle Lerner Index ranges between zero and one, with zero (LI_{itc}=O) implying to perfect competition and larger values reflecting more market power and less competition. Lerner Index can also be negative (P<MC) which is not suitable in the long run. The index has also often been used as a measure of competition. Although the link between market power and competition might seem obvious, it has been shown that the Lerner index does not always point in the expected direction when competitive conditions change (Stiglitz 1989, Boone 2008). Moreover, Lerner Index captures both the impact of pricing power on the asset side of the banks' balance sheet and the elements associated with the cost efficiency on their liability side. Marginal cost is one of the most important and necessary variables to compute Lerner Index (MC (Q) = $\frac{dC}{dQ}$).

However, in most empirical data sets marginal cost is unavailable or limited therefore it can be estimated by using econometric methods. A popular approach has been to estimate a translog cost function and take its derivative to obtain the marginal cost (Delis, Kokas and Ongena 2015). Therefore, in my research I estimated marginal cost with OLS and a translog function from Thorsten Beck website.

3.6 Foreign Bank Ownership

In principle, an institution is defined as a foreign bank if at least 50% of the bank's shares are held in foreign hands (Mirzaei, Moore, Liu (2013)). In my research, in order to pursue uniformity between domestic and foreign owned banks, I maintain "more than 40%" share ownership to define foreign ownership and use this information to construct the foreign-owned dummy variable. This variable identifies the direct effect of foreign ownership on the market power of individual banks. The relationship between bank profitability and ownership exists because of the spillover effects from the superior performance of privately-owned banks compared with publicly-owned banks, which do not always aim at profit maximization (Panayiotis, Sophocles and Matthaios, 2005).

Spillover effect is whether a banking system with a higher foreign bank presence in general induces changes in individual bank market power (Panayiotis, Sophocles, Matthaios 2005). Finally, foreign bank entry can stimulate competition in domestic markets in general and put downward pressure on prices (Levine 1996, Beck, Ioannidou, and Schafer 2012). This has the result of foreign bank takes over an existing domestic bank (Panayiotis, Sophocles and Matthaios 2005).

4) Empirical results

4.1 Sample and estimating Procedure

The sample for this study was drawn from the population of cooperative, commercial and saving banks in the OECD economic countries for the time period 2002-2015. The models are estimated using OLS analysis. In my research, I use panel data due to the fact that panel data allows you to control for variables you cannot observe or measure. With panel data, I include variables at different levels of analysis suitable for multilevel models. I use Fixed Effect because I analyze the impact of Bank's market structure that varies over time. Furthermore, as it can be observed in Table 1 I provide detailed definitions for the variables used to estimate equation (1). More precisely, I use the ROA as the dependent variables. I select the Hirschman-Herfindahl Index (HHI) and Concentration Ratio (CR5) (five-bank concentration ratio) as the measures of banking

structure. Lerner Index as the measure of market power and competition. Total Loans, Equity, and OBSI size as measures of Bank Characteristics and finally Foreign Ownership, Manufacturing and Real GDP as Country Characteristics. The natural logarithm of bank's income from loans is an alternative variable (proxy) for profitability so that if I change the variable of profitability my results are not driven from the data but from the economic relationship (we call it robustness).

4.2 Result analysis

In Table 7, I report the baseline results from the estimation of the basic equation. The error term obtained from the basic equation is likely to be serially correlated due to the fact that the dependent variable is observed at the bank-year while some of the explanatory variables are observed at the country level. To this end I cluster the standard errors by country. The specifications include different levels of fixed effects The adjusted R-squared suggest that the inclusion of Bank and Year Fixed effect represents 41.1% of the cross-sectional heterogeneity.

In column I, I use an OLS approach and find that the banking system concentration enters negatively (-0.249) and statistically significant. An increase in HHI by 10% will reduce the ROA by 2.49%. Considering that the standard deviation of HHI is 10.8% and the trend on ROA is decreasing, it seems that the HHI is a very important explanatory factor of the bank-level profitability.

In column II, III, IIV, I add sequentially fixed effects to alleviate endogeneity concerns. The coefficient of HHI in all of the regressions is negatively and statistically significantly. Most importantly, when I add bank and year fixed effect then the coefficient of HHI is 0.862 which means that the OLS had a downward trend due to the endogeneity. Also, when we add the country and specialization fixed effects nothing changes because the bank fixed effects are the highest level and saturates the unobserved heterogeneity that arises from country and specialization omitted factors. The implications of these results are then straightforward. The market structure seems to play an important role in explaining bank's profitability. More precisely, I find a negative and significant effect of market structure on bank's profitability.

As it can be observed, there is a gradual increase in the economic significance of the HHI. More precisely, in regression II the number of the coefficient of the HHI is 0.622 which is statistically significant at 5% level. Thus this means that an 10% increase in Hirschman-Herfindahl Index (HHI) leads to a decrease in the coefficient of Return on Assets (ROA) by 6.22%. Similar for regressions IV and V.

