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Banking Market Structure, Financial Dependence and Growth: International Evidence from Industry Data

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ABSTRACT

This paper explores the empirical relevance of banking market structure on growth. There is substantial evidence of a positive relationship between the level of development of the banking sector of an economy and its long-run output growth. Little is known, however, about the role played by the market structure of the banking sector on the dynamics of capital accumulation. This paper provides evidence that bank concentration promotes the growth of those industrial sectors that are more in need of external finance by facilitating credit access to younger firms. However, we also find evidence of a general depressing effect on growth associated with a concentrated banking industry, which impacts all sectors and all firms indiscriminately.

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The importance of financial development for economic growth has been extensively analyzed in recent years. The amount of credit that the banking sector makes available for productive uses is one of the most significant measures of financial development. Such an indicator of size of the banking sector has been shown to have a significant, positive effect on growth. In this paper we study whether for a given size, the *market structure* of the banking sector has empirical relevance for economic growth. If it is agreed that the size of the banking sector is important to capital accumulation, does it matter whether the underlying industry structure is unconcentrated, thus approximating perfectly competitive conditions, or whether instead market power is concentrated among few banking institutions?

We find that concentration in the banking sector determines a general deadweight loss which depresses growth. However, we also find evidence that bank concentration promotes the growth of those industries that are more in need of external finance by facilitating credit access to firms, especially younger ones.

There are theoretical reasons, as well as anecdotal evidence, suggesting that the market structure of the banking sector has a non-trivial impact on the process of capital accumulation. Conventional wisdom suggests that any departure from perfect competition in the credit market introduces inefficiencies that would harm firms' access to credit, thus hindering growth. Pagano (1993), for example, shows this effect in a simple endogenous growth model. On the other hand, some recent contributions have pointed out that banks with monopoly power have a greater incentive to establish lending relationships with their client firms, thus facilitating their access to credit lines. Mayer (1988), Mayer (1990) and Petersen and Rajan (1995) highlight this potential incompatibility between bank competition and the establishment of close lending relationships.

There is some historical evidence on the positive role of concentrated credit markets for economic development. Gerschenkron (1965), for example, mentions the importance

of institutions such as the Credit Mobilier for the industrialization of France, or that of the Great Banks for Germany's development. Cohen (1967) explains the similar role played by Banca Commerciale Italiana and Credito Italiano for Italy, two banks whose combined assets accounted for about 60 percent of the total market. Likewise, Sylla (1969) argues that monopoly-enhancing regulation in the financial sector at the time of the Civil War contributed to industrialization in the United States. By the same token, Mayer (1990) mentions how Japan's post-war development has been boosted by their main-bank system.

While the arguments on both sides of this theoretical debate are compelling, no broad-scope, cross-country empirical study has been conducted to test either stance. In this paper we choose to take an agnostic position on the issue in order to explore the consistency of each theory with the available data.[1]

This paper contributes to the recent line of empirical research on financial intermediation and growth. Following the original contributions by Goldsmith (1969), Gurley and Shaw (1967), McKinnon (1973), and Shaw (1973), economists in recent years have returned to this problem. Among the newer contributions, King and Levine (1993) present the first broad, cross-country analysis of the importance of various indicators of financial development. They find that countries initially endowed with a more sizeable credit sector experienced faster growth in the following thirty years. Also using cross-country regression analysis, Levine and Zervos (1998) make an important refinement by showing the joint, independent relevance for growth of both banks and capital markets.

[1]Petersen and Rajan (1995) present some indirect empirical evidence analyzing credit availability for a cross-section of U.S. small businesses located in markets characterized by different degrees of bank concentration. They find that firms are less credit constrained in more concentrated banking markets, and younger firms are charged lower loan rates. Shaffer (1998), on the other hand, finds evidence from cross-sectional U.S. data that household income grows faster in markets with a higher number of banks. In two very recent contributions, Bonaccorsi di Patti and Dell'Ariccia (2000), using cross-industry, cross-provinces Italian data, find that firms in more informationally opaque sectors grow more in more concentrated banking markets, while Black and Strahan (2000), with cross-state U.S. data find a negative relationship between banking concentration and the number of new firms.

