What Drives Bank Competition?

Some International Evidence

Stijn Claessens and Luc Laeven*

April 2003

Abstract: Using bank-level data and applying the Panzar and Rosse (1987) methodology, we estimate the degree of competition in 50 countries' banking systems. We then relate our competitiveness measure to countries' structural and regulatory indicators and find systems with greater foreign bank entry, and fewer entry and activity restrictions to be more competitive. We find no evidence that banking system concentration negatively relates to competitiveness. Our findings confirm that contestability determines effective competition, especially through allowing (foreign) bank entry and reducing activity restrictions. At the same time, our findings also suggest that competition policy in the financial sector can be more complicated than perhaps previously thought.

* Claessens is at the University of Amsterdam and a Research Fellow at the CEPR. Laeven is at the World Bank. We thank Allen Berger, Nicola Cetorelli, Hans Degryse, Enrica Detragiache, Gaston Gelos, Hannah Hempel, Patrick Honohan, Ross Levine, Bernard Yeung, and conference participants at the World Bank for helpful comments. This paper's findings, interpretations, and conclusions are entirely those of the authors and do not necessarily represent the views of the World Bank, its Executive Directors, or the countries they represent. Prepared for the Federal Reserve Bank of Cleveland conference on Bank Competition.

INTRODUCTION

Competition in the financial sector matters for a number of reasons. As in other industries, the degree of competition in the financial sector can matter for the efficiency of the production of financial services. And, again as in other industries, it can matter for the quality of financial products and the degree of innovation in the sector. A reason specific to the financial sector why competition matters is the link between competition and stability, long recognized in theoretical and empirical research and most importantly in the actual conduct of prudential policy towards banks. The importance of these competition aspects has become further clear from recent experiences in East Asia and other emerging markets leading some to argue that excessive competition has been one of the factors contributing to the financial crises. It has also been shown, theoretically as well empirically, that the degree of competition in the financial sector can matter for the access of firms and households to financial services and external financing, in turn affecting overall economic growth, although not all relationships are clear. As in other sectors, the degree of competition in the banking system itself will depend on entry barriers, including on foreign ownership, and the severity of activity restrictions, but also on the importance of competition among all type financial institutions (commercial banks, finance companies, merchant banks, insurance companies, capital markets).

While some of these relationships between competition and banking system performance and stability have been analyzed in the theoretical literature, empirical research on the issue of competition, particularly cross-country research, is still in an early stage. A hindrance for the cross-country research used to be data problems, as little bank-level data were available outside the main developed countries, but recently established databases are allowing for better empirical

work. Another hindrance on the interpretation of existing empirical work has been that it did not always take into account a number of theoretical issues. The long-existing theory of industrial organization has shown that the competitiveness of an industry cannot be measured by market structure indicators alone (such as number of institutions, Herfindahl or other concentration indexes). Rather, testing for the degree of effective competition needs a structural, contestability approach. To date, however, few cross-country tests have taken this approach.

Empirical research on competition in the financial sector has also not yet reflected recent analysis comparing financial systems' functioning. This analysis of financial systems' functioning and performance has made clear that characterizing financial systems by the prevalence of certain type of institutions or importance of markets can be misleading. Although countries vary greatly in their structures, e.g., the relative importance of banks and securities markets, these may not be the most important characteristics for their functioning, including competition. Research indeed has shown that what matters in the end for financial sector efficiency, access, growth and financial stability are the functions that the financial sector provides which may or may not vary by financial structure (Demirgüç-Kunt and Levine, 2001). This importance of functions rather than institutions or structures may also apply to the issue of competition, suggesting that tests focusing on how the structure of banking systems, e.g., number of institutions, may affect competition are not complete.

Finally, financial services industries have been undergoing rapid changes, in part triggered by deregulation and technological advances. These changes have led to many changes, including dis-intermediation, removal of barriers between financial products, consolidation, increased

cross-border capital flows, greater commercial presence, and more financial integration, as well as some risks and short-run costs. They have made the definition of a financial market and any particular financial service more complex. They also have increased the network properties of financial services, making achieving perfect competition more complex, as having a pro-competitive entry/exit regime in terms of institutions or markets for various types of financial services in place is not enough. And it is making empirical analyses of the competitive nature of financial systems more complicated.

These considerations suggest some advantages of using a more structural approach to assessing the degree of competition in the financial sector. While one cannot expect to address all issues, a more formal test of the degree of competition will allow one to overcome some of these concerns. It will also allow a comparison of results to other approaches to measuring competition, such as using concentration ratios or the number of banks in a market. Structural competition tests have been applied to banking systems in a number of individual countries, but not on a broad cross-country basis. The purpose of this paper is to estimate and document a measure of competition for a large cross-section of countries and to find some factors helping explain differences. We specifically seek to analyze the role of entry and activity regulations, and the role of foreign banks in affecting the competitive conditions of banking systems. Since the importance of banks of different size and the role of non-bank financial institutions in affecting the overall competition in the financial sector have received limited attention, we also study those.

Using bank-level data and applying an adapted version of the Panzar and Rosse (1987) methodology, we estimate the degree of competition in 50 countries' banking systems. We then relate our competitiveness measure to countries' structural and regulatory indicators. We find that systems with greater foreign bank entry, and lack of entry and activity restrictions have a higher competitiveness score. We find no evidence that banking system concentration negatively relates to competitiveness. Our findings confirm that contestability determines effective competition, especially through allowing (foreign) bank entry and eliminating activity restrictions. They also suggest that competition policy in the financial sector can be more complicated than perhaps previously thought.

The paper proceeds as follows. Section 1 gives a review of related literature, both on the effects of competition in the financial sector as well as measuring competition in general and in the financial sector specifically. Section 2 discusses the methodology used to test for the degree of competition in the banking market of a particular country. Section 3 presents the data we use and the selection criteria we used for the sample we end up using. The section also presents the main empirical results and relates the measure of competition to some structural and policy variables. Section 4 reports several robustness tests. Section 5 concludes.

1. LITERATURE REVIEW

We review several, related strands of literature. We start with a short review of the growing literature on the definition and effects of competition in the financial sector. We then review the empirical literature that has investigated the relationships between structural and regulatory factors and performance, access to financing and growth, all as they relate to the competitive

structure of the banking systems. Since these papers have mostly not attempted to test a specific structural model, we review briefly the general theory on measuring competition and then review some of the empirical papers that have applied structural competition tests to the financial sector.

1.1 General Effects of Competition in Banking

As a first-order effect, one would expect increased competition in the financial sector to lead to lower costs and enhanced efficiency, even allowing for the fact that financial products are heterogeneous. In a theoretical model, Besanko and Thakor (1992), for example, analyze the allocation consequences of a relaxing of entry barriers and find that equilibrium loan rates decline and on deposit interest rates increase, even when allowing for differentiated competition. As recent research has highlighted, however, the relationships between competition and banking system performance, access to financing, stability and growth are more complex (for a recent review of the theoretical literature on competition and banking, see Vives 2001). Market power in banking, for example, may up to a degree be beneficial for access to financing. As Vives states, the view that competition policy is unambiguously good in banking is more naive than in other industries and vigorous rivalry may not be the first best for financial sector performance. Neither does necessarily technological progress lowering production or distribution costs for financial services providers lead to more or better access to external financing. A few examples of theoretical papers will show these specific findings.

In a dynamic world, a bank and borrower establish relationships to overcome information problems. The higher its market power, the more likely the bank invests in information gathering about firms, especially to informationally opaque firms, and the more likely it provides

credit (Rajan, 1992). More competition can then undermine the incentives of banks to invest in a relationship. But the relationship involves sunk costs and leads to a hold-up problem: the incumbent bank has more information about the borrower than its competitors. This increases the switching costs for the borrower, especially for better quality borrowers since they will face adverse conditions when trying to look for financing from another bank, as they will be perceived as a poor credit. Borrowers will be more willing to enter a relationship with a bank if they are less likely subject to a hold-up problem, for example, when the market for external financing is more competitive. The net effect of these problems is that the degree of lending by banks can vary with the overall competitive environment. Boot and Thakor (2000), for example, show that increased interbank competition may induce banks to make not less, but more relationship loans. There can also be effects from the type of information problem back to the scope for potential competition, that is, endogenizing competition. Dell'Ariccia, Friedman and Marquez (1999), for example, show that the presence of information asymmetries in lending relationships can become a barrier to entry in the banking system.

Technological progress lowering costs can also affect the competitive structure of markets and thereby affect the access to and terms of external financing, but again not in an obvious manner. Endogenizing competition, Hauswald and Marquez (2002), for example, analyze the impact of technological progress on competition in financial services. While better information technology may lead to improved information processing, it may also lead to low costs of information or even free access to information. Better access to information can decrease interest rates, but an improved ability to process information can increase interest rates. They show that the net effects on competition hinge on the overall effect ascribed to

technological progress. Marquez (2002) analyze how information generated through the process of lending can impact the structure of the banking industry to the extent that that this information is proprietary to the banks. He shows that in markets where new entrants have specific expertise in evaluating credit risks or in markets with high borrower turnover, entry should be easier so that incumbents' bank information advantages are reduced. Again, the preferred market structure in terms of access may depend on the degree of information asymmetries and the ownership and control structures for information.

Apart from its effects on access and terms of financing, the relationships between competition and stability are not obvious. Many academics and especially policy makers have stressed the importance of franchise value for banks in maintaining incentives for prudent behavior. This in turn has led banking system regulators to carefully balance entry and exit. This has often been a static view, however. Perotti and Suarez (2002), for example, draw attention to the importance of the dynamic pattern of entry and exit regulation in driving the current actions of banks. They show in a formal model that the behavior of banks today will be affected by both current and future concentration and the degree to which authorities will allow for a contestable system in the future. In a dynamic model, current concentration does not necessarily reduce risky lending, but an expected increase in future market concentration can make banks choose to pursue safer lending today.

1.2 General Empirical Studies on Banking System Performance and Structure

A number of papers have investigated the competitive conditions in banking systems. The focus of these papers has been varied. Some try to document only the degree of competition or lack thereof, others try to identify also structural and institutional factors which help explain variations in effective competition across banks, countries or over time. Some others go further and try to establish the impact of competition or lack thereof on bank efficiency, access to financing, stability and growth. While many of these papers are not formal structure-performance-conduct tests, their results have been interpreted as indicative of the degree of competition and/or its causes and consequences in the financial sector.

Much of the literature that has (or has not) tested a specific structural model has been concerned with the US and a few developed countries. The focus has also been on the profitability of banks and efficiency with which banks operate, as they relate to factors such as the structure of the market, the degree of domestic deregulation, the effects of merger and acquisitions, and the degree of consolidation in the industry. In one of the first papers, Berger and Hannan (1989) investigate the commonly observed relationship between market concentration and profitability. They try to separate the effects of non-competitive price behavior from those of greater efficiency of firms with larger market shares. Using data for US banks during the period 1983-85, they find that non-competitive price behavior could explain the relationship. Berger (1995) also explores the relationship between market power and profit. He finds, however, limited evidence for any specific theory of bank profits, including the structure-conduct-performance hypothesis. Regulatory reform, large-scale consolidation, and competitive pressure from other countries have changed substantially the banking environment in European countries. Angelini and Cetorelli (2000) analyze the evolution of competitive conditions in the

Italian banking industry using firm-level balance sheet data for the period 1983-1997. They find some evidence of a substantial increase in competitive conditions in the banking market after the introduction of the European Single Banking License, with a decrease in markups.

There is some empirical evidence for the U.S. and some other markets regarding the effects of concentration in the financial system on access to and costs of external financing and growth. Petersen and Rajan (1995) offer empirical evidence for the U.S. that firms are less credit constrained and face cheaper credit the more concentrated the credit market is. Degryse and Ongena (2002) show in the case of Belgium that loan rates increase in the distance between the firm and competing banks (and decrease in the distance from the lender and the firm), suggesting that increased distance relaxes price competition. Berger, Klapper and Udell (2001) investigate the effects of bank size, foreign ownership, and distress on lending to informationally opaque small firms for Argentina. Their results suggest that large and foreign-owned institutions may have difficulty extending relationship loans to opaque small firms. Collender and Shaffer (2001) document how in the U.S., non-metropolitan employment grew faster in areas where there was a more concentrated initial banking structure and where there were locally owned bank offices.

Consolidation and its effect on bank lending terms has been a much-researched topic and too large a literature to review here. Gilbert (1984) reviews the earlier studies, while Berger, Demsetz, and Strahan (1999) review more recent studies on the effects of consolidation, including studies on the effects of consolidation on access to financing, mainly for the U.S. A more policy-oriented review on the effects of consolidation is G-10 (2001). More recently, technological progress and its effects in the banking industry has been more researched and

Berger (2002) reviews this literature. Claessens and Klingebiel (2001) and Claessens, Dobos, Klingebiel and Laeven (2003) review the general and more recent literature on competition in the financial sector as well, trying to infer policy lessons for developing and other countries.

