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Banking competition and economic growth: cross-country evidence

Abstract

The aim of this paper is to analyse the effect of banking competition on industry economic growth using both structural measures of competition and measures based on the new empirical industrial organization perspective. The evidence obtained in the period 1993-2003 for a sample of 53 sectors in 21 countries indicates that financial development promotes economic growth. The results also show that bank monopoly power has an inverted-U shaped effect on economic growth, suggesting that bank market power has its highest growth effect at intermediate values. The latter result is consistent with the literature on relationship lending which argues that bank competition can have a negative effect on the availability of finance for companies that are informationally more opaque.

Key words: economic growth; banking competition; financial development
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1. Introduction

The empirical evidence available (King and Levine, 1993a and b; Levine and Zervos, 1998; Guiso, Jappelli, Padula and Pagano, 2004; Levine, 2005; Loayza and Rancière, 2006; Hasan, Koetter and Wedow, 2009; among others) permits us to state that the development of financial markets in general, and of banking markets in particular, plays an important role in the explanation of economic growth. This result is not surprising if we take into account that the sources of economic growth are both productivity gains and capital accumulation, the financial sector being the mechanism through which savings are channelled into investment either directly (in the markets) or indirectly (via financial intermediaries).

However, Rajan and Zingales (1998) note that the positive correlation habitually found between financial development and economic growth may be due to a problem of omitted variables. Given that financial development depends on the capacity of economies to save and, according to the principal theories of growth, the saving rate is the principal determinant of economic growth, the observation of a positive relation in cross-country regressions, or in time series for one country, may be no more than the reflection of the relationship of both variables (economic growth and financial development) with the saving rate. It is therefore necessary to identify the mechanism through which financial development enhances long term economic growth.

With this objective of making explicit the mechanisms through which financial development favours economic growth, Rajan and Zingales (1998) explore the capacity of the financial sector to provide lendable funds to the different sectors of the economy according to their external financial dependence. A large part of the theoretical research establishes that the financial markets and banking institutions help to solve the problems of adverse selection and moral hazard, thus reducing the cost of finance. In this way, financial development should help those firms or sectors where the problems of moral hazard and asymmetrical information are present to obtain funds. Thus, Rajan and Zingales (1998) propose a test to verify this hypothesis, assuming that the sectors most dependent on external financing will grow faster the more developed are the financial markets to which they have access. In the test, therefore, we analyse whether *ex-ante* financial development facilitates access to financing, and therefore enhances *ex-post* growth in the more financially dependent sectors. This approach has the advantage of making explicit one of the mechanisms by which the financial sector affects growth, providing a robust test of causality by correcting for country and industry characteristics. The test is thus not so dependent on the macroeconomic modelling habitual in the literature on economic growth, which consists of explaining economic

growth by proxies of financial development (such as the importance of bank credit and/or stock market capitalisation relative to GDP).

As well as the importance of financial development, another subject of interest that has received much less attention is the influence of the degree of banking competition on economic growth. From a theoretical point of view, the literature on the subject shows ambiguous effects. Thus on the one hand conventional economic theory teaches us that exercise of market power leads to an equilibrium solution characterised by a higher interest rate and a lower quantity of financing than in a situation of perfect competition. In consequence, the social inefficiency of monopoly translates into the financing of a smaller number of investment projects, and therefore into lower economic growth. Thus, given investment opportunities in a country and in a particular sector, the fact that the banking sector enjoys market power will reduce the incentives to invest in the most financially dependent sectors, therefore reducing their potential growth.

However, although market power can imply higher costs of financing, in the literature there is no consensus as to its effects on the supply of lendable funds. Thus it is usually said that where market power exists, banks may have more incentive to invest in the acquisition of soft information by establishing close relationships with borrowers over time (*relationship banking*), facilitating the availability of credit and consequently reducing firms' financial constraints (Dell´Ariccia and Marquez, 2004). In this scenario, the banks can make their investments in relationships with clients profitable in the long term as a consequence of the existence of an information monopoly (Rajan, 1992; Petersen and Rajan, 1995). Furthermore, as argued by Boot (2000), even though a firm runs the risk of paying higher interest rates in the context of non-competitive banking markets, the firm can benefit from a greater availability of finance. Nevertheless, there is also the threat of being "locked in" (*hold-up problem*) as a consequence of the informational monopoly. To sum up, therefore, the effect of market power on the conditions of finance is a matter to be settled with empirical evidence.

Despite the abundant literature devoted to quantifying market power, there are hardly any studies that explore the relationship between banking competition and economic growth. The only exceptions are the studies by Cetorelli and Gambera (2001) and Claessens and Laeven (2005). In the first case, they analyse empirically the effect of the concentration of banking markets on the economic growth of sectors in the 1980s, using information on 41 countries and 36 manufacturing sectors. Their results indicate that banking concentration promotes the growth of the youngest firms in the sectors most dependent on external finance, facilitating access to credit for the youngest firms.

However, the authors find a negative general effect of concentration on growth which affects all sectors and firms indiscriminately. Therefore, if we accept the use of market concentration as a measure of competition, greater market power would favour the economic growth of the youngest firms, precisely those in which asymmetries of information and uncertainty are most intense. It is in this group of firms, therefore, where the soft and informal information that credit institutions can acquire through informal client relationships acquires its greatest value.

Given the limitations presented by the use of market concentration indicators as measures of competition, Claessens and Laeven (2005) analyse the effect of banking competition on economic growth using an indicator of market power based on the new empirical industrial organisation (NEIO): the *H* statistic of Panzar and Rosse. Their results show that the industries most dependent on bank financing grow faster in the countries with stiffer banking competition, so they reject the hypothesis that market power can favour access to finance. Furthermore, since the results are not maintained when measures of concentration are used as a proxy for competition, the validity of studies that use concentration as a measure of market power is called into question.

Since the theory offers ambiguous results about the effect of banking competition on economic growth, it is necessary to have available more empirical evidence on this matter, especially in view of the shortage of studies hitherto. Also, the need for additional evidence is in this case even more important if we take into account that the only two existing studies use exactly the same sample, countries, sectors and variables, so there is a need for evidence obtained from new samples to be able to test the robustness of the results obtained so far.

In this context, this study makes the following contributions. First, as well as the *H*-statistic used by Claessens and Laeven (2005), we use the Lerner index of market power. This index presents the advantage that it can be calculated annually, enabling us to test more accurately the effect of the initial level of competition on economic growth and not only the effect of the average levels. It will furthermore allow us to test the robustness of the results obtained using different indicators of banking competition. Second, while Claessens and Laeven (2005) use the indicator of financial dependence constructed by Rajan and Zingales (1998) for the period 1980-1989 to analyse the effects on growth in those years (or alternatively 1980-1997), in our case we calculate indicators of external financial dependence for a more recent period (1993-2003). Also, the indicators of competition are calculated for the same years for which observations of the degree of financial dependence are available. Third, the sample covers a wider range

of sectors, as both Rajan and Zingales (1998) and Claessens and Laeven (2005) studied only the manufacturing sector.

In line with previous studies, the results obtained indicate that financial development promotes economic growth. The results also show that bank monopoly power has an inverted-U effect on economic growth, suggesting that market power has its highest effect at intermediate values. This last result is consistent with the literature on relationship banking which argues that banking competition can have a negative effect on the availability of finance for more informationally opaque firms by reducing the expected benefits of the investments in obtaining specific information from clients.

Taking into account that financial development promotes economic growth, in the current context of financial crisis, the decline in the indicators of financial development (as for example total capitalization as percentage of GDP) is translated into a reduction in the GDP growth rate. In fact, Maudos (2010) shows that over the period 1999-09, the annual contribution of financial development to GDP growth in the euroarea is 0.15 percentage points (pp.) per year, explaining 12% of economic growth. However, in the period of crisis 2007-09, the annual contribution in only 0.022 pp. which gives evidence of the strong impact of the financial crisis.

After this introduction, the structure of the paper is as follows. In section 2 we review the existing literature on the influence of banking competition on economic growth, both that which analyses its effect on the financial conditions of firms (cost and availability of finance) and that which directly studies its influence on economic growth at an aggregate level. Section 3 describes the methodology to be used for the measurement of the market power of the banks, of external financial dependence, and the specification used to analyse the effect of competition on sector growth. Section 4 describes the sources of information and variables used to obtain the empirical results shown in section 5. Section 6 analyses the sensitivity of results using various robustness tests. Finally, the conclusions are presented in section 7.

2. Banking competition and growth: background

Basically, there are two areas of research in which the direct or indirect effect of banking competition on economic growth has been analysed. In the first case, studies that focus on the importance of relationship banking, as well as analysing the effect of the intensity and duration of banking relationships on firms' conditions of finance, typically analyse the effect of competition in the banking markets on the terms of the finance granted, i.e. both on the cost of financing and on the availability of credit, which

in the long term affects investment and economic growth (Petersen and Rajan, 1995; Berlin and Mester, 1999; D´Auria et al., 1999, among others). In the second case, a small number of studies have analysed directly the effect of banking competition on economic growth (Cetorelli and Gambera, 2001; Claessens and Laeven, 2004).