Among the control variables, manufacturing and the natural logarithm of the off-balance sheet items enter negatively, while the equity, foreign ownership and real GDP

enter positively, as suggested by economic theory and earlier empirical studies (Beck, Demirgüç-Kunt, Levine, 2005). Total Loans enters positively and statistically significant at 1% level in column (1). This indicates that loans influence banking system stability. A strong negative correlation between concentration and loans might explain the loss of significance of total loans. Adjusted R^2 range from 0.144 to 0.443 depending on the specification. Moreover, I find that more concentration in the banking sector leads to higher performance in the manufacturing sectors that are financially dependent on banks. This finding should not come as a surprise given the previous findings in the economic literature (Hoxha, 2013). Another advantage of the higher concentration for the manufacturing sectors is that large banks lend a greater fraction of their assets than do smaller banks, and that large banks focus more on business lending (DeYoung, Hunter, & Udell, 2004).

In Table 8, I report the impact of Lerner index on profitability. Given that the alternative indices of market power and competition are still open to some critique, I favor the Lerner index and its variants as my proxy for market power. Lerner index measures the deviations of prices from marginal cost. Also, as Beck, De Jonghe, and Schepens (2013) readily argue, the Lerner index is a good proxy for current and future profits stemming from pricing power, while it is not constrained by the extent of the market. Moreover, the Lerner index captures both the impact of pricing power on the asset side of the banks' balance sheet and the elements associated with the cost efficiency on their liability side (Delis, Kokas, Ongena (2015)).

In Table 8, I observe that the coefficient of Lerner index is negative and statistically significant when I control for bank fixed effect but switch sign when I add the year fixed effects (common shocks). Higher market reduces the ROA during good periods but when I control for common shocks via the inclusion of fixed effects then higher market power reduces the ROA. On the same line is the interpretation of foreign ownership, which is statistically insignificant in column III-IV. This result shows that the average foreign bank in my sample does not have a significantly higher profitability compared to the average domestically owned banks. For instant, in the regression I the number of the coefficient of foreign ownership is 0.010 which is statistically significant at 5% level. Thus an increase in the coefficient of Foreign Ownership at 1% leads to an increase in the depended variable of Return on Assets (ROA) at 0.010. Moreover, in regression II that includes Bank Fixed Effect, the number of the coefficient of the Foreign Ownership is 0.027 which is statistically significant at 5% level. Therefore, an increase in the coefficient of Foreign Ownership at 1% leads to an increase in the coefficient of Return on Assets (ROA) at 0.027. In regression III I include Bank Fixed Effect and Year Fixed Effect. Regression IV includes

Bank Fixed Effect, Year Fixed Effect and Country Fixed Effect. Regression V includes Bank Fixed Effect, Year Fixed Effect, Country Fixed Effect and Specialization Fixed Effect. Therefore, in the regressions III, IV V the number of the coefficient of Foreign Ownership is 0.010 which is not statistically significant. Therefore, as it can be observed from the Table 8 the economic significance in regressions III, IV, V are lower compare to the regressions I, II. This is expected because. The relation between market power and foreign ownership can also be affected by a number of characteristics of the banking industry. Claessens, Demirg¨uc¸-Kunt, and Huizinga (2001) show that foreign banks have lower interest margins, overhead expenses, and profitability than domestic banks in developed countries, whereas the opposite is true in developing countries. Moreover, Lensink and Hermes (2004) find that foreign bank entry into less developed countries leads to higher costs and margins for the local banks, and Micco, Panizza, and Yan (2007) that foreign-owned banks in developing countries are more cost-efficient than private local banks. Therefore, these studies found that the reasons for foreign entry, as well as the competitive conditions, might differ significantly between developed and developing countries (Delis, Kokas, Ongena (2015)).

The theoretical considerations discussed in section 2, also suggest that there may be a non-linear relation between HHI and bank's profitability. Too much concentration could eventually trigger a situation where banks profitability increases. To control for the nonlinearities I squared the HHI. In column I, the coefficient of HHI is negative and statistically significant and the coefficient of HHI squared is positive and statistically. This means that there is a threshold (marginal effect) that we calculate the turning point. The marginal effect is calculated by taking the first derivative and yields 0.449. Above that average threshold the HHI will positively influence the profitability and vice versa.

Besides the nonlinearities, I investigate interactions term between the banking structure and bank's characteristics. In column II and III, I create interactions for the HHI with OBSI size and foreign ownership, respectively. The interaction terms are positively and statistically significant at 1%. The results indicate that higher off-balance sheet activity and higher foreign ownership can enhance bank's profitability. Last but not least, in column VI I estimate the nonlinearities with the right hand side to be lagged once. The results indicate that our analysis does not suffer from reverse causality.

4.3 Sensitivity analysis

Table 9 indicates the sensitivity test for Hirschman-Herfindahl Index (HHI). In that Table, I investigate the causes and consequences of changing the HHI with the five-bank concentration indicator. Given that my sample size changes over the sample period, including banks beyond the top five might introduce measurement bias. For this reason, I favor the five-bank concentration indicator, which equals the share of assets of the five largest banks relative to total banking system assets. From Beck, Demirgu¨cE-Kunt, Levine, 2005, the data suggest that concentration generally varies little over time.