Many of these studies pertain to developed countries and are mostly not of a cross-country nature. There are a number of papers, however, investigating across countries the effects of specific structural or other factors presumed to relate to the competitive environment on banking performance. Claessens, Demirgüç-Kunt and Huizinga (2001) investigate the role of foreign banks in a cross-country study and show that entry by foreign banks makes domestic banking systems more efficient by reducing their margins. In a broad survey of rules governing banking systems, Barth, Caprio and Levine (2001) document for 107 countries various regulatory restrictions in place in 1999 (or around that time) on commercial banks, including various entry and exit restrictions and practices. Using this data, Barth, Caprio and Levine (2002) investigate empirically, among others, the cost and benefits of these restrictions. They find that tighter entry requirements are negatively linked with bank efficiency, leading to higher interest rate margins and overhead expenditures, while restricting foreign bank participation tends to increase bank fragility. These results are consistent with the view that tighter entry restrictions tend to limit competition and emphasize that it is not the actual level of foreign presence or bank concentration, but the contestability of a market that is positively linked with bank efficiency and stability.

Using bank level data for 77 countries, Demirgüç-Kunt, Laeven, and Levine (2003) investigate the impact of bank concentration and regulations on bank efficiency. They find that

bank concentration has a negative and significant effect on the efficiency of the banking system except in rich countries with well-developed financial systems and more economic freedoms. Furthermore, they find bank-level based support that regulatory restrictions on entry of the new banks, particularly concerning foreign banks, and implicit and explicit restrictions on bank activities, are associated with lower levels of bank efficiency.

There have also been papers studying the impact of the structure of banking systems on access to financing, growth and other economic variables. Using the empirical methodology of Rajan and Zingales (1998), Cetorelli and Gambera (2001) document in a cross-section study that banking sector concentration exerts a depressing effect on overall economic growth, though it promotes the growth of industries that depend heavily on external finance. Using the same data and similar methodology, Deiida and Fatouh (2002) find that banking concentration is negatively associated with per capita growth and industrial growth only in low-income countries, while there is no significant relationship between banking concentration and growth in high-income countries. Dell'Ariccia and Bonaccorsi di Patti (forthcoming) also employ this approach and find that bank competition has a positive effect on firm creation. They also find, however, that the degree of information asymmetries in the country limit the overall positive effects of bank competition on firm credit, consistent with theories that competition may reduce credit to informationally opaque firms. Finally, Cetorelli (2001) also uses this methodology and finds that banking concentration enhances industry concentration, especially in sectors highly dependent on external finance, although these effects are less strong in countries with well-developed financial systems.

Beck, Demirgüç-Kunt and Maksimovic (2002) investigate the effects of bank competition on firm financing constraints and access to credit, also using a cross-country approach, but with firm-level data. They find that bank concentration increases financing constraints and decreases the likelihood of receiving bank finance for small and medium-size firms, but not for large firms. The relation of bank concentration and financing constraints is reduced in countries with an efficient legal system, good property rights protection, less corruption, better developed credit registries and a larger market share of foreign banks, while a greater extent of public bank ownership exacerbates the relation. Further, less contestability and restrictions on banks' activities exacerbate the relation, while high entry and capital requirements alleviate it.

Eschenbach and Francois (2002) investigate, using a dynamic, simultaneous system approach, the relationship between financial sector openness, competition and growth. Using a panel estimation of 130 countries, they report a strong relationship between financial sector competition/performance and financial sector openness and between growth and financial sector openness/competition. They also find evidence of the presence of economies of scale in the financial sector.

Finally, some papers have analyzed the relationship between banking concentration and banking crises. Beck, Demirguc-Kunt and Levine (2002) show, using data on 79 countries over the period 1980-1997, that crises are less likely (i) in more concentrated banking systems, (ii) in countries with fewer regulatory restrictions on bank competition and activities, and (iii) in

economies with better institutions, i.e., institutions that encourage more competition and support private property rights.

1.3 Competition Testing: Theory

Most papers reviewed so far did not test for the degree of competition in the banking system using a specific structural model. The general contestability literature has suggested, however, specific ways on how to go about testing for the degree of competition. Klein (1971), Baumol, Panzar, and Willig (1982) were the first to develop a formal theory of contestable markets. They draw attention to the fact that there are several sets of conditions that can yield competitive outcomes, even in concentrated systems. On the other hand, they showed that collusive actions could be sustained even in the presence of many firms. Their work has spanned a large theoretical and empirical literature covering many industries. More recently, theoretical and empirical research has focused on issues such as sunk costs, entry costs and barriers, network externalities, and the effects of tying between related products or services (see Claessens et al. 2003, for a review of these issues as they may apply to finance).

Two types of empirical tests for competition can be distinguished as they have been applied to financial sector (and other industries). The model of Bresnahan (1982) and Lau (1982), as expanded in Bresnahan (1989), uses the condition of general market equilibrium. The basic idea is that profit-maximizing firms in equilibrium will choose prices and quantities such that marginal costs equal their (perceived) marginal revenue, which coincides with the demand

price under perfect competition or with the industry's marginal revenue under perfect collusion. This model allows for an easy to use test statistic and a direct relationship to a natural measure of excess capacity. Specifically, a parameter, λ, can be estimated which provides a measure of the degree of imperfect competition, varying between perfect competition ($\lambda = 0$) or full market power ($\lambda = 1$). The main empirical advantage is that one only needs to use industry aggregate data (although using firm-specific data is possible as well).[1]

The alternative approach is Rosse and Panzar (1977), expanded by Panzar and Rosse (1982) and Panzar and Rosse (1987). This methodology, abbreviated here to the PR model, uses firm (or bank)-level data. It investigates the extent to which a change in factor input prices is reflected in (equilibrium) revenues earned by a specific bank. Under perfect competition, an increase in input prices raises both marginal costs and total revenues by the same amount as the rise in costs. Under monopoly, an increase in input prices will increase marginal costs, reduce equilibrium output and consequently reduce total revenues. The PR model also provides a measure ("H-statistic") between 0 and 1 of the degree of competitiveness of the industry, with less than 0 being a collusive (joint monopoly) competition, less than 1 being monopolistic competition and 1 being perfect competition. It can be shown, if the bank faces a demand with constant elasticity and a Cobb-Douglas technology, that the magnitude of H can be interpreted as an inverse measure of the degree of monopoly power, or alternatively, as we do, as a measure of the degree of competition.

[1] The Bresnahan test has been critised as suffering from a multicollinearity problem (see Perloff and Shen, 2001). The severity of this criticism is being debated, however.

The advantage of the PR model is that it uses bank-level data and allows for bank-specific differences in production function. It also allows one to study differences between types of banks (e.g., larges versus small, foreign versus domestic). Its drawback is that it assumes that the banking industry is in long-run equilibrium, but a separate test exists whether this is satisfied.[2] As we have access to bank-level information and as we want to study differences among banks, we choose for the PR model. The empirical specification we use is explained in more detail in section two.

1.4 Competition Testing: Empirical Results for Banking Systems

A number of papers have applied either the Breshnahan or the PR methodology to the issue of competition in the financial sector, although mostly to the banking system specifically.[3] The Breshnahan test has been applied in a number of papers, with one of the first papers being Shaffer (1989). He applies the methodology to a sample of US banks and finds results that strongly reject collusive conduct, but are consistent with perfect competition. Using the same model, Shaffer (1993) studies the competition conditions in Canada and finds that the Canadian banking system was competitive over the period 1965-1989, although being relatively concentrated. He also finds that the degree of competition in Canada was generally stable following regulatory changes in 1980.

[2] In case of short-run, but not long run equilibrium, the parameter H represents a one-tail test in the sense that a positive value rejects any form of imperfect competition, but a negative value is consistent with a variety of possibilities, including short-run competition (see further Shaffer 1983 and Shaffer and DiSalvo, 1994).
[3] Cetorelli (1999) provides more detail on these formal tests and reviews some of the results of previous studies of empirical banking studies.

Gruben and McComb (forthcoming) applied the Breshnahan methodology to Mexico before 1995 and find that the Mexican banking system was super-competitive, that is marginal prices were set below marginal costs. One of the few studies with a relatively large sample of countries is Shaffer (2001), which uses the Breshnahan model for 15 countries in North America, Europe, and Asia during 1979-91. He finds significant market power in five markets and excess capacity in one market. Estimates were consistent with either contestability or Cournot type oligopoly in most of these countries, while five countries were significant more competitive than Cournot. Since the data refer to the period before the European single banking license was adopted, the result may, however, not be reflective of the current situation.

Shaffer (1982) was also one of the first to apply the PR model to banks. He estimated it for New York banks using data for 1979 and found monopolistic competition. Nathan and Neave (1989) study Canadian banks using the PR methodology. The results for Canada are consistent with the results of Shaffer (1989) using the Breshnahan methodology, in that they can also reject monopoly power for the Canadian banking system (Nathan and Neave found perfect competition for 1982 and monopolistic competition for 1983-84). Some other studies have applied the PR methodology to some non-North America and non-European banking systems. For Japan, for example, Molyneux, Thornton and Lloyd-Williams (1996) find evidence of a monopoly situation in 1986-1988.

A number of papers have applied the P-R methodology to European banking systems. These papers include Molyneux, Lloyd-Williams, and Thornton (1994), Vesala (1995), Molyneux, Thornton and Lloyd-Williams (1996), Coccorese (1998), Bikker and Groeneveld

(2000), Bikker and Haaf (2001), De Bandt and Davis (2000), and Hempel (2002). The countries covered, the time periods and some of the assumptions used vary between the studies. Although the findings varied somewhat consequently, generally the papers can reject both perfect collusion as well as perfect competition and find mostly evidence of monopolistic competition (Bikker and Haaf (2001) summarize the results of some ten studies). Bikker and Groeneveld (2000), for example, find monopolistic competition in all of the 15 EU-countries they study.

Some of these studies find differences between types of banks. For Germany, for example, Hempel (2002) reports for 1993-1998 differences between savings and cooperative banks on one hand and credit banks on the other hand as well as between several size categories. She cannot find clear evidence of a change in competitive behavior, however, despite a slight increase in concentration during the period studied. Others have also found differences in competitiveness between sizes of banks. De Bandt and Davis (2000), for example, find for the period 1992-96 for small banks in France and Germany monopoly while they find monopolistic competition for small banks in Italy and for the large banks in all three countries in their sample. This suggests that in these countries small banks have more market power, maybe as they cater more to local markets.

Tests on the competitiveness of banking systems for developing countries and transition economies using these models are few to date. Gelos and Roldos (2002) analyze a number of banking markets using the PR-methodology, including some developing countries. They report that, overall banking markets in their sample of eight European and Latin American countries have not become less competitive, although concentration has increased. They conclude that

lowered barriers to entry, such as allowing increased entry by foreign banks, appeared to have prevented a decline in competitive pressures associated with consolidation. Philippatos and Yildirim (2002) investigate 14 Central and Eastern European banking systems using bank-level data and the PR-methodology. They find, except for Latvia, Macedonia, and Lithuania, that these banking systems can neither be characterized as perfectly competitive or monopolistic. They also conclude that large banks in transition economies operate in a relative more competitive environment compared to small banks.[4]

Differences between assessments of the competitiveness of banking systems using the Breshnahan and the P-R methodologies appear small, as already noted for Canada. In a broad comparison, Bikker and Haaf (2001) use both the PR model as well as the Breshanan model, the latter to the market for deposit and loan facilities. They first apply the PR model to 17 European and six non-European (US, Japan, Korea, New Zealand and Canada) markets. They reject both perfect competition and perfect cartel for all markets when including all banks, but cannot reject perfect collusion for Australia and Greece when analyzing only small banks. They find some evidence that smaller banks operate in less competitive environments than larger banks do, suggesting that local markets are less competitive than national or international markets are. They also find that in general, competition appears to be less in non-European countries. Using the Breshanan model for nine EU-countries in their sample of 17 EU-countries, they find that the markets for deposit and loan facilities are probably highly competitive, a result in line with their results of the PR model, suggesting that the two methodologies lead to similar assessments.

[4] Their findings on differences across countries find support in the analysis of Fries, Neven and Seabright (2002). The latter investigate bank performance in 16 transition economies and find that bank performance varies significantly with progress in banking and enterprise reform as well as competitive conditions in the respective country.

Empirical competition tests using other than the Breshanan and PR model have also been conducted, although few so far. Kessidis (1991) has developed a model of contestability which focuses on sunk costs. A recent study using this model on the EU-banking markets is Corvoisier and Gropp (2002). They focus on the effects of advances in information technology, given its effects on sunk costs, on competition. They find evidence for an increase in contestability in deposit markets and more moderate effects for loans markets, which they conjecture is because technology has reduced sunk costs more in deposit than in loan markets.

2. METHODOLOGY

We use the Panzar and Rosse (1982, 1987) (henceforth PR) approach to assess the competitive nature of banking markets around the world. The PR H statistics is calculated from reduced form bank revenue equations and measures the sum of the elasticities of the total revenue of the banks with respect to the bank's input prices. The PR H statistic is interpreted as follows. $H<0$ indicates a monopoly; $H=1$ indicates perfect competition; and $0<H<1$ indicates monopolistic competition. Nathan and Neave (1989) point out that this interpretation assumes that the test is undertaken on observations that are in long-run equilibrium. We therefore also test whether the observations are in long-run equilibrium, which involves estimating a parameter E, where $E=0$ indicates equilibrium and $E<0$ indicates disequilibrium.

