Banking competition and economic growth

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ABSTRACT

Although it is recognized that competition is the most efficient and desirable market structure, banking markets represent an example of sectors where a competitive environment may be even harmful because, without an adequate degree of market power, banks cannot get enough information about borrowers and are less willing to engage in lending relationships with their clientele. In turn, these phenomena may have an adverse impact on their lending activity and hence on the overall economic performance. Both theoretical and empirical economic literature have not reached a clear-cut consensus on the way banks contribute to economic growth in either a more competitive or more concentrated environment. In this paper we survey the existing literature on the connection between competition in banking markets and real economic activity, also providing some new empirical evidence on the issue.

KEYWORDS: Banking; Competition; Market structure; Market power; Economic growth

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1. Introduction

The idea that competition is the most desirable market structure represents one of the long-established principles in economics. It guarantees both productive efficiency and allocative efficiency, boosts innovation by both incumbent and entrant firms, allows consumers to buy at lower prices and choose among different producers of goods and services, and ultimately benefits the society as a whole. Yet, there are industries where competition is either unfeasible or harmful. For example, markets involving natural monopoly, patents, exclusive resource ownership, externalities, asymmetric information are barely able to reach the competitive result, thus calling for specific ways of intervention in order to improve market outcomes.

A strand of economic literature maintains that competition in banking markets is likely to exert adverse effects on their performance and stability, undermining both individuals and credit institutions and generating unavoidable spillover effects on the overall economy. Undoubtedly, the huge number of people that today make use of banks and their services, especially in developed countries, makes clear that the behaviour and choices of credit institutions directly influence real economy in a special and more substantial way than other industries.

Hence, given the now well recognized, crucial function of banks in the economy, especially their role in credit supply but also in the transmission of monetary policy and the payment system, it appears important to investigate the consequences of the degree of competition in the banking industry on economic performance.

Assessing and measuring competition and/or market power in the banking industry has long been an important issue in the economic literature. In recent years, the role of banking market power in spurring economic development has become the focus of several theoretical and empirical studies. Challenging the conventional view according to which less competitive banking industries reduce social welfare, some authors have conjectured that a higher degree of market power can increase the information availability for banks in their lending activity as well as their willingness to engage in closer lending relationships with their clientele.

However, both theoretical and empirical works have not achieved unambiguous results, which proves the difficulty of analysing and gauging such topic.

In this paper we survey the existing literature on the connection between competition in banking markets and economic performance, also providing some new empirical evidence on the issue. Particularly, Sections 2 and 3 sketchily present the role and importance of financial markets and banks, respectively, as an engine for economic development. Section 4 is devoted to the analysis of

theoretical models predicting the impact of banks' behaviour on both credit markets and overall economy, while the empirical literature on the link between banking competition and economic growth is reviewed in Section 5. An original GMM estimation for assessing the relationship between the degree of competition and economic growth in a wide sample of countries is provided and discussed in Section 6. Finally, Section 7 draws some brief conclusions.

2. Financial markets and growth

Schumpeter (1911) was a pioneer in studying in depth the role of financial intermediaries within the real economy, particularly for technological innovation and economic development. One of his ideas was that credit does create real value, in contrast with Ricardo's view that banking activity does not increase a country's wealth. Early important empirical works that confirms such role are those by Goldsmith (1969) and McKinnon (1973), which however contrast with the ideas of other economists who maintain that finance is a rather minor factor in economic development: for example, Robinson (1952) argued that "where enterprise leads, finance follows".

In the last decades, many empirical analyses have found that financial development leads and speeds economic growth. The first noteworthy study on this topic has been proposed by King and Levine (1993), who use data regarding 77 countries in the period 1960-1989 and find that a series of predetermined indicators of the "financial depth" (the size of the formal financial intermediary sector relative to GDP, the importance of banks relative to the central bank, the percentage of credit allocated to private firms, the ratio of credit issued to private firms to GDP) are positively and significantly correlated with real economic activity (GDP growth, the rate of physical capital accumulation, improvements in the efficiency of capital allocation). Hence, a deeper financial sector can foster long-run growth: the latter is stimulated by both productivity gains and capital accumulation, and the financial sector represents the mechanism through which savings are channelled into investment either directly (in the markets) or indirectly (via financial intermediaries).

The main difficulty in assessing the precise relationship between the financial sector and economic growth concerns the proper understanding of the causality link between them. Actually, even if the empirical evidence reports a positive correlation between finance and growth, this might not be a signal that the financial system (and banks) brings about real economic activity, being possible that the role of financial institutions is endogenously determined as a result of economic growth.

The causality and endogeneity issues have fuelled the adoption of more sophisticated econometric techniques, like dynamic panel estimation methods and instrumental variables estimations, where variables that could exogenously affect financial development have been added (protection of property rights, quality of the legal enforcement system, level of trust, corruption, etc.). Even so, their results have broadly confirmed the evidence of the previous studies, showing that financial development does positively influence the real economy. Of course, given the complexity of the subject, a concern regarding possible omitted variables still persists, in the sense that the positive effect of financial variables could merely be the reflection of something else affecting simultaneously the financial and the real side (Manning, 2003; Zingales, 2003).

3. Banking markets and growth

Among financial intermediaries, banks have always had a rather extensive and deep-rooted role in the functioning of every market, which proves the importance of banking institutions for the real economy. It follows that a clear-cut understanding of the forces driving economic growth cannot overlook the crucial function played by banks, particularly their role in directing savings to investment opportunities, which still remains fundamental notwithstanding the increasing weight of stock markets.

Actually, World Bank data show that at the world level domestic credit provided by banks to private sector (as a percentage of GDP) still increased from 1990 to 2012, going from 79 to 83 per cent, although differences exist between macro-areas: for example, it grew in the United Kingdom (from 105 to 166 per cent) and the Euro area (from 75 to 100 per cent), while it fell in Japan (from 172 to 107 per cent) and the United States (from 53 to 50 per cent). For sake of comparison, in the same period the world stock market capitalization (as a percentage of GDP) rose from 46 to 74 per cent, with substantial growth in the United States (from 51 to 116 per cent), the United Kingdom (from 78 to 116 per cent) and the Euro area (from 21 to 50 per cent), and a reduction in Japan (from 94 to 62 per cent). Overall, it emerges a stable and remarkable importance of banks in the various world economies, even if with some differences.

Levine and Zervos (1998) have employed an empirical framework similar to King and Levine (1993), but focusing specifically on the links between stock market and bank credit, on the one side, and real economic activity on the other side. The results of their analysis, which considers 47 countries between 1976 and 1993, indicate that increasing bank credit allows an increase in real per capita income (also, their simulations display a notable magnitude of this impact) and that stock markets provide different services from banks (i.e., they are complements rather than substitutes).

Other studies on the link between financial development and economic growth have considered bank variables (usually, private or domestic credit) and found the same evidence (e.g. Levine et al., 2000; Beck and Levine, 2004; Law and Singh, 2014).

As regards the characteristics of the banking industry, a flood of studies has concentrated on the role played by the degree of competition among banks for the real economy. Two main reasons have supported this choice (Cetorelli, 2009). First, the banking sector has been generally characterized by strong regulation (due to the intrinsic nature of what is exchanged therein), unlike the great majority of industries, where market structure and competitive conduct are determined endogenously; thus, competition might even be considered as exogenous when studying its impact on the real economy. Second, and probably more challenging in the perspective of economic analysis, there is an interesting divergence of theoretical conjectures about the effects of bank competition on economic development.

A competitive environment in the banking market may be beneficial because of its pressure on prices: particularly, it pushes down lending rates for borrowers and raises deposit rates for lenders, thus boosting both savings and investments, hence private sector development, capital accumulation, individual welfare and economic development. It is worth also noting that firms facing lower lending rates would be induced to take less risk in their business, in this way enhancing the stability of the banking and financial markets. In addition, competition increases the number of banks, helping to cover previously unbanked areas, and contributes to the development of new products and services (technological advancements over the last years are ATMs, telephone banking, internet banking, the increased use of credit and debit cards). As a consequence, in terms of regulation of the banking industry structure, commonly recommended measures have been the liberalization of the markets and the removal of entry barriers, whose aim clearly was to contain banks' market power and spur competition (Cetorelli, 2001).

However, there are other aspects related to this issue that cannot be disregarded and may cast doubts on the whole beneficial welfare impact of banking competition on the economy. Greater competition among banks may shrink the supply of credit to informationally opaque borrowers because of adverse selection and moral hazard. If we assume that both effects exist and coexist, the negative "information" effect may surmount the positive "competition" effect in those segments of the credit market where asymmetric information problems are severe. Instead, with less competitors in the market, banks are more willing to engage in relationship lending with borrowers (investing in the acquisition of soft information by establishing with them close ties over time), which results in more efficient screening and monitoring and grants better ex-post loan performance but also more enterprises, more employment, more economic activity and more growth. Besides, it is often

maintained that a more concentrated and less competitive banking industry is better in diversifying business risk and exploiting economies of scale.[1] Thus, in terms of economic performance the superiority of competition over other market structures is not straightforward (Beck, 2015).

It has been also found that more banks' market power could be helpful in solving adverse selection and moral hazard between firms and banks in developing markets with weak legal systems and poor institutional infrastructure, since, by establishing long-term relationship, banks in these environments may solve optimally the problems with debtors (La Porta et al., 1998), with beneficial effects on economic growth. Hence, banking market power acts as a substitute for strong legal protection of creditors and property rights.

Whatever the direction of the effect, it is clear that the level of banking competition impacts the availability of credit for firms and households, thus influencing the choices of borrowers that rely on banks for their external financing. Hence, in countries where banks represent the main providers of financial funds to entrepreneurs, the supply of bank credit is a crucial requirement to the creation and development of firms, and therefore to employment and economic growth (Bonaccorsi di Patti and Dell'Ariccia, 2004).

Under this respect, the regulator must face a trade-off: with many banks in the market, the quantity of available credit is larger, but in more concentrated markets (i.e. with a good deal of market power) banks have more incentives to acquire information on potential borrowers, which leads to a higher quality of the applicant pool.