As it can be observed from the Table 9, the coefficient of the five-bank concentration ratio in regression I is -0.453 which is statistically significant at 1% level. Therefore, Regression (column I) indicates that an increase in the coefficient of the five-bank concentration ratio (CR5) at 10% leads to a decrease in the depended variable of Return on Assets (ROA) at 4.53%. Column II, bank fixed effects, shows a dramatic decrease in the five-bank concentration ratio (CR5) at -2.444. Thus, an increase in the coefficient of the five-bank concentration ratio (CR5) at 10% leads to a decrease in the depended variable of Return on Assets (ROA) at 24.44% which is higher than the decrease in regression I. Furthermore, the Table 9 shows that the coefficient of the five-bank concentration ratio (CR5) increases slightly at -2.295 and stays stable in regression III which is identified at the bank-year level, in regression IV which is identified at the bank-country-year level and in regression V which is identified at the bank-country-year-specialization level. Therefore, an increase in the coefficient of the five-bank concentration ratio (CR5) at 10% leads to a decrease in the depended variable of Return on Assets (ROA) at 22.95% which is higher than the decrease in regression I and regression II. Moreover, among the control variables, manufacturing and the natural logarithm of the off-balance sheet items enter negatively, while the equity, foreign ownership and real GDP enter positively. At this point I would like to highlight that the signs of the control variables are the same as in Table 9 which I investigate the impact of Hirschman-Herfindahl Index (HHI) on Profitability. More precisely, Total loans enter positively in regression I at 0.171 and statistically significant at 1% level. I observe that there is an increase in the coefficient on Total loans to 0.485 in regression II which is statistically significant at 5% level. Subsequently, in regression III, IV, V the coefficient of Total loans stays stable at 0.135 which is not statistical significant at any level. Moreover, equity and real GDP sign positive and statistically significant at 1% level in all five regressions. However, foreign ownership is statistically significant at 1% level in regression I but statistically insignificant in regression II, III, IV, V.

Table 10 shows the sensitivity test for Return on Assets (ROA). In detail, the dependent variable for that test is the natural logarithm of bank's income from loans (ln(il)). The natural logarithm of bank's income from loans is an alternative variable

(proxy) for profitability so that if I change the variable of profitability my results are not driven from the data but from the economic relationship. Results are similar to the baseline results in table 7. So, I can conclude that from the robustness check regarding the choice of the HHI (table 9) and bank's profitability (table 10) the baseline results are not driven from data manipulation.

5. Conclusion

This dissertation analyzes the impact of Bank's market structure on Bank's profitability of the OECD economic countries. I collect bank level data for all the 35 member countries in the OECD organization between 2002 and 2015 to estimate the profitability of banks through the use of the return on assets. For the estimation technique I used fixed effect and cluster the standard errors at the country level. I find that higher competition reduces bank's profitability. An even more importantly, I find the existence of nonlinearities in the relationship between market structure and profitability. The estimates thus suggest that moderate levels of concentration boost bank's ROA. Both findings are economically relevant and robust to the use of alternative concentration, competition and profitability measures, and alterations in sample and model specifications.

Tables Section

Table 1. Variable definitions and sources

Name	Description	Data source
ROA	The ratio of net income to total assets.	Own calculation
Ln(il)	The natural logarithm of bank's income from loans	Fitch connect
HHI	Hirschman-Herfindahl index of each bank's total earning assets	Own calculations
CR5	The five-bank concentration ratio.	Own calculation
Lerner index	The ability of an individual bank to charge a price above marginal cost. More precisely, $LI_{itc} = \frac{P_{itc} - MC_{itc}}{P_{itc}}$, where P and MC are the price of bank output at time t and the marginal cost. The marginal cost is estimated with OLS and a translog cost function from Thorsten Beck.	Own calculations
Total loans	Total loans divided by total assets.	Fitch connect
Equity	Equity capital divided by total assets.	Fitch connect
OBSI size	Natural logarithm of the off-balance sheet items.	Fitch connect
Foreign ownership>40	The ratio of the number of foreign banks over the number of all banks.	World bank
Manufacturing	The sum of gross minus the value of intermediate inputs used in the production of manufacturing (%).	World bank
GDP	Real GDP (%).	World bank

Table 2: Summary statistics

The table reports summary statistics for the variables used in the empirical analysis. The variables are defined in Table 1.

Variables	Level	Obs.	Mean	Std. Dev.	Min.	Max.
ROA	Bank	40,418	0.780	1.111	-23.596	76.140
Ln(il)	Bank	40,418	9.700	1.484	2.708	17.666
HHI	Country	40,418	0.070	0.108	0.002	1.000
CR5	Country	40,418	0.241	0.063	0.031	1.000
Lerner index	Bank	40,418	0.338	0.290	0.009	0.550
Total loans	Bank	40,418	0.638	0.172	0.010	1.387
Equity	Bank	40,418	0.088	0.049	0.001	0.841
OBSI size	Bank	40,418	9.530	2.289	-1.583	21.359
Foreign ownership>40	Country	40,418	0.286	1.675	0.000	13.000
Manufacturing	Country	40,418	17.414	4.090	5.451	30.563
GDP	Country	40,418	1.393	2.596	-8.269	10.800