2.1 Competitive environment test I

We estimate the following reduced form revenue equations on pooled samples for each country:

$$\begin{aligned}\ln(P_{it}) = \alpha &+ \beta_1 \ln(W_{1,it}) + \beta_2 \ln(W_{2,it}) + \beta_3 \ln(W_{3,it}) + \\ &+ \gamma_1 \ln(Y_{1,it}) + \gamma_2 \ln(Y_{2,it}) + \gamma_3 \ln(Y_{3,it}) + \\ &+ \delta D + \varepsilon_{it}\end{aligned} \tag{1}$$

where P_{it} is the ratio of gross interest revenue to total assets (proxy for output price of loans), $W_{1,it}$ is the ratio of interest expenses to total deposits and money market funding (proxy for input price of deposits), $W_{2,it}$ is the ratio of personnel expense to total assets (proxy for input price of labor),[5] $W_{3,it}$ is the ratio of other operating and administrative expense to total assets (proxy for input price of equipment/fixed capital). The subscript *i* denotes bank *i*, and the subscript *t* denotes year *t*.

We include several control variables. Specifically, $Y_{1,it}$ is the ratio of equity to total assets, $Y_{2,it}$ is the ratio of net loans to total assets, and $Y_{3,it}$ is the logarithm of total assets (to control for potential size effects). D is a vector of year dummies for the years 1995 through 2001 (we drop the year dummy for the year 1994). We take natural logarithms of all variables. We estimate model (1) both using OLS with time dummies and GLS with fixed bank-specific effects (in the latter case $\alpha = \alpha_i$). The *H*-statistic equals $\beta_1 + \beta_2 + \beta_3$ and we test whether $H = 1$ or whether $H = 0$ using a F-test. In what follows we refer to H1 as the H-statistic based on model (1) and estimated using OLS, and to H2 as the H-statistic based on model (1) and estimated using GLS

[5] Due to lack of data on total employees, we do not express the unit cost of labor in terms of total employees but in terms of total assets.

with fixed-bank effects. Model (1) is similar to models used previously in the literature to estimate H-statistics for banking industries.

2.2 Equilibrium test I

Since the PR-model is only valid if the market is in equilibrium, we also estimate the following equation for each country:

$$\begin{aligned} \ln(ROA_{it}) = \alpha &+ \beta_1 \ln(W_{1,it}) + \beta_2 \ln(W_{2,it}) + \beta_3 \ln(W_{3,it}) + \\ &+ \gamma_1 \ln(Y_{1,it}) + \gamma_2 \ln(Y_{2,it}) + \gamma_3 \ln(Y_{3,it}) + \\ &+ \delta D + \varepsilon_{it} \end{aligned} \tag{2}$$

where ROA is the pre-tax return on assets (pre-tax profits to total assets). Because return on assets can take on (small) negative values, we compute the dependent variable as *ROA*'=ln(1+*ROA*) where *ROA* is the unadjusted return on assets. We define the equilibrium *E*-statistic as $\beta_1 + \beta_2 + \beta_3$. We test whether $E = 0$, again using a F-test. If rejected, the market is assumed not to be in equilibrium. The idea behind model (2) is that, in equilibrium, returns on bank assets should not be related to input prices. This approach for testing whether the observations are in long-run equilibrium has previously been used in the literature (see, for example, Shaffer 1982 and Molyneux et al. 1996). Model (2) is similar to the models used in those papers. In what follows we will refer to E1 as the E-statistic based on model (2) and estimated using OLS, and to E2 as the E-statistic based on model (2) and estimated using GLS with fixed-bank effects.

2.3 Competitive environment test II

For robustness, we estimate the following alternative reduced revenue equations:

$$\begin{aligned}\ln(Pa_{it}) = \alpha &+ \beta_1 \ln(Wa_{1,it}) + \beta_2 \ln(Wa_{2,it}) + \beta_3 \ln(Wa_{3,it}) + \\ &+ \gamma_1 \ln(Y_{1,it}) + \gamma_2 \ln(Y_{2,it}) + \gamma_3 \ln(Y_{3,it}) + \\ &+ \delta D + \varepsilon_{it}\end{aligned} \tag{1a}$$

where Pa_{it} is the ratio of total revenue to total assets (where total revenue is calculated as gross interest revenue plus other operating revenues, such as fee income, commission income, etc.), $Wa_{1,it}$ is the ratio of interest expenses to total deposits and money market funding plus total other funding (including bonds, subordinated debt and hybrid capital), $Wa_{2,it}$ is the ratio of personnel expense to total deposits plus money market instruments plus net loans, $Wa_{3,it}$ is the ratio of other operating and administrative expense to fixed assets. The dependent variable now includes non-interest revenues. The *H*-statistic equals $\beta_1 + \beta_2 + \beta_3$. We test again whether $H = 1$ and whether $H = 0$ (F-tests). In what follows we refer to H3 as the H-statistic based on model (1a) and estimated using OLS, and to H4 as the H-statistic based on model (1a) and estimated using GLS with fixed-bank effects.

2.4 Equilibrium test II

We estimate the following equation for each country:

$$\ln(ROA_{it}) = \alpha + \beta_1 \ln(Wa_{1,it}) + \beta_2 \ln(Wa_{2,it}) + \beta_3 \ln(Wa_{3,it}) + \\ + \gamma_1 \ln(Y_{1,it}) + \gamma_2 \ln(Y_{2,it}) + \gamma_3 \ln(Y_{3,it}) + \\ + \delta D + \varepsilon_{it} \tag{2a}$$

We define the equilibrium E-statistic as $\beta_1 + \beta_2 + \beta_3$. We then test whether $E = 0$ (F-tests). If rejected, the market is not in equilibrium. In what follows we refer to E3 as the E-statistic based on model (2a) and estimated using OLS, and to E4 as the E-statistic based on model (2a) and estimated using GLS with fixed-bank effects.

3. DATA AND EMPIRICAL RESULTS

3.1 Data

We use bank-level data from BANKSCOPE, a database containing bank financial statements used in a number of other cross-country studies. We have panel data for the years 1994-2001 and we include all banks (commercial banks, savings banks, cooperative banks, and bank holding companies). We use data from consolidated accounts if available, and otherwise from unconsolidated accounts (to avoid double-counting).

We start with the complete sample of banks in BANKSCOPE, resulting in a total number of bank-year observations of 54,038 (on average 6,755 banks per year). The sample we end up using is smaller, however, as we apply some selection criteria. First, we apply a number of outlier rules to the main variables (roughly corresponding to the 1st and 99th percentiles of the

distributions of the respective variables).[6] We also delete countries with less than 50 bank-year observations (we need a reasonable number of bank-year observations for each country to estimate the H-statistic; we set the minimum number of observations to 50). This reduced sample consists of 37,107 bank-year observations. We also delete countries with data for less than 20 banks since we need at least 20 observations per country to get reasonable accurate H estimates for each country.[7] Furthermore, some countries in Bankscope do not have adequate coverage of banks and only include the very large banks in the country. Annex 1 provides for a detailed overview of how the various outlier rules affect the sample we end up using.

The final sample consists of 35,834 bank-year observations (4,479 banks on average per year). It is an unbalanced panel with the largest number of 5,002 banks observations for the year 1999.[8] The final sample we use consists of 50 countries.[9] Table 2 reports the summary statistics of each of the bank-specific variables by country (country averages). A description and definition of the variables can be found in Table 1. In terms of number of banks, banks from France

[6] We need to exclude a large number of Japanese banks, because BANKSCOPE does not have data on personnel expense for most large Japanese banks. Our sample of Japanese banks is therefore much smaller than the actual number of Japanese banks.

[7] We therefore drop observations from the following countries (with number of bank-year observations between brackets): Bahrain (55), Bolivia (100), Cayman Islands (52), Cyprus (51), El Salvador (62), Ireland (80), Israel (91), Jordan (59), Kazakhstan (60), Republic of Korea (59), Nepal (50), Puerto Rico (US) (55), Saudi Arabia (70), Slovak Republic (80), Slovenia (90), Sweden (73), Thailand (61), United Arab Emirates (66), and Vietnam (59).

[8] The distribution of the sample across years is as follows: 3,934 banks in 1994, 4,327 banks in 1995, 4,633 banks in 1996, 4,731 banks in 1997, 4,852 banks in 1998, 5,002 banks in 1999, 4,741 banks in 2000, and 3,614 banks in 2001. The total number of bank-year observations is 35,834.

[9] These countries are (with number of bank-year observations between brackets): Argentina (278), Australia (126), Austria (760), Bangladesh (132), Belgium (371), Brazil (248), Canada (224), Chile (148), Colombia (167), Costa Rica (111), Croatia (196), Czech Republic (90), Denmark (646), Dominican Republic (121), Ecuador (106), France (1,926), Germany (13,015), Greece (95), Honduras (68), Hong Kong, China (243), Hungary (112), India (399), Indonesia (353), Italy (2,508), Japan (100), Kenya (106), Latvia (85), Lebanon (371), Luxembourg (277), Malaysia (228), Mexico (58), Netherlands (227), Nigeria (86), Norway (259), Pakistan (148), Panama (88), Paraguay (92), Peru (132), Philippines (237), Poland (138), Portugal (213), Russian Federation (232), South Africa (186), Spain (839), Switzerland (1,048), Turkey (69), Ukraine (71), United Kingdom (569), United States (7,261), and Venezuela (171).

Germany, Italy, Switzerland and United States dominate the sample. In each of these countries we have more than 1,000 bank-year observations (see also Table 3).

3.2 Competitive environment tests

We estimate the *H*-statistics on the basis of the four models. The four estimates vary as follows in terms of estimation technique, Pooled OLS with time dummies vs. Fixed effects with time dummies, and in terms of dependent variable, Gross interest revenue as dependent variable vs. Total revenues as dependent variable. The results are reported in Table 3. Out of the 200 estimates, there are only two inconsistent estimates. Specifically, using the fixed effects with total revenues as the dependent variable estimator, the estimate of 1.08 observed for Honduras and the estimate of –0.02 for Japan are both theoretical impossible.[10] Otherwise, we find that the four measures generally provide close estimates of the H-statistic for each country. The correlations between the estimates are between 0.14 and 0.40 (see also Table 5). Excluding the 10 countries with the largest absolute differences among each of the four estimates,[11] the correlations between the estimates are higher, between 0.23 and 0.61. This suggests that the methods are quite robust. The average H-statistic varies between the four estimation techniques from 0.60 to 0.70, suggesting that monopolistic competition is the best description of the average degree of competition. There do not appear to be any strong patterns among type of countries, although it is interesting that some of the largest countries (in terms of number of banks and

[10] However, both estimates are not statistically significantly different from 1 respectively 0 (and very close to 1 and 0 in economic terms).
[11] These countries are: Bangladesh, Greece, Hong Kong (China), Hungary, Japan, Mexico, Paraguay, South Africa, Turkey, and Ukraine.

general size of their economy) have relatively low values for the H-statistics. The U.S., for example, has an H1 of 0.15 and Germany has an H1 of 0.39, much below the overall average.

3.2 Equilibrium tests

Conducting the equilibrium tests we find that the banking systems of most countries are in "equilibrium" (Table 4). Although the F-tests indicate disequilibria for many countries from a statistical point of view, in the sense that the tests reject that the parameter E equals zero, the absolute levels of the equilibrium-*E*-statistics are so close to zero that we can argue that the systems are in "equilibrium" from an economic point of view. We therefore proceed with using all observations.

3.3 Determinants of the *H*-Statistic

We next try to identify factors that can explain the assessment of the competitiveness of the banking system across countries. To do so, we regress each of the four *H*-statistics on a number of country characteristics. The regression model is as follows:

$$H_i = \alpha + \beta \mathrm{B}_i + \varepsilon_i$$

where H_i is the *H*-statistic for country *i*, based on individual bank data for the period 1994-2001, and B_i is a vector of country characteristics. Since there is some variation between the four

measures, we also conduct the regressions using the average of the four *H*-statistics as dependent variable as a robustness test.

We run the cross-country regressions for our regular sample of 50 countries that includes only countries with at least 50 bank-year observations and at least 20 banks. We also run the cross-country regressions using a smaller sample of 39 countries that includes only countries with at least 100 bank-year observations and at least 20 banks.