4. Theoretical models with banks and growth

To assess the influence of the degree of competition of banking markets on economic performance, theoretical models usually juxtapose two polar situations: competitive vs. monopolistic banking industries. As we noted before, a monopolistic bank is expected to ask for

[1] There is not a general consensus on this point. Actually, according to a body of literature diversification cannot increase the stability of a banking system as a whole. For example, De Vries (2005) argues that, since banks are linked each other through the interbank deposit market, participations (like syndicated loans) and deposit interest rate risk, there is potential for systemic breakdowns, because possibly large losses due to exogenous factors (e.g. failures) might lead to a chain reaction. Similarly, Wagner (2010) shows that diversification at financial institutions can be undesirable because it makes systemic crises more likely; actually, in case every bank diversifies into the assets of other banks, it reduces its own probability of failure, but such diversification also makes the banks more similar to each other, thus exposing them to the same risks. Regarding the benefits of exploiting economies of scale in banking, it is straightforward that they exist only up to a certain (often relatively small) size, beyond which no significant further advantages can be achieved.

higher interest rates on loans, to make fewer loans, to pay lower interest rates on deposits and to set higher service fees than a competitive bank, thus generating losses in the economy's overall social welfare. However, this surely holds in case markets are perfect and information is complete, while in the real world it is hard to believe that this happens in the banking industry, and in financial markets in general.

Actually, in providing financial funds (quite a peculiar commodity) to firms and individuals, banks confront with the problem of lack of information about both the characteristics of people requesting credit and the projects they intend to undertake with the loan money. This asymmetry in information between lenders and borrowers causes problems of adverse selection (difficulty of distinguishing safer from riskier borrowers) and moral hazard (difficulty of enforcing and monitoring clients' behaviour in using borrowed funds). The advantage of a monopolistic (or oligopolistic) banking system is that it can better cope with these problems than a competitive structure, and this aspect should be accounted for when balancing them.

As Guzman (2000a) observes, the literature that investigates the relationship between bank structure and macroeconomic performance makes use of two different classes of models: partial equilibrium models and general equilibrium models. The first group focuses on the bank-borrower relationship and is not concerned with the impact of the banking industry structure on the real economy, while the second group takes into account also the influence of the banking structure on the economy, but it sacrifices many details in the analysis of the relationship between banks and borrowers.

Starting with the partial equilibrium models, Broecker (1990) analyses a credit market with adverse selection and shows that loan interest rates are rising in the degree of competition (measured through the number of banks). Actually, in presence of asymmetric information, competition among banks in the provision of loans can lead to adverse selection in the banks' credit-worthiness evaluation process, because, as the number of banks grows, there is a parallel increase in the probability that a given "bad" borrower will pass the screening test of at least one bank. This will induce banks to charge higher loan rates. On the contrary, more concentrated (less competitive) banking markets should be associated to more favourable loan rates.

Petersen and Rajan (1995) focus on the long-term relationships between banks and businesses, and develop a simple static, three-period model showing that there is need of some market power in the banking industry so as to provide credit institutions the incentive to adequately screen and monitor borrowers, and thus assess the quality of new firms getting financed. This result can be motivated by the fact that market power gives banks the possibility to acquire and retain clients over time. Actually, in case of perfect competition high-quality borrowers (i.e. those successful) that

were financed by a given bank can easily obtain better conditions in future periods from another bank, but the latter will surely suffer much less cost of screening and monitoring compared to the first bank. Anticipating this aftermath, banks operating in competitive markets will be compelled to apply loan conditions that compensate them for possible losses if the entrepreneurs turn out to be bad (for example, higher interest rates), which can distort the entrepreneur's incentives and persuade him to choose the risky project. Thus, adverse selection can cause moral hazard which in turn can lead to credit rationing (Petersen and Rajan, 1995, p. 411). In contrast, banks enjoying some degree of market power could offer better initial conditions, on the grounds that they will be able to recover any cost linked to the opening of a lending relationship in the future. This produce an important aftereffect: significantly more young firms obtain external financing in concentrated markets than in competitive markets.

In a paper exploring the link between market structure and the solvency of the banking sector, Caminal and Matutes (1997) propose a model that incorporates moral hazard, with banks trying to overcome it either by monitoring or by rationing credit. They show that market power in banking raises the interest rate on loans. This causes both a tightening of credit and smaller loans (because, for a given level of monitoring, higher interest rates will lead firms to choose more risky investment projects) and an increase of monitoring by banks, which will lower the share of credit-constrained borrowers. In terms of the overall volume of loans, the effect of a higher interest rate is ambiguous: lending will expand thanks to the increase in monitoring, but will reduce due to credit rationing.

In their theoretical framework with both capital market competition and inter-bank competition, Boot and Thakor (2000) show that banks focusing on competition with capital market tend to invest in transaction-based lending, whereas inter-bank competition creates incentives to differentiate a bank from other banks, which positively affects relationship lending as a value-added strategy. This is due to the fact that relationship banking will charge lower interest rate of loans to small businesses.

Manove et al. (2001) present a model with entrepreneurs and banks (both are risk-neutral) and find that, when there is a continuum of banks that behave competitively in the presence of asymmetric information, the use of collateral in debt contracts is likely to reduce the screening effort of banks below its socially efficient level, so it leads them to fund an excessive number of worthless investment projects. It follows that too many bad projects are financed and too many entrepreneurs experience bankruptcy. On the contrary, the use of collateral exemptions or the mandated use of partial equity financing seem able to better promote entrepreneurial activity and the maintenance of quality standards for investment projects.

Marquez (2002) investigates the implications of banks' both gathering information about borrowers and screening their creditworthiness for competition and market structure in the banking industry. He employs a model of competition in banking where banks are constrained in the number of loans they can grant, and borrowers are heterogeneous (i.e. some of them have profitable investment opportunities, while others do not) but this characteristic is observable only after granting a loan. Among his main findings, it emerges that markets with many small competing banks may have higher expected interest rates in equilibrium than markets composed of a few large banks: actually, since increased competition among banks makes them less effective in their screening (small banks will have less information about the market than a large bank), more bad borrowers are likely to obtain financing, and this may lead to an increase in interest rates (which adversely impacts economic growth). Conversely, in more concentrated banking markets the loan interest rate will be lower, since larger banks are more effective in screening borrowers.

The interaction between banks' strategic use of information and their function in promoting the efficient allocation of credit is also the focus of the study by Hauswald and Marquez (2006). They present a spatial competition model in which banks enter a loan market and invest resources to collect borrower-specific information, whose quality is a decreasing function of the distance between banks and borrowers. It comes out that the acquisition of proprietary information allows banks to create a threat of adverse selection for their rivals, thus softening price competition, but also to capture customers from competitors, thereby extending their market share (even if this effect reduces as they move away from their area of expertise). However, borrowers located farther away from the bank that has screened them benefit from lower rates, but lending decisions become less efficient as distance increases. In their framework, increased competition reduces banks' rents and decreases their overall incentives to generate information, thereby affecting both the pricing and the allocation of credit. Particularly, less information production means that banks are more prone to make errors in their lending decisions as competition intensifies, while information acquisition increases the efficiency of credit markets because it helps allocate funds to creditworthy borrowers. Hence, bank consolidation that is likely to reduce competitive pressure promotes soft information acquisition by banks.

As is evident, the above models support the idea that monopoly in banking may be economically beneficial, especially because it allows to overcome adverse selection and moral hazard problems. Of course, this conclusion is limited to the specific frameworks, hence it does not mean that the benefits from a monopoly outweigh all its costs.

Turning to the general equilibrium models, Smith (1998) deals with the impact of a banking monopoly on the level of income and business cycle. In his theoretical framework, a model with

overlapping generations with production subject to aggregate shocks is employed, where borrowers can finance through banks or bilateral loan contracts (which limit a monopoly bank's power). He shows that a competitive banking system leads to higher income and output levels and less severe business cycles than a monopoly system; essentially, competitive banks benefit the economy because their monitoring costs are lower than those characterizing bilateral lending, so more funds are available for loans, with increases in production and income. Instead, in case of a monopolistic banking market, the higher interest rates raise the opportunity cost of obtaining funds for all borrowers, and thus further raise also the cost of external financing.

By means of a simple, general equilibrium model that allows for credit rationing, Guzman (2000b) examines how the market structure of the banking system impacts capital accumulation and economic growth. He compares the performance of an economy with a monopolistic banking system to that of an economy whose banking system is competitive. His results point out that a monopolistic banking system is detrimental to both capital accumulation and economic growth. Comparing the two market structures, in monopoly either the interest rate paid on deposits will be lower (thus, less funding will be available for borrowers, implying a greater likelihood of credit rationing) or the interest rate charged on loans will be higher (leading to more monitoring, which require the use of more resources for that). Hence, monopoly power in banking tends to depress the economy.

Starting from an endogenous growth model with both a real sector and a banking sector, Deidda and Fattouh (2005) find that concentration in the credit market exerts two opposite effects on growth: on the one hand, it induces economies of specialization, which is beneficial to growth; on the other hand, it results in duplication of banks' investment in fixed capital, which is detrimental to growth. However, the above trade-off is ambiguous and can vary along the process of economic development.

Cetorelli and Peretto (2012) propose a dynamic, general equilibrium model where banks operate in a Cournot oligopoly and show that bank competition (i.e. an increase in the number of credit institutions) has an intrinsically ambiguous impact on capital accumulation. Particularly, more banks lead to a higher quantity of credit available to entrepreneurs (which is in line with the conventional view about the benefits of competition), but also to diminished incentives to offer relationship services that improve the probability of success of investment projects. In their opinion, the above theoretical results explain the conflicting evidence emerging from the empirical studies of the effects of bank competition on economic growth, because in economies where intrinsic market uncertainty is high (low), less (more) competition leads to higher capital accumulation.

Summing up, in contrast with the evidence drawn from the partial equilibrium models, the common theme with the general equilibrium models is that monopoly in banking tends to be detrimental to the economy, because it causes less capital accumulation and lower economic growth. This result is mainly due to the harmful effects deriving from the monopoly's excessive wasting of productive resources linked to maintaining profits at a higher level than the competitive framework. However, it must be acknowledged that general equilibrium models sacrifice details on the interaction between banks and borrowers, thus ignoring the possibility of moral hazard (Guzman, 2000a).