Table 3: Correlation matrix

	ROA	Ln(il)	HHI	Lerner index	CR5	Total loans	Equity	OBSI size	Foreign ownership>40	Manufacturing	GDP
ROA	1.00										
Ln(il)	0.01	1.00									
HHI	0.16	-0.05	1.00								
Lerner index	0.16	0.06	0.06	1.00							
CR5	0.22	0.04	0.85	0.34	1.00						
Total loans	-0.14	0.03	0.18	-0.02	0.12	1.00					
Equity	0.35	-0.20	0.22	0.28	0.34	-0.12	1.00				
OBSI size	0.08	0.73	0.01	0.30	0.19	-0.02	0.00	1.00			
Foreign ownership>40	0.10	0.10	0.15	0.16	0.30	-0.15	0.09	0.16	1.00		
Manufacturing	-0.13	0.01	-0.30	-0.47	-0.50	0.01	-0.24	-0.19	-0.31	1.00	
GDP	0.24	0.08	0.18	0.14	0.26	-0.11	0.10	0.08	0.11	0.00	1.00

Table 4: Number of banks in the sample for the OECD countries

Year													
2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Number of Banks													
4,942	4,758	4,801	5,709	5,631	5,707	5,479	5,542	5,354	3,677	3,668	3,652	3,648	3,304

Table 5: Summary statistic for concentration (HHI) per country and year

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Australia	0.520			0.405	0.191	0.187	0.182	0.191	0.207	0.271	0.291	0.290	0.290	0.295	0.236
Austria	0.267	0.233	0.135	0.125	0.106	0.115	0.120	0.098	0.116	0.244	0.238	0.223	0.226	0.239	0.163
Belgium	0.096	0.091	0.096	0.279	0.271	0.288	0.238	0.215	0.224						0.200
Canada	0.208	0.197	0.193	0.185	0.191	0.188	0.255	0.186	0.141	0.161	0.169	0.176	0.176	0.180	0.185
Czech Republic	0.234	0.262	0.207	0.207	0.201	0.228	0.216	0.193	0.196	0.256	0.249	0.246	0.231	0.242	0.222
Denmark	0.046	0.049	0.792	0.504	0.457	0.477	0.350	0.319	0.331	0.364	0.355	0.348	0.332	0.325	0.371
Estonia	0.563	0.573	0.578	0.580	0.541	0.496	0.672	0.682	0.672	0.517	0.505	0.499	0.497	0.481	0.567
Finland		0.888	0.890	0.491	0.687	0.400	0.713	0.657	0.527	0.594	0.583	0.579	0.563	0.538	0.594
France	0.019	0.020	0.017	0.015	0.017	0.020	0.024	0.024	0.026	0.208	0.217	0.212	0.227	0.310	0.036
Germany	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.003	0.003	0.003	0.003	0.003	0.002
Greece	0.502	0.515	0.155	0.123	0.169	0.146	0.138	0.139	0.151	0.343	0.346	0.845	0.517	0.799	0.224
Hungary	0.134	0.170	0.135	0.128	0.121	0.151	0.250	0.210	0.228	0.261	0.281	0.291	0.266	0.256	0.194
Iceland	0.450	0.215	0.296	0.163	0.209	0.325	0.507	0.498	0.499	0.503	0.506	0.507	0.502	0.503	0.307
Ireland	0.890	0.501	0.389	0.521	0.406	0.650	0.671	0.323	0.517	0.581	0.602	0.910	0.920	0.930	0.561
Israel	0.370	0.625	0.631	0.625	0.650	0.656	0.629	0.601	0.615	0.614	0.637	0.662	0.680	0.660	0.609
Italy	0.072	0.161	0.178	0.008	0.009	0.008	0.008	0.010	0.013	0.020	0.022	0.023	0.025	0.028	0.016
Japan	0.004	0.006	0.007	0.010	0.011	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Korea, Rep.	0.301	0.283	0.271	0.261	0.300	0.301	0.302	0.302	0.302	0.458	0.458	0.461	0.411	0.414	0.327
Luxembourg	0.051	0.050	0.055	0.055	0.052	0.042	0.043	0.052	0.054	0.077	0.073	0.105	0.127	0.166	0.065
Netherlands	0.220	0.187	0.185	0.186	0.159	0.186	0.129	0.098	0.118	0.163	0.155	0.141	0.137	0.190	0.155
New Zealand	0.951	0.942		0.496	0.264	0.250	0.252	0.189	0.223	0.222	0.221	0.221	0.212	0.211	0.259
Norway	0.612	0.584	0.115	0.143	0.281	0.271	0.295	0.286	0.283	0.309	0.311	0.322	0.338	0.324	0.294
Poland	0.188	0.132	0.097	0.098	0.095	0.082	0.078	0.073	0.084	0.136	0.116	0.106	0.123	0.132	0.103
Portugal	0.501	0.499	0.517	0.142	0.138	0.160	0.173	0.184	0.183	0.293	0.325	0.284	0.277	0.378	0.248
Slovak Republic	0.213	0.200	0.196	0.162	0.184	0.164	0.170	0.155	0.152	0.198	0.179	0.177	0.193	0.197	0.179
Slovenia	0.259	0.235	0.216	0.197	0.203	0.216	0.190	0.183	0.180	0.232	0.213	0.132	0.219	0.257	0.208
Spain	0.218	0.399	0.173	0.143	0.124	0.118	0.107	0.116	0.156	0.255	0.322	0.251	0.284	0.297	0.162
Sweden	0.616	0.623	0.099	0.320	0.316	0.305	0.304	0.297	0.295	0.320	0.317	0.314	0.315	0.311	0.343
Switzerland	0.562	0.334	0.345	0.399	0.415	0.386	0.104	0.344	0.344	0.428	0.400	0.368	0.368	0.356	0.365
United Kingdom	0.138	0.118	0.231	0.145	0.146	0.152	0.181	0.127	0.127	0.152	0.150	0.145	0.148	0.161	0.151
United States	0.028	0.029	0.039	0.044	0.053	0.060	0.077	0.070	0.071	0.097	0.094	0.092	0.094	0.095	0.060
Total	0.074	0.069	0.074	0.074	0.079	0.078	0.066	0.077	0.077	0.092	0.090	0.087	0.091	0.093	0.079