As explanatory variables we use a number of variables also used in other cross-country studies to explain banking system performance and stability. From the date base established by Barth, Caprio, and Levine (2001), we use two regulatory variables, the Entry fit test variable, an indicator of the severity of the entry regime with higher scores indicating less severe restrictions; and the Activity restrictions variable, indicating the limits imposed on commercial banks to engage in securities markets, insurance and real estate activities. The Entry fit variable refers to the actual practices of the supervisory agencies in the country, while the Activity variable refers to the legal rules in place.[12] We also use from the Barth, Caprio, and Levine data base a number of banking system structure variables: the share in assets/numbers of banks which are foreign-controlled, the Foreign bank ownership variable; the density of bank banks, the Logarithm of the number of banks per million inhabitants in a particular country; and a measure of banking system concentration, the 5-bank concentration ratio.[13] Data typically refer to the situation as of end-

[12] We also used from the Barth, Caprio, and Levine data base the degree of entry applications denied, but did not find this variable to have significant effects and therefore did not add it.
[13] We also used from the Barth, Caprio, and Levine data base the degree of state-owned banks, but again did not find this variable to have significant effects and therefore did not add it

1999, which is towards the end of our data period. As in other studies, we rely on the relative stability of the regulation and supervision indicators.

We furthermore use a number of other data to describe the structure of the banking system, the competition coming from the non-banking sector, the macro-economic conditions, and the overall development of the country. To investigate the impact of the degree of competition banks face from non-bank financial institutions, we use a measure of the size of the capital markets in the country, specifically we use stock market capitalization to GDP. We also use data collected by Beck, Demirguc-Kunt and Levine (2000) on the importance of the insurance industry, specifically we use life insurance penetration, defined as the amount of annual life insurance premiums collected divided by GDP. These data refer to the year-end 1994. We expect to find a positive coefficient for both indicators as the more developed these other parts of the financial sector are, the more competitive pressure there will be on the banking system.

We also investigate the impact of the existence of public credit registries on the competitiveness of banks. Credit bureaus are set up to improve information sharing which is often thought to reduce the informational rents that banks could otherwise extract from their customers (Jappelli and Pagano, 2000). We may therefore expect more competitive pressure in countries with public credit registries. At the same time, a credit registry may act as a collusive device that shields incumbent banks that may control the registry, from competition from other banks and from non-bank financial institutions. The data on whether or not there is a public credit registry in the country come from the World Bank Database on Credit Registers.

Finally, we control for the countries' general economic development and macro-economic stability as these can be expected to affect banking system performance. As proxy for the general level of development of the country, we use the logarithm of per capita GDP in 1995. Others have found that the general level of development can affect how the structure of the banking system, including its concentration, affects it performance and competitiveness. We expect that in more developed countries banking system structure indicators have a less close relationship with competitiveness indicators. As an indicator for macro-economic stability, we use the inflation rate in 1995. We expect that it will be less likely that a banking system will be more competitive when it is subject to high inflation as prices of financial services, such as interest rates, will be less informative. Both variables come from the World Development Indicators (WDI).

Table 5 reports the matrix of correlations between and among the dependent and independent variables. As a start, it is useful to note that many of the correlations are not statistically significant, out of the 55 correlations only 18 are significant at the 10% level. As noted, the four competitiveness indicators are positively correlated among each other, although only half of the correlations are statistically significant at the 10% level. There are positive correlations between the competitiveness indicators and the banking systems concentration variables, although many are not statistically significant. The correlations between the competitiveness indicators and the number of banks per population, log of per capita GDP and inflation are mostly not statistically significant. The most consistency in the correlations is for the foreign bank ownership and activity restrictions where both two of the four correlations with

the competitiveness indicators are statistically significant at the 10% or better level. In terms of correlations among the independent variables, the bank density variable is significant negatively related to the activity restriction and inflation variables and significant positively to the general development variable. Activity restrictions are significant negatively related the general development and significant positively to inflation, while inflation and general level of development are significant negatively related, which is to be expected.

Table 6 reports the base regression results regarding the cross-country determinants of our PR's *H*-statistic. The results are presented in panels, depending on the number of independent variables included. All regressions include the two macro-economic variables we have, GDP per capita and inflation, to control for differences in economic development. Besides these two macro variables, Panel A includes only the entry fitness test and foreign ownership variables. Panel B includes besides these two variables also the bank concentration and the density of banks variables. Panel C investigates specifically the impact of restrictions on the activities of banks, in terms of providing other types of financial services. Panel D investigates the role of both entry fitness test and foreign ownership as well as restrictions on the activities of banks. Panels E and F investigate directly the impact of competition from other financial services industries (inter-industry competition) by adding variables on the size of other financial services industries. Since the variables we have on these other industries are correlated (see Beck et al. 2001), we enter the non-bank financial development variables one at a time. Panels G and H investigate the impact of the existence of public credit registries on the competitiveness of banks, controlling for the other factors already mentioned.

Since the H-statistics are generated variables from the first step regressions, we use the standard errors of the estimated H-statistics (reported in Table 3) to control for heteroskedasticity in the dependent variable. Our cross-country regressions are thus estimated by weighted ordinary least squares, where the weights are equal to the inverse of the estimated variance of a particular country's generated H-statistic. As a result, we attach more value in the regressions to those H-statistics that are estimated with less error.[14] We further adjust the standard errors of the regression model using the White method to control for remaining heteroskedasticity in the error terms.

There are many coefficients that are not statistically significant and results that vary between the different regression specifications, in part because the number of observations varies between the regressions. There is some consistency, however, across the regression results. Of the variables we use, we find that cross-country variations in bank competition are best explained by differences in the degree of foreign bank ownership and activity restrictions. More foreign bank ownership and fewer activity restrictions seem to improve the level of competition in the home market, results we find in most of our specifications. Next, we find for some specifications that less severe entry fitness tests also positively affect banking system competition, although when we control for activity restrictions even this result disappears. We find a similar effect for the presence of a credit registry, in that the significance of the registry variable (Panel G) disappears when we include the foreign ownership, entry and activity restrictions variables (Panel H). The general level of development and the inflation rate are most often not statistically significant and the signs of the coefficients are not always obvious.

[14] We also conducted the regression not weighting and found very similar results.

Besides the foreign bank ownership and activity restrictions variables, we find little evidence that variables describing the banking system structure can help explain its measured competitiveness, or at least in the way typically posed. We find that bank concentration and none of the four *H*-statistics are negatively correlated as may be expected, but rather we find some positive relationship, that is, more concentrated banking systems seem to face a greater degree of competition. It may be that the *H*-statistic and the bank concentration measure are two variables that measure different concepts, that is, bank concentration may not be a good summary statistic for bank competitive environment. Similarly, the density of banks variable is never significantly positively related to the competition indicator, and, although not statistically significant, has sometimes even a negative sign, that is the fewer banks, the more competitive the system is (Panel B).

Finally, in panel I, we include all variables that explain most of the variation in the competition indicators, i.e., activity restrictions, foreign ownership and concentration. We no longer find that concentration affects the competitiveness of the banking system in a significant way. We continue to find that increased foreign ownership and reduced activity restrictions positively affect competition. Since the effects of the degree of permitted contestability may vary by market structure, we also checked for interaction effects between our entry and activity restrictions variables and the banking structure variables. We did not find, however, any consistent results for these interaction effects (not reported). In summary, it appears that assuring a contestable system is the most important to guarantee a competitive banking system.

4. ROBUSTNESS TESTS

We want to conduct a number of robustness checks to verify that our results are not affected by the specific measure we used for the competitiveness of banking systems, or the type of banks or the sample of countries we focus on in the regressions. We start by excluding those countries that fail to meet the equilibrium test described in section 2. In particular, we consider countries to be in disequilibrium if at least one of the different equilibrium tests considered is rejected both from a statistical and economic significance point of view, where statistical significance is indicated by a p-value of the test statistics is lower than 5 percent, and economic significance is indicated by a coefficient that exceeds 5 percent (0.05) in absolute value. According to these rules, the following countries are in disequilibrium: Japan, Paraguay, and Turkey. Our main results are not affected when excluding these three countries (not reported).

As a second robustness test, we differentiate between small banks and large banks in countries with a large cross-section of banks. Small banks can be assumed to operate predominantly at a local scale whereas large banks can be assumed to compete at both national and international levels, with medium banks taking intermediate positions. Indeed, as mentioned, others have found that measures of competitiveness can differ depending on whether small and large banks are studied (Hempel 2002 and De Bandt and Davis 2000). These tests have, however, been done for either one country or for economies which were comparable in size, e.g., some of the largest EU-countries.

We can differentiate between small banks and large banks only in countries with a large cross-section of banks.[15] For countries with such a large cross-section of banks, i.e., France, Germany, Italy, and the U.S., we therefore include only banks with at least US$ 5 billion in total assets (in any period). The resulting competitiveness indicators for the sample of largest banks in these countries are almost all larger than the ones for the whole sample (the one exception is the H2 measure for the U.S which is slightly lower). This suggests that in these countries large banks operate in a more competitive environment, possibly because they are less locally oriented (not reported).

For the other countries, the H-statistics are unchanged and identical to those reported in Table 3. We then combine the new H-statistics for the four countries with those of the other countries and rerun the same cross-country regressions as in Table 6, differing in independent variable only for the four countries with a large number of banks. Our results do not alter qualitatively, although the statistical significance of the effect of activity restrictions on the H-statistics reduces somewhat (not reported). Again, we find that fewer restrictions on activities and more foreign bank ownership lead to a higher of competitiveness in the banking system.

[15] This is for a number of reasons. First, for these countries the difference between measures of competitiveness for the two different groups of banks is expected to be larger due to the presence of a large number of small banks that do not compete at national levels. Second, on a cross-country basis, the problem arises with the definition of small and large banks. If this is done relative to the country's market, e.g., the largest five banks in the country, then it will capture banks of very different asset size across countries. It will have the advantage that we can assume that the largest banks in a country have nation-wide coverage and do compete with each other, assuming the national market is the relevant market. It will be hard to argue, however, that it is a size effect since a large bank in one country can be a very small bank in another country. At the same time, an absolute measure of a large bank has some advantages as it allows for easier comparison across markets. We may have also better quality of data, as large banks may have better reporting standards. Furthermore, even if it are the small banks that are more important in affecting the competitive environment in the country, we would still see that reflected in our competitiveness indicators for the large banks.

As a third robustness check, we run the regressions on a smaller sample of 39 countries that includes countries with at least 100 bank-year observations and at least 20 banks (i.e., at least five year-observations on average per bank). This rule leads us to exclude the following countries: Bangladesh, Czech Republic, Greece, Honduras, Japan, Latvia, Mexico, Panama, Paraguay, Turkey, and Ukraine. This rules also leads us to remove those countries with "invalid" *H*-statistic estimates (i.e., above 1) (probably due to lack of observations). The regression results based on this smaller set of countries are reported in Table 7, where we follow the specifications used in Table 6, panel I.

We find that the activity restriction variables and the foreign bank ownership variables are statistically significant. The signs remain the same: fewer activity restrictions and more foreign bank ownership lead to more competition. The concentration, number of banks, and entry-fit test variables do not enter significantly. Finally, the inflation and per capita income variables are no longer statistically significant.

5. CONCLUSIONS

Using a structural model, we estimate competitiveness indicators for a large cross-section of countries. When we relate our competitiveness indicator to a number of country characteristics, we find that less activity restrictions in the banking sector and greater foreign bank presence can make for more competitive banking systems. We also sometimes find that entry restrictions on commercial banks can reduce competition. This suggests that being open to new entry is the most important competitive pressure. We find no evidence that banking system

concentration is negatively associated with competitiveness. At the opposite, we sometimes find some evidence that more concentrated banking systems are more competitive. Similarly, we have some, although not strong evidence that the competitiveness of banking systems relates negatively to the number of banks in the country. We find that many of these results remain using a number of robustness tests.

While our results confirm much of traditional industrial organization theory that contestability rather than structure is the most important for competition, the fact that the structure matters so little, or even in opposite ways to expectations, might surprise many involved with competition policy in the financial sector. It suggests at the minimum that competition policy in the financial sector is more complicated than perhaps previously thought. Competition policy in the financial sector has traditionally centered on balancing franchise value, important for prudential concerns and related to the so-called special nature of banks, with allowing more competition forces with greater entry. This tradeoff implied that the preferred solution often was thought to be a more concentrated system with less entry that was less competitiveness. Changes in the production and distribution of financial services, and large deregulations, including the removal of barriers between markets and products, may have made for new industrial structures that require a different competition policy paradigm. Some of the elements of this new paradigm for the financial sector can be borrowed from traditional industrial organization research. It will need to be adapted, however, to take into account the increased importance of networks and network externalities in financial services industries.

References

Angelini, Paolo and Nicola Cetorelli. "Bank Competition and Regulatory Reform: The Case of the Italian Banking Industry", Federal Reserve Bank of Chicago Working Paper No. 99-32 (December 1999).

Barth, James R., Gerard Caprio Jr., and Ross Levine. "The Regulation and Supervision of Banks Around the World: A New Database." In: Robert E. Litan and Richard Herring (eds.), *Integrating Emerging Market Countries into the Global Financial System*, Brookings-Wharton Papers on Financial Services, Brookings Institution Press, Washington, DC (2001), 183–241.

Barth, James R., Gerard Caprio Jr., and Ross Levine. "Bank Regulation and Supervision: What Works Best?", mimeo, World Bank, 2002.