5. Banking competition and growth: the empirical evidence

While in theoretical models it is straightforward to use the number of operating banks as a measure of market competition, in empirical investigations it is much more difficult to find a suitable index of the level of competitive pressure among banks. In the literature, three different groups of indicators have been generally used (Beck, 2008): market structure measures, competition measures and regulatory measures.

5.1 Using market structure measures

Banking competition has been often proxied by market structure indicators, like concentration ratios, number of banks, Herfindahl-Hirschman indices. They can be considered as "crude" measures, because they just link actual market shares with market outcome (in terms of prices or profits) but do not allow inferences on the competitive behaviour of banks. For example, they do not take into account that banks with different ownership behave differently, and that banks might not compete directly with each other in the same line of business (Beck, 2008). Most importantly, in the literature it is not clear whether market structure determines bank behaviour (structure-conduct-performance hypothesis) or is determined by performance (efficient structure hypothesis). However, market structure measures are easy to calculate, do not need to be estimated, so do not require any assumptions on banks' behaviour characteristics.

The empirical evidence coming from studies that employ such indicators is quite mixed, reflecting the now well-known difficulties of disentangling positive from negative effects of banking industry features on economic performance.

Using data drawn from the US National Survey of Small Business Finances, conducted in 1988-1989, Petersen and Rajan (1995) empirically test their theoretical conjecture regarding the possibility that firms developing strong ties with a creditor get benefits from such relations that

reduce as credit markets become more competitive. For the purpose, they use local market concentration as a proxy for market power and find that young firms operating in areas with high bank concentration are more likely to obtain capital from institutional sources and at better conditions (lower lending rates) than in less concentrated markets. Hence, if we accept that market concentration may be used as a measure of competition, greater banks' market power would promote youngest firms' growth, i.e. those characterized by the most severe information asymmetries and uncertainty.

Berger et al. (1998) ask whether the consolidation of the US banking industry (measured through the Herfindahl-Hirschman index and banks' market shares) has substantially reduced the supply of credit to small businesses. They consider a sample of over 6000 US bank M&As in the period 1980-1996, from which they deduce that, while the mere aggregation of banking institutions is associated with a significant negative impact on small business lending, there are considerable offsetting effects due to both the reaction of other banks in the same local markets and the dynamic lending restructuring of consolidated institutions. Also, they find that small and medium size bank mergers are associated with an increase in small business lending, whereas larger bank mergers generally involve their reduction. The picture is therefore consistent with a reasonably well-functioning dynamic banking market, where some relationship-based small business loans may be dropped because consolidated institutions no longer have a comparative advantage in making this type of loan, but other local lenders step forward and extend these loans.

The role of banking market structure on the economic performance – particularly, growth in industrial sectors – is also the heart of the study by Cetorelli and Gambera (2001). Their research question is to assess whether the level of concentration in the banking industry affects capital accumulation. Following the methodological approach of Rajan and Zingales (1998), they employ a cross-country dataset (with information on 41 countries and 36 manufacturing sectors in the 1980s) and try to give an answer by investigating the impact that a more concentrated banking market structure exerts on firms operating in sectors that are highly dependent on external finance availability. Their results portray a significant influence of bank concentration on industrial growth: particularly, they find that bank concentration has a first-order negative effect on growth (supporting the "traditional" idea that more concentrated banking industries produce lower credit availability for the economy), but also that higher banking concentration stimulates the growth of those industrial sectors where young firms are more dependent on external finance. Thus, we come back to the Petersen and Rajan (1995)'s result: as long as banks' market power promotes relationship lending, a more concentrated banking industry can generate positive effects, in terms of

firms' and industry growth, for those sectors that are more in need of establishing such relationships.

In their empirical analysis focusing on the real per capita income growth in US metropolitan and nonmetropolitan markets, Collender and Shaffer (2003) show that the local Herfindahl-Hirschman index of bank deposits generally exhibits a negative and significant coefficient for both short-run and long-run models, indicating that more concentrated banking markets are associated with slower growth in real personal income on average in those areas.

Beck et al. (2004) explore the impact of bank competition on firms' access to credit using firm-level data on 74 developed and developing countries drawn from the World Business Environment Survey (WBES) as well as other information on the market structure of the banking sector where those firms were located. Their results indicate that in more concentrated banking markets firms of all sizes face higher financing obstacles, an effect that tends to decrease as moving from small to medium and large firms. The above relationship disappears in countries with high levels of GDP per capita, well-developed institutions, an efficient credit registry and a high share of foreign banks, while is stronger in presence of substantial public bank ownership, a high degree of government interference in the banking system and restrictions on banks' activities. Hence, their empirical evidence basically supports the 'structure-performance' hypothesis, which emphasizes the negative effects of banks' market power (whose inefficiencies result in less loans supplied at a higher interest rate), while it is inconsistent with the 'information-based' hypothesis that stresses the potential positive effects of bank concentration (which, in presence of information asymmetries and agency problems, might increase the amount of loans supplied to opaque borrowers).

Cetorelli (2004) analyzes the effect of bank deregulation and bank concentration on the market structure of non-financial sectors using a panel of 27 manufacturing sectors in 28 OECD countries in the period 1990-1997. The main evidences are that sectors where incumbents are more dependent on external sources of finance have a disproportionately larger average firm size if they are in countries with a more concentrated banking industry, and that such an effect of bank concentration on industry market structure is substantially reduced, if not reverted, for countries after becoming members of the European Union. Hence, there is a confirmation of the idea that market power gives banks an implicit equity stake in the firms with whom they have already established long lasting relationships, at the same time representing a financial barrier to entry in non-financial industries.

Bonaccorsi di Patti and Dell'Ariccia (2004) use a panel of data on 22 industries in the 103 Italian provincial credit markets for the years 1996 to l999 and find evidence of a bell-shaped relationship between bank market power (proxied by the Herfindahl-Hirschman index of concentration of deposits and the share of deposits held by banks) and firm creation: at a relatively low level,

increasing bank market power yields higher rates of firm birth, while at a relatively high level, further increases determine a reduction in firm creation. Besides, when market power is beneficial to firm creation, this positive effect is larger for more opaque industries, whereas, when market power is detrimental to firm creation, this negative effect is mitigated for more opaque industries. Their evidence therefore supports the idea that banking market power can help economic activity and promote growth in the presence of a high degree of asymmetric information in credit markets.

Berger et al. (2004) test the hypothesis that relatively large market shares and relatively high efficiency for community banks may promote economic growth. For the purpose, they use data on 49 countries from 1993 to 2000, which also allow an investigation based on a rich mixture of economic conditions, market structures and degrees of development. One of their empirical results from both developed and developing nations actually shows that greater market shares and higher efficiency of small, private, domestically-owned banks are associated with faster GDP growth.

In their investigation on the effect on loan conditions of geographical distance between firms, the lending bank and all other banks in the vicinity, Degryse and Ongena (2005) use data regarding more than 15 000 bank loans to small firms from the loan portfolio of a large Belgian bank and find evidence that loan rates increase with the local Herfindahl-Hirschman index (calculated on the number of banks' branches).

To empirically deepen the issue of their theoretical model concerning the link between concentration in the banking industry and economic growth, Deidda and Fattouh (2005) use Rajan and Zingales (1998)'s cross-country industry data and estimate a growth equation similar to Cetorelli and Gambera (2001), finding that banking concentration is negatively and significantly associated with per-capita income growth and industrial growth only in low-income countries. Hence, reducing concentration is more likely to promote growth in low-income countries than in high-income ones.

Cetorelli and Strahan (2006) investigate the impact of bank concentration and bank deregulation on the industry structure of non-financial sectors, and particularly ask whether concentration of market power in banking has an effect on the number of firms in a given sector, on average firm size and on the overall firm-size distribution. Actually, as the previous factors are important determinants of a sector's capital accumulation, such investigation represents a contribution for assessing how banking market structure affects overall economic growth. Using data on US local markets for banking and nonfinancial sectors, they find that more competition among banks (i.e. lower concentration and looser restrictions on geographical expansion) is associated both with more firms in operation and with a smaller average firm size, even if it does not have any impact on largest firms. This finding appears consistent with the idea that banks with market power erect an

important financial barrier to entry, therefore harming the entrepreneurial sector of the economy, also if this is recognized to happen so as to protect the profitability of their existing borrowers.

Coccorese (2008) employs two separate tests (a standard Granger-Sims causality test, and a regression where the direction of causality is studied by taking into account the impact of changes in banks' internal and external factors on their own market shares) in order to study the causality between the level of concentration in the banking industry (proxied by the loan concentration ratio of the eight major banks) and economic growth in Italian regions for the years 1991-2001. His results unambiguously show that in the short-run (i.e. considering 1-year differences) economic growth is negatively caused by banking consolidation, while in the long-run (i.e. considering 3-year differences) economic growth appears to affect banking concentration, so that economic expansions tend to reduce the market shares of banks and thus help the achievement of a stronger competition among credit institutions.

Mitchener and Wheelock (2013) perform an analysis on the impacts of banking market structure and regulation on economic growth in the US for the period 1899-1929, when the manufacturing sector was expanding rapidly and restrictive branching laws segmented the US banking system geographically. The authors make use of data on banking market concentration and manufacturing industry-level growth rates for US states and find that banking market concentration generally had a positive impact on manufacturing sector growth, even when they control for other aspects of banking market structure and policy. Consequently, this within-country result is in contrast with evidence from cross-country studies finding that concentration tends to retard growth.

5.2 Using competition measures

In line with the theory of industrial organization, it must be admitted that the competitive level of a given industry cannot be measured using only market structure indices, since the assessment of the degree of effective competition requires specific structural models that incorporate the behaviour of firms, while the use of market structure proxies could lead to results that reflect factors other than competition, which is one of the issues raised by the contestability literature (Baumol et al., 1982; Claessens and Laeven, 2005).