Table 6: Summary statistic for competition (Lerner index) per country and year

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Australia	0.239			0.255	0.246	0.233	0.184	0.257	0.267	0.241	0.254	0.295	0.304	0.317	0.251
Austria	0.164	0.195	0.191	0.192	0.186	0.179	0.178	0.229	0.277	0.286	0.258	0.199	0.300	0.303	0.218
Belgium	0.166	0.162	0.154	0.138	0.160	0.093	0.009	0.097	0.163						0.129
Canada	0.186	0.191	0.215	0.175	0.211	0.189	0.186	0.244	0.291	0.311	0.333	0.329	0.335	0.339	0.252
Czech Republic	0.243	0.263	0.292	0.335	0.322	0.326	0.278	0.458	0.453	0.452	0.464	0.468	0.482	0.484	0.361
Denmark	0.259	0.377	0.199	0.195	0.174	0.151	0.123	0.234	0.230	0.185	0.237	0.231	0.254	0.290	0.217
Estonia	0.277	0.328	0.346	0.339	0.360	0.325	0.327	0.303	0.461	0.452	0.507	0.532	0.577	0.577	0.401
Finland		0.319	0.283	0.183	0.185	0.193	0.126	0.289	0.258	0.146	0.183	0.243	0.265	0.292	0.221
France	0.160	0.171	0.204	0.221	0.223	0.202	0.184	0.232	0.252	0.269	0.265	0.295	0.271	0.278	0.210
Germany	0.166	0.182	0.193	0.187	0.206	0.171	0.159	0.212	0.255	0.264	0.253	0.269	0.273	0.292	0.217
Greece	0.111	0.236	0.144	0.175	0.214	0.176	0.112	0.196	0.176	0.056	0.040	0.044	0.118	0.172	0.144
Hungary	0.191	0.233	0.230	0.249	0.252	0.259	0.203	0.278	0.331	0.305	0.240	0.263	0.255	0.312	0.255
Iceland	0.229	0.243	0.280	0.349	0.379	0.348	0.550	0.355	0.502	0.426	0.296	0.228	0.306	0.306	0.331
Ireland	0.132	0.233	0.219	0.152	0.145	0.164	0.164	0.218	0.367	0.416	0.424	0.646	0.450	0.556	0.274
Israel	0.115	0.125	0.184	0.161	0.192	0.205	0.144	0.218	0.282	0.226	0.249	0.263	0.288	0.319	0.217
Italy	0.217	0.260	0.172	0.236	0.256	0.246	0.210	0.259	0.250	0.267	0.301	0.302	0.340	0.328	0.265
Japan	0.191	0.220	0.211	0.234	0.238	0.243	0.211	0.267	0.281	0.275	0.290	0.282	0.279	0.269	0.251
Korea, Rep.	0.325	0.328	0.340	0.317	0.302	0.286	0.211	0.237	0.280	0.331	0.275	0.258	0.249	0.278	0.290
Luxembourg	0.144	0.157	0.196	0.210	0.205	0.191	0.143	0.223	0.261	0.236	0.270	0.303	0.162	0.301	0.207
Netherlands	0.116	0.092	0.172	0.169	0.147	0.184	0.189	0.165	0.284	0.295	0.307	0.285	0.315	0.273	0.217
New Zealand	0.286	0.262		0.219	0.225	0.211	0.190	0.226	0.232	0.259	0.267	0.292	0.308	0.306	0.251
Norway	0.143	0.170	0.218	0.260	0.236	0.186	0.164	0.282	0.284	0.276	0.279	0.329	0.356	0.404	0.269
Poland	0.175	0.141	0.173	0.189	0.231	0.240	0.219	0.257	0.285	0.308	0.309	0.304	0.343	0.310	0.250
Portugal	0.219	0.248	0.312	0.197	0.168	0.161	0.115	0.208	0.179	0.118	0.214	0.053	0.135	0.300	0.173
Slovak Republic	0.197	0.217	0.243	0.259	0.289	0.285	0.305	0.339	0.400	0.398	0.384	0.404	0.435	0.454	0.318
Slovenia	0.222	0.224	0.257	0.268	0.257	0.259	0.201	0.254	0.287	0.243	0.190	0.236	0.345	0.334	0.255
Spain	0.204	0.242	0.285	0.255	0.262	0.248	0.228	0.312	0.329	0.293	0.317	0.289	0.340	0.351	0.279
Sweden	0.174	0.206	0.249	0.242	0.233	0.193	0.176	0.251	0.273	0.252	0.278	0.330	0.375	0.422	0.249
Switzerland	0.167	0.180	0.180	0.132	0.138	0.059	0.201	0.153	0.204	0.141	0.140	0.174	0.154	0.177	0.156
United Kingdom	0.171	0.264	0.292	0.261	0.249	0.247	0.117	0.297	0.327	0.266	0.187	0.216	0.226	0.242	0.244
United States	0.323	0.341	0.306	0.296	0.266	0.229	0.236	0.362	0.364	0.388	0.385	0.406	0.398	0.417	0.322
Total	0.239	0.260	0.245	0.235	0.232	0.201	0.198	0.273	0.294	0.289	0.289	0.302	0.308	0.324	0.258