Demirgüç-Kunt and Maksimovic (1998) use instead firm-level data and show, in a cross-country study, that where the legal system is more developed firms have greater access to external funds, which in turn allows them to grow faster. Meanwhile, Rajan and Zingales (1998) render an innovative contribution to the field by focusing on a cross-industry, cross-country analysis. First, they construct a measure of the dependence on external finance of a wide range of industrial sectors, in which differences among sectors depend mainly on technology-specific factors.[2] Second, they test whether industries that are more dependent on external finance grow faster in countries that are more financially developed. They find that this is indeed the case, thus providing evidence confirming the overall importance of financial development on growth.

Our paper tests the importance of banking market structure for growth. We use an extension of the Rajan and Zingales data set, with both cross-industry and cross-country characteristics. Similar to the approach taken by King and Levine or Levine and Zervos, we begin by evaluating the total, average effect of bank concentration on industrial growth. That is, we test whether, by and large, industries grow more or less if they are in countries with a more concentrated banking sector. Given the opposing theoretical views described earlier, the answer to this question is not obvious. On the one hand, if bank concentration simply results in lower credit availability, then growth should be slower in countries with a more concentrated banking market. On the other hand, if the market power associated with bank concentration generates positive effects by enhancing the formation of lending relationships, then growth should be faster in countries with a concentrated banking sector. We find that bank concentration has an average *depressive* effect on industry growth.

However, our empirical study goes beyond the analysis of this average effect of bank

[2]For example, an industrial sector at high R&D intensity is expected to rely more on external sources of finance than other, more traditional, sectors (e.g. Computing or Chemical products as opposed to Tobacco or Leather).

market structure. As remarked by Rajan and Zingales, industries differ among each other in terms of their relative dependence on external sources of finance. Again, given the opposing theoretical views one might expect that firms in sectors especially dependent on external finance should suffer more, and therefore grow less than average, when faced with a concentrated banking sector. On the other hand, if bank concentration enhances the formation of lending relationships, then one could expect that precisely those firms in industries especially dependent on external finance should benefit disproportionately more when faced with a concentrated banking sector. Exploiting industry-specific information, we thus ask whether bank concentration has a heterogeneous impact *across* industrial sectors.

The tests we carry out are actually even more precise: corporate finance theory suggests that firms' relative age may affect their dependence on external finance. For example, Rajan and Zingales show that, in median terms, U.S. firms raise a positive amount of external finance only up to the tenth year of their life. Therefore, one would expect to find stronger evidence of either effect of bank concentration by focusing the analysis specifically on the external financial needs of younger firms. Since the data set provides separate information on the financial needs of firms less than ten years old and on the more mature ones, we are able to do that. Therefore, our empirical test is: all else equal, do industries whose younger firms are especially dependent on external finance grow more or less rapidly in countries where the banking sector is highly concentrated? The results show robust evidence that industries in which young firms are more dependent on external finance will in fact grow relatively *faster* in those countries where the banking sector is more concentrated.

The two results are not in contradiction. On the contrary, taken together they allow us to confirm the basic predictions of both theories of banking market structure and growth: a more concentrated banking industry imposes a deadweight loss in the credit

market as a whole, resulting in a reduction in the total quantity of loanable funds, exactly as conventional wisdom would suggest. However, subjecting to more careful scrutiny the complexity of the microeconomic relationship between firms' financial needs and sources of finance, we also find evidence that the effect is *heterogeneous* across industrial sectors, and that in fact, specific categories of firms and industries seem to benefit from a concentrated banking sector.

In the next section we describe in more detail the theory behind our empirical study. Section II contains the illustration of the models used for hypothesis testing. In Section III we describe the data set. The empirical results are presented in Section IV, while Sections V and VI contain a large variety of robustness tests. In Section VII we present various refinements of the analysis, while Section VIII elaborates on the several policy implications associated with the results of our investigation and presents concluding remarks.