Actually, the behaviour of incumbent banks may be rather influenced by the threat of entry (Besanko and Thakor, 1992). Even performance measures, like bank margins or profitability, can also be imperfect proxies of the industry competitiveness, because they are often influenced by factors like a country's stability, the taxation characteristics in the financial sector, the quality of information and judicial systems of the country, and other bank-specific factors (e.g. scale of operations, risk preferences).

In order to get more robust indicators of the degree of competition, the structural, contestability approach suggested by the industrial organization literature chooses to take into account (when possible) the actual bank conduct, entry barriers, activity restrictions, competition from other financial intermediaries (e.g. capital markets, non-bank financial institutions, insurance companies).

Thus, recently in banking studies structural measures of competition have been either complemented or substituted by indices estimated within the so-called new empirical industrial organization (NEIO) literature. The most widely adopted competition measures are the H-statistic, the Lerner index and the Boone indicator.

The H-index has been proposed by Panzar and Rosse (1987). It is obtained by estimating a reduced revenue equation and corresponds to the sum of the elasticities of bank revenues with respect to the input prices. As Panzar and Rosse (1987) demonstrate, on the assumption that firms operate at their long-run equilibrium, a value of the H-statistic equal to 1 is consistent with a situation of perfect competition (where changes in costs are fully reflected in changes in output prices), a value of H between 0 and 1 indicates the existence of monopolistic competition (banks are only partly sensitive to cost changes in setting prices, which indicates an intermediate degree of market power over price), and values equal to or less than 0 are consistent with a situation of monopoly or collusive oligopoly (where, because of the absence of any competitive pressure, banks adjust prices with very little or no regard to changes in costs).

Hence, the H-statistic basically catches the reaction of output to input prices, but impose some restrictive assumptions on banks' cost function and require that the market in question is in equilibrium. In the empirical literature, estimates of the H-statistics vary widely (e.g. see Claessens and Laeven, 2004, and Bikker and Spierdijk, 2008). It is worth also noting that, using bank-level data for 50 countries' banking systems for the years 1994-2001, Claessens and Laeven (2004) relate this competitiveness measure to indicators of countries' banking system structures and regulatory regimes and find no evidence that the H-index is negatively related to banking system concentration, while it is significantly influenced by contestability indicators like restrictions on the activities of banks and restrictions to their entry in the industry, whose signs are negative and positive, respectively. Hence, having a contestable system may be more important for improving competitiveness than a system with low concentration.

More recently, Bikker et al. (2012) have shown that it makes little sense to use the H-index as an explanatory variable in a regression, because it results in a non-ordinal statistic of market power. As a matter of fact, they find that a positive value of the H-statistic is inconsistent with standard forms of imperfect competition, but a negative value may arise under various conditions, including short-run or even long-run competition. Shaffer and Spierdijk (2015) go even further: by analysing the

equilibrium response of revenue to changes in marginal costs in five alternative oligopoly settings, they demonstrate that neither the sign nor the magnitude of the H-index can reliably identify the degree of market power. Actually, a positive value can arise also in non-competitive scenarios, which means that the H-statistic can take either sign for any degree of competition. The authors conclude that the Panzar-Rosse revenue test, being likely to provide ambiguous conclusions on the level of market competition, can be used neither as a quantitative measure nor as a one-sided measure of market power.

The Lerner index (Lerner, 1934) assesses a bank's market power by considering the difference between price and marginal cost (divided by price), which should be equal to zero in perfect competition, but positive in less competitive environments as here price is set above marginal cost. Hence, the Lerner index catches the capacity of firms to set prices above marginal costs (as a proportion of prices), which is the heart of market power, so that its value should decrease in the degree of competitiveness. It has also the advantage of being calculated at the bank level.

The Boone indicator associates performance with differences in efficiency (Boone, 2008). Particularly, the idea is that fiercer competition enables more efficient firms (i.e. those with lower marginal costs) to earn relatively higher profits or market shares than less efficient competitors. Hence, it is calculated on firm-level data as the percentage change in profits or market shares due to one per cent change in marginal costs (Boone and van Leuvensteijn, 2010; van Leuvensteijn et al., 2011).

The studies that have tried to ascertain some relationship between banking competition and economic growth by means of the above measures are quite few compared to the importance of the issue, and usually make use of either the H-statistic or the Lerner index.

Carbo et al. (2003) use five proxies of market competition among savings and commercial banks in five regions in Spain: a deposit-related Herfindahl-Hirschman Index, a deflated loan-deposit rate spread, a deflated mark-up of price over marginal cost, and two different versions of the Lerner index. They perform some Granger-causality tests of the relationship between banking sector competition and regional economic performance over the years 1986-1998 and find that, although banking competition seems to have increased in Spain after deregulation (i.e., savers earned higher returns and borrowers paid lower rates), this improvement does not appear to have played an important role in the concurrent expansion of regional GDP over the same period. The suggested reasons for this outcome are that perhaps there would be need of much larger changes in returns to savers and costs to borrowers in order to promote economic growth, or that other factors (for example, differences in legal and cultural environments) need to be better specified in the analysis.

Claessens and Laeven (2005) investigate the relationships between banking system competition and the provision of external financing, and employ the empirical setup developed by Rajan and Zingales (1998), i.e. working on sectoral growth data, where an estimated H-statistic is added as a measure of the degree of competition in the country's banking system (which enters as a term that interacts with the sectoral measure of financial dependence). It comes out that competition is positively associated with countries' industrial growth, suggesting that more competitive banking systems are better at providing financing to financially dependent firms. This result allows them to reject the hypothesis that market power can facilitate access to finance. Furthermore, as market structure (measured by the concentration in the banking system) does not significantly affect industrial sector growth, they also call into question the validity of studies that use concentration as a measure of market power.

Fernandez de Guevara and Maudos (2011) analyse the effect of banking competition on industry economic growth using both structural measures of competition and measures based on the NEIO perspective (namely, the H-statistic and the Lerner index). They again consider an empirical framework similar to Rajan and Zingales (1998) but concerning a more recent period (1993-2003) and a wider range of sectors (53 industries in 21 countries for the period 1993-2003). Finally, as they focus on European countries, the chosen financially developed country to act as benchmark (i.e. that with the most highly developed financial markets) is the UK. In contrast with the evidence by Claessens and Laeven (2005), their results indicate that greater market power generates greater economic growth, i.e. there is a negative effect of banking competition on economic growth. The authors attribute this evidence to the presence of relationship banking: in order to solve the problems of asymmetric information in financial activity, banks choose to establish close relationships with borrowers, which will facilitate their access to finance. There is also some evidence that bank market power has an inverted-U-effect on growth, suggesting that the overall economic growth potential of the sectors is highest at intermediate values of market power, when banks capitalize on the advantages derived from investing in lasting relationships with their clients and can thus overcome the typical problems of asymmetric information and moral hazard associated with the financial intermediation activity, since sectors in an intermediate interval of the distribution of external dependence benefit substantially.

Starting from data on 37 countries between 1994 and 2006, Hoxha (2013) empirically finds that more concentration in the banking sector leads to higher performance in the manufacturing sectors that are financially dependent on banks. Moreover, it emerges that banking competition (measured through the Panzar-Rosse H-statistic) does not have a positive effect on manufacturing sectors that are dependent on external financing, but it might even harm them. Both results are in line with the

idea that in less competitive conditions banks are better able to absorb the high monitoring costs of firms, so they can provide more credit to opaque, credit-constrained firms, while stronger competition induces banks to screen firms less rigorously and lend more to "bad borrowers".

Finally, Soedarmono (2010) explores the link between bank competition and economic development in a sample of Asian countries over the period 1999-2007. His research setup is close to Beck et al. (2004), but, in order to capture the degree of banking market power, he adopts the NEIO approach by Uchida and Tsutsui (2005) – which provides the degree of market power by estimating banks' first order condition of profit maximization together with the cost function and the inverse demand function – rather than using bank concentration ratios. Also, he disentangles economic development into two types of indicator according to different economic sector (agricultural and industrial sector growth). The results show that there is a U-shaped relationship between the market power parameter and the real annual growth rate of GDP, but, since more than 70 per cent of observation are above the inflection point, they substantially indicate that the relation between banks' market power and economic growth tends to be positive. Also, higher banking market power improves agricultural sector growth, while this positive relationship disappears when observing industrial sector.

Comparing the above evidences, it comes out that NEIO techniques – although with few, yet unavoidable exceptions – seem to support the existence of a positive relationship between banking market power and economic performance.

5.3 Using regulation measures

A third way to capture the degree of competition among banks is to use indicators of the regulatory framework, because they can provide clues of the contestability of the banking system. Actually, for competition to work (and even for improving efficiency) it may often be more important how "contestable" the banking market is, rather than simply how many banks operate there. Market contestability depends on both the actions of incumbent banks and the various types of barriers to entry and exit.

Regulation measures include entry requirements, formal and informal barriers to entry for domestic and foreign banks, activity restrictions and other regulatory requirements that might impede entry into the market. Generally, due to the difficulty of quantifying such factors, they are proxied by wider institutional indicators, like the country's contractual and informational characteristics.

Under this respect, one of the most relevant studies concentrating on the role of deregulation in banking markets for the real economy is that by Jayaratne and Strahan (1996). Their focus is a

single country, United States, in the period 1972-1992, when an intense process of deregulation took place and individual states (in different years) removed regulatory barriers to bank entry (so that banking markets have become gradually more competitive). The authors investigate whether the above deregulation – through more credit availability – has translated into faster economic growth, in a framework where they can count on both cross-sectional and time dimensions and where they can directly gauge and compare the changes in bank competition and efficiency from before to after deregulation, also better dealing with causality.

Particularly, they estimate a growth regression where a branching indicator is added: it equals to one for states without restrictions on branching via M&A, so that its estimated coefficient measures the increase in per capita economic growth stemming from branch deregulation. The results of their estimations confirm the causal link between banking deregulation and state income growth: for example, they find that in the sample period the yearly personal income growth in a state was more than 0.5 per cent higher after deregulating its banking industry.

Overall, their study has the merit to show that economic growth may accelerate after bank branching reform, especially because of improvements in loan quality (in line with the idea that economies with financial systems which channel savings into better projects grow faster) rather than increase in loan quantity (as they do not find a consistent upsurge in lending after branch reform), which suggests that bank monitoring and screening improvements are able to foster economic growth.