Table 7: The impact of HHI on Profitability

The table reports coefficient and t-statistics (in brackets). The dependent variable is the ROA. All the variables are defined in Table 1. All regressions include fixed effects and the standard errors are robust as shown in the last row of the Table. The *, **, *** marks denote statistically significance at the 10, 5, and 1% level, respectively.

	I	II	III	IV	V
HHI	-0.249***	-0.622**	-0.862***	-0.862***	-0.862***
	[-3.330]	[-2.189]	[-3.083]	[-3.083]	[-3.083]
Total loans	0.141***	0.425**	0.122	0.122	0.122
	[2.823]	[2.204]	[0.628]	[0.628]	[0.628]
Equity	7.153***	8.905***	8.564***	8.564***	8.564***
	[44.990]	[9.892]	[9.523]	[9.523]	[9.523]
OBSI size	-0.016***	-0.044***	0.029***	0.029***	0.029***
	[-5.174]	[-10.382]	[3.802]	[3.802]	[3.802]
foreign ownership>40%	0.018***	0.032***	0.011	0.011	0.011
	[3.869]	[2.631]	[0.897]	[0.897]	[0.897]
Manufacturing	-0.012***	0.052***	-0.162***	-0.162***	-0.162***
	[-5.021]	[9.279]	[-15.080]	[-15.080]	[-15.080]
GDP	0.067***	0.044***	0.064***	0.064***	0.064***
	[37.370]	[17.155]	[13.770]	[13.770]	[13.770]
Observations	40,418	40,028	40,028	40,028	40,028
Adjusted R-squared	0.144	0.411	0.443	0.443	0.443
Bank FE	No	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes
Country FE	No	No	No	Yes	Yes
Specialization FE	No	No	No	No	Yes
Clustered standard errors	Robust	Robust	Robust	Robust	Robust

Table 8: The impact of Lerner index on Profitability

The table reports coefficient and t-statistics (in brackets). The dependent variable is the ROA. All the variables are defined in Table 1. All regressions include fixed effects and the standard errors are robust as shown in the last row of the Table. The *, **, *** marks denote statistically significance at the 10, 5, and 1% level, respectively.

	I	II	III	IV	V
Lerner index	-0.881***	-0.901***	1.358***	1.358***	1.358***
	[-7.984]	[-5.455]	[4.630]	[4.630]	[4.630]
Total loans	0.074	0.318	0.141	0.141	0.141
	[1.493]	[1.644]	[0.734]	[0.734]	[0.734]
Equity	7.080***	8.818***	8.507***	8.507***	8.507***
	[44.614]	[9.844]	[9.543]	[9.543]	[9.543]
OBSI size	-0.018***	-0.051***	0.039***	0.039***	0.039***
	[-6.127]	[-11.460]	[4.832]	[4.832]	[4.832]
foreign ownership>40%	0.010**	0.027**	0.010	0.010	0.010
	[2.211]	[2.193]	[0.832]	[0.832]	[0.832]
Manufacturing	-0.022***	0.034***	-0.173***	-0.173***	-0.173***
	[-7.896]	[4.182]	[-16.378]	[-16.378]	[-16.378]
GDP	0.069***	0.049***	0.057***	0.057***	0.057***
	[38.019]	[15.774]	[11.331]	[11.331]	[11.331]
Observations	40,418	40,028	40,028	40,028	40,028
Adjusted R-squared	0.189	0.411	0.443	0.443	0.443
Bank FE	No	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes
Country FE	No	No	No	Yes	Yes
Specialization FE	No	No	No	No	Yes
Clustered standard errors	Robust	Robust	Robust	Robust	Robust

Table 9: Sensitivity test for HHI

The table reports coefficient and t-statistics (in brackets). The dependent variable is the ROA. All the variables are defined in Table 1. All regressions include fixed effects and the standard errors are robust as shown in the last row of the Table. The *, **, *** marks denote statistically significance at the 10, 5, and 1% level, respectively.