Baumol, William J., John C. Panzar, and Robert D. Willig. *Contestable Markets and the Theory of Industry Structure.* San Diego: Harcourt Brace Jovanovich, 1982.

Beck, Thorsten, Asli Demirgüç-Kunt and Ross Levine. "A New Database on the Structure and Development of the Financial Sector." *World Bank Economic Review* 14 (2000), 597–605.

Beck, Thorsten, Asli Demirgüç-Kunt and Ross Levine, "Bank Concentration and Crises." (2002), mimeo, World Bank and University of Minnesota

Beck, Thorsten, Asli Demirgüç-Kunt and Vojislav Maksimovic, "Bank Competition, Financing Constraints and Access To Credit," (2002), mimeo, World Bank and University of Maryland.

Berger, Allen N. "The Profit-Structure Relationship in Banking – Tests of Market Power and Efficient-Structure Hypothesis." *Journal of Money, Credit, and Banking* 27 (1995), 404–31.

Berger, Allen N. "Technological Progress and the Banking Industry." *Journal of Money, Credit, and Banking* forthcoming.

Berger, Allen N., Rebecca S. Demsetz, and Philip E. Strahan. "The Consolidation of the Financial Services Industry: Causes, Consequences, and Implications for the Future." *Journal of Banking and Finance* 23 (February 1999), 135–94.

Berger, Allen N and Timothy H. Hannan. "The Price-Concentration Relationship in Banking." *Review of Economics and Statistics* 71 (1989), 291–99.

Berger, Allen N, Leora Klapper, and Gregory F. Udell, "The Ability of Banks to Lend to Informationally Opaque Small Businesses," *Journal of Banking and Finance* 25 (2001).

Besanko, David A. and Anjan V. Thakor. "Banking Deregulation: Allocational Consequences of Relaxing Entry Barriers." *Journal of Banking and Finance* 16 (1992), 909–32.

Bikker, Jacob A., and Katharina Haaf. "Competition, Concentration and Their Relationship: An Empirical Analysis of the Banking Industry." DNB Staff Report No. 68, De Nederlandsche Bank, July 2001.

Bikker, Jacob A., and Johannes M. Groeneveld. "Competition and Concentration in the EU Banking Industry," *Kredit und Kapital* 33 (2000), 62–98.

Boot, Arnoud, A.V. Thakor, "Can Relationship Banking Survive Competition?", *Journal of Finance*, 55, 2, 2000, 679-713.

Bresnahan, Timothy F. "The Oligopoly Solution Concept Is Identified." *Economics Letters* 10 (1982), 87–92.

Bresnahan, Timothy F. "Studies of Industries With Market Power." In: Richard Schmalensee and Robert D. Willig (eds.), *Handbook of Industrial Organization, Volume II* (North Holland, New York) (1989).

Cetorelli, Nicola. "Competitive Analysis in Banking: Appraisal of the Methodologies." *Economic Perspectives*, Federal Reserve Bank of Chicago (1999), 2–15.

Cetorelli, Nicola, "Does Bank Concentration Lead to Concentration in Industrial Sectors?" Federal Reserve Bank of Chicago Working Paper 2001-01, 2001.

Cetorelli, Nicola and Michele Gambera. "Banking Market Structure, Financial Dependence and Growth: International Evidence from Industry Data." *Journal of Finance* 56 (2001), 617–648.

Claessens, Stijn, Asli Demirgüç-Kunt and Harry Huizinga. 2001. "How Does Foreign Entry Affect Domestic Banking Markets?" *Journal of Banking and Finance* 25, 891–911.

Claessens, Stijn, Gergely Dobos, Daniela Klingebiel, and Luc Laeven. "The Growing Importance of Networks in Finance and Its Effects on Competition," mimeo University of Amsterdam, World Bank, January. Forthcoming in Anna Nagurney (Ed.), 2003 *Innovations in Financial and Economic Networks,* Edward Elgar Publishers, MA.

Claessens, Stijn and Daniela Klingebiel. "Competition and Scope of Activities in Financial Services." *World Bank Research Observer* 16 (2001), 18–40.

Collender, Robert N. and Sherill Shaffer, "Banking Structure and Employment Growth," mimeo University of Wyoming, and USDA/ERS 2001.

Coccorese, Paolo. "Assessing the Competitive Conditions in the Italian Banking System: Some Empirical Evidence." *BNL Quarterly Review* 205 (1998), 171–191.

Corvoisier, Sandrine and Reint Gropp, "Contestability, Technology and Banking," working paper, ECB, Frankfurt, 2002.

De Bandt, Olivier, and E. Philip Davis. "Competition, Contestability and Market Structure in European Banking Sectors on the Eve of EMU." *Journal of Banking and Finance* 24 (2000), 1045–66.

Degryse, Hans, and Steven Ongena. "Distance, Lending Relationships, and Competition," University of Tilburg, working paper, 2002.

Deiida, L. and B. Fatouh, "Concentration in Banking Industry and Economic Growth" , mimeo, University of London, 2002

Dell'Ariccia, Giovanni, Erza Friedman, and Robert Marquez, "Adverse selection as a barrier to entry in the banking industry." *Rand Journal of Economics*, 30 (3):515-534, 1999, Autumn.

Dell'Ariccia, Giovanni and Emilia Bonaccorsi di Patti. "Bank Competition and Firm Creation." *Journal of Money, Credit, and Banking* Forthcoming.

Demirgüç-Kunt, Aslı, and Ross Levine (Eds), 2001, *Financial Structure and Economic Growth: A Cross-Country Comparison of Banks, Markets, and Development,* MIT Press, Cambridge, MA.

Demirgüç-Kunt, Asli, Luc Laeven, and Ross Levine. 2003. "The Impact of Bank Regulations, Concentration, and Institutions on Bank Margins." Mimeo, World Bank.

Eschenbach, Felix, and Joseph Francois. "Financial Sector Competition, Services Trade and Growth." CEPR Discussion Paper No. 3573 (October 2002).

Fries, Steven, Damien Neven and Paul Seabright, "Bank performance in transition economies," Working Paper 76, EBRD, London, 2002

Gelos, R. Gaston and Jorge Roldos. "Consolidation and Market Structure in Emerging Market Banking Systems." IMF Working Paper No. 02/186, November 2002.

G-10, "Report of Consolidation in Financial Sector," Bank for International Settlements: Basel, Switzerland. January 2001.

Gilbert, R. Alton. "Bank Market Structure and Competition: A Survey." *Journal of Money, Credit, and Banking* 16 (November 1984), 617–45.

Gruben, William C. and Robert P. McComb, "Privatization, Competition, and Supercompetition in the Mexican Commercial Banking System," mimeo, Federal Reserve Bank of Dallas *Journal of Banking and Finance* forthcoming.

Hempel, S. Hannah, "Testing for Competition Among German Banks," 2002. Discussion Paper 04/02, Economic Research Centre of the Deutsche Bundesbank.

Hauswald, Robert and Robert Marquez. "Information Technology and Financial Services Competition," *Review of Financial Studies* forthcoming

Jappelli, T. and M. Pagano (2000),"Information sharing in credit markets: a survey," Working paper no. 36, Centre for Studies in Economics and Finance (CEFS), University of Salerno.

Kessidis, I. "Entry and Market Contestability: The Evidence from the United States," in *Entry and Market Contestability: An International Comparison,* P. Geroski and J. Schwallbach (Eds). Blackwell, Oxford.

Klein, Michael. "A Theory of the Banking Firm." *Journal of Money, Credit, and Banking* 7 (February 1971), 205–18.

Lau, Lawrence. "On Identifying the Degree of Competitiveness from Industry Price and Output Data." *Economics Letters* 10 (1982), 93–99.

Marquez. Robert "Competition, Adverse Selection, and Information Dispersion in the Banking Industry," *Review of Financial Studies* forthcoming

Molyneux, Philip, D. Michael Lloyd-Williams, and John Thornton. "Competitive Conditions in European Banking." *Journal of Banking and Finance* 18 (May 1994), 445–59.

Molyneux, Philip, John Thornton, and D. Michael Lloyd-Williams. "Competition and Market Contestability in Japanese Commercial Banking." *Journal of Economics and Business* 48 (1996), 33–45.

Nathan, Alli, and Edwin H. Neave. "Competition and Contestability in Canada's Financial System: Empirical Results." *Canadian Journal of Economics* 22 (August 1989), 576–94.

Panzar, John C., and James N. Rosse. "Structure, Conduct and Comparative Statistics." Bell Laboratories Economics Discussion Paper (1982).

Pagano, M. and T. Jappelli (1993), "Information sharing in credit markets," *Journal of Finance* 43(5), December, 1693-1718.

Panzar, John C., and James N. Rosse. "Testing for 'Monopoly' Equilibrium." *Journal of Industrial Economics* 35, 443–56 (1987).

Perloff, Jeffrey M., and Edward Z. Shen. "Collinearity in Linear Structural Models of Market Power." Mimeo, University of California at Berkeley (December 2001).

Perotti, Enrico C., and Javier Suarez. "Last Bank Standing: What Do I Gain If You Fail?" *European Economic Review* 46 (October 2002), 1599–1622.

Petersen, Mitchell A. and Rajan, Raghuram G. "The Effect of Credit Market Competition on Lending Relationships," *Quarterly Journal of Economics* 110 (1995), 407-443.

Philippatos, George C. and H. Semith Yildirim. "Competition and Contestability in Central and Eastern European Banking Markets." Mimeo University of Tennessee (February 2002)

Rajan, Raghuram G., "Insider and Outsiders, the Choice between Informed and Arm's-Length Debt," *Journal of Finance* 47:1367-1400,1992.

Rajan, Raghuram G. and Luigi Zingales, "Financial dependence and growth," *American Economic Review* 88, 559-587, 1998.

Rosse, James N., and John C. Panzar. "Chamberlin vs. Robinson: An Empirical Test for Monopoly Rents." Bell Laboratories Economics Discussion Paper No. 90 (1977).

Shaffer, Sherrill. "A Non-Structural Test for Competition in Financial Markets." In: *Bank Structure and Competition, Conference Proceedings*, Federal Reserve Bank of Chicago (1982), 225–43.

Shaffer, Sherrill. "Competition in the U.S. Banking Industry." *Economics Letters* 29 (1989), 321–23.

Shaffer, Sherrill. "A Test of Competition in Canadian Banking." *Journal of Money, Credit, and Banking* 25 (February 1993), 49–61.

Shaffer, Sherrill. "Banking Conduct Before the European Single Banking License: A Cross-Country Comparison." *North American Journal of Economics and Finance* 12 (2001), 79–104.

Shaffer, Sherrill and James DiSalvo. "Conduct in a banking duopoly" *Journal of Banking and Finance* 18 (1994), 1063-82.

Vesala, Jukka. "Testing for Competition in Banking: Behavioral Evidence from Finland." Bank of Finland Studies, Working Paper No. E:1, 1995.

Vives, Xavier. "Competition in the Changing World of Banking." *Oxford Review of Economic Policy* 17 (2001), 535–45.

Table 1 Description and definition of variables

Variable name	Description
H1	H-statistic estimated using pooled OLS with time dummies and with gross interest revenues as dependent variable in the reduced form revenue equations (i.e., in model I). Source: Author's calculations.
H2	H-statistic estimated using pooled GLS with bank-specific effects and time dummies and with gross interest revenues as dependent variable in the reduced form revenue equations (i.e., in model II). Source: Author's calculations.
H3	H-statistic estimated using pooled OLS with time dummies and with total revenues as dependent variable in the reduced form revenue equations (i.e., in model III). Source: Author's calculations.
H4	H-statistic estimated using pooled GLS with bank-specific effects and time dummies and with total revenues as dependent variable in the reduced form revenue equations (i.e., in model IV). Source: Author's calculations.
P	The ratio of gross interest revenue to total assets. Source: BANKSCOPE.
Pa	The ratio of total revenue to total assets (where total revenue is calculated as gross interest revenue plus other operating revenues, such as fee income, commission income, etc.). Source: BANKSCOPE.
W1	The ratio of interest expenses to total deposits and money market funding. Source: BANKSCOPE.
Wa1	The ratio of interest expenses to total deposits and money market funding plus total other funding (including bonds, subordinated debt and hybrid capital). Source: BANKSCOPE.
W2	The ratio of personnel expense to total assets. Source: BANKSCOPE.
Wa2	The ratio of personnel expense to total deposits plus money market instruments plus net loans. Source: BANKSCOPE.
W3	The ratio of other operating and administrative expense to total assets. Source: BANKSCOPE.
Wa3	The ratio of other operating and administrative expense to fixed assets. Source: BANKSCOPE.
Y1	The ratio of equity to total loans. Source: BANKSCOPE.
Y2	The ratio of net loans to total assets. Source: BANKSCOPE.
Y3	The logarithm of total assets. Source: BANKSCOPE.
ROA	Pre-tax return on assets, calculated as the ratio of pre-tax profits to total assets. Source: BANKSCOPE.
Concentration	5-Bank concentration ratio of deposits. Source: Barth, Caprio and Levine (2001).
Log(number of banks/population)	The logarithm of the ratio of the number of banks in the country and the total population of the country. Source: Barth, Caprio and Levine (2001) and World Bank Development Indicators.
Foreign bank ownership	Foreign bank ownership. Source: Barth, Caprio and Levine (2001).
Entry-fit test	Entry-fit test. A higher score indicates fewer restrictions on entry into banking. Source: Barth, Caprio and Levine (2001).
Activity restrictions	Activity restrictions. A higher score indicates more restrictions on banks to engage in activities other than banking (including securities, insurance, and real estate). Source: Barth, Caprio and Levine (2001).
Log of per capita GDP	Logarithm of per capita GDP in 1995 values.
Inflation	Change in the consumer price index. Source: World Bank Development Indicators.
Stock market capitalization to GDP	Stock market capitalization to GDP. Source: Beck et al.
Life insurance penetration	Life insurance penetration. Source: Beck et al.
Public credit registry	Dummy variable taking value of one if a public credit registry exists, and zero otherwise. Source: World Bank.