Relationship lending, banking competition and finance conditions

Generally, the existence of market power implies that the price is set above that of equilibrium (equal to the marginal cost) and that the quantity of goods or services traded is less than competitive equilibrium. Consequently, greater competition in banking markets will imply a lower price of credit and greater credit availability and this will result in higher investment and economic growth.

However, the financial sector in general, and the banking sector in particular, are characterised by the existence of asymmetries of information between banks and borrowers. These asymmetries may prevent some exchanges which, had they not existed, would have taken place. In this sense, one of the ways in which financial intermediaries can reduce or mitigate asymmetries of information is through repeated interaction with the client and the establishment of relationships of trust, all of which receives the name of relationship banking (see Boot, 2000). By means of these lasting relationships the financial institution acquires soft and informal information which allows it to screen and monitor its clients more efficiently, making possible the exchange of lendable funds which otherwise might not have taken place.

In the field of relationship banking, some studies find that a lasting relationship with the client, though it does not generate benefits in terms of lower costs of finance, does favour access to finance (Petersen and Rajan, 1994; Elsas and Kanhen, 1998; Harhoff and Karting, 1998; Cole, 1998) or requires the client to offer fewer assets in guarantee (Chakrabortt and Hu, 2006; Degryse and Van Cayseele, 2000). At the same time, the lasting relationship of trust gives the bank market power over its clients, who become informationally captured (*hold-up problem*). It is therefore possible for lasting relationships with the client to generate market power and at the same time to favour access to finance for a larger number of firms. Consequently a positive relationship could be observed between market power in the banking sector and economic growth.

One of the studies that has had most subsequent influence on the analysis of the effect of banking competition on the determination of the value of the relationship between the bank and the borrowing firm is that of Petersen and Rajan (1995). These authors develop a theoretical model and test empirically that when the banking markets

are competitive, banks have fewer incentives to invest in relationship building, the borrowing firms being subjected to greater financial constraints. Berlin and Mester (1999) also find a negative effect of competition on the cost of finance.

D´Auria *et al.* (1999) analyse the importance of relationship banking for the cost and the availability of credit for four of the main regions of Italy. Their results indicate that an increase in concentration (Herfindahl-Hirschman index) causes an increase in the cost of financing. Nevertheless, the economic impact of concentration on the rate of interest on loans is very small. Also for the Italian case, Angelini *et al.* (1998) analyse the effect of relationship banking on the conditions of financing for firms showing that concentration is not a statistically significant variable, in contrast to the evidence offered by Petersen and Rajan (1995).

Degryse and Ongena (2005) analyse the effects of the geographical distance between the firm and the lending bank, on the one hand, and between the firm and the competing banks on the other, on the interest rate on loans to small firms They find that the effect of concentration on the cost of finance is positive and significant, though of very small magnitude. Carbó *et al.* (2009) analyse the effect of banking competition on the financial constraints on Spanish SMEs using the Lerner index as an indicator of competition. Their results support the market power hypothesis, insofar as the rationing of credit is greater for firms situated in less competitive banking markets. However, the result is just the opposite when they use indices of concentration to measure competitive rivalry

Banking competition and economic growth: cross-country analysis

As stated earlier, the mechanism through which financial development facilitates economic growth is made explicit in Rajan and Zingales (1998). Studies carried out before had merely observed the existence of a positive correlation between these two variables, without establishing the direction of causality. Although King and Levine (1993a) investigate precisely this problem of causality and show that the predetermined component of financial development is a good predictor of growth over the next 10 to 30 years, Rajan and Zingales put forward two arguments that call into question King and Levine's results. First, the positive correlation between financial development and economic growth may reflect a problem of omitted variable related to both variables, such as the saving rate. And second, the variables that proxy financial development (like stock market capitalisation as a percentage of GDP) may be leading indicators of future growth rather than causal factors. For these reasons, the contribution of Rajan and Zingales is to design an empirical test that makes explicit the mechanisms through

which financial development affects growth. They propose, therefore, a test of causality that corrects both for country and sectoral effects. Rajan and Zingales consider a mechanism whereby financial development facilitates firms' access to external finance, especially to those most dependent on financing, thus propitiating increased investment and economic growth.

Secondly, as remarked by Cetorelli and Gambera (2001), though there are a number of studies of the effect of financial development on economic growth, the evidence on the effect of market structure is very limited. With this aim, Cetorelli and Gambera extend the model of Rajan and Zingales (1998) by introducing as an explanatory variable of economic sector growth the concentration of the national banking markets.. The principal limitation of Cetorelli and Gambera's study is that they use market concentration as a proxy for banking competition.

Dell´Ariccia and Bonaccarsi (2004) also use market concentration to analyse the effect of banking competition on the creation of firms in the Italian non-financial sector. Their results show a non-monotonous relationship between banking competition and the creation of firms, with a range in which increases in market power can be beneficial. They also show that banking competition is less favourable for the creation of firms in industrial sectors where asymmetries of information are greater.

Claessens and Laeven (2005) is the first to analyse the effect of banking competition on economic growth using an indicator of competition based on the NEIO. Specifically, Claessens and Laeven use the results of a previous study (Claessens and Laeven, 2004) in which they calculate the *H*-statistic for 20 countries, though the analysis of its effect on economic growth is reduced to 16 countries. Their main conclusion is that the most competitive banking systems can reduce *hold-up* problems and the costs of financial intermediation, favouring the access of firms to external finance. Furthermore, given the low degree of correlation between the *H*-statistic and market concentration, the indicators of concentration do not help to forecast sector growth.

3. Methodology

3.1. Model specification

The basic model of reference for analysing the effect of banking competition on economic growth takes as its starting point the specification adopted in Rajan and Zingales (1998), subsequently expanded in Cetorelli and Gambera (2001) and Claessens

and Laeven (2005) to analyse the effect of market structure and banking competition on economic growth.

In the initial study by Rajan and Zingales (1998), the specification focuses on analysing the effect of financial development, and consequently on testing whether the sectors most dependent on external finance present higher rates of growth in countries with a higher level of financial development. The innovation of the specification is to introduce the interaction between a country characteristic (financial development) and an industry characteristic (external financial dependence), thus avoiding some problems of identification present in the *cross-country* regressions habitual in the literature on economic growth. Moreover, as commented by Claessens and Laeven (2005), the specification is less subject to the criticisms of omitted variable bias or model specification than are traditional approaches that relate financial sector development directly to economic growth.

The expansion of the Rajan and Zingales model to test the effect of the degree of banking competition on growth takes into account the mechanism by which competitive rivalry in the banking markets affects growth, which is through firms' financial dependence. Thus the introduction of the financial development variable interacting with the indicator of banking competition permits us to verify whether the sectors that require most external finance grow faster in countries with more competition in their banking systems, or whether, on the contrary, higher levels of market power facilitate access to finance for firms that would not have obtained it in highly competitive contexts. With this second hypothesis we would observe a positive relationship between the level of market power and economic growth. Thus, following the specification of Claessens and Laeven (2005), the reference model to be estimated is as follows:

$$\begin{aligned} Growth_{j,k} &= Constant + \psi_1 Sector\ Dummies_{\ j} + \psi_2 Country\ Dummies_k + \\ &\psi_3\ Industry\ share\ in\ value\ added_{j,k} + \psi_4 External\ Dependence_j * Financial\ Development_k + \\ &\psi_5 External\ Dependence_j * Banking\ Competition_k + \varepsilon_{j,k} \end{aligned} \quad (1)$$

where *j*=sector, *k*=country, *Growth*= average annual real growth rate of value added of sector *j* in country *k,* and *Banking competition* is the indicator of degree of banking competition in country *k* (Lerner index, *H*-statistic, or, alternatively, an indicator of market concentration).

The sector and country *dummies* capture the influence of effects specific to each sector or country, respectively. The beginning-of-period sector share in value added captures the possible "convergence" effect at sectoral level, insofar as the sectors with large initial shares usually grow at a slower rate, so a negative ψ_3 could be expected.

Also, as pointed out by Guiso *et al.* (2004), the inclusion of the initial share in total value added avoids the bias derived from the possible correlation between financial development and sector specialisation, so it is necessary to estimate the effect of financial development on sector growth net of any effect that it may have through sector specialisation[1].

3.2. The measurement of banking competition

In the majority of the studies referred to above that analyse the influence of banking competition on conditions of financing (and therefore, in the final instance, on economic growth), the intensity of banking competition is proxied through a market concentration index.

However, in parallel, there exists an abundance of recent studies that show the limitations of proxying the intensity of banking competition by measures of market concentration. Thus, the theory of contestable markets[2] demonstrates that the result of perfect competition can be found even in highly concentrated market situations and that a collusive agreement can be reached with a large number of firms. Therefore, the degree of competition is not necessarily related to the number of competitors and/or to the concentration of the market, but depends on the conditions of entry into the sector.