	I	II	III	IV	V
CR5	-0.453***	-2.444***	-2.295***	-2.295***	-2.295***
	[-11.541]	[-11.782]	[-8.707]	[-8.707]	[-8.707]
Total loans	0.171***	0.485**	0.135	0.135	0.135
	[3.228]	[2.226]	[0.608]	[0.608]	[0.608]
Equity	7.086***	8.506***	8.183***	8.183***	8.183***
	[42.116]	[8.387]	[8.004]	[8.004]	[8.004]
OBSI size	-0.016***	-0.012*	0.032***	0.032***	0.032***
	[-5.032]	[-1.844]	[4.029]	[4.029]	[4.029]
foreign ownership>40%	0.019***	0.017	0.000	0.000	0.000
	[3.880]	[1.295]	[0.009]	[0.009]	[0.009]
Manufacturing	-0.028***	0.026***	-0.162***	-0.162***	-0.162***
	[-9.867]	[4.598]	[-12.604]	[-12.604]	[-12.604]
GDP	0.063***	0.032***	0.028***	0.028***	0.028***
	[32.256]	[10.520]	[3.690]	[3.690]	[3.690]
Observations	34,523	34,047	34,047	34,047	34,047
Adjusted R-squared	0.156	0.414	0.439	0.439	0.439
Bank FE	No	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes
Country FE	No	No	No	Yes	Yes
Specialization FE	No	No	No	No	Yes
Clustered standard errors	Robust	Robust	Robust	Robust	Robust

Table 10: Sensitivity test for ROA

The table reports coefficient and t-statistics (in brackets). The dependent variable is the ln(il). All the variables are defined in Table 1. All regressions include fixed effects and the standard errors are robust as shown in the last row of the Table. The *, **, *** marks denote statistically significance at the 10, 5, and 1% level, respectively.

	I	II	III	IV	V
HHI	-0.388***	-0.422***	-0.127***	-0.127***	-0.127***
	[-7.118]	[-7.589]	[-3.412]	[-3.412]	[-3.412]
Total loans	0.223***	0.103**	0.948***	0.948***	0.948***
	[5.965]	[2.317]	[16.582]	[16.582]	[16.582]
Equity	-6.181***	-5.966***	-3.363***	-3.363***	-3.363***
	[-49.717]	[-24.298]	[-11.708]	[-11.708]	[-11.708]
OBSI size	0.496***	0.559***	0.079***	0.079***	0.079***
	[183.249]	[142.870]	[37.787]	[37.787]	[37.787]
foreign ownership>40%	0.043***	0.009*	0.029***	0.029***	0.029***
	[11.473]	[1.664]	[5.956]	[5.956]	[5.956]
Manufacturing	0.032***	-0.006***	0.024***	0.024***	0.024***
	[18.822]	[-2.608]	[6.632]	[6.632]	[6.632]
GDP	-0.015***	-0.106***	-0.032***	-0.032***	-0.032***
	[-6.816]	[-18.765]	[-15.612]	[-15.612]	[-15.612]
Observations	25,706	25,706	25,294	25,294	25,294
Adjusted R-squared	0.607	0.690	0.984	0.984	0.984
Bank FE	No	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes
Country FE	No	No	No	Yes	Yes
Specialization FE	No	No	No	No	Yes
Clustered standard errors	Robust	Robust	Robust	Robust	Robust

Table 11: Nonlinearities and interactions for HHI

The table reports coefficient and t-statistics (in brackets). The dependent variable is the ROA. All the variables are defined in Table 1. All regressions include fixed effects and the standard errors are robust as shown in the last row of the Table. The *, **, *** marks denote statistically significance at the 10, 5, and 1% level, respectively.

	I	II	III	IV
	Nonlinearities in HHI	Interaction	Interaction	Lagged variables
HHI	-6.096***	-8.167***	-6.314***	-5.996***
	[-8.445]	[-9.912]	[-8.573]	[-13.990]
HHI squared	8.094***	8.544***	8.295***	7.535***
	[8.749]	[9.234]	[8.854]	[11.967]
HHI * OBSI size		0.212***		
		[4.390]		
HHI * foreign ownership>40%			0.420***	
			[3.657]	
Total loans	0.213	0.218	0.220	-0.459***
	[1.139]	[1.165]	[1.172]	[-2.797]
Equity	8.393***	8.440***	8.365***	1.308**
	[9.435]	[9.499]	[9.418]	[2.435]
OBSI size	0.034***	0.017**	0.034***	-0.022***
	[4.487]	[2.252]	[4.495]	[-3.260]
foreign ownership>40%	0.015	0.012	-0.039**	0.012
	[1.195]	[1.024]	[-2.160]	[1.012]
Manufacturing	-0.164***	-0.172***	-0.160***	-0.106***
	[-15.517]	[-15.391]	[-14.949]	[-12.017]
GDP	0.043***	0.044***	0.042***	0.099***
	[8.308]	[8.398]	[7.900]	[19.667]
Observations	40,028	40,028	40,028	40,548
Adjusted R-squared	0.449	0.450	0.450	0.484
Year FE	N	N	N	N
Country FE	N	N	N	N
Specialization FE	N	N	N	N
Bank FE	N	N	N	N
Clustered standard errors	Robust	Robust	Robust	Robust

References

Athanasoglou, P.P., Brissimis, S.N. and Delis, M.D., 2005, Bank-Specific, Industry-Specific and Macroeconomic Determinants of Bank Profitability. Journal of International Financial Markets, Institutions and Money 18 (2), 121–136.Mimeo.