Table 2 Summary statistics

This table reports country averages for the years 1994-2001 of the main variables used for the competitive environment test. Y3 is expressed in billions of U.S. dollars. All other variables are expressed as percentages. A description of each variable can be found in Table 1.

Country	P	Pa	W1	Wa1	W2	Wa2	W3	Wa3	Y1	Y2	Y3	ROA
Argentina	9.79%	14.15%	5.76%	5.45%	3.97%	3.12%	3.57%	111.40%	15.30%	48.49%	2.22	0.59%
Australia	7.25%	9.07%	6.44%	5.46%	1.22%	0.84%	1.71%	268.30%	7.19%	73.39%	28.90	1.31%
Austria	5.61%	7.14%	3.73%	3.39%	1.50%	1.11%	1.22%	135.96%	6.91%	57.37%	1.85	0.66%
Bangladesh	6.25%	8.40%	5.40%	5.21%	1.14%	0.81%	0.98%	171.97%	4.90%	54.35%	0.59	1.39%
Belgium	6.53%	7.39%	5.20%	4.66%	1.17%	0.95%	1.02%	281.94%	7.25%	42.91%	17.30	0.74%
Brazil	15.99%	20.64%	13.91%	12.83%	3.75%	3.70%	4.93%	434.57%	12.86%	37.97%	9.09	1.84%
Canada	6.66%	8.28%	5.54%	5.27%	1.35%	1.00%	1.44%	399.61%	8.77%	65.74%	11.30	0.61%
Chile	10.45%	11.53%	8.71%	7.72%	1.68%	1.30%	1.36%	68.45%	14.66%	59.88%	2.89	0.97%
Colombia	15.68%	21.39%	12.49%	11.95%	3.49%	2.52%	5.10%	186.44%	13.67%	61.37%	0.99	0.94%
Costa Rica	12.48%	14.90%	10.43%	10.20%	2.43%	1.74%	2.63%	173.47%	15.89%	63.14%	0.21	1.52%
Croatia	8.02%	10.86%	5.31%	4.69%	2.28%	2.01%	2.64%	60.76%	17.46%	47.06%	0.48	0.82%
Czech Republic	8.12%	10.29%	6.77%	6.45%	0.91%	0.76%	2.40%	115.25%	8.74%	42.76%	3.94	0.43%
Denmark	7.59%	8.80%	3.37%	3.23%	2.17%	1.58%	1.63%	107.87%	12.53%	55.35%	3.29	1.60%
Dominican Rep.	13.34%	16.15%	10.04%	8.79%	2.74%	2.13%	3.40%	92.12%	12.81%	58.29%	0.46	2.26%
Ecuador	13.71%	18.05%	10.35%	9.99%	3.23%	2.70%	4.35%	120.61%	14.49%	49.04%	0.31	1.76%
France	6.69%	8.27%	4.95%	4.70%	1.76%	1.33%	1.45%	323.05%	7.32%	56.19%	14.70	0.72%
Germany	6.35%	7.26%	4.01%	3.78%	1.50%	1.01%	1.10%	111.98%	5.05%	61.14%	1.75	0.71%
Greece	9.47%	11.95%	7.71%	7.73%	1.89%	1.45%	1.49%	88.14%	9.45%	43.99%	9.95	1.62%
Honduras	15.26%	16.38%	10.82%	9.61%	3.03%	2.33%	3.26%	87.50%	12.09%	56.65%	0.16	1.65%
Hong Kong	7.60%	8.61%	6.17%	6.09%	1.05%	0.83%	0.82%	131.70%	13.18%	56.01%	11.10	1.48%
Hungary	11.43%	13.84%	9.45%	8.59%	1.54%	1.26%	2.81%	462.20%	10.03%	47.29%	1.41	1.70%
India	9.73%	11.14%	7.76%	7.67%	1.79%	1.37%	0.86%	88.50%	5.00%	43.74%	3.82	0.86%
Indonesia	13.11%	14.23%	11.31%	10.52%	1.29%	0.91%	1.67%	189.61%	10.65%	62.56%	1.73	1.55%
Italy	7.23%	8.30%	5.06%	4.34%	1.90%	1.57%	1.52%	116.90%	10.91%	50.47%	6.21	1.12%
Japan	3.55%	3.91%	1.73%	1.71%	1.01%	0.65%	0.80%	53.28%	4.48%	69.22%	37.90	-0.26%
Kenya	14.07%	16.85%	9.68%	9.58%	2.70%	2.25%	3.19%	109.05%	17.51%	50.01%	0.12	2.07%
Latvia	8.15%	12.50%	4.20%	4.06%	2.54%	2.28%	4.12%	99.18%	11.99%	35.77%	0.17	1.10%
Lebanon	10.04%	11.16%	7.90%	7.88%	1.65%	1.43%	1.26%	79.54%	9.80%	32.88%	0.58	1.20%
Luxembourg	6.06%	8.39%	5.75%	5.71%	1.18%	1.09%	1.20%	389.11%	6.55%	26.54%	3.93	1.03%
Malaysia	7.11%	8.21%	4.82%	4.79%	0.87%	0.61%	0.87%	125.70%	9.25%	59.92%	4.86	1.53%
Mexico	15.92%	17.90%	14.02%	13.64%	1.96%	1.43%	3.13%	640.54%	15.03%	60.83%	7.73	0.77%
Netherlands	6.22%	8.14%	5.40%	5.27%	1.38%	1.08%	1.21%	194.32%	7.81%	56.52%	38.40	1.08%
Nigeria	12.13%	18.13%	7.65%	7.53%	2.41%	2.43%	5.73%	126.17%	11.40%	33.21%	0.44	3.95%
Norway	7.13%	8.31%	5.49%	4.82%	1.20%	0.75%	1.42%	161.21%	8.39%	84.68%	4.23	1.31%
Pakistan	9.17%	10.93%	7.50%	7.49%	1.38%	1.06%	1.46%	97.74%	7.33%	44.82%	1.28	1.27%
Panama	8.40%	9.48%	6.59%	6.08%	1.07%	0.74%	1.38%	125.83%	9.57%	62.78%	0.57	1.44%
Paraguay	15.24%	17.98%	10.06%	10.21%	3.71%	2.79%	3.59%	166.56%	15.47%	55.42%	0.14	2.59%
Peru	11.56%	13.64%	7.57%	7.42%	2.87%	2.15%	3.88%	82.93%	10.74%	58.46%	0.76	0.80%
Philippines	9.10%	11.00%	7.77%	7.62%	1.45%	1.13%	2.49%	108.49%	16.72%	62.19%	1.75	1.17%
Poland	13.49%	16.40%	10.61%	10.57%	2.29%	1.82%	0.76%	46.23%	11.83%	49.09%	1.92	2.06%
Portugal	7.41%	8.79%	6.07%	5.81%	1.42%	1.15%	1.41%	86.93%	8.17%	51.06%	9.25	0.54%

Country	P	Pa	W1	Wa1	W2	Wa2	W3	Wa3	Y1	Y2	Y3	ROA
Russian Federation	12.00%	19.98%	8.42%	8.12%	3.16%	2.76%	5.26%	192.91%	18.39%	42.98%	0.85	3.98%
South Africa	13.34%	16.05%	11.32%	10.24%	2.11%	1.48%	2.07%	189.70%	10.84%	71.99%	8.68	1.96%
Spain	6.74%	7.77%	4.23%	4.13%	1.64%	1.20%	1.18%	68.05%	8.81%	56.67%	12.20	1.10%
Switzerland	4.43%	8.27%	3.86%	3.33%	2.09%	1.95%	1.98%	290.41%	13.59%	59.94%	9.96	1.50%
Turkey	19.33%	19.62%	12.73%	12.64%	2.51%	2.23%	3.30%	118.05%	11.77%	37.65%	2.13	2.94%
Ukraine	14.89%	22.66%	10.27%	10.07%	3.37%	2.95%	5.32%	131.04%	21.53%	47.07%	0.12	3.81%
United Kingdom	7.54%	9.94%	5.66%	5.23%	1.75%	1.52%	1.89%	221.12%	12.09%	50.58%	43.50	1.68%
United States	6.89%	8.33%	4.79%	4.71%	1.48%	1.11%	1.62%	145.91%	9.03%	63.12%	10.80	1.59%
Venezuela	18.13%	20.12%	8.40%	8.12%	3.90%	3.11%	5.09%	526.08%	12.53%	45.18%	0.78	2.99%
Total	7.30%	8.80%	5.07%	4.77%	1.67%	1.26%	1.56%	150.65%	8.21%	58.12%	6.64	1.13%

Table 3 H-statistics

The table displays estimated H-statistics for each country in the sample based on the Panzar and Rosse (1987) approach. The H-statistics are based on a sample that includes observations from countries with a total number of at least 50 bank-year observations and observations on at least 20 banks. H1 is the H-statistic estimated using pooled OLS with time dummies and with gross interest revenues as dependent variable in the reduced form revenue equations. H2 is the H-statistic estimated using pooled GLS with bank-specific fixed effects and time dummies and with gross interest revenues as dependent variable in the reduced form revenue equations. H3 is the H-statistic estimated using pooled OLS with time dummies and with total revenues as dependent variable in the reduced form revenue equations. H4 is the H-statistic estimated using pooled GLS with bank-specific fixed effects and time dummies and with total revenues as dependent variable in the reduced form revenue equations. Standard errors of the H-statistics are reported between brackets.

Country	H1	H2	H3	H4	Number of banks	Number of observations
	Pooled OLS	Fixed effects	Pooled OLS	Fixed effects		
Argentina	0.71	0.78	0.62	0.80	105	278
	(0.06)	(0.07)	(0.05)	(0.07)		
Australia	0.43	0.86	0.94	0.98	26	126
	(0.19)	(0.05)	(0.13)	(0.05)		
Austria	0.48	0.70	0.75	0.71	160	760
	(0.04)	(0.03)	(0.04)	(0.03)		
Bangladesh	0.88	0.84	0.66	0.39	28	132
	(0.12)	(0.11)	(0.17)	(0.12)		
Belgium	0.54	0.58	0.87	0.91	76	371
	(0.05)	(0.04)	(0.06)	(0.05)		
Brazil	0.92	0.85	0.79	0.74	96	248
	(0.05)	(0.08)	(0.04)	(0.05)		
Canada	0.62	0.61	0.83	0.60	49	224
	(0.06)	(0.06)	(0.09)	(0.06)		
Chile	0.76	0.68	0.64	0.57	31	148
	(0.07)	(0.07)	(0.09)	(0.06)		
Colombia	0.76	0.57	0.68	0.63	39	167
	(0.08)	(0.08)	(0.07)	(0.09)		
Costa Rica	0.89	0.92	0.92	0.95	30	111
	(0.06)	(0.03)	(0.05)	(0.04)		
Croatia	0.52	0.58	0.58	0.57	45	196
	(0.07)	(0.08)	(0.10)	(0.09)		
Czech Republic	0.56	0.80	0.56	1.00	25	90
	(0.08)	(0.10)	(0.18)	(0.18)		
Denmark	0.41	0.53	0.52	0.53	100	646
	(0.05)	(0.03)	(0.06)	(0.06)		
Dominican Republic	0.46	0.85	0.73	0.83	27	121
	(0.10)	(0.09)	(0.11)	(0.07)		
Ecuador	0.36	0.81	0.72	0.81	35	106
	(0.11)	(0.08)	(0.07)	(0.08)		
France	0.59	0.63	0.81	0.71	355	1,926
	(0.03)	(0.02)	(0.02)	(0.02)		
Germany	0.39	0.60	0.65	0.69	2,226	13,015