I. Theoretical Background

The negative effect of banking market power is a direct application of standard results from market theory. Banks with monopoly power would determine, with respect to perfect competition, an equilibrium with higher loan rates and a smaller quantity of loanable funds. This would clearly reduce economic growth. Conversely, the positive effect derives from the greater incentive for monopolistic banks to establish lending relationships, which in turn promotes firms' access to investment funds. According to the model developed in Petersen and Rajan (1995), a bank will establish lending relationships with young firms with no record of performance, thus bearing initial informational costs, if it can share in their future stream of profits, should they turn out to be successful. However, in highly competitive credit markets, a bank knows that it may not be able to maintain a tie with the successful firms: once these firms are established they will seek the lowest-cost supply of credit available in the market. Banks that did not invest initial

resources in funding the unknown firms would have a cost advantage in offering better credit conditions than the bank attempting to recoup the original cost. In the presence of this free-riding problem, competition in banking can induce credit rationing in the sense that potentially high quality (but young and unknown) entrepreneurs may not get funded (for similar analyses of externalities in information production and credit market competition see also Lang and Nakamura (1989) and Cetorelli and Peretto (2000)).

This theoretical argument is implicitly based on an assumption of market incompleteness. For example, a possible solution to the free-riding problem under competition would be to allow banks to hold equity positions. Under this scenario, the bank would participate in future profit sharing regardless of whether the firm maintains a lending relationship. In fact, one can argue that monopoly power gives the bank an implicit equity stake in the firm it is financing. Regulatory restrictions, however, may prevent a bank from writing equity contracts. We explore how the degree of regulatory restrictions affect the empirical relationship between banking market power and industrial growth in Section VII.

II. Model Specifications

A. Basic Model

The first model explores the role of bank concentration for industrial growth at large, that is, regardless of specific industry characteristics. We write our basic growth equation as,

$$\begin{aligned} Growth_{j,k} &= Constant + \Psi_1 \cdot Industry\ dummies_j \\ &+ \Psi_2 \cdot Country\ controls_k \\ &+ \psi_3 \cdot Industry\ share\ of\ manufacturing\ value\ added_{j,k} \\ &+ \psi_4 \cdot Bank\ concentration_k \end{aligned} \tag{1}$$

$$+ \quad Error_{j,k},$$

where a subscript j indicates that the variable refers to the *j-th* industry. Similarly, a subscript k indicates a variable regarding the *k-th* country. Uppercase coefficients indicate vectors.

The industry dummies correct for industry-specific effects. The country controls, among which is the level of bank development, are regressors customarily used in cross-country growth studies that we include to reduce the possibility of model mispecification due to the omission of important variables. The entire vector of country control variables is described in greater detail in the presentation of the empirical results.

The j industries in the data set all belong to manufacturing.[3] Similar to the role played by per-capita income in standard cross-country growth equations, the industry j share of total value added in manufacturing in country k, calculated at the beginning of the period, captures an industry-specific convergence effect: sectors that have already grown substantially in the past are unlikely to continue to grow at a high rate in the future. Therefore, ψ_3 is expected to have a negative sign.

Finally, the level of bank concentration isolates the total effect of bank market structure on industrial growth. As we mentioned above, theory suggests that there are two opposing effects on growth that we can associate with bank concentration. Therefore, the sign of ψ_4 is a priori ambiguous.

B. Extended Model

The approach outlined above enables us to identify an economy-wide effect of bank concentration, common to all industrial sectors. In other words, this would be the effect we would find if we used growth rate averages, aggregated across sectors in each

[3]As Rajan and Zingales note, this is done "...in order to reduce the dependence on country-specific factors, like natural resources..." (Rajan and Zingales (1998, p. 567]).

country. The use of industry-specific information yields instead a deeper exploration and understanding of the role played by banking market structure for growth. This model specification allows us to decompose the total effect of bank concentration in first, an economy-wide effect and second, a sector-specific effect.

The extended model specification is as follows:

$$\begin{aligned} Growth_{j,k} &= Constant + \Phi_1 \cdot Industry\ dummies_j \\ &+ \Phi_2 \cdot Country\ controls_k \\ &+ \phi_3 \cdot Industry\ share\ of\ manufacturing\ value\ added_{j,k} \\ &+ \phi_4 \cdot Bank\ concentration_k \\ &+ \phi_5 \cdot (External\ dependence_j \cdot Bank\ concentration_k) \\ &+ \phi_6 \cdot (External\ dependence_j \cdot Bank\ development_k) \\ &+ Error_{j,k}. \end{aligned} \tag{2}$$

In this extended specification of the model we include the interaction between the level of external financial dependence of industry j and bank concentration in country k. We test whether sectors that are more in need of external finance grow disproportionately slower or faster if they are in a country with high bank concentration. Following the same arguments as above, the sign of ϕ_5 is a priori ambiguous. As an additional control, we also include the interaction between external financial dependence and the level of bank development. The coefficient ϕ_6 of this interaction term, extensively analyzed in Rajan and Zingales (1998), is expected to be positive. As anticipated in the introduction, we focus on the external financial needs of younger firms (those less than ten years old).[4]

[4]Results regarding more mature firms are, however, presented in the section devoted to robustness tests.