Berger, A.N. and Hannan, T.H., 1993. Using efficiency measures to distinguish among alternative explanations of the structure-performance relationship in banking (No. 93-18). Board of Governors of the Federal Reserve System (US).

Beck, T., Ioannidou, V. and Schäfer, L., 2012. *Foreigners vs. natives: Bank lending technologies and loan pricing*. Center for Economic Research.

Beck, T., Demirgüç-Kunt, A. and Levine, R., 2006, Bank concentration, competition, and crises: first results, Journal of Banking &Finance.

Beck, T., De Jonghe, O. and Schepens, G., 2013, Bank competition and stability: Cross-country heterogeneity, Tilburg University

Berger, A.N., 1995, The Profit-Structure relationship in banking tests of Market-Power and Efficient-Structure Hypothesis, Journal of Money, Credit and Banking.

Bourke, P., 1989. Concentration and other determinants of bank profitability in Europe, North America and Australia, Journal of Banking & Finance.

Boone, J., 2008. A New Way to Measure Competition, The Economic Journal.

Calomiris, C.W. and Hubbard, R.G., 1995. Finance and Competitiveness in Developing Countries.

Casu, B., Girardone, C. and Molyneux, P., 2015, Introduction to Banking.

Cetorelli, N., 2004.Real effects of bank competition

Cetorelli, N. and Strahan, P.E., 2006. Finance as a Barrier to Entry: Bank Competition and Industry Structure in Local U.S. Markets, The journal of Finance.

Claessens, S. and Laeven, L., 2003. What Drives Bank Competition? Some International Evidence, Journal of Money, Credit and Banking.

Delis, M.D., Kokas, S. and Ongena, S., 2016. Foreign ownership and market power in banking: Evidence from a world sample, Journal of Money, Credit and Banking.

Edwards, S., Allen, A.J. and Shaik, S., 2006. Market structure conduct performance (SCP) hypothesis revisited using stochastic frontier efficiency analysis, Finance Forum, 2005/2.

Evanoff, D.D. and Fortier, D.L., 1988. Reevaluation of the structure-conduct-performance paradigm in banking, Journal of Financial service research.

Focarelli, D. and Pozzolo, A.F., 2001. The patterns of cross-border bank mergers and shareholdings in OECD countries, Journal of Banking & Finance.

Goldberg, L.G. and Rai, A., 1996. The Structure-Performance Relationship for European Banking. Journal of Banking and Finance.

Goddard, J., Molyneux, P. and Wilson, J.O., 2004. The profitability of European banks: a cross-sectional and dynamic panel analysis. Manchester School 72 (3), 363–381.

Graddy, D.B. and Kyle, R., 1979. The simultaneity of bank decision-making, market structure, and bank performance, The Journal of Finance.

Gale, B.T. and Branch, B.S., 1982. Concentration versus Market Share: Which Determines Performance and Why Does It Matter?

Gilligan, T., Smirlock, M. and Marshall, W., 1984. Scale and scope economies in the multi-product banking firm, Journal of Monetary Economics.

Gilbert, R.A., 1984. Bank Market Structure and Competition: A Survey, Journal of Money, Credit and Banking.

Hoxha, I., 2013. The market structure of the banking sector and financially dependent manufacturing, International review of Economics & Finance.

Jiménez, G., Ongena, S., Peydró, J.L. and Saurina, J., 2012. Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications, American economic association.

Jayaratne, J. and Strahan, P.E., 1998. Entry Restrictions, Industry Evolution, and Dynamic Efficiency: Evidence from Commercial Banking, Journal of Law and Economics.

Levine, R., 1996. Financial Development and Economic Growth: Views and Agenda, Journal of Economic Literature

Mester, L.J., 1993. Efficiency in the savings and loan industry, Journal of Banking & Finance.

Mirzaei, A., Moore, T. and Liu, G., 2013. Does market structure matter on banks' profitability and stability? Emerging vs. advanced economies, Journal of Banking & Finance.

Micco, A., Panizza, U. and Yanez, M., 2007. Bank ownership and performance. Does politics matter?, Journal of Banking & Finance

Molyneux, P. and Thornton, J., 1992. Determinants of European bank profitability: A note. Journal of banking & Finance, 16(6), pp.1173-1178.

Pasiouras, F. and Kosmidou, K., 2007. Factors influencing the profitability of domestic and foreign commercial banks in the European Union, Research in international business and finance.

Saunders, A. and Cornett, M.M., 2011. Financial Institutions Management: A Risk Management Approach.

Stiglitz, J.E., 1989. Imperfect information in the product market.

Stevens, J.L., 1990. Tobin's q and the structure-performance relationship: comment. The American Economic Review, 80(3), pp.618-623.

Smirlock, M., 1985. Evidence on the (Non) Relationship between Concentration and Profitability in Banking Journal of Money, Credit and Banking.