Country	H1	H2	H3	H4	Number of banks	Number of observations
	Pooled OLS	Fixed effects	Pooled OLS	Fixed effects		
	(0.02)	(0.01)	(0.02)	(0.01)		
Greece	0.89	0.84	0.55	0.77	21	95
	(0.06)	(0.06)	(0.07)	(0.10)		
Honduras	0.70	0.71	0.76	1.08	21	68
	(0.09)	(0.12)	(0.08)	(0.14)		
Hong Kong, China	0.75	0.72	0.86	0.47	44	243
	(0.06)	(0.08)	(0.07)	(0.08)		
Hungary	0.83	0.48	0.86	0.84	26	112
	(0.06)	(0.09)	(0.06)	(0.08)		
India	0.52	0.53	0.50	0.55	60	399
	(0.04)	(0.04)	(0.04)	(0.04)		
Indonesia	0.66	0.56	0.59	0.66	97	353
	(0.04)	(0.06)	(0.06)	(0.08)		
Italy	0.48	0.58	0.68	0.67	472	2,508
	(0.03)	(0.02)	(0.03)	(0.02)		
Japan	0.53	0.82	0.53	-0.02	44	100
	(0.13)	(0.17)	(0.10)	(0.28)		
Kenya	0.41	0.69	0.53	0.67	34	106
	(0.14)	(0.09)	(0.09)	(0.10)		
Latvia	0.58	0.42	0.86	0.79	24	85
	(0.11)	(0.16)	(0.13)	(0.14)		
Lebanon	0.67	0.75	0.61	0.73	63	371
	(0.06)	(0.04)	(0.05)	(0.05)		
Luxembourg	0.77	0.86	0.88	0.75	76	277
	(0.03)	(0.03)	(0.04)	(0.04)		
Malaysia	0.70	0.72	0.62	0.66	41	228
	(0.06)	(0.04)	(0.07)	(0.05)		
Mexico	0.91	0.89	0.73	0.60	27	58
	(0.10)	(0.10)	(0.09)	(0.10)		
Netherlands	0.68	0.92	0.94	0.90	44	227
	(0.04)	(0.06)	(0.06)	(0.07)		
Nigeria	0.62	0.74	0.66	0.67	42	186
	(0.06)	(0.07)	(0.05)	(0.06)		
Norway	0.05	0.59	0.91	0.72	48	259
	(0.12)	(0.05)	(0.09)	(0.04)		
Pakistan	0.39	0.51	0.47	0.55	21	148
	(0.19)	(0.11)	(0.12)	(0.08)		
Panama	0.59	0.69	0.70	0.97	32	88
	(0.07)	(0.10)	(0.11)	(0.07)		
Paraguay	0.50	0.93	0.64	0.32	23	92
	(0.06)	(0.12)	(0.16)	(0.55)		
Peru	0.76	0.73	0.69	0.71	24	132
	(0.06)	(0.06)	(0.08)	(0.07)		
Philippines	0.60	0.75	0.59	0.70	45	237
	(0.05)	(0.04)	(0.06)	(0.05)		

Country	H1	H2	H3	H4	Number of banks	Number of observations
	Pooled OLS	Fixed effects	Pooled OLS	Fixed effects		
Poland	0.77	0.79	0.71	0.82	40	138
	(0.05)	(0.05)	(0.06)	(0.07)		
Portugal	0.53	0.72	0.69	0.74	37	213
	(0.07)	(0.05)	(0.06)	(0.05)		
Russian Federation	0.60	0.55	0.54	0.46	106	232
	(0.06)	(0.09)	(0.05)	(0.09)		
South Africa	0.81	0.96	0.67	0.95	45	186
	(0.07)	(0.03)	(0.07)	(0.04)		
Spain	0.35	0.61	0.59	0.58	157	839
	(0.04)	(0.02)	(0.03)	(0.02)		
Switzerland	0.59	0.62	0.74	0.74	227	1048
	(0.03)	(0.02)	(0.03)	(0.03)		
Turkey	0.58	0.30	0.67	0.28	34	69
	(0.12)	(0.20)	(0.11)	(0.40)		
Ukraine	0.61	0.91	0.90	0.31	30	71
	(0.10)	(0.21)	(0.10)	(0.17)		
United Kingdom	0.60	0.73	0.78	0.84	106	569
	(0.04)	(0.03)	(0.04)	(0.03)		
United States	0.15	0.49	0.47	0.52	1,135	7,261
	(0.01)	(0.01)	(0.01)	(0.01)		
Venezuela	0.67	0.77	0.72	0.80	55	171
	(0.09)	(0.06)	(0.06)	(0.06)		

Table 4 Equilibrium tests

The table displays estimated E-statistics for the different countries in our sample using alternative specifications and estimation techniques, as well as the p-values of a test that E equals zero. The E-statistics E1 and E2 are estimated using our base specification. The E-statistics E3 and E4 are estimated using our alternative specification. E1 and E3 are estimated using pooled OLS, while E2 and E4 are estimated using fixed effects. All regressions include time dummies.

Country	E1	E1=0	E2	E2=0	E3	E3=0	E4	E4=0	Number of banks	Number of observations
	Pooled OLS	p-value	Fixed effects	p-value	Pooled OLS	p-value	Fixed effects	p-value		
Argentina	-0.01	0.07	-0.03	0.00	-0.01	0.02	-0.03	0.01	105	278
Australia	0.01	0.92	-0.00	0.67	0.00	0.97	-0.00	0.71	26	126
Austria	-0.00	0.29	-0.01	0.02	-0.00	0.43	-0.01	0.01	160	760
Bangladesh	-0.00	0.83	-0.02	0.04	-0.01	0.35	-0.03	0.02	28	132
Belgium	0.01	0.02	0.01	0.16	0.01	0.09	0.01	0.25	76	371
Brazil	-0.00	0.54	-0.02	0.03	0.01	0.36	-0.02	0.09	96	248
Canada	-0.01	0.02	-0.03	0.00	-0.02	0.03	-0.03	0.00	49	224
Chile	-0.01	0.04	-0.03	0.00	-0.01	0.04	-0.02	0.01	31	148
Colombia	-0.02	0.08	-0.04	0.01	-0.02	0.06	-0.03	0.02	39	167
Costa Rica	0.00	0.66	0.00	0.19	0.00	0.96	0.00	0.36	30	111
Croatia	-0.01	0.12	-0.00	0.89	-0.00	0.76	-0.00	0.85	45	196
Czech Republic	-0.02	0.00	-0.00	0.72	-0.01	0.05	0.01	0.27	25	90
Denmark	-0.01	0.26	-0.02	0.00	0.00	0.84	-0.01	0.03	100	646
Dominican Republic	-0.03	0.00	-0.02	0.09	-0.04	0.01	-0.01	0.44	27	121
Ecuador	-0.01	0.20	0.03	0.02	0.00	0.93	0.03	0.01	35	106
France	-0.00	0.01	-0.01	0.00	-0.00	0.15	-0.01	0.01	355	1,926
Germany	-0.01	0.00	-0.01	0.00	-0.00	0.01	-0.01	0.00	2,226	13,015
Greece	-0.00	0.83	-0.01	0.58	-0.00	0.74	0.00	0.77	21	95
Honduras	-0.01	0.20	0.02	0.20	-0.01	0.14	0.03	0.10	21	68
Hong Kong, China	0.01	0.10	0.01	0.37	0.00	0.73	0.01	0.17	44	243
Hungary	-0.00	0.55	-0.01	0.18	0.00	0.84	0.00	0.84	26	112
India	-0.03	0.00	-0.03	0.00	-0.02	0.00	-0.02	0.00	60	399
Indonesia	-0.01	0.01	-0.01	0.43	-0.01	0.14	-0.01	0.36	97	353
Italy	-0.01	0.00	-0.01	0.00	-0.00	0.04	-0.00	0.41	472	2,508
Japan	-0.03	0.02	-0.13	0.00	-0.02	0.07	-0.07	0.09	44	100
Kenya	-0.03	0.14	-0.04	0.13	-0.01	0.59	-0.02	0.54	34	106
Latvia	0.01	0.60	-0.01	0.72	0.01	0.39	0.01	0.56	24	85
Lebanon	-0.02	0.00	-0.02	0.00	-0.01	0.04	-0.03	0.00	63	371
Luxembourg	0.00	0.21	0.00	0.96	0.00	0.39	-0.00	0.47	76	277
Malaysia	-0.00	0.52	-0.01	0.52	-0.00	0.57	-0.00	0.76	41	228
Mexico	0.03	0.03	-0.05	0.00	-0.00	0.60	-0.04	0.01	27	58
Netherlands	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	44	227
Nigeria	-0.01	0.36	-0.02	0.02	0.01	0.43	-0.01	0.39	42	186
Norway	0.02	0.01	-0.00	0.65	0.02	0.01	-0.00	0.85	48	259
Pakistan	-0.00	0.66	-0.00	0.96	-0.00	0.72	0.01	0.15	21	148
Panama	-0.00	0.89	0.02	0.10	-0.02	0.05	0.03	0.03	32	88
Paraguay	-0.04	0.00	-0.05	0.03	-0.04	0.06	-0.19	0.37	23	92
Peru	-0.02	0.01	-0.01	0.04	-0.02	0.02	-0.01	0.05	24	132

Country	E1	E1=0	E2	E2=0	E3	E3=0	E4	E4=0	Number of banks	Number of observations
	Pooled OLS	p-value	Fixed effects	p-value	Pooled OLS	p-value	Fixed effects	p-value		
Philippines	-0.02	0.00	-0.01	0.22	-0.01	0.14	-0.00	0.81	45	237
Poland	0.00	0.78	0.02	0.01	0.00	0.50	0.03	0.00	40	138
Portugal	-0.02	0.02	-0.01	0.02	-0.01	0.03	-0.01	0.00	37	213
Russian Federation	-0.01	0.36	-0.01	0.23	-0.01	0.49	-0.02	0.25	106	232
South Africa	-0.01	0.39	0.01	0.13	-0.00	0.40	0.01	0.03	45	186
Spain	-0.02	0.00	-0.02	0.00	-0.02	0.00	-0.02	0.00	157	839
Switzerland	0.01	0.05	0.01	0.00	0.00	0.10	0.01	0.01	227	1048
Turkey	-0.02	0.00	-0.06	0.07	-0.02	0.04	-0.07	0.12	34	69
Ukraine	-0.01	0.12	-0.01	0.62	0.01	0.36	-0.02	0.36	30	71
United Kingdom	0.01	0.00	-0.00	0.14	0.01	0.05	-0.00	0.91	106	569
United States	-0.00	0.00	-0.01	0.00	-0.00	0.01	-0.00	0.00	1,135	7,261
Venezuela	-0.01	0.41	0.01	0.22	-0.00	0.65	0.01	0.16	55	171

Table 5 Correlation matrix

H1 is the H-statistic estimated using pooled OLS with time dummies and with gross interest revenues as dependent variable in the reduced form revenue equations. H2 is the H-statistic estimated using pooled GLS with bank-specific fixed effects and time dummies and with gross interest revenues as dependent variable in the reduced form revenue equations. H3 is the H-statistic estimated using pooled OLS with time dummies and with total revenues as dependent variable in the reduced form revenue equations. H4 is the H-statistic estimated using pooled GLS with bank-specific fixed effects and time dummies and with total revenues as dependent variable in the reduced form revenue equations. All H-statistics are based on the Panzar-Rosse (1987) approach. p-values below correlation coefficients. A description of each variable can be found in Table 1.

	H1	H2	H3	H4	Concentration	Log(Number of banks/population)	Entry fit test	Foreign bank ownership	Activity restrictions	Log of Per capita GDP	Inflation
H1	1.00										
H2	0.40	1.00									
	0.00										
H3	0.21	0.26	1.00								
	0.15	0.07									
H4	0.14	0.20	0.38	1.00							
	0.32	0.16	0.01								
Concentration	0.34	0.26	0.26	0.23	1.00						
	0.04	0.11	0.11	0.17							
Log(Number of banks/population)	-0.38	-0.10	0.25	0.19	-0.26	1.00					
	0.02	0.53	0.11	0.22	0.12						
Entry fit test	0.03	0.22	0.18	0.34	0.31	0.14	1.00				
	0.84	0.17	0.26	0.03	0.05	0.37					
Foreign bank ownership	0.30	-0.06	0.45	0.10	-0.08	0.23	0.02	1.00			
	0.09	0.74	0.01	0.59	0.68	0.20	0.90				
Activity restrictions	0.17	-0.07	-0.39	-0.43	-0.10	-0.55	-0.17	-0.05	1.00		
	0.28	0.68	0.01	0.01	0.54	0.00	0.30	0.79			
Log of Per capita GDP	-0.22	-0.01	0.35	0.01	-0.07	0.69	0.04	0.16	-0.45	1.00	
	0.13	0.92	0.01	0.95	0.66	0.00	0.81	0.38	0.00		
Inflation	0.28	-0.11	-0.11	-0.01	0.25	-0.54	0.12	0.10	0.42	-0.66	1.00
	0.06	0.46	0.47	0.96	0.14	0.00	0.47	0.60	0.01	0.00	

Table 6 Cross-Country Determinants of H-statistics

H1 is the H-statistic estimated using pooled OLS with time dummies and with gross interest revenues as dependent variable in the reduced form revenue equations. H2 is the H-statistic estimated using pooled GLS with bank-specific fixed effects and time dummies and with gross interest revenues as dependent variable in the reduced form revenue equations. H3 is the H-statistic estimated using pooled OLS with time dummies and with total revenues as dependent variable in the reduced form revenue equations. H4 is the H-statistic estimated using pooled GLS with bank-specific fixed effects and time dummies and with total revenues as dependent variable in the reduced form revenue equations. All H-statistics are based on the Panzar-Rosse (1987) approach. Havg is the average of H1 though H4. All regressions are estimated using weighted OLS with heteroskedasticity-consistent standard errors. As weights, we use for each country observation the inverse of the variance of the generated H-statistic. A constant was added, but is not reported. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. A description of each variable can be found in Table 1.