C. Focusing on the Interaction

Finally, in a third model specification we focus our attention on the analysis of the differential effect of bank concentration across industries, captured by the interaction term. Since we find that bank concentration actually has beneficial effects on industries more in need of external finance, a result not obvious ex-ante, we want to be convinced that this effect is indeed robust. We thus estimate a third model specification, where we drop the level of bank concentration by itself, keeping only the interaction terms. The reason for choosing to focus on this specification to run robustness tests is that it is econometrically more sound: since we are not identifying first-order effects, we can drop the vector of country controls, and instead we can include country dummies (in addition to the industry ones), thus eliminating possible biases caused by omitted country-specific regressors. The model specification is therefore as follows:

$$\begin{aligned} Growth_{j,k} &= Constant + \Gamma_1 \cdot Industry\ dummies_j \\ &+ \Gamma_2 \cdot Country\ dummies_k \\ &+ \gamma_3 \cdot Industry\ share\ of\ manufacturing\ value\ added_{j,k} \\ &+ \gamma_4 \cdot (External\ dependence_j \cdot Bank\ development_k) \\ &+ \gamma_5 \cdot (External\ dependence_j \cdot Bank\ concentration_k) \\ &+ Error_{j,k}, \end{aligned} \tag{3}$$

where subscripts and variables are the same as described previously.

III. Data

The empirical analysis relies on our augmented version of the Rajan and Zingales data set.[5] The sample includes 41 countries and for each of them 36 industries, yielding a remarkably large sample size. The 36 industries, as mentioned earlier, are all selected from

[5]The data set was kindly made available by the authors.

the manufacturing sector. The relevant growth variable is the average (compounded) rate of growth of real value added for each industrial sector in each country between 1980 and 1990.

Rajan and Zingales calculate the measure of external financial dependence for each industry for U.S. sectors, arguing that the "dependence of U.S. firms on external finance [is] a good proxy for the demand for external funds in other countries" (Rajan and Zingales 1998, pp. 563–65)).

Table I about here

We augment the data set to include measures of concentration of the banking sector. Specifically, for each country we calculate the sum of market shares (measured in total assets) of the three and of the five largest banks. The data source is the IBCA-BankScope 1997 CD, which contains detailed balance sheet information on individual banking institutions for the period 1989 to 1996. For each country we then compute the concentration ratios for every year in the sample for which there is exhaustive information (the computation for some countries in some years is made unreliable since only a small fraction of bank balance sheets were reported.) Averages over time constitute our measures of bank concentration. Table I contains the list of countries in the data set and the corresponding measures of bank concentration. As we proceed in the description of the empirical results, we will introduce and describe additional variables used for robustness tests (all variables are summarized in Table II.)

Table II about here

IV. Empirical Results

We were unable to find data to construct the concentration measures going back earlier than 1989. Since the growth variable refers to the decade 1980 to 1990, we

are exposed to the potential problems that an ex-post variable could generate, such as endogeneity. However, we are confident that in this case the ex-post determination does not constitute an important issue. First, the market structure of the banking sector, at the country level, does not vary substantially over such a short time period. We checked this by analyzing for each country the pattern of variability of the concentration ratios calculated for the 1989 to 1996 period. We found that indeed such ratios are remarkably stable over time. For example, we calculated the range for the three-bank concentration ratio in each country. The cross-country median range of variation in the 1989 to 1996 period was only three percentage points. Even more telling, in about seventy percent of the countries (27 out of 41) the three-bank ratio had a variation over time of less than five percentage points.[6] To our knowledge, there are no reasons to believe that such stability over the 1989 to 1996 period should not also be found in the contiguous 1980 to 1990 period.