Later, Black and Strahan (2002) have again focused on the US states, considering the period 1976-1994 and regressing the number of yearly new business incorporations per capita on, among others, banking competition and market power variables, like states' deregulation indicators and deposits HHI. Their results suggest that policies such as branching and interstate banking reform, which fostered competition and consolidation in the US banking sector, have helped entrepreneurship. Particularly, they find that the rate of new incorporations in a state has increased significantly following deregulation, and that the latter has been able to reduce the negative effect of high levels of concentration in local markets (actually, incumbent banks in previously protected markets had to face the potential entry of a large number of competitors following deregulation). Hence, consolidation, and the associated decline in small bank market share, seems to have helped entrepreneurs, not harmed them.

Still working on US data, Zarutskie (2006) consider a large panel of privately held firms in the years 1987-1998 for understanding the impact of bank competition (captured by a dummy for the years 1994-1998, i.e. those following the Riegle-Neal Interstate Banking and Branching Efficiency Act) on firm borrowing and investment. The interesting evidence of her investigation is that new

firms (which are also those characterized by the largest informational asymmetries) have significantly less outside debt on their balance sheets when operating in the more competitive banking markets following deregulation, because they replace it with contributed equity capital, but the latter is not enough to enable them to invest as much they would have in less competitive banking markets. Newly formed firms are also smaller and earn higher returns on assets following deregulation, which is consistent with their investing less due to greater financial constraints. Quite to contrary, the oldest firms in the sample (i.e., those probably characterized by the smallest informational asymmetries) use more outside debt and invest more following deregulation.

These findings are in line with the prediction of the model by Petersen and Rajan (1995), as it appears that more competition among creditors discourages them from lending to new firms when their credit qualities are not well known. It follows that an increase in banking market competition may have quite different impacts on the borrowing and investment behaviour of newer and more established firms.

Huang (2008) investigates whether the removal of restrictions on statewide branch-banking create significant growth acceleration in deregulated US states; for the purpose, he employs a geographic-matching methodology that compares economic performance of pairs of contiguous counties separated by state borders, where on one side restrictions on statewide branching were removed relatively earlier. He focuses on 23 separate deregulation events that took place between 1975 and 1990, and observes statistically significant growth accelerations after deregulation in only five of them, none of which occurred prior to 1985. Therefore, he finds only little support for the conclusions of Jayaratne and Strahan (1996), as regulation and deregulation of commercial banks' geographic expansion seem to exert little measurable effect on the local economy.

Some studies have also investigated the role of the US financial sector deregulation on firm-level innovation and, thereby, economic growth. Chava et al. (2013) work on patents and citations data during the years 1970-2005, and show that intrastate banking deregulation, which increased the local market power of banks, decreased the level and risk of innovation by young, private firms, while interstate banking deregulation, which decreased the local market power of banks, increased the level and risk of innovation by young, private firms. Such contrasting effects also translate into contrasting effects on economic growth, which means that the nature of financial sector deregulation significantly influences its potential benefits to the real economy. Still using patent and citation information for US listed corporations and private firms in the period 1976-2006, Cornaggia et al. (2015) find evidence that the deregulation of state-level branching laws causes overall reductions in state-level innovation. This result is driven by corporations headquartered within states that deregulate, but innovation increases among external-finance-dependent private

firms because branching deregulation expands access to credit for these firms, which relaxes their financial constraints and allows them to pursue innovative projects.

Overall, there are important signals that deregulation in banking markets can allow gains in the economic activity of countries, even if our brief survey considers only the US states. Nonetheless, relationship lending as well as monitoring activities from banks confirm to be crucial factors that affect banking industries and therefore cannot be neglected by both scholars and policy-makers.

6. An empirical assessment of the link between banking competition and economic growth

In order to investigate a possible causal link between banking competition and economic growth, here we propose a novel empirical analysis in the spirit of Levine et al. (2000) and Beck and Levine (2004).

Particularly, we have built a panel of countries and estimated the following growth regression using the generalised method of moments (GMM) estimator (Arellano and Bond, 1991; Arellano and Bover, 1995):

$$GROWTH_{c,p} = \alpha_0 \ln INITGDP_{c,p-1} + \alpha_1 \ln BANKCOMP_{c,p} + \beta' X_{c,p} + \phi_p + \varepsilon_{c,p} \,. \qquad (1)$$

In Equation (1), $GROWTH_{c,p}$ is the average annual growth rate of real per capita GDP of country c (c = 1,...,N) during period p (p = 1,...,P), $INITGDP_{c,p-1}$ represents the initial level of the per capita GDP, $BANKCOMP_{c,p}$ is a measure of the level of banking competition, $X_{c,p}$ is a vector of control variables, ϕ_p are period dummies, and $\varepsilon_{c,p}$ is the error term.

The use of a dynamic panel data approach, where the equation to be estimated has at least one lagged dependent variable on the right-hand side, allows to correct for potential reverse causality between our two variables of interest – banking competition and economic growth – which may bias the estimation. Our (unbalanced) panel has both a cross-sectional dimension (113 countries) and a time series dimension (the period 1993-2012). Nickell (1981) has shown that using the Least Squares Dummy Variables (LSDV) estimator for large N and small P leads to a downward bias because the lagged endogenous variable is correlated with the individual effect by construction, thus leading to inconsistent estimation. A common solution is to switch to a first difference framework, in order to get rid of the fixed effects.

Arellano and Bond (1991) propose the first-difference GMM estimator, where instruments for the lagged dependent variables from the second and third lags are introduced, while Arellano and Bover (1995) and Blundell and Bond (1998) have developed the system GMM estimator by using

the first differenced values as well as lagged values as instruments. Both estimators can be suitably employed when the left-hand-side variable is dynamic and depends on the past realizations and some regressors may be endogenous.

In order to deal with both the reverse causality problem and the potential endogeneity of the explanatory variables, we choose the system GMM estimation because, as Arellano and Bover (1995) and Blundell and Bond (1998) highlight, it can noticeably improve efficiency and avoid the weak instruments problem that characterizes the first-difference GMM estimator. It consists in the estimation of a system of two simultaneous equations, one in levels (with lagged first differences as instruments) and the other in first differences (with lagged levels as instruments). This implies that the system GMM estimation only requires 'internal' instruments.

Another choice concerns the use of the one-step or the two-step system GMM estimator. One-step GMM estimators are built under the assumption that the weighting matrix is known (and is independent of estimated parameters) and are efficient under the assumptions of homoscedasticity and no correlation of the error terms, while two-step GMM estimators weight the moment conditions by a consistent estimate of their covariance matrix and do not require the above hypotheses. We here employ the two-step GMM estimator, which is regarded as asymptotically more efficient than the one-step GMM estimator (Bond et al., 2001).

Consistent with the literature on growth empirics, our panel data of 113 countries are averaged over four non-overlapping 5-year periods (1993-1997, 1998-2002, 2003-2007 and 2008-2012), so that possible business cycle effects are mitigated.

As a proxy for banking competition, we use a widely accepted measure (see Section 5.2), namely the Lerner index (Lerner, 1934). Clearly, it needs to be estimated in a first step, and we employ two different methodologies. One is the customary method, requiring the estimation of a total cost function (normally, a translog specification) from which the marginal cost is derived (as the latter cannot be directly measured) and used together with the observed price for the computation of the Lerner index. The second is based on the framework developed within the stochastic frontier analysis by Kumbhakar et al. (2012) and Coccorese (2014), which allows an easier way of estimation (as less data are required) and avoids the use of both calculated and observed data.

Regarding the 'conventional' Lerner index, for each country we estimated the following translog cost function with three inputs and one output:

$$\ln(TC_{it}/W_{3it}) = a_0 + a_Q \ln Q_{it} + \sum_{h=1}^{2} a_h \ln(W_{hit}/W_{3it}) + a_T \ln TREND + \tag{2}$$

$$+\frac{1}{2}\left\{a_{QQ}\left(\ln Q_{it}\right)^2+\sum_{h=1}^{2}a_{hh}\left(\ln(W_{hit}/W_{3it})\right)^2+a_{TT}\left(\ln TREND\right)^2\right\}+$$

$$+a_{12}\ln(W_{1it}/W_{3it})\ln(W_{2it}/W_{3it})+\sum_{h=1}^{2}a_{Qh}\ln Q_{it}\ln(W_{hit}/W_{3it})+a_{QT}\ln Q\ln TREND_{it}+$$

$$+\sum_{h=1}^{2}a_{Th}\ln TREND\ln(W_{hit}/W_{3it})+v_{it}\ ,$$

where $i = 1,...,B$ and $t = 1,...,T$ index banks and years, respectively, TC is the total cost (measured as the sum of both interest and non-interest total expenses), Q is the output (here assumed as the sum of total loans and total other earning assets), W_1 is the price of deposits (equal to the ratio between interest expense and total deposits), W_2 is the price of labour (proxied by the ratio between personnel expenses and total assets), W_3 is the price of physical capital (given by the ratio between all other expenses and total fixed assets), $TREND$ is a time trend included to account for technical change (Hunter and Timme, 1986), and v_{it} is the error term.

In the above specification, we have divided total costs and factor prices by W_3 in order to impose the condition of linear homogeneity in input prices.

Making use of the parameters that result from the estimation of the cost function (and considering that, according to the linear homogeneity conditions, $a_{Q3} = -a_{Q1}-a_{Q2}$), for each bank and year we compute the marginal cost MC_{it} as

$$MC_{it}=\frac{\partial TC_{it}}{\partial Q_{it}}=\frac{\partial \ln TC_{it}}{\partial \ln Q_{it}}\frac{TC_{it}}{Q_{it}}=\left(a_Q+a_{QQ}\ln Q_{it}+\sum_{h=1}^{3}a_{Qh}\ln W_{hit}+a_{TQ}\ln TREND\right)\frac{TC_{it}}{Q_{it}} \qquad (3)$$

and the ‘conventional’ Lerner index as

$$LERNER\_C_{it}=\frac{P_{it}-MC_{it}}{P_{it}}, \qquad (4)$$

where P_{it} is the price charged by banks on their output, calculated as the ratio between interest income plus other operating income (i.e. total revenue) and the sum of total loans and total other earning assets (i.e. Q).