On the empirical side, recent studies have also shown the inadequacy of using market concentration as an indicator of competition (Berger *et al.*, 2004; Maudos and Fernández de Guevara, 2004 and 2007; Fernández de Guevara *et al.*, 2005; Claessens and Laeven, 2004; among others), pointing to the necessity of using alternative indicators.

For these reasons, and with the aim of solving the limitations implicit in the use of structural measures of competition based on the concentration of the markets, in the field of banking economics various instruments of competition are used from the so-called "new empirical industrial organization".

In our case, competition is measured through the Lerner index of market power and the Panzar and Rosse *H*-statistic. In the first case, the existing studies (Fernández de Guevara *et al.*, 2005, Carbó, Rodríguez and Udell, 2009) show that there is very little (and even no) correlation with the indicators of concentration. In the same vein

[1] The basis of the argument is that financial development can affect both the growth of a sector and the pattern of specialisation, so that it incentivises the less financially developed countries to specialise in sectors less dependent on external finance.
[2] Baumol (1982) and Baumol, Panzar and Willig (1982).

Claessens and Laeven (2004 and 2005) show a low correlation between the H's statistic and the indicators of market concentration, questioning, therefore, the results of studies that use structural indicators of competition. In general, there is no relationship between competitive conditions and market structure as measured by concentration ratios.

The Lerner index of market power

The Lerner index measures the capacity to set prices (interest rates and fees) above marginal costs as a proportion of prices, this difference between price and marginal cost being the essence of market power. Given the limitations of the statistical information available we assume, as do Fernández de Guevara *et al.* (2005 and 2007), that banking production is proxied by total assets, a joint index of market power being estimated for the total of banking activity, defined as follows[3]:

$$\frac{\left[r^{*}_{TA} - cm_{TA} \right]}{r^{*}_{TA}} \qquad (2)$$

where r_{TA} is proxied by the ratio of total revenue to total assets, and marginal costs include both operating and financial costs. As we will explain latter, marginal costs are estimated from a translog cost function.

The Panzar and Rosse methodology

The *H*-statistic of Panzar and Rosse (1987) has also been extensively used to analyse the degree of competition in the banking markets. Thus, in the case of European banks, Molyneux, Lloyd-Williams, and Thornton (1994), De Bandt and Davis (2000), Bikker and Haaf (2002), among others, show the existence of monopolistic competition on the basis of the *H*-statistic. Also the recent study by Claessens and Laeven (2004) examines the determinants of market power in a sample of more than 50 countries (including Europe), the results of the *H*-statistic being compatible with the existence of monopolistic competition in most of the countries analysed. Their results also show the absence of any link between competitive conditions and market structure.

The essence of the Panzar and Rosse methodology (1987) is to analyse the elasticity of revenues to variations in factor input prices by estimating a reduced revenue equation. As demonstrated by Panzar and Rosse (1987), on the assumption that firms operate at their long term equilibrium levels, a value of the *H*-statistic (defined as the sum of the elasticities of the revenue of the bank with respect to the bank´s input

[3] See, for example, Fernández de Guevara *et al.* (2005) for the analytical derivation of the Lerner index from a model of behaviour of banking firms.

prices) equal to 1 is consistent with a situation of perfect competition; a value of *H* between 0 and 1 indicates the existence of monopolistic competition, while values equal to or less than 0 are consistent with a situation of monopoly[4].

Indicators of market concentration

In order to test the robustness of results and to analyse the problems that may be presented in studies that value the effect of banking competition on economic growth by means of indicators of concentration, in this study we will use three indicators of concentration for each country: CR3 (the market share of the 3 largest banks), CR5 (share of the 5 largest) and the Herfindahl-Hirschman index (HHI), which is defined as the sum of the square of the market shares (based on total assets) of all the banks that compete in the market. Although previous studies that have analysed the effect of concentration on growth have used CR3 (or CR5) the disadvantage of these absolute indicators of concentration is that the relative position of a country may differ depending on the indicator used. Furthermore, these indicators do not take into account the number of banks in each sector, so the use of the Herfindahl- Hirschman index as indicator of concentration is more reliable.

3.3. Financial dependence

Following the approach of Rajan and Zingales (1998), the identification of the external financial dependence at the sectoral level is based on the available information on a country with developed capital markets in which firms do not face frictions in their access to financing.

The choice of a financially developed country to act as benchmark (the USA in the study by Rajan and Zingales, 1998) is one way to avoid the problem of identification between the demand for external funds and its supply, as the higher the degree of financial development the fewer are the restrictions on access to the supply of finance, the latter being precisely what we want to measure.

In our case, because of the availability of information, the benchmark country is the United Kingdom. Since the database used to proxy the degree of financial dependence (*Amadeus –Bureau van Dijk*) only contains information on European firms,

[4] In perfect competition, a proportional variation in the input prices induce a proportional change in revenue, since the *output* that minimises average costs does not vary, while the price of the output varies in the same proportion. In a market with monopolistic competition, revenue grows less than proportionally to variations in the input prices because the demand faced by firms in the products market is inelastic. In the case of monopoly, a growth in the price of *inputs* increases marginal costs, reduces the equilibrium level of production and consequently, reduces revenue.

we use the European country with the most highly developed financial markets and with a productive structure sufficiently diversified for there to be information on all sectors of activity, i.e. the United Kingdom. For example, with data referring to 2003, the last year that we will use in the study, stock market capitalisation represents 120.9% of GDP in the United Kingdom, as against the 66% of the EU-15 average and the 115.4% of the USA (Source: European Commission, 2005: "Financial Integration Monitor"). The degree of financial development of the United Kingdom is therefore closer to that of the USA than to the average of the EU-15.

The use of a benchmark is also based on the assumption that there are technological reasons (project scale, gestation period, etc.) why some sectors depend more than others on external finance, and that these reasons are the same in all countries. Thus, the assumption is that if a sector in the United Kingdom has certain technological characteristics, those same characteristics will be present in the rest of the countries in the sample analysed. The fact that it is technological reasons that determine the degree of financial dependence of a certain sector implies that it is more appropriate to use the average of the indicator of financial dependence for a period long enough for the measurement not to be affected by possible *shocks* of financial supply or demand external to the firm. However, too long a period could mean that the production technology of a sector could change, and therefore, so could the degree of financial dependence. In the study we consider it adequate to take the average of the indicator of financial dependence over ten years.

As we will remark later when describing the empirical approach used, the degree of external financial dependence will be measured for the firms that are quoted on the Stock Exchange. As remarked above, since what we want to measure is the availability (supply) of finance (and not the equilibrium between supply and demand) in frictionless capital markets, the quantity of finance captured will tend to coincide with that desired in the case of quoted firms, as these are less restricted in their access to external finance than others of smaller size whose only sources of finance are the individual entrepreneurs' own resources or banking finance. In other words, the assumption is that quoted firms face a perfectly elastic supply curve for funds.

4. Sources of information, sample and variables used

The achievement of the objectives of the study requires us to combine different sources of statistical information on variables of real and financial activity. In the first

case, it is necessary to possess information on economic growth at sectoral level for the countries analysed, which is the dependent variable of the model. In the case of financial variables, we need information in order to proxy the financial development of economies and the financial dependence of sectors, as well as the level of competition in the banking markets of each country.

The information needed to measure the economic growth (our dependent variable) is taken from *The 60-Industry Database* for 57 sectors (classified in the International Standard Industrial Classification of all Economic Activities, Revision 3, ISIC-Rev.3) of the *Groningen Growth and Development Centre*[5], which is comparable with the STAN database of the OECD, and provides information with broad and homogeneous dissagregation for a large number of countries. The database contains information on value added for agriculture, industry, construction and services in 26 countries (the EU-15, Norway, Central and Eastern Europe, the USA, Canada, Japan, Korea Taiwan and Australia) for the period 1979-2003. Nevertheless, as we will comment later, the period finally used is 1993-2003. The variable to be explained will be the average annual growth rate of real value added for each sector in each country from 1993 to 2003. As in other papers, we restrict our attention to manufacturing industries in order to reduce dependence on national-specific factors. However, we also include the private service sectors of the economy due to their important contribution to the GDP[6]. Finally, the data used comprise information for 57 sectors of the total of economic activity (agriculture, industry, construction and services) classified according to the ISIC rev. (see table 1). For some of the countries in the sample (specifically, Canada, Korea and Norway) the last year available is 2002 (instead of 2003), so for these three countries the average growth rate of value added refers to the period 1993-2002.

The database of the *Groningen Growth and Development Centre* presents various advantages over the one used in Rajan and Zingales (1998). First, it directly offers the deflators of gross value added for each of the sectors of activity included. It is important to use specific deflators for each sector, since the use of a common deflator for all sectors of activity (the *Producer Price Index* used by Rajan and Zingales, 1998) may introduce error in the measurement of the real variations. For example, in the telecommunications or office equipment sector, prices have evolved very differently from the prices of the economy as a whole. Using an aggregate deflator would cause us to compute part of the price variation as a variation in real activity. Secondly, as already remarked, it allows us to carry out the analysis for all sectors of the economy, without

[5] The database is available at http://www.ggdc.net/dseries/60-industry.html.
[6] Financial intermediation sector (sectors 43, 44 and 45) are excluded in the estimation of equation 1. In section 6, we check the robustness of the results estimating equation 1 only for the manufacturing sectors.

having to circumscribe it to manufacturing sectors. However, the use of this statistical source limits the range of countries that can be studied, and as it does not offer the number of firms in each sector, it does not permit us to analyse the effects of financial development and banking competition on the average size of firms and/or the creation of new firms.