In addition, we also constructed the series of the rank of the three-bank and the five-bank concentration ratios. In other words, we allow for the possibility that the averages calculated over the 1989 to 1996 period are possibly different from the ones we would have calculated for the 1980 to 1990 period, but we require that countries keep their relative position in the ranking. This is a less stringent condition than requiring that concentration ratios remain unchanged. Finally, we calculate a dummy variable (high-low concentration) as an additional alternative to our three-bank and five-bank ratios. Following the above reasoning, even though the actual values of concentration in the earlier period may have been different from our indices, and perhaps some rankings may have changed as well, as long as the range of variation was not so large to make a country shift from the high to the low concentration cluster (or vice versa), a concentration measure constructed on 1989 to 1996 averages is very likely to be similar to the one we

[6] As a term of comparison, the cross-country average three-bank ratio in our sample is approximately fifty-five percent.

would have constructed for the 1980 to 1990 period, had the data been available. In the empirical analysis we test the robustness of the results to the use of this alternative measures of market structure.

Table III about here

Still on the issue of endogeneity, one could also argue that bank market structure simply adjusts to a level which is optimal for a country's industrial structure. However, this consideration overlooks the fact that there are political and institutional factors that distort the natural development of financial systems. Interest groups, or governments, or both, will shape the legal, institutional and economic environment for private gains that may not necessarily coincide with the proper development, in terms of both size and structure, of the financial industry.[7] Moreover, in general, the market structure of the banking sector is a favorite policy variable for reasons not necessarily related to industry growth.[8] Hence, the objective function of the regulator is such that the "optimal" level of bank concentration may be unrelated to that requested by the industry structure of the economy.

Beyond this line of discussion, we resolve the concerns regarding the potential endogeneity of the market structure of the banking sector using instrumental variables (IV) estimation. We have selected as instruments two variables determining a country's institutional characteristics, and two variables proxying for market size. In addition to institutional factors, it is in fact likely that for reasons of minimum scale economies, a larger market is able to accommodate a higher number of banks. The institutional variables are an indicator of the legal origin of a country and one concerning the extent to which laws are enforced in a country (see La Porta, Lopez-de-Silanes, Shleifer and

[7]Rajan and Zingales (1999) extensively elaborate on this argument.

[8]For example, the regulator often controls competition in the banking industry to prevent excessive surplus extraction or for reasons related to the safety and soundness of the industry.

Vishny (1997)).[9] The proxies for market size are country total population and total Gross Domestic Product (GDP), measured in U.S. dollars.[10]

We perform a Durbin-Wu-Hausman (DWH) test of overidentifying restrictions for each of the regressions in the paper. The test (see Davidson and MacKinnon (1993, pp. 237–42)) verifies the null hypothesis that the introduction of IVs has no effect on the estimates of the regression's coefficients. There are two terms including the measure of concentration in our equations, namely, the level of concentration and the interaction of external dependence and concentration. When both terms are present in the regressions, instruments must be used for both variables. Therefore, for each of the regressions we perform a DWH F-test, which is reported as the bottom line in each table. If the P-value of the F-test is below ten percent (i.e., the null hypothesis is rejected and the IVs are jointly accepted), then IV estimates are reported. Otherwise, OLS estimates are reported. We choose the ten percent significance level for prudence, since we want to correct for possible endogeneity when there is the slightest risk of its occurrence.

Anticipating our results, in the vast majority of the regressions we find that the test fails to reject the null hypothesis and that, even when they are used, IVs do not particularly alter the results of the OLS estimations. Therefore, bank concentration is robust to the issue of endogeneity, both in level and in interaction.

A. Basic Model

In table IV we report the results of regressions based on the specification in equation (1), in which we add one country control variable at a time.

Table IV about here

[9]For another example of instrumental variable approach to tackle the issue of endogeneity of financial variables in growth regressions, see Levine, Loayza and Beck (2000). A time-series analysis of causality between financial variables and growth is in Demetriades and Hussein (1996).

[10]As shown in Table III, the negative correlation between bank concentration and the measures of market size are indeed quite high, especially that with total GDP. In fact, we also tested whether by using bank concentration we were not just capturing a market size effect. The results, not reported, show that bank concentration is robust to the inclusion of market size variables.