Finally, for each country c we have calculated the 5-year ‘conventional’ Lerner index $LERNER\_C_{c,p}$, as an average of the individual bank values, with each bank weighted by its total assets (at constant prices, in 2005 local currency).

So as to sketch the way of estimating the 'stochastic' version of the Lerner index,[2] let us consider a profit-maximizing bank *i* that, depending on the characteristics of the market, at year *t* sets an output price P_{it} higher than or equal to its marginal cost MC_{it}:

$$P_{it} \geq MC_{it} \ . \tag{5}$$

Multiplying both terms of (5) by the ratio between the level of output Q_{it} and total costs TC_{it}, and considering that $MC_{it} = \frac{\partial TC_{it}}{\partial Q_{it}}$, we get

$$\frac{P_{it} Q_{it}}{TC_{it}} \geq \frac{\partial TC_{it}}{\partial Q_{it}} \frac{Q_{it}}{TC_{it}} \ , \tag{6}$$

which can be written as

$$RC_{it} \geq \frac{\partial \ln TC_{it}}{\partial \ln Q_{it}} \ . \tag{7}$$

where $RC_{it} = TR_{it}/TC_{it}$ represents the revenue share to total costs for bank *i* at time *t*, while the right-hand side is the cost elasticity with respect to output.

Since (7) originates from (5), saying that bank *i*'s price deviates from its marginal cost – i.e. from the long-run (minimum) equilibrium price in a perfectly competitive market – is equivalent to saying that bank *i*'s revenue-cost ratio deviates from its cost elasticity with respect to output. Hence, the distance between RC_{it} and $\partial \ln TC_{it}/\partial \ln Q_{it}$ provides a measure of market power.

We can interpret (7) as a stochastic cost frontier model (Aigner et al., 1977; Meeusen and van den Broeck, 1977) and write

$$RC_{it} = \frac{\partial \ln TC_{it}}{\partial \ln Q_{it}} + v_{it} + u_{it} \ . \tag{8}$$

Here, $\frac{\partial \ln TC_{it}}{\partial \ln Q_{it}} + v_{it}$ is the minimum level that the observed revenue-cost ratio RC_{it} can reach, i.e. its frontier, of which $\frac{\partial \ln TC_{it}}{\partial \ln Q_{it}}$ is the deterministic part and v_{it} is its stochastic part. Together, they constitute the 'stochastic frontier'.

[2] For further details, see Coccorese (2014), pp. 75-78.

The amount by which RC_{it} fails to reach its minimum is the non-negative (one-sided) term u_{it}, which therefore is able to capture the mark-up of bank *i* at time *t*. Regarding v_{it}, it represents a symmetric (two-sided) noise term that needs to be included for the reason that the revenue share RC_{it} (and, consequently, bank's revenues and/or costs) could be affected by unobserved factors, e.g. optimization errors. As (8) is a sort of stochastic frontier function, estimating u_{it}, i.e. mark-up, is possible if we adapt to our framework the stochastic frontier approach.

We again start from the translog cost function shown in (2) and derive the cost elasticity with respect to output as:

$$\frac{\partial \ln TC_{it}}{\partial \ln Q_{it}} = a_Q + a_{QQ} \ln Q_{it} + \sum_{h=1}^{2} a_{Qh} \ln(W_{hit} / W_{3it}) + a_{QT} TREND \,. \tag{9}$$

Substituting (9) into (8), we get:

$$RC_{it} = a_Q + a_{QQ} \ln Q_{it} + \sum_{h=1}^{2} a_{Qh} \ln(W_{hit} / W_{3it}) + a_{QT} TREND + u_{it} + v_{it} \ . \tag{10}$$

Equation (10) looks like the stochastic frontier model as suggested by Aigner et al. (1977) and Meeusen and van den Broeck (1977), and the specification of the error term is made up of two components, u_{it} and v_{it}, i.e. mark-up and random noise, each with different characteristics. It can be estimated by means of maximum likelihood, assuming that the non-negative term u_{it} is independently half-normally distributed with mean 0 and variance σ_u^2 and that the usual error term v_{it} is independently normally distributed with mean 0 and variance σ_v^2.

Rearranging (8) and omitting the noise term for notational convenience, we can write:

$$\frac{P_{it} Q_{it}}{TC_{it}} \frac{\partial \ln Q_{it}}{\partial \ln TC_{it}} - 1 = u_{it} \frac{\partial \ln Q_{it}}{\partial \ln TC_{it}} \ . \tag{11}$$

After further manipulations, we get:

$$\frac{P_{it} - MC_{it}}{MC_{it}} = \theta_{it} = \frac{u_{it}}{\frac{\partial \ln TC_{it}}{\partial \ln Q_{it}}} \ . \tag{12}$$

The left-hand side of (12) contains another definition of mark-up, labelled as θ_{it}, where the distance between price and marginal cost is expressed as a fraction of the latter rather than the former. However, it is straightforward to obtain the 'stochastic' version of the Lerner index by means of the following formula:

$$LERNER\_S_{it} = \frac{\theta_{it}}{1+\theta_{it}} \ . \tag{13}$$

To sum up, in order to get the 'stochastic' Lerner indices, we start by estimating (10) using maximum likelihood, then substituting the resulting parameters into (9) so as to generate the cost elasticity with respect to output. From the estimation of (10) we also get $\hat{u}_{it}$, i.e. the Jondrow et al. (1982) conditional mean estimator of u_{it}. Next, using (12) we calculate θ_{it}, which finally drives us to $LERNER\_S_{it}$ by means of (13).

To obtain the 5-year 'stochastic' Lerner indices $LERNER\_S_{c,p}$, for each country c we have again averaged the bank-level values using total assets (at constant prices, in 2005 local currency) as weights.

Banks' balance sheet data come from the BankScope database, while the GDP deflators for each country are drawn from the World Development Indicators managed by the World Bank. We only consider commercial, cooperative and savings banks, and use either unconsolidated or consolidated data (depending on their availability: in our sample, about 4 per cent of the banks are consolidated). The total sample employed for the estimation of the competition indices (to be used in the growth regression) consists of 99,431 bank-year observations regarding 11,985 credit institutions in 113 countries.[3]

Once got the 5-year values of the two competition measures $BANKCOMP_{c,p}$, in a second step we use them as regressors of Equation (1), where the vector of control variables $X_{c,p}$ (all included as natural logarithms) comprises:

- the gross enrolment ratio for secondary school (*SCHOOL*), i.e. the ratio between the number of students enrolled in secondary education regardless of age and the population of the age group that officially corresponds to secondary education;
- the investment to GDP ratio (*INV*);
- the government consumption expenditure as a fraction of GDP (*GOV*);
- the inflation rate (*INFL*), proxied by the average annual variation of the consumer price index;
- the average annual variation of population (*POPGROWTH*).

[3] In the calculation of the Lerner indices, we faced the problem that for every country the number of banks for which information is available in Bankscope fluctuates considerably from year to year, and has also expanded over time (De Bandt and Davis, 2000; Corvoisier and Gropp, 2002; Bhattacharya, 2003). Addressing the possibility of selection bias would require the identification of a sizeable number of banks whose data are available throughout the whole period under investigation (20 years); unfortunately, in our sample only about 12% of total observations belong to ever-present institutions. Therefore, we have been compelled to treat the data as a cross section.

The initial income variable *INITGDP* captures the convergence effect generally predicted by growth models. The secondary-school enrolment ratio *SCHOOL* helps to take into account the possible link between the level of investment in human capital and growth. The variables *INV*, *GOV* and *INFL* are included as control variables for macroeconomic environment, while *POPGROWTH* account for the impact of demographic changes on economic growth.[4]

For assessing the robustness of results, other control variables (again in natural logarithms) are considered in additional regressions:

- the ratio between domestic credit to private sector provided by banks and GDP (*BANKCREDIT*), an indicator of local banking market development;
- the sum of exports and imports of goods and services as a fraction of GDP (*TRADE*), which measures the openness of the overall economy;
- the black market exchange rate index (*BMP*), a proxy for black market premium, i.e. international price distortions that may hinder efficient investment decisions and hence economic growth (Dollar, 1992). Here, this variable ranges between 0 (in case black market premium is equal to, or greater than, 50 per cent) and 10 (for countries with no black-market exchange rate), with higher values corresponding to lower black market premium and thus lower price bias;
- a regulation quality index (*REGQUALITY*), which provides a measure of the perceptions about the ability of the government to formulate and implement sound policies and regulations that allow private sector development; its value runs from -2.5 to 2.5, with higher values corresponding to better governance.[5]

All the above variables are customary in the analysis regarding the determinants of economic growth (e.g.: Solow, 1956; Lucas, 1988; Mankiw et al., 1992; Easterly, 1994; Barro and Sala-i-Martin, 1995; Levine and Zervos, 1998; Beck et al., 2000; Beck and Levine, 2004). Their time series, together with the data on GDP, are retrieved from the World Bank Development Indicators database, except the black market exchange rate index, which is collected from the Fraser Institute.

The list of countries (with the corresponding number of observations included in the estimations of both steps) is displayed in Table 1, while Table 2 provides some descriptive statistics of the variables entering the growth regressions, and Table 3 delivers their correlation matrix.

Regarding the competition measures, as expected, the conventional and stochastic Lerner indices are positively correlated, also if we observe a low degree of correlation among them (+0.1269).

[4] In order to include in the regressions possible negative values, *LERNER_C* enters as ln(1+*LERNER_C*), *INFL* enters as ln(1+*INFL*), and *POPGROWTH* enters as ln(1+*POPGROWTH*).

[5] This variable enters the regressions as ln(5+*REGQUALITY*).

However, we have to remember that the stochastic estimated values are by construction bounded between 0 and 1, while the conventional measure is calculated using (observed) price and (estimated) marginal cost: hence, for the latter there are no ex-ante restrictions, which entails a much higher variability. This becomes evident when we look at the (first step) bank level indices: the correlation coefficient is +0.2001, which becomes +0.4842 in case we consider only banks whose conventional Lerner index lies between 0 and 1. We can also note that economic growth is significantly correlated with the Lerner indices (even though with a modest magnitude).