The information on financial development is proxied through the variables most commonly used, such as the credit/GDP ratio, stock market capitalisation/GDP, and the sum of both (total capitalisation/GDP)[7]. The first ratio is taken from the *International Financial Statistics* database of the International Monetary Fund, while stock market capitalisation is obtained directly from the *World Development Indicators* database published by the United Nations.

Each country's degree of financial dependence is proxied on the basis of the *Amadeus* database (*Bureau van Dijk*), which contains financial and economic information on more than 7 million European firms. For each firm, the database offers information on the sector of activity to which it belongs according to different sector classifications. Specifically, the *Amadeus* data used were obtained according to the NACE Rev.1.1 classification. To homogenise the sector classifications a double process of conversion was necessary. First the *Amadeus* data were reclassified according to the ISIC rev. 3.1. Second, the sectors were aggregated according to the ISIC rev. 3 classification, to obtain, as a result, the aggregations offered by the database of the *Groningen Growth and Development Centre*. The equivalences between classifications were made on the basis of the four digits disaggregations obtained from the United Nations[8].

Rajan and Zingales (1998) present a measure of external financial dependence on the basis of the flow of investments made by the firm that cannot be financed with the *cash flow* generated[9]. The information available in *Amadeus* does not permit financial dependence to be calculated in this way, so it is proxied by means of balance sheet data from the firms Specifically, the degree of external financial dependence is proxied as the ratio of debt with cost to current liabilities. Specifically, the definition used is as follows:

$$\frac{[Non\,current\,liabilities]+[Current\,liabilities:loans]}{[Total\,assets]-[Current\,liabilities:creditors]-[Other\,current\,liabilities]} \quad (3)$$

[7] See in Beck et al. (2003) a justification of the different proxies for financial development. See also Chinn and Ito (2006) and Baltagi et al. (2009).
[8] http://unstats.un.org/unsd/class/default.htm
[9] Rajan and Zingales define the external dependence as capital expenditures minus cash flows from operations divided by capital expenditures.

This ratio may also be expressed as Interest Bearing Debt / [Stockholders' Equity + Interest Bearing Debt] and represents the debt to total capital ratio, excluding accounts payable and accrual liabilities from the numerator and the denominator of the ratio. Expression (3) avoids potential biases in the financial dependence indicator related to trade credit, which is a function of the firm's operations and its contractual relationship with its suppliers.

With data on the quoted firms of the United Kingdom, the above ratio is calculated for each sector, aggregating in the numerator and in the denominator the data on the firms quoted in each year. Subsequently we obtain the average of the annual data during the period 1993-2003, so that the degree of financial dependence refers to the average of the period. As suggested by Rajan and Zingales (1998), the use of the average of the data smoothes temporal fluctuations and reduces the effects of outliers. Altogether, for the United Kingdom, information is available for 9,087 firms that are quoted on the capital markets.

Table 1 shows the degree of external financial dependence for the different sectors of activity. As can be appreciated from the table, of the 57 sectors initially considered, the criteria used for the calculation of the degree of dependence on external finance (listed companies) oblige us to ignore nine sectors of activity.

The sector presenting the highest level of external financial dependence is "Radio and television receivers" (1.31), followed at a considerable distance by "Legal, technical and advertising" (0.72), "Inland transport" (0.71) and "Air transport" (0.69), while at the opposite extreme we find sectors "Research and development" (0.16), "Office machinery" (0.23), "Building and repairing of ships and boats" (0.27), and "Other instruments" (0.27).

In the case of the measurement of banking competition, the information necessary for estimating the Lerner index, the *H*-statistic and the indices of concentration of the banking markets are taken from the *BankScope* database of the *Bureau van Dijk*. Specifically, the database contains information at firm level on the financial statements (balance sheets and profit and loss accounts) of the banks. Of the total of the countries available in the database, the sample used is formed by the banking sectors of those countries with information available on the economic growth of the sector value added described above, with the exception of the four countries of Eastern Europe (Hungary, Slovakia, Poland and the Czech Republic) and Taiwan. The reason for the exclusion is the low representativeness of the banks of these countries supplied by *BankScope*. In total, the sample is formed by 21 countries. Furthermore, although the database contains information from the mid 1980s onwards, the sample is

unrepresentative before 1993, this being the reason for selecting the period 1993-2003. The sample includes commercial banks, savings banks, credit cooperatives, and other types of financial institutions. Of the total of observations available in *BankScope*, we eliminated those banks: a) that did not offer information for any of the variables necessary to measure the indicators of competition and, b) with information of doubtful reliability or *outliers*. In this last case, we eliminated the observations whose prices for banking output (total assets), and for the inputs necessary to estimate the marginal costs used to construct the Lerner indices, are more than +/- 2.5 times the standard deviation. With these criteria, the sample is formed by an unbalanced panel of 36,281 observations.

The calculation of the Lerner index according to expression (2) requires us to proxy the average price of banking activity and to estimate the corresponding marginal cost. In the first case, the price is obtained as the ratio of bank revenue/total assets, while marginal costs are estimated from a *translog* cost function according to the following expression[10]:

$$\ln C_i = \alpha_0 + \ln TA_i + \frac{1}{2}\alpha_k \left(\ln TA_i\right)^2 + \sum_{j=1}^{3} \beta_j \ln w_{ji} +$$
$$+\frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3} \beta_{jk} \ln w_{ji} \ln w_{ki} + \frac{1}{2}\sum_{j=1}^{3} \gamma_j \ln TA_i \ln w_{ji} + \mu_1 Trend + \mu_2 \frac{1}{2} Trend^2 + \qquad (4)$$
$$+\mu_3 Trend \ln TAi + \sum_{j=1}^{3} \lambda_j trend \ln w_{ji} + \ln u_i$$

According to expression (4) the total costs of bank i (C_i) depend on total assets (*TA*) and on the input prices (w_1=price of labour, proxied as the ratio of personnel costs to total assets; w_2=price of physical capital, proxied as the ratio of operating costs other than personnel to the value of fixed assets; and w_3=price of deposits, proxied as the ratio of financial costs to deposits) and on technical change (proxied by a tendency, *Trend*). In the estimation of the costs function, fixed effects are introduced to capture the effect of possible unobserved variables specific to each bank. Symmetry and linear homogeneity in input prices restrictions are imposed.

The first column of table 2contains the value of the Lerner index for each of the 21 banking sectors analysed. The index of each country is obtained as the weighted average of the value of the Lerner indices of the banks in the sample, using as weighting factor the total assets of each bank. The information shows the existence of marked

[10] The approach to the measurement of the price of banking activity and to the estimation of marginal costs is similar to that used in Maudos and Fernández de Guevara (2004), Fernández de Guevara *et al.* (2005 and 2007) and Carbó *et al.* (2006).

differences in the degree of competition among the countries of the sample, highlighting the high values (low competitiveness) of the USA, Ireland and Spain, and the low values of Luxembourg and Belgium.

Following Bikker and Haaf (2002) and Claessens and Laeven (2004), the *H*-statistic is based on the estimation of the following revenue function:

$$\log(IT/TA)_{it} = \sum_{j=1}^{3} \alpha_j \log w_{it}^J + \beta \log S_{it} + \sum_{n=1}^{2} E_{it}^n + \lambda_i + u_{it} \qquad (5)$$

where the sub-indices *i* and *t* represent the bank and the year, respectively, *IT*= total revenue (financial and non-financial), *TA*= total assets, *w* is the input prices (labour, lendable funds and physical capital), *S* is a scale variable (specifically, the total assets) which measures the degree of utilisation of the installed capacity at which each firm operates and controls for potential size effects, and *E* are exogenous variables specific to each bank which affect revenue (specifically, the ratio of equity to total assets, the ratio of loans to total assets, and the ratio of deposits to total lendable funds). The revenue equation is estimated separately for each banking sector and fixed effects (λ_i) are introduced in order to capture the influence of other bank-specific unobservable factors that may affect its revenue.

Once equation (5) has been estimated, the *H*-statistic is calculated as the sum of the elasticities of the total revenue with respect to the input prices: $H = \sum_{j=1}^{3} \alpha_j$.

Table 2 shows the values of the *H*-statistic and the *p-value* of the test of the null hypothesis that the value of the statistic will be equal to 0, or alternatively, 1. In all cases the value of the statistic is between 0 and 1, so the situation of monopolistic competition cannot be rejected, in all the banking sectors with the exception of Portugal where the results are compatible with the existence of perfect competition (the value of *H* is not statistically different from 1)[11]. The lowest values of the *H*-statistic correspond to the banking sectors of Denmark (0.22) and Sweden (0.36), indicating the existence of greater market power in these two countries. At the opposite extreme, and therefore with greater competitive rivalry, stand the banking sectors of Portugal and Greece.