Panel A. Entry and foreign ownership

	(1) H1	(2) H2	(3) H3	(4) H4	(5) Havg
Entry fit test	0.004	0.005	0.004	-0.008	-0.001
	(0.038)	(0.011)	(0.029)	(0.015)	(0.021)
Foreign bank ownership	0.006***	0.003***	0.004***	0.003**	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log of Per capita GDP	-0.124**	-0.065	-0.030	-0.049	-0.066*
	(0.049)	(0.041)	(0.031)	(0.039)	(0.038)
Inflation	-0.031	-0.042	-0.024	-0.051	-0.043
	(0.057)	(0.038)	(0.033)	(0.043)	(0.042)
Observations	32	32	32	32	32
R-squared	0.59	0.38	0.36	0.19	0.44

Panel B. Bank concentration, number of banks, entry and foreign ownership

	(1) H1	(2) H2	(3) H3	(4) H4	(5) Havg
Concentration	0.738***	0.377**	0.369**	0.379**	0.449***
	(0.206)	(0.158)	(0.160)	(0.177)	(0.158)
Log(Number of banks/population)	-0.018	-0.008	0.021	0.007	0.008
	(0.038)	(0.028)	(0.029)	(0.034)	(0.029)
Entry fit test	-0.039	-0.026*	-0.020	-0.030	-0.030
	(0.037)	(0.014)	(0.031)	(0.022)	(0.025)
Foreign bank ownership	0.006***	0.004***	0.003***	0.002*	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log of Per capita GDP	-0.045	-0.010	-0.029	-0.025	-0.036
	(0.047)	(0.037)	(0.033)	(0.046)	(0.035)
Inflation	-0.039	-0.014	-0.027	-0.049	-0.035
	(0.030)	(0.031)	(0.028)	(0.041)	(0.027)
Observations	31	31	31	31	31
R-squared	0.77	0.64	0.50	0.39	0.64

Panel C. Activity restrictions

	(1) H1	(2) H2	(3) H3	(4) H4	(5) Havg
Activity restrictions	-0.058***	-0.025***	-0.040***	-0.028***	-0.036***
	(0.014)	(0.006)	(0.008)	(0.006)	(0.008)
Log of Per capita GDP	-0.068*	-0.022	0.006	-0.015	-0.023
	(0.040)	(0.029)	(0.019)	(0.028)	(0.026)
Inflation	0.077	0.052	0.032	0.028	0.043
	(0.047)	(0.033)	(0.027)	(0.035)	(0.031)
Observations	39	39	39	39	39
R-squared	0.62	0.39	0.58	0.43	0.58

Panel D. Activity restrictions, Entry, and Foreign Ownership

	(1) H1	(2) H2	(3) H3	(4) H4	(5) Havg
Activity restrictions	-0.045***	-0.025***	-0.031***	-0.028***	-0.032***
	(0.010)	(0.006)	(0.005)	(0.007)	(0.006)
Entry fit test	0.029	0.020*	0.018*	0.012	0.019*
	(0.020)	(0.010)	(0.010)	(0.014)	(0.010)
Foreign bank ownership	0.004***	0.002***	0.003***	0.001	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log of Per capita GDP	-0.092***	-0.034	-0.002	-0.021	-0.034
	(0.033)	(0.028)	(0.015)	(0.027)	(0.022)
Inflation	0.043	0.024	0.020	0.012	0.022
	(0.041)	(0.034)	(0.023)	(0.034)	(0.026)
Observations	31	31	31	31	31
R-squared	0.78	0.61	0.75	0.51	0.77

Panel E. Activity restrictions, entry, foreign ownership and competition from other financial services industries: stock markets

	(1) H1	(2) H2	(3) H3	(4) H4	(5) Havg
Activity restrictions	-0.047***	-0.028***	-0.030***	-0.029***	-0.033***
	(0.011)	(0.007)	(0.005)	(0.009)	(0.006)
Stock market capitalization to GDP	0.015	0.063	-0.022	0.023	0.017
	(0.051)	(0.042)	(0.031)	(0.050)	(0.034)
Entry fit test	0.030	0.014	0.019	0.011	0.018
	(0.022)	(0.009)	(0.012)	(0.014)	(0.011)
Foreign bank ownership	0.004***	0.002*	0.003***	0.001	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log of Per capita GDP	-0.095**	-0.024	-0.001	-0.018	-0.034
	(0.037)	(0.029)	(0.014)	(0.029)	(0.023)
Inflation	0.047	0.044	0.015	0.015	0.026
	(0.044)	(0.041)	(0.024)	(0.041)	(0.029)
Observations	28	28	28	28	28
R-squared	0.78	0.67	0.76	0.53	0.77

Panel F. Activity restrictions, entry, foreign ownership and competition from other financial services industries: insurance companies

	(1) H1	(2) H2	(3) H3	(4) H4	(5) Havg
Activity restrictions	-0.046***	-0.025***	-0.031***	-0.028***	-0.033***
	(0.011)	(0.006)	(0.005)	(0.007)	(0.006)
Life insurance penetration	0.300	2.098**	-0.450	1.770	0.647
	(1.967)	(0.901)	(1.041)	(1.215)	(1.233)
Entry fit test	0.029	0.011	0.018	0.008	0.018
	(0.022)	(0.010)	(0.012)	(0.014)	(0.012)
Foreign bank ownership	0.004***	0.003***	0.002***	0.002*	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log of Per capita GDP	-0.089**	-0.032	0.004	-0.028	-0.034
	(0.038)	(0.028)	(0.014)	(0.030)	(0.024)
Inflation	0.050	0.041	0.019	0.015	0.028
	(0.042)	(0.035)	(0.023)	(0.037)	(0.029)
Observations	29	29	29	29	29
R-squared	0.78	0.71	0.76	0.58	0.77

Panel G. Credit information

	(1) H1	(2) H2	(3) H3	(4) H4	(5) Havg
Public credit registry	0.163*	0.049	0.158**	0.073	0.119*
	(0.092)	(0.049)	(0.060)	(0.059)	(0.060)
Log of Per capita GDP	-0.090**	-0.045	-0.003	-0.030	-0.043
	(0.042)	(0.035)	(0.020)	(0.031)	(0.029)
Inflation	0.005	0.010	0.001	-0.014	-0.005
	(0.049)	(0.036)	(0.024)	(0.034)	(0.034)
Observations	46	46	46	46	46
R-squared	0.40	0.26	0.32	0.14	0.33

Panel H. Credit information, Activity restrictions, Entry, and Foreign Ownership

	(1) H1	(2) H2	(3) H3	(4) H4	(5) Havg
Public credit registry	0.097	-0.004	0.069*	-0.020	0.045
	(0.058)	(0.042)	(0.040)	(0.058)	(0.040)
Activity restrictions	-0.038***	-0.025***	-0.025***	-0.030***	-0.027***
	(0.012)	(0.009)	(0.006)	(0.009)	(0.006)
Entry fit test	0.038*	0.019**	0.023*	0.012	0.023*
	(0.022)	(0.009)	(0.013)	(0.016)	(0.013)
Foreign bank ownership	0.005***	0.002	0.003**	0.004**	0.003***
	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)
Log of Per capita GDP	-0.089***	-0.035	-0.001	-0.013	-0.034**
	(0.023)	(0.032)	(0.011)	(0.020)	(0.016)
Inflation	0.027	0.027	0.012	0.010	0.012
	(0.034)	(0.040)	(0.022)	(0.031)	(0.022)
Observations	30	30	30	30	30
R-squared	0.78	0.54	0.76	0.54	0.76

Panel I. Bank concentration, number of banks, activity restrictions, entry and foreign ownership

	(1) H1	(2) H2	(3) H3	(4) H4	(5) Havg
Concentration	0.346	0.211	0.014	0.157	0.155
	(0.203)	(0.160)	(0.143)	(0.170)	(0.136)
Log(Number of banks/population)	-0.057	-0.024	-0.019	-0.010	-0.022
	(0.042)	(0.028)	(0.030)	(0.045)	(0.033)
Activity restrictions	-0.036***	-0.017**	-0.031***	-0.023**	-0.027***
	(0.012)	(0.006)	(0.008)	(0.009)	(0.008)
Entry fit test	0.005	-0.004	0.018	-0.000	0.006
	(0.030)	(0.015)	(0.021)	(0.023)	(0.021)
Foreign bank ownership	0.005***	0.003***	0.003***	0.001*	0.003***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)
Log of Per capita GDP	0.002	0.016	0.024	0.002	0.005
	(0.055)	(0.040)	(0.037)	(0.062)	(0.041)
Inflation	0.021	0.022	0.017	-0.002	0.015
	(0.032)	(0.032)	(0.020)	(0.036)	(0.023)
Observations	30	30	30	30	30
R-squared	0.84	0.72	0.75	0.55	0.80

Table 7 Robustness: Cross-Country Determinants of H-statistics and Countries with at least 100 bank-year observations

Dependent variable is the H-statistic. The regression results are based on a sample of countries that excludes countries with an estimated H-statistic that is based on a sample of less than 100 bank-year observations. H1 is the H-statistic estimated using pooled OLS with time dummies and with gross interest revenues as dependent variable in the reduced form revenue equations. H2 is the H-statistic estimated using pooled GLS with bank-specific fixed effects and time dummies and with gross interest revenues as dependent variable in the reduced form revenue equations. H3 is the H-statistic estimated using pooled OLS with time dummies and with total revenues as dependent variable in the reduced form revenue equations. H4 is the H-statistic estimated using pooled GLS with bank-specific fixed effects and time dummies and with total revenues as dependent variable in the reduced form revenue equations. All H-statistics are based on the Panzar-Rosse (1987) approach. Havg is the average of H1 though H4. All regressions are estimated using weighted OLS with heteroskedasticity-consistent standard errors. As weights, we use for each country observation the inverse of the variance of the generated H-statistic. A constant was added, but is not reported. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. A description of each variable can be found in Table 1.

Panel A. Bank concentration, number of banks, activity restrictions, entry and foreign ownership

	(1) H1 Large Banks	(2) H2 Large Banks	(3) H3 Large Banks	(4) H4 Large Banks	(5) Havg Large Banks
Concentration	0.299	0.189	0.008	0.169	0.135
	(0.224)	(0.177)	(0.144)	(0.189)	(0.146)
Log(Number of banks/population)	-0.057	-0.023	-0.040	-0.037	-0.034
	(0.065)	(0.038)	(0.041)	(0.054)	(0.046)
Activity restrictions	-0.038**	-0.019**	-0.033***	-0.023*	-0.028***
	(0.014)	(0.007)	(0.009)	(0.011)	(0.009)
Entry fit test	0.003	-0.003	0.017	-0.005	0.005
	(0.032)	(0.017)	(0.023)	(0.027)	(0.022)
Foreign bank ownership	0.006***	0.003***	0.003***	0.002*	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log of Per capita GDP	0.017	0.024	0.065	0.056	0.031
	(0.101)	(0.057)	(0.057)	(0.073)	(0.065)
Inflation	0.047	0.036	0.031	0.016	0.026
	(0.052)	(0.040)	(0.024)	(0.029)	(0.028)
Observations	22	22	22	22	22
R-squared	0.86	0.74	0.79	0.62	0.82

Annex 1 Sample and Outlier rules

This annex presents the outlier rules applied to the initial sample of banks from BANKSCOPE and how each of these rules affects our sample. A description of each variable can be found in Table 1.

Outlier rule	Number of bank-year observations
All banks for the years 1994-2001	54,038
-/- Observations for which:	
Interest income to total assets (P)<2%	843
Interest income to total assets (P)>30%	756
Interest expense to total deposits plus money market funding (W1)<1%	2,461
Interest expense to total deposits plus money market funding (W1)>20%	1,806
Personnel expense to total assets (W2)<0.5%	3,631
Personnel expense to total assets (W2)>20%	3,958
Other operating and administrative expenses to total assets (W3)<0.1%	170
Other operating and administrative expenses to total assets (W3)>20%	179
Equity to total assets (Y1)<1%	232
Equity to total assets (Y1)>50%	310
Net loans to total assets (Y2)<1%	862
Net loans to total assets (Y2)>100%	37
Pre-tax profits to total assets (ROA)<-10%	72
Pre-tax profits to total assets (ROA)>20%	23
	38,698
-/- Observations from countries with less than 50 bank-year observations	1,591
	37,107
-/- Observations from countries with data on less than 20 banks	1,273
	35,834