INSERT TABLE 1 AROUND HERE

INSERT TABLE 2 AROUND HERE

INSERT TABLE 3 AROUND HERE

The results of the GMM estimations for our base model are presented in Table 4. They show a strong positive association between banks' market power (as expressed by the Lerner indices) and economic growth. Actually, both competition measures enter the regressions significantly at the 1 per cent significance level. Hence, there is a robust evidence that economic growth is higher when banks can rely on some market power, i.e. in a less competitive environment.

INSERT TABLE 4 AROUND HERE

As Table 5 makes clear, the above results are globally confirmed also in case we include additional control variables in the regression. Particularly, both Lerner indices always retain their positive sign and significance, which drops at the 10 per cent level only when considering the conventional measure and adding the bank credit as control variable.

INSERT TABLE 5 AROUND HERE

The AR(2) tests indicate that, as expected, the null hypothesis of no second-order serial correlation in the residuals of the estimated equations cannot be rejected, while the Hansen test of overidentifying restrictions (which verifies the validity of the full instrument set) is generally not rejected at the 5 per cent level (with a few exceptions regarding *LERNER_C*), thus confirming that our instruments are adequate.

We can try to use the estimation results for assessing the economic impact of variations in the level of banking competition. Regarding the stochastic Lerner index, and considering its lowest (significant) coefficient across the seven estimations of Tables 4 and 5, an increase of *LERNER_S* of 10 per cent from the median value (i.e. from 0.1373 to 0.1510) would allow a country to grow

0.0334×(ln(0.1510)–ln(0.1373))×100 = 0.3 percentage points faster per year. The same reasoning for the conventional Lerner index leads to 1.1 percentage points higher annual growth. Even if these examples should be carefully evaluated, nonetheless they foreshadow an economically meaningful relationship between banking competition and economic growth and suggest that moderating banking competition can have an economically sizable impact on economic growth.

The coefficients of the various control variables generally exhibit the expected sign. Initial income (*INITGDP*) is negatively correlated to economic growth (and is often significant at least at the 5 per cent level), confirming the presence of a convergence effect among countries. The secondary-school enrolment ratio (*SCHOOL*) enters the growth regression positively, but its coefficient is mostly insignificant, which proves that in our sample the human capital stock seldom has a positive impact on local growth. As expected, the investment-to-GDP ratio (*INV*) appears to be a crucial determinant of economic growth, as it is positive and significant at the 1 per cent level in all regressions. The coefficient of *GOV* is generally negative, showing that higher levels of government consumption expenditure exert a negative impact on growth; however, it is always statistically insignificant. We find a strong negative relationship between inflation (*INFL*) and growth, a signal that macroeconomic instability adversely affects economic performance (Easterly and Rebelo, 1993; Fischer, 1993; Levine and Zervos, 1998). Finally, *POPGROWTH* displays a negative and generally significant coefficient, indicating that, when population grows faster, the available resources must be spread more thinly over the population of workers, with adverse effects on economic growth (Mankiw et al., 1992).

Regarding the period dummies, there is a clear evidence that in the last 5-year interval of our sample (corresponding to the years 2008-2012) there has been a significant drop in the growth rates of the sample countries (often larger than 1 per cent per year), most likely due to the effects of the global financial crisis.

The additional regressions show that the only variable significantly affecting growth is the black market exchange rate premium (*BMP*): as its coefficient is positive, we find confirmation that lower price distortions (i.e. higher *BMP* values) enhance investment and economic activity.

7. Conclusions

Among other reasons, banks (and other financial intermediaries) are important because they are the best response to the fact that information is costly: their activity specializes in evaluating the credit worthiness of clients and monitoring borrowers to ensure they meet their obligations. Banks collect savings, and convert them into long-lived assets like housing loans and lending to

businesses, gaining profits from the spread between the rates charged to borrowers and the rates offered to the pool of savers as well as from the provision of other services.

Banks also exert a significant influence on how efficiently the resources of an economy are allocated between competing uses, e.g. whether some sectors get too little or too much credit relative to what the economy needs to perform at its best, or whether lending and other financial activities are provided at the lowest cost.

If it is accepted that banks – and the financial system – are closely related to real economy, it is questioned both the possibility that the characteristics of the banking industry can influence economic activity and the quality of this potential impact. The theoretical and empirical contributions seem to converge towards the idea that banking does matter for economic performance, nevertheless at present there is no consensus on the way banks contribute to economic growth in either a more competitive or more concentrated environment.

In this paper we have tried to summarize the existing literature on the impact of banking competition on growth, both sectoral and aggregate, which has not reached a definite conclusion. After all, there are several factors that push in one direction or another.

In a competitive environment, interest rates on loans are low, so there is more access to credit by firms and better risk diversification for banks. However, given the presence of imperfect information about customers, which does not allow charging higher interest rates only to more risky individuals, banks might be also forced to increase loan rates to the whole pool of borrowers, generating problems of adverse selection (overall risk increases because those that are willing to pay high interest rates are also likely to be the most risky clients) and moral hazard (higher loan rates provide borrowers an incentive to choose more risky projects), or even to ration credit, with adverse consequences on entrepreneurs and economic activity.

Instead, few large credit institutions in a less competitive, more concentrated banking industry would be able to more easily reduce business risk through diversification by sectors and regions, at the same time opting for long-term relationship lending (as banks are more willing to invest in obtaining customer-specific information and provide multiple tailored services to the client, foreshadowing adequate returns in future periods), which mitigates the problem of asymmetric information (especially for small enterprises). This would result in a higher bank stability and more credit availability for informationally opaque firms. On the other side, the failure of even one large bank is likely to impose high costs on the economy because of contagion effects; hence, relying on this ‘too-big-to-fail’ status, big banks have a tendency to take more risk in their business activity, in this way undermining the stability of the industry and the growth path of the economy.

To sum up, regarding the role of bank competition in favouring real economic activity, there is no clear evidence on the dominance of a particular banking market structure, even if the review reported in this paper – together with the results of the cross-country empirical analysis – seems to indicate a slight tendency for scholars to accept the idea that too much competition among banks is not advantageous to the economy.

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TABLE 1 – *List of countries and number of observations*

Country	# observations in the first step	# observations in the second step
Albania	89	3
Algeria	93	4
Angola	65	2
Argentina	595	4
Armenia	145	3
Australia	215	3
Austria	2,583	4
Azerbaijan	81	1
Bahamas	86	4
Bahrain	51	2
Bangladesh	325	3
Belarus*	37	2
Belgium	770	4
Benin	70	3
Bolivia	140	3
Botswana	83	4
Bulgaria	158	2
Burkina Faso	86	4
Cambodia	72	2
Cameroon	83	3
Canada	734	4
Chile	342	3
China	394	4
Colombia	361	4
Congo, Dem. Rep.	67	2
Costa Rica	464	4
Cote d'Ivoire	22	1
Croatia	380	3
Cyprus	121	4
Czech Republic	228	3
Denmark	1,329	4
Dominican Republic	442	4
Ecuador	300	4
Egypt	55	1
El Salvador	119	4
Estonia	48	2
Ethiopia	24	2
Finland	84	4
France	3,656	4
Georgia	92	3
Germany	28,328	4
Ghana	152	4
Greece	231	4
Guatemala	43	3
Honduras	152	3
Hong Kong	154	4
Hungary	202	4
Iceland	81	3
India	976	4
Indonesia	816	4
Ireland	122	3
Israel	113	3
Italy	9,511	4
Japan	7,812	4
Jordan	125	4
Kazakhstan	229	4
Kenya	259	3
Kuwait	44	2
Latvia	202	3
Luxembourg	1,411	4
Macao*	86	3
Macedonia	144	3
Malawi	51	4
Malaysia	396	4
Mali	79	4
Malta	72	3
Mauritania	45	3
Mauritius	112	4
Mexico	171	2
Moldova	152	3
Montenegro	18	1
Morocco	94	4
Mozambique	113	4
Nepal	100	4
Netherlands	228	4
New Zealand	102	4
Nigeria	305	3
Norway	1,120	4
Oman	46	2
Pakistan	139	2
Panama	233	4
Paraguay	231	4
Peru	248	4
Philippines	448	4
Poland	478	4
Portugal	319	4
Qatar	58	2
Romania	258	4
Russian Federation	6,059	4
Saudi Arabia	97	2
Senegal	65	4
Serbia	260	2
Sierra Leone	32	2
Slovak Republic	146	3
Slovenia	164	3
South Africa	182	4
Spain	1,818	4
Sri Lanka	46	2
Sudan*	83	3
Sweden	913	4
Switzerland	4,583	4
Tanzania	90	1
Thailand	254	4
Trinidad and Tobago	55	2
Tunisia	187	4
Turkey	220	4
Uganda	69	2
Ukraine	426	4
United Kingdom	765	4
United States	10,234	4
Uruguay	269	4
Venezuela	455	4
Vietnam	61	1
TOTAL	*99,431*	*369*

The first step refers to the estimation of the competition measures, the second step to the growth regressions.
* This country is not included in the second-step estimations containing the *BMP* variable.