If structural indicators of competition are used, the results agree irrespective of the indicator used. Thus, at the top, with more concentrated markets, are the banking sectors of Finland and Canada, while at the opposite extreme stand the USA and Germany.

[11] The validity of the *H*-statistic rests on the assumption that sectors are in long term equilibrium. To test this assumption, we re-estimate the revenue equation replacing the dependent variable by ROA (return on assets), so the long term equilibrium is compatible with a value of the sum of the elasticities associated with the input prices equal to 0. In practically all cases it is not possible to reject this hypothesis.

The analysis of the correlations among the different indicators of banking competition (not reported) deserves a special mention. In the case of structural indicators, the correlation among the three indicators of concentration is very high (0.99 between CR3 and CR5, and 0.94 between CR3 or CR5 and HH). In the case of indicators based on the NEOI, the correlation between the Lerner index and the *H*-statistic is, as expected, negative and statistically significant, since a higher value of the *H*-statistic implies greater competition (and therefore, lower value of the Lerner index). However, the correlation of market concentration is only significant with the *H*-statistic, though it is positive, implying that the most highly concentrated banking sectors present greater competitive rivalry, contrary to the usual interpretation. This last result shows, in line with previous studies (Fernández de Guevara *et al.*, 2005, Claessens and Laeven, 2005), the inadequacy of using concentration as a measure of competition. Carbó et al. (2009) compare the relationship between all these indicators of competition obtaining the same inconsistency between them.

5. Empirical results

In this section we present the results of the estimation of equation (1) where the dependent variable is the average annual real growth rate in the period 1993-2003 of the value added of each sector in each country[12]. In each regression, estimated by ordinary least squares, industry and country dummies are introduced (although not reported), as well as the initial share in value added. Initially, with the aim of replicating the results of Rajan and Zingales (1998) with the sample used in this study, we offer the results referring to the effect of financial development on economic growth without including therefore the proxies for competition in the banking markets. At the end of each table we offer the calculation of the economic impact associated with financial development (tables 5 to 8) and banking competition (tables 6 to 8). Specifically, last rows of the tables shows the differential in economic growth between a sector situated in percentile 75 of the distribution and another sector situated at percentile 25 when they are located in a country with a level of financial development and/or banking competition situated in percentile 75 relative to another country situated in percentile 25 (with less financial development and lower level of competition).

Column 1 of table 5 shows the results of the basic specification of Rajan and Zingales. In line with these authors, the results show that the sectors most dependent on external finance grow faster in countries with more developed financial markets,

[12] Table 3 summarises the variables and sources of information used, the descriptive statistics being shown in table 4.

irrespective of the indicator of financial development used (stock market capitalisation /GDP, credit/GDP or total capitalisation/GDP). Specifically, the economic impact of going from a situation of low financial development (as in the case of Greece which is in percentile 25 of the distribution) to another of higher development (Sweden, situated in percentile 75), translates into approximately 0.50 percentage points of growth of the more financially dependent sectors. Consequently, in line with the prior studies by Rajan and Zingales (1998), Cetorelli and Gambera (2001), Guiso *et al.* (2004) and Claessens and Laeven (2005), we obtain evidence favourable to the hypothesis that financial development facilitates economic growth.

Taking as reference the total capitalisation as proxy variable for financial development, if we additionally introduce into the regression the effect of banking competition, the results differ depending on the indicator used (table 6). Thus if the degree of competition is proxied by the concentration of the banking market, the effect is negative, though it is statistically significant only for the Herfindahl-Hirschman index. This result contrasts with the evidence obtained by Cetorelli and Gambera (2001) who find that the most concentrated banking sectors promote the economic growth of those sectors that depend more heavily on external finance by facilitating the access to credit of the youngest firms. However, our evidence agrees with that of Claessens and Laeven (2004) who report a negative (though not significant) coefficient for the interaction of concentration (CR3) with financial dependence.

If instead of using the concentration of the market as proxy for competition we introduce the *H*-statistic (column 4) into the regression, the results re-confirm the positive effect of financial development on economic growth. The interaction of the *H*-statistic with the financial dependence variable presents a negative sign and is statistically significant, implying that greater market power generates greater economic growth. This result contrasts with the evidence obtained by Claessens and Laeven (2005) as it implies a negative effect of banking competition on economic growth.

In the last column of table 6 we show the results when the degree of competition in the banking system is proxied by means of the Lerner index of market power. In this case, the influence of the interaction between the Lerner index and the degree of financial dependence on growth is not statistically significant.

The comparison of the economic impact on economic growth associated with financial development and with the indicators of competition shows different results depending on the indicator of competition. Thus in the case of market concentration, passing from the concentration of a country situated in percentile 25 of the distribution (United Kingdom) to another situated in percentile 75 (Norway in terms of CR5 and

Herfindahl-Hirschman index or Belgium in terms of CR3) translates into a reduction that varies between 0.09 and 0.32 percentage points (pp.), as against an increase of around 0.45 pp. if financial development increases. However, in terms of the *H*-statistic, passing from a situation of low competitive rivalry (Canada, in percentile 25 with an *H*-statistic value of 0.58) to another of greater rivalry (Belgium, in percentile 75 with an *H*-statistic value of 0.77) it translates into a fall of 0.53 pp. in the rate of economic growth, a value similar to that of the increase in the degree of financial development (0.51 pp.).

6. Robustness tests

We now turn to present some robustness tests in order to analyse the sensitivity of the results. Specifically, as well as the tests already carried out in terms of different indicators of banking competition, these tests make reference to: 1) the initial values of financial development and banking competition; 2) the sectors used; 3) the existence of a non-linear relationship between bank competition and economic growth; and 4) the exclusion of the country used as benchmark for the estimation of the degree of financial dependence.

Given that the effect of banking competition and financial development on economic growth is not contemporaneous but affects future growth, it is of interest to analyse the initial effect of financial development and banking competition on the average growth of the period analysed. With this objective, table 7 shows the results proxying the indicators of financial development and banking competition in the initial year (1993). In the case of the *H*-statistic, the value taken as reference is the statistic estimated in the sub-period 1993-98.

In the case of financial development, the results of table 7 confirm once again the positive effect of the interaction between financial dependence and financial development on economic growth, so that the sectors most dependent on external finance experience higher rates of growth in countries with a higher level of financial development.

In the case of the structural indicators of banking competition, the results again show a negative effect irrespective of the indicator used, the Herfindahl-Hirschman index being the most relevant from the point of view of statistical significance. As we have commented earlier, this result contrasts with the evidence found by Cetorelli and Gambera (2001) though we should not forget the limitations of the use of measurements of market concentration to proxy the degree of banking competition.

The results change radically when we use indicators from the NEIO perspective to measure banking competition. In the case of the *H*-statistic (column 4), the effect is once again negative and statistically significant, meaning that an increase in competition (higher value of the *H*-statistic) translates into a slower rate of growth of sector value added. In the case of the Lerner index, now the sign is positive and statistically significant, which also shows the negative effects of banking competition on economic growth. As we have remarked, this positive link between the levels of market power and economic growth can be justified in the context of relationship banking. To solve the problems of asymmetrical information in financial activity, banks can opt to establish close relationships with borrowers, which will facilitate their access to finance.

The second test of robustness refers to the sector analysed. According to Rajan and Zingales (1998), their analysis (and therefore that of Cetorelli and Gambera, 2001; and Claessens and Laeven, 2005) refers to the manufacturing sector in order to reduce the dependence on country-specific factors such as the availability of natural resources. Specifically, the results refering to the manufacturing sector[13] confirm once again the positive effect of financial development on the economic growth of the sectors most dependent on external finance. As regards the influence of market concentration, the results do not vary from those obtained in table 6 for the total of sectors of the economy, confirming the negative effect of the Herfindahl-Hirschman index. Finally, the results are also robust when we use indicators of banking competition from the theory of industrial organisation, verifying the negative influence of competition on economic growth.

To check for a non-linear relationship between bank competition and economic growth, table 8 adds a squared term of the interaction term between financial dependence and bank market power indicators. In the case of the market concentration indicators, and in line with Cetorelli and Gambera (2001), results points to an inverted-U effect of bank market power on economic growth, although results are not statistically significant for the HHI.

If, instead of using the market concentration indicators as proxy for bank competition, we introduce into the regression the non-structural indicators, we find that bank market power has an inverted-U effect. This result is in concordance with Cetorelli and Gambera (2001) and suggests that the overall economic growth potential of the sectors is highest at intermediate values of market power, since sectors in an intermediate interval of the distribution of external dependence benefit substantially. This is due to the fact that with moderate levels of market power, banking firms

[13] From the total of sectors hitherto analysed we have eliminated the mining sector (sector 4), construction (sector 33) and all the services sectors (from 34 to 57). Results are available upon request.

capitalise on the advantages derived from investing in lasting relationships with their clients, and can thereby overcome the typical problems of asymmetric information and moral hazard associated with the task of financial intermediation.

Finally, the results are maintained if from the total sample used we exclude the United Kingdom, which is the country used as *benchmark* for the estimation of the financial dependence variable[14].

7. Conclusions

One of the questions that has received special attention in recent years is the analysis of the effect of financial development on economic growth. However, the effect of banking competition on economic growth has received much less attention as shown by the fact that to date (as far as we know) only two studies have been published that have presented empirical evidence on this important question. This is surprising if we take into account that the theory offers ambiguous results in respect of the effect of banking competition on growth, so it is an issue to be resolved empirically. Furthermore, the fact that the only two existing studies made use the same sample makes it even more necessary to bring additional empirical evidence with other samples that will permit testing of the robustness of the results so far obtained.

In this context, the objective of the study is to contribute with additional evidence by analysing the effect of financial development and competition in the banking markets on economic growth using a sample of 53 sectors in 21 countries over the period 1993-2003. For this purpose, we expand the sector coverage of the sample, as the financial dependence and growth used by Rajan and Zingales (1998), Cetorelli and Gambera (2001), and Claessens and Leaven (2005) are only of the manufacturing sector. Also, it is the only study that constructs the test from databases (especially in the case of the financial dependence variable) different from those of the original study by Petersen and Rajan (1998). Further contributions of the study are the use of two measures of banking competition based on the theory of industrial organisation, and the testing of the robustness of the results to the use of structural indicators of competition (market concentration).

[14]The results are also robust if we include in the estimation the effect of variables specific to each country that are usually used in regressions to explain economic growth. Specifically, we include two explanatory variables: a) human capital (proxied by the average of the years of schooling attained by the population over 25 years of age –Source: Barro and Lee, 2000; and b) the initial GDP per capita, obtained from the OECD publication National Accounts. Results are available upon request to the authors.

The results obtained show a positive effect of financial development on the economic growth of the sectors most dependent on external finance, confirming the results obtained in other studies. The results also show that the exercise of a certain level of market power favours the growth of the sectors most dependent on external finance. More precisely, results also show that bank monopoly power has an inverted-U effect on economic growth, suggesting that the positive effect of market power on growth is highest at intermediate values. These results are in agreement with recent contributions in the field of relationship banking which show that the banks with monopoly power have greater incentives to establish relationships with their clients by facilitating their access to credit and consequently reducing the financial constraints on firms (Dell´Ariccia and Marquez, 2004). The fact that the existence of asymmetries of information is a fundamental characteristic of the banking activity causes banks to seek to solve the asymmetries, in many cases, by establishing stable and long-lasting relationships with their clients. These relationships may confer market power on the banks, as the clients may become informationally "locked in" with the bank (*hold-up problem*). Despite this greater market power, and despite the bank's greater knowledge of the borrowers, it is possible for the latter to obtain finance on conditions which they would not have obtained otherwise. Having market power is important to be able to implement these relationship strategies because it guarantees that the banks will be able to recover their investment in the acquisition of the information (Boot and Thakor, 2000) and to solve, therefore, the problems of asymmetrical information.

An implication of our results is in the current context of financial crisis, the decline in the indicators of financial development (as for example total capitalization as percentage of GDP) is translated into a reduction in the GDP growth rate. In fact, the results presented in Maudos (2010) shows that over the period 1999-09, the annual contribution of financial development to GDP growth in the euroarea is 0.15 percentage points (pp.) per year, explaining 12% of economic growth. However, in the period of crisis 2007-09, the annual contribution in only 0.022 pp. which gives evidence of the strong impact of the financial crisis.

Our results show that in the bank sector, neither perfect competition nor monopoly is the optimal banking market structure from the point of view of economic growth, but rather an intermediate monopolistic competition situation is most advantageous. Furthermore, according to conventional wisdom there is a trade-off between financial stability and competition in banking; some market power must therefore be permitted in order to guarantee financial sector stability and, consequently, to promote economic growth.

The results obtained are robust to different alternative specifications. Specifically, the results do not vary when the indicators of financial development and banking competition are dated in the initial year, or when the analysis is circumscribed to the manufacturing sector, or when the country used as a benchmark (UK) is excluded from the analysis.

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References

Angelini, P., Disalvo, R., Ferri, G., 1998. Availability and cost of credit for small businesses: customer relationships and credit cooperatives. Journal of Banking and Finance 22, 925-54.

Baltagi, B., Demetriades, P. Law, S., 2009. Financial development and openness: Evidence from panel data. Journal of Development Economics 89(2), 285-296.

Baumol, W.J., 1982. Contestable markets: An uprising in the theory of industry structure. American Economic Review 72, 1-15.

Baumol, W.J., Panzar, J.C., Willig, R.D., 1982. Contestable markets and the theory of industry structure. Harcourt Brace Jovanovich, San Diego.

Beck, T., Demirgüç-Kunt, A., Lozaya, N., 2000. Finance and sources of growth. Journal of Financial Economics 58, 261-300.

Beck, T., Demirgüç-Kunt, A., Levine, R., 2003. A new database on financial development and structure. World Bank Group Working Paper No 2784.

Berger, A., Demirgüç-Kunt, A., Levine, R., Haubrich, J., 2004. Bank concentration and competition: an evolution in the making. Journal of Money, Credit and Banking 355, 433-451.

Berlin, M., Mester, L.J., 1999. Deposits and relationship lending, The Review of Financial Studies 12, 579-607.

Bikker, J.A., Haaf, K., 2002. Competition, concentration and their relationship: an empirical analysis of the banking industry. Journal of Banking and Finance 26, 2191-2214.

Boot, W., 2000. Relationship banking: what do we know?. Journal of Financial Intermediation 9, 7-25.

Carbó, S., Humphrey, D., Maudos, J., Molyneux,P., 2009. "Cross-country comparisons of competition and pricing power in European Banking", Journal of International Money and Finance, 28, 115-134.

Carbó, S., Rodriguez, F., Udell, G., 2009. Bank Market Power and SME Financing Constraints. Review of Finance 13(2), 309-340.

Cetorelli, N., Gambera, M., 2001. Banking market structure, financial dependence and growth: international evidence from industry data. Journal of Finance 56, 617-648.

Chakraborty, A., Charles X. Hu, 2006. Lending erelationships in line-of-credit and nonline-of-credit loans: evidence from collateral use in small business. Journal of Financial Intermediation 151, 86-107.

Chinn, M., Ito, I.,2006. What matters for financial development? Capital controls, institutions, and interactions. Journal of Development Economics, 81(19), 163-192.

Claessens, S., Laeven, L., 2004. What drives bank competition? Some international evidence. Journal of Money, Credit and Banking 36(3), 563-583.

Claessens, S., Laeven, L., 2005. Financial dependence, banking sector competition, and economic growth. Journal of the European Economic Association 3(1), 179-207.

Cole, R.A., 1998. The importance of relationships to the availability of credit. Journal of Banking and Finance 22, 959-977.

D'Auria, C., Foglia, A., Reedtz, P., 1999. Bank interest rates and credit relationships in Italy. Journal of Banking and Finance 23(7), 1067-93.

De Bandt, O., Davis, E. P., 2000. Competition, contestability and market structure in European banking sectors on the eve of EMU. Journal of Banking and Finance 24, 1045-1066.

Degryse, H., Van Cayseele, P., 2000. Relationship lending within a Bank-based system: evidence from European small business data. Journal of Financial Intermediation 9, 90-109.

Degryse, H., Ongena, S. 2003. Distance, lending relationships, and competition. The Journal of Finance 60(1), 231-66.

Dell´Ariccia, G., Marquez, R., 2004. Information and bank credit allocation. Journal of Financial Economics 72(1), 185-214.

Dell´Ariccia, G., Bonaccorsi di Patti, E., 2004. Bank Competition and Firm Creation. Journal of Money, Credit, and Banking 36(2), May, pp. 225-251

Elsas, R., Krahnen, J.P., 1998. Is relationship lending special? Evidence from credit-file data in Germany. Journal of Banking and Finance 22, 1283-1316.

Fernández de Guevara, J., Maudos, J., 2004. Measuring welfare loss of market power: an application to European banks. Applied Economics Letters 11(13), 833-836.

Fernández de Guevara, J., Maudos, J., Pérez, F., 2005. Market power in European banking. Journal of Financial Services Research 27(2), 109-137.

Fernández de Guevara, J., Maudos, J., Pérez, F., 2007. Integration and competition in the European financial markets. Journal of International Money and Finance, 26, 26-45.

Guiso, L., Jappelli,T., Padula, M., Pagano, M., 2004. Financial market integration and economic growth in the UE. Economic Policy, October, 523-577.

Harhoff, D., Körting, T., 1989. Lending relationships in Germany – Empirical evidence from survey data. Journal of Banking and Finance 22, 1317-1353.

Hasan, I., Koetter, M. and Wedow, M., 2009. Regional growth and finance in Europe: Is there a quality effect of bank efficiency? Journal of Banking and Finance, 33(8), 1413-1422

King, R., Levine, R., 1993a. Finance and growth: Schumperter might be right. Quarterly Journal of Economics 108, 717-737.