TABLE 2 – *Summary statistics for the growth regressions*

Variable	**Mean**	**St.dev.**	**Min**	**Median**	**Max**	**N.obs.**
GROWTH	0.0262	0.0262	-0.1158	0.0245	0.1418	369
LERNER_C	0.2162	0.1253	-0.4427	0.2009	0.5768	369
LERNER_S	0.1444	0.0657	0.0277	0.1373	0.3859	369
INITGDP	12 116.44	15 536.52	131.11	4066.07	81 188.74	369
SCHOOL	0.7853	0.2964	0.0660	0.8549	1.5516	369
INV	0.2343	0.0554	0.0590	0.2290	0.4662	369
GOV	0.1564	0.0514	0.0460	0.1543	0.3150	369
INFL	0.0984	0.2804	-0.0299	0.0422	3.6734	369
POPGROWTH	0.0129	0.0142	-0.0284	0.0117	0.1285	369
BANKCREDIT	0.5398	0.4471	0.0156	0.3882	2.3608	367
TRADE	0.8323	0.4907	0.1760	0.7094	4.2239	369
BMP	9.8510	0.7994	0	10	10	353
REGQUALITY	0.3756	0.8657	-1.7279	0.2908	2.0229	369

Variable	**Description**	**Source**
GROWTH	Average annual variation of per capita GDP (constant 2005 US$)	World Development Indicators, World Bank
LERNER_C	Conventional Lerner index (average over the period)	Own calculation
LERNER_S	Stochastic Lerner index (average over the period)	Own calculation
INITGDP	Initial per capita GDP (constant 2005 US$)	World Development Indicators, World Bank
SCHOOL	Gross enrollment ratio for secondary school (students enrolled in secondary education regardless of age/population of the age group which officially corresponds to secondary education; average over the period)	World Development Indicators, World Bank
INV	Gross capital formation/GDP (average over the period)	World Development Indicators, World Bank
GOV	General government final consumption expenditure/GDP (average over the period)	World Development Indicators, World Bank
INFL	Average annual variation of the consumer price index (2005=100)	World Development Indicators, World Bank
POPGROWTH	Average annual variation of population	World Development Indicators, World Bank
BANKCREDIT	Domestic credit to private sector by banks/GDP (average over the period)	World Development Indicators, World Bank
TRADE	Sum of exports and imports of goods and services/GDP (average over the period)	World Development Indicators, World Bank
BMP	Black market exchange rate index (ranging between 0 - black market premium equal to, or greater than, 50% - and 10 - no black-market exchange rate -; average over the period)	Economic Freedom of the World, Fraser Institute
REGQUALITY	Perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development (index running from approximately -2.5 to 2.5, with higher values corresponding to better governance; average over the period)	Worldwide Governance Indicators, World Bank

TABLE 3 – *Correlation matrix for the growth regressions*

	GROWTH	*LERNER_C*	*LERNER_S*	*INITGDP*	*SCHOOL*	*INV*	*GOV*	*INFL*	*POPGROWTH*	*BANKCREDIT*	*TRADE*	*BMP*	*REGQUALITY*
GROWTH	1												
LERNER_C	0.1681*	1											
LERNER_S	0.1475*	0.1269*	1										
INITGDP	-0.2065*	-0.1086*	-0.2203*	1									
SCHOOL	-0.0091	-0.2067*	-0.1246*	0.6248*	1								
INV	0.3622*	0.1293*	0.0305	-0.0514	0.1099*	1							
GOV	-0.1413*	-0.0813	-0.0913	0.4075*	0.4706*	0.0481	1						
INFL	-0.3327*	-0.1032*	0.1840*	-0.1610*	-0.0846	0.0026	0.0137	1					
POPGROWTH	-0.1776*	0.2894*	-0.0395	-0.0651	-0.4389*	-0.0117	-0.2212*	-0.0741	1				
BANKCREDIT	-0.0709	-0.0939	-0.1665*	0.6207*	0.5095*	0.1021	0.2874*	-0.2244*	-0.1807*	1			
TRADE	0.1312*	0.0859	0.1335*	0.2291*	0.1752*	0.1124*	0.0549	-0.0391	-0.0530	0.3221*	1		
BMP	0.1226*	-0.0057	-0.1444*	0.1010	0.0611	-0.0225	0.0681	-0.1547*	-0.0561	0.1397*	0.0976	1	
REGQUALITY	-0.0645	-0.1987*	-0.2725*	0.7543*	0.7014*	0.0155	0.4234*	-0.2266*	-0.2806*	0.6721*	0.3053*	0.2470*	1

* = the level of the correlation coefficient is significant at the 5% level or better.

TABLE 4 – *Banking competition and economic growth: GMM estimates for the base model*

Variable	*Coeff.*	*t*		*Coeff.*	*t*	
lnINITGDP	-0.0111	-2.85	***	-0.0095	-2.18	**
lnLERNER_C	0.1707	3.17	***	-		
lnLERNER_S	-			0.0457	3.66	***
lnSCHOOL	0.0165	1.64		0.0084	0.63	
lnINV	0.0770	6.88	***	0.0894	6.58	***
lnGOV	0.0121	0.79		-0.0085	-0.42	
lnINFL	-0.0864	-6.54	***	-0.0915	-5.00	***
lnPOPGROWTH	-0.7955	-3.49	***	-0.7606	-2.15	**
ϕ_2	-0.0038	-1.04		0.0009	0.33	
ϕ_3	-0.0123	-2.13	**	-0.0064	-1.54	
ϕ_4	-0.0184	-3.07	***	-0.0139	-3.11	***
Constant	0.2534	5.02	***	0.3398	4.62	***
Observations	369			369		
Countries	113			113		
AR(2) p-value	0.159			0.707		
Hansen p-value	0.142			0.172		
Instruments	31			31		

The dependent variable is the annual compounded growth rate of real per capita GDP in each five-year period (*GROWTH*).
Significance for the parameter estimates: *** = 1% level; ** = 5% level; * = 10% level.
All regressions are two-step system GMM. *t*-values are clustered by country and incorporate the Windmeijer (2005) correction.
Competition variables are treated as endogenous; the initial level of GDP and control variables are treated as predetermined; time dummies are treated as exogenous. Regressors have been instrumented by lagged values and higher order lags (instruments are collapsed). The Hansen *J* statistic tests the joint validity of instruments.

TABLE 5 – *Banking competition and economic growth: GMM estimates for the extended models*

Variable	*Coeff.*	*t*		*Coeff.*	*t*		*Coeff.*	*t*		*Coeff.*	*t*	
lnINITGDP	-0.0048	-0.97		-0.0038	-0.56		-0.0116	-3.22	***	-0.0098	-2.34	**
lnLERNER_C	0.1146	1.81	*	-			0.1391	2.35	**	-		
lnLERNER_S	-			0.0378	3.89	***	-			0.0334	2.61	***
lnSCHOOL	0.0180	1.64		0.0118	0.86		0.0211	2.29	**	0.0158	1.16	
lnINV	0.0721	7.72	***	0.0839	6.38	***	0.0715	7.23	***	0.0786	5.72	***
lnGOV	-0.0154	-0.89		-0.0290	-1.44		0.0045	0.31		-0.0125	-0.73	
lnINFL	-0.0910	-5.65	***	-0.0990	-4.78	***	-0.0876	-6.72	***	-0.0847	-5.30	***
lnPOPGROWTH	-0.7228	-3.56	***	-0.6079	-1.98	**	-0.5395	-2.63	***	-0.6289	-2.33	**
lnBANKCREDIT	-0.0092	-1.26		-0.0057	-0.83		-			-		
lnTRADE	-			-			0.0188	1.05		0.0209	1.71	*
lnBMP	-			-			-			-		
lnREGQUALITY	-			-			-			-		
ϕ_2	-0.0013	-0.30		0.0004	0.13		-0.0048	-1.29		-0.0018	-0.58	
ϕ_3	-0.0075	-1.05		-0.0054	-1.21		-0.0142	-2.44	**	-0.0090	-1.88	*
ϕ_4	-0.0113	-1.50		-0.0117	-2.25	**	-0.0222	-3.53	***	-0.0174	-3.45	***
Constant	0.1384	2.11	**	0.2222	2.55	**	0.2483	5.62	***	0.3043	5.08	***
Observations	367			367			369			369		
Countries	113			113			113			113		
AR(2) p-value	0.153			0.614			0.131			0.348		
Hansen p-value	0.028			0.071			0.035			0.136		
Instruments	35			35			35			35		

Variable	*Coeff.*	*t*		*Coeff.*	*t*		*Coeff.*	*t*		*Coeff.*	*t*	
lnINITGDP	-0.0118	-3.22	***	-0.0098	-2.81	***	-0.0135	-2.12	**	-0.0143	-2.06	**
lnLERNER_C	0.1488	3.32	***	-			0.1992	3.94	***	-		
lnLERNER_S	-			0.0335	2.59	**	-			0.0485	3.29	***
lnSCHOOL	0.0202	2.20	**	0.0136	1.30		0.0202	1.57		0.0095	0.84	
lnINV	0.0697	9.68	***	0.0780	7.04	***	0.0671	6.41	***	0.0818	6.65	***
lnGOV	-0.0005	-0.03		-0.0130	-0.75		0.0115	0.82		-0.0100	-0.47	
lnINFL	-0.0936	-5.78	***	-0.1026	-6.47	***	-0.0872	-8.39	***	-0.0910	-5.32	***
lnPOPGROWTH	-0.7083	-2.10	**	-0.4899	-1.35		-0.6224	-1.77	*	-0.7024	-1.26	
lnBANKCREDIT	-			-			-			-		
lnTRADE	-			-			-			-		
lnBMP	0.0521	3.43	***	0.0426	4.28	***	-			-		
lnREGQUALITY	-			-			0.0278	0.51		0.0471	0.80	
ϕ_2	-0.0043	-1.43		-0.0009	-0.31		-0.0051	-1.38		-0.0001	-0.02	
ϕ_3	-0.0104	-2.24	**	-0.0050	-1.29		-0.0129	-2.17	**	-0.0057	-1.43	
ϕ_4	-0.0171	-3.29	***	-0.0144	-3.22	***	-0.0186	-2.96	***	-0.0132	-2.64	***
Constant	0.1036	1.68	*	0.1894	3.04	***	0.2059	2.69	***	0.2935	4.09	***
Observations	353			353			369			369		
Countries	110			110			113			113		
AR(2) p-value	0.681			0.721			0.193			0.852		
Hansen p-value	0.206			0.090			0.199			0.289		
Instruments	35			35			35			35		

The dependent variable is the annual compounded growth rate of real per capita GDP in each five-year period (*GROWTH*).
Significance for the parameter estimates: *** = 1% level; ** = 5% level; * = 10% level.
All regressions are two-step system GMM. *t*-values are clustered by country and incorporate the Windmeijer (2005) correction.
Competition variables are treated as endogenous; the initial level of GDP and control variables are treated as predetermined; time dummies are treated as exogenous. Regressors have been instrumented by lagged values and higher order lags (instruments are collapsed). The Hansen *J* statistic tests the joint validity of instruments.