King, R., Levine, R., 1993b. Finance, Entrepreneurship and Growth: Theory and Experience. Journal of Monetary Economics 32, 513-542.

Levine, R., Zervos, S., 1998. Stock markets, banks, and economic growth. American Economic Review 88, 537-58.

Levine, R., 2005. Finance and growth: theory, evidence and mechanisms. in Phillipe Aghion and Steven Durlauf ed), Handbook of Economic Growth, Amsterdam: North-Holland Elsevier Publishers, chapter 12, 865-934.

Loayza, N., Rancière, R., 2006. Financial development, financial fragility, and growth. Journal of Money, Credit and Banking 38(4), 1051-1076.

Maudos, J., Fernández de Guevara, J., 2004. Factors explaining the interest margin in the banking sectors of the European Union. Journal of Banking and Finance 28(9), 2259-2281.

Maudos, J., Fernández de Guevara, J., 2007. The cost of market power in the banking sectors: social welfare loss vs. inefficiency cost, Journal of Banking and Finance 31(7), 2103-2125.

Maudos, J., 2010. Observatory about the financial integration in Europe: Analysis of the Spanish case. 2009 in Observatory of the Reform of the European Financial Markets, forthcoming.

Molyneux, P., Lloyd-Williams, D.M., Thornton, J., 1994. Competitive conditions in European banking. Journal of Banking and Finance 18, 445-459

Panzar, J.C., Rosse, J.N., 1987. Testing for monopoly equilibrium. Journal of Industrial Economics 35, 443-456.

Petersen, M., Rajan, R., 1994. The benefits of lending relationship: evidence from small business data. Journal of Finance 49, 1367-1400.

Petersen, M., Rajan R., 1995. The effect of credit market competition on lending relationships. Quarterly Journal of Economics 110, 407-443.

Rajan, R., 1992. Insiders and outsiders, the choice between informed and arm's length debt. Journal of Finance 47, 1367-1400.

Rajan, R., Zingales, L., 1998. Financial dependence and growth. American Economic Review 88, 559-587.

Table 1. Financial dependence across sectors in the United Kingdom

Averages over 1993-2003

Sector GGDC	Sector	Dependencia financiera
1	Agriculture	n.a.
2	Forestry	n.a.
3	Fishing	n.a.
4	Mining and quarrying	0.44
5	Food, drink & tobacco	0.52
6	Textiles	0.36
7	Clothing	0.31
8	Leather and footwear	0.32
9	Wood & products of wood and cork	0.44
10	Pulp, paper & paper products	0.36
11	Printing & publishing	0.55
12	Mineral oil refining, coke & nuclear fuel	0.42
13	Chemicals	0.51
14	Rubber & plastics	0.38
15	Non-metallic mineral products	0.50
16	Basic metals	0.36
17	Fabricated metal products	0.50
18	Mechanical engineering	0.52
19	Office machinery	0.23
20	Insulated wire	n.a.
21	Other electrical machinery and apparatus nec	0.55
22	Electronic valves and tubes	0.24
23	Telecommunication equipment	0.31
24	Radio and television receivers	1.31
25	Scientific instruments	0.32
26	Other instruments	0.27
27	Motor vehicles	0.43
28	Building and repairing of ships and boats	0.27
29	Aircraft and spacecraft	0.56
30	Railroad equipment and transport equipment nec	n.a.
31	Furniture, miscellaneous manufacturing; recycling	0.41
32	Electricity, gas and water supply	0.52
33	Construction	0.35
34	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	0.46
35	Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.47
36	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	0.34
37	Hotels & catering	0.42
38	Inland transport	0.71
39	Water transport	0.41
40	Air transport	0.69
41	Supporting and auxiliary transport activities; activities of travel agencies	0.38
42	Communications	0.33
43	Financial intermediation, except insurance and pension funding	0.53
44	Insurance and pension funding, except compulsory social security	n.a.
45	Activities auxiliary to financial intermediation	0.52
46	Real estate activities	0.45
47	Renting of machinery and equipment	0.62
48	Computer and related activities	0.52
49	Research and development	0.16
50	Legal, technical and advertising	0.72
51	Other business activities, nec	0.60
52	Public administration and defence; compulsory social security	n.a.
53	Education	0.37
54	Health and social work	0.42
55	Other community, social and personal services	0.36
56	Private households with employed persons	n.a.
57	Extra-territorial organizations and bodies	n.a.

Source: Amadeus (Bureau Van Dijk).

Table 2. Bank competition indicators

	Lerner index	H-statistic			CR3	CR5	Herfindahl-Hirschman index
		H-statistic	P-value H=0	P-value H=1			
Australia	0.295	0.706	0.000	0.000	48.75	64.74	1,102
Austria	0.217	0.613	0.000	0.000	35.01	46.23	620
Belgium	0.188	0.772	0.000	0.000	50.46	69.09	1,215
Canada	0.256	0.580	0.000	0.000	56.11	76.59	2,200
Germany	0.227	0.641	0.000	0.000	16.06	23.29	198
Denmark	0.241	0.220	0.000	0.000	48.63	68.00	1,106
Spain	0.307	0.522	0.000	0.000	32.23	44.85	531
Finland	0.293	0.717	0.000	0.002	71.65	88.65	2,379
France	0.207	0.524	0.000	0.000	28.05	40.29	435
Greece	0.210	0.983	0.000	0.000	61.18	76.84	1,648
Ireland	0.311	0.583	0.000	0.003	45.74	56.95	957
Italy	0.246	0.592	0.000	0.000	23.50	33.24	344
Japan	0.283	0.538	0.000	0.000	20.45	29.33	295
Korea	0.287	0.668	0.000	0.000	37.29	52.82	769
Luxembourg	0.156	0.834	0.000	0.000	19.40	29.19	320
Netherlands	0.236	0.779	0.000	0.003	52.96	63.02	1,279
Norway	0.218	0.646	0.000	0.000	52.76	65.79	1,211
Portugal	0.260	0.946	0.000	0.269	43.28	59.18	975
Sweden	0.249	0.364	0.000	0.000	43.95	63.29	1,010
United Kingdom	0.292	0.826	0.000	0.000	26.44	36.62	407
USA	0.341	0.625	0.000	0.000	10.06	15.20	111

Source: BankScope (Bureau Van Dijk) and own elaboration.

Table 3. Definition and source of variables

	DESCRIPTION AND SOURCE
Growth	Average annual real growth rate of value added in a particular sector in each country over the period 1993-2003. Source: *The 60-Industry Database* (classified on the basis of ISIC rev. 3) of the *Groningen Growth and Development Centre*.
Share in value added	The value added of each sector expressed as a percentage of the total value added in the initial year (1993). Source: *Groningen Growth and Development Centre*.
Financial dependence	Financial dependence is proxied by the ratio of long term debt and short term debt distinct from creditors to working capital. Source: *Amadeus* (*Bureau Van Dijk*).
Financial development	
- Credit/GDP	Credit is taken from the database *International Financial Statistics* of the International Monetary Fund. GDP comes from *National Accounts* (OECD).
- Market capitalisation /GDP	Stock market capitalization is taken from *World Development Indicators* (United Nations).
- Total capitalisation /GDP	Sum of the credit and stock market capitalization variables.
Banking competition	
- Lerner index	The Lerner index of market power is calculated by estimating average prices of banking activity (as the ratio of total revenue to total assets) and marginal costs (specifying a *translog* costs function). The value of the index is calculated for each bank in each year of the sample (1993-2003), using the mean weighted according to assets, in the explanatory equation of the economic growth of the individual values. The source of information is *BankScope*.
- H-statistic	*The H-statistic* is estimated from a revenue function for each country in the period 1993-2003. The source of information is *BankScope*.
- Market concentration	Market concentration is proxied by 3 indicators: CR3 and CR5 (market share of the 3 or 5 largest banks), and by the Herfindahl-Hirschman index (squared sum of the market shares of all the banks in each country available in *BankScope*). The means for the period 1993-2003 are calculated from the annual data for each country. The source of information is *BankScope*.

Table 4. Descriptive statistics of the sample used

	Mean	Standard deviation	Median	Maximum	Minimum	25th percentile	75th percentile
Growth. 1993-2003 (%)	4.92	10.62	2.65	74.45	-17.86	0.67	5.33
Financial dependence	0.45	0.17	0.43	1.31	0.16	0.36	0.52
Share in value added	1.85	2.25	0.93	13.78	0.00	0.37	2.60
Private credit/GDP (%)	105.22	24.90	102.34	148.45	63.43	85.14	128.91
Market capitalisation/GDP (%)	73.16	37.71	62.32	161.60	15.80	41.91	96.51
Total capitalisation/GDP (%)	178.39	42.65	170.55	275.38	102.74	154.24	201.25
CR3 (%)	39.29	15.88	43.28	71.65	10.06	26.44	50.46
CR3-1993 (%)	44.16	20.06	40.77	83.89	10.09	27.19	60.37
CR5 (%)	52.59	19.25	56.95	88.65	15.20	36.62	65.79
CR5-1993 (%)	57.75	22.15	60.46	88.26	15.52	38.00	76.28
Herfindahl-Hirschman index	910	603	957	2379	111	407	1211
Herfindahl Hirschman index-1993	1208	1215	917	6039	107	456	1470
H-statistic	0.65	0.17	0.64	0.98	0.22	0.58	0.77
H-statistic: 1993-1997	0.71	0.16	0.72	0.99	0.45	0.58	0.84
Lerner index	0.25	0.04	0.25	0.34	0.16	0.22	0.29
Lerner index-1993	0.23	0.07	0.22	0.39	0.10	0.16	0.29

Notes: Growth is the annual real growth rate of value added in a particular sector in each country over the period 1993-2003 (source: The 60-Industry Database of the Groningen Growth and Development Centre. Share in value added is the value added of each sector expressed as a percentage of the total value added in the initial year, 1993 (source: Groningen Growth and Development Centre). Financial dependence is proxied by the ratio of long term debt and short term debt distinct from creditors to working capital (source: Amadeus). Credit is taken from the International Financial Statistics (IMF). Stock market capitalization is taken from World Development Indicators (United Nations). Total capitalization is the sum of the credit and stock market capitalization variables. CR3 and CR5 is the market share of the 3 or 5 largest banks in each country in each year. CR3-1993 and CR5-1995 are the market share of the 3 or 5 largest banks in each country in year 1993. The Herfindahl-Hirschman indexis the squared sum of the market shares of all the banks in each country available in BankScope.
The Lerner index of market power is calculated by estimating average prices of banking activity (as the ratio of total revenue to total assets) and marginal costs (specifying a translog costs function). The value of the index is calculated for each bank in each year of the sample (1993-2003), using the mean weighted according to assets, in the explanatory equation of the economic growth of the individual values. The source of information is BankScope. The H-statistic is estimated from a revenue function for each country in the period 1993-2003. The source of information is BankScope.

Table 5. Economic growth and financial development

	(1)	(2)	(3)
Constant	0.0126	-0.0015	-0.0201
	(0.0151)	(0.0167)	(0.0193)
Share in value added. 1993	-0.0905	-0.0843	-0.0954
	(0.1356)	(0.1352)	(0.1350)
Financial dependence*Credit/GDP	0.0005 *		
	(0.0003)		
Financial dependence*Market capitalisation/GDP		0.0006 **	
		(0.0002)	
Financial dependence*Total capitalisation/GDP			0.0006 ***
			(0.0002)
R^2 adj.	0.8222	0.8229	0.8236
Number of observations	995	995	995
Differential in real growth rate	0.40	0.53	0.49

Notes: The dependent variable is the annual growth rate in real value form the period 1993-03 for each sector in each country. Definitions and data sources are in Table 3. The differential in real growth rate measures (in percentage terms) how much faster a sector at the 75th percentile level of financial dependence grows with respect to a sector at the 25th percentile level when is located in a country at the 75th percentage of financial development rather than in one at 25th percentile. All regressions include both country and sector fixed effects (not reported). Robust standard errors are reported in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6. Economic growth, financial development and banking competition

	(1)	(2)	(3)	(4)	(5)
Constant	-0.0172	-0.0184	-0.0166	0.0150	-0.0180
	(0.0196)	(0.0197)	(0.0194)	(0.0215)	(0.0310)
Share in value added. 1993	-0.0955	-0.0955	-0.0977	-0.0975	-0.0957
	(0.1350)	(0.1351)	(0.1349)	(0.1341)	(0.1351)
Financial dependence*Total capitalisation/GDP	0.0006 ***	0.0006 ***	0.0006 ***	0.0007 ***	0.0006 ***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Financial dependence*CR3	-0.0414				
	(0.0535)				
Financial dependence*CR5		-0.0178			
		(0.0442)			
Financial dependence*Herfindahl index			-0.2382 *		
			(0.1385)		
Financial dependence*H-statistic				-0.1684 ***	
				(0.0470)	
Financial dependence*Lerner index					-0.0166
					(0.1952)
R^2 adj.	0.8236	0.8235	0.8240	0.8259	0.8235
Number of observations	995	995	995	995	995
Differential in real growth rate					
Financial development	0.46	0.48	0.45	0.51	0.49
Bank competition	-0.16	-0.09	-0.32	-0.53	-0.02

Notes: The dependent variable is the annual growth rate in real value form the period 1993-03 for each sector in each country. Definitions and data sources are in Table 3. The differential in real growth rate measures (in percentage terms) how much faster a sector at the 75th percentile level of financial dependence grows with respect to a sector at the 25th percentile level when is located in a country at the 75th percentage of financial development (bank competition) rather than in one at 25th percentile. All regressions include both country and sector fixed effects (not reported). Robust standard errors are reported in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7. Economic growth, initial financial development and banking competition

	(1)	(2)	(3)	(4)	(5)
Constant	-0.0079	-0.0120	-0.0079	0.0104	-0.0544
	(0.0168)	(0.0173)	(0.0168)	(0.0203)	(0.0238)
Share in value added. 1993	-0.1017	-0.0980	-0.1017	-0.0952	-0.0995
	(0.1345)	(0.1349)	(0.1346)	(0.1346)	(0.1344)
Financial dependence*Total capitalisation/GDP 1993	0.0006 ***	0.0007 ***	0.0006 ***	0.0008 ***	0.0008 ***
	(0.0002)	(0.0002)	(0.0021)	(0.0002)	(0.0002)
Financial dependence*CR3 1993	-0.1540 **				
	(0.0698)				
Financial dependence*CR5 1993		-0.0057			
		(0.0390)			
Financial dependence*Herfindahl index 1993			-0.1545 **		
			(0.0698)		
Financial dependence*H-statistic 1993-98				-0.1055 **	
				(0.0524)	
Financial dependence*Lerner index 1993					0.2789 **
					(0.1142)
R^2 adj.	0.8248	0.8238	0.8248	0.8246	0.8250
Number of observations	995	995	995	995	995
Differential in real growth rate					
Financial development	0.50	0.59	0.50	0.67	0.67
Bank competition	-0.85	-0.04	-0.26	-0.46	0.62

Notes: The dependent variable is the annual growth rate in real value form the period 1993-03 for each sector in each country. Definitions and data sources are in Table 3. The differential in real growth rate measures (in percentage terms) how much faster a sector at the 75th percentile level of financial dependence grows with respect to a sector at the 25th percentile level when is located in a country at the 75th percentage of financial development (bank competition) rather than in one at 25th percentile. All regressions include both country and sector fixed effects (not reported). Robust standard errors are reported in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8. Economic growth, initial financial development and banking competition (non-linear relationship between bank competition and growth)

	(1)	(2)	(3)	(4)	(5)
Constant	-0.0213	-0.0275	-0.0112	0.0193	-0.0973 ***
	(0.0178)	(0.0191)	(0.0171)	(0.0685)	(0.0334)
Share in value added. 1993	-0.1046	-0.1022	-0.1027	-0.0949	-0.0934
	(0.1342)	-(0.7590)	(0.1345)	(0.1347)	(0.1343)
Financial dependence*Total capitalisation/GDP 1993	0.0006 ***	0.0007 ***	0.0006 ***	0.0008 ***	0.0008 ***
	(0.0002)	(0.0002)	(0.0021)	(0.0002)	(0.0002)
Financial dependence*CR3 1993	0.4871 **				
	(0.1923)				
Financial dependence*CR3 1993^2	-0.6016 ***				
	(0.2088)				
Financial dependence*CR5 1993		0.3928 *			
		(0.2174)			
Financial dependence*CR5 1993^2		-0.3701 *			
		(0.1985)			
Financial dependence*Herfindahl index 1993			0.0820		
			(0.2164)		
Financial dependence*Herfindahl index 1993^2			-0.3975		
			(0.3443)		
Financial dependence*H-statistic 1993-98				-0.1745	
				(0.5127)	
Financial dependence*H-statistic 1993-98^2				0.0484	
				(0.3581)	
Financial dependence*Lerner index 1993					1.4691 **
					(0.6598)
Financial dependence*Lerner index 1993^2					-2.5084 *
					(1.3698)
R^2 adj.	0.8255	0.8243	0.8248	0.8244	0.8254
Number of observations	995	995	995	995	995
Differential in real growth rate					
Financial development	0.50	0.59	0.50	0.67	0.67
Bank competition	-1.07	-0.87	-0.07	0.05	-2.30

Notes: The dependent variable is the annual growth rate in real value form the period 1993-03 for each sector in each country. Definitions and data sources are in Table 3. The differential in real growth rate measures (in percentage terms) how much faster a sector at the 75th percentile level of financial dependence grows with respect to a sector at the 25th percentile level when is located in a country at the 75th percentage of financial development (bank competition) rather than in one at 25th percentile. All regressions include both country and sector fixed effects (not reported). Robust standard errors are reported in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%