The dependent variable is the average annual growth in value added for each sector in each country, while the three-bank ratio is the measure of bank concentration. Unless otherwise noted, the dependent variable and the measure of bank concentration will remain the same in all of the following regressions. The country control variables are the level of bank development, the logarithm of per capita income in 1980, stock market capitalization over GDP in 1980, an accounting standards indicator, and a measure of the level of human capital. The measure of bank development is the commonly used ratio between domestic credit to the private sector and GDP, and is expected to have a positive effect. Per-capita GDP captures the convergence effect of the economy as a whole to its long-run steady state, and is therefore expected to have a negative sign. Stock market capitalization controls for the relative importance of alternative sources of external finance and is expected to have a positive sign. Accounting standards is an index reflecting the quality of disclosure of firms' annual reports (see Rajan and Zingales (1998, p. 571)). The poorer such standards, the higher the information cost that a bank has to sustain to determine the quality of an entrepreneur. The expected sign for this term is also positive. The level of human capital, another typical regressor in growth equations, is measured as average number of school years in population over age 25 (as in Barro and Lee (1993)), and is expected to have a positive effect as well.

All control variables have the sign that one would expect to find in any cross-country growth equation. Also as expected, the share of total value added in manufacturing is negative and significant. The main result to highlight is that the level of bank concentration has a negative and significant coefficient. The effect of bank concentration is robust to the inclusion of the various control variables. This result lends support to the prior that a concentrated banking industry imposes a deadweight loss in the credit market and on the economy as a whole.

In order to gauge the economic relevance of the bank concentration variable, we

perform a standard comparative dynamics exercise. Specifically, we calculate the total impact on growth if we were going from a country at the 25th percentile of the distribution of bank concentration to a country at the 75th percentile. The effect on growth based on the estimated coefficients in the regression in column (b) of Table IV is a negative 1.5 percentage points.[11] Note that the average growth across sectors is 3.6 percent (see Table II). We should not take these number at face value, since this model specification is exposed to the aforementioned omitted variable bias, due to the non-inclusion of potentially important country variables. However, the overall evidence suggests that the total effect is, on average, negative and significant, both statistically and economically.

B. Extended Model: Economy-wide and Sector-specific Effects

In Table V we report the results of regressions based on the specification in equation (2), in which, again, we add one country control variable at a time, and where we include the interaction between external financial dependence and bank concentration, together with that between external financial dependence and bank development, acting as a control. External financial dependence refers to that of the younger firms in the data set.

Table V about here

The level of bank concentration by itself maintains a negative and significant coefficient in the regressions (a) through (d), while we highlight that the interaction coefficient

[11] Column (b) regression has the highest number of controls that still allows us to use the largest sample size, with 1150 observations. Column (c) and (d) regressions have more controls but the inclusion of accounting standards and human capital brings the sample size down to 950 observations, with a loss of nine of the original countries in the data set. The countries are Bangladesh, Costa Rica, Egypt, Jordan, Kenya, Morocco, Pakistan, Sri Lanka, and Zimbabwe. We choose to present our basic results based on the larger sample, in order to minimize informational losses (nine countries out of forty-one represent a rather significant twenty-two percent). Moreover, since the nine countries are all developing countries, we want to avoid sample bias. At any rate, based on the estimates of column (d), the effect of increasing bank concentration would be a negative 2.4 percentage points.

is instead positive and significant. The two effects of bank concentration are robust to the inclusion of the various control variables, all showing the expected sign.[12] The interaction between external financial dependence and bank development becomes insignificant in the last three columns where, as we mentioned in footnote 11, the inclusion of accounting standards and human capital makes nine countries drop from the sample.

The combined results are consistent with the theoretical priors. They suggest that bank concentration has a negative effect on growth that, on average, affects all sectors indiscriminately. However, when we introduce the dimension of the intensity of external financial dependence, we identify an industry-specific, positive effect of bank concentration. This effect is consistent with the theoretical prior that bank market power, by facilitating the formation of lending relationships, enhances the growth potentials for those sectors that are more in need of establishing such relationships. The result indicates that the impact of bank concentration on growth is not uniform across industries. Consequently, bank concentration has an important redistribution effect. We elaborate further on this point and the related policy implications in the following sections.

It is also worthwhile remarking that our results are shielded by a potentially important objection. External financial dependence in the data set is measured on U.S. sectors. However, U.S. sectors with higher external financial dependence are those that grew more over time. We also know that countries at a comparable level of economic development are similar in terms of their industry structure. Therefore, it is likely that sectors with high external financial dependence grew more not just in the U.S. but also in those countries similar to the U.S., i.e., the richest countries. Suppose now that, similar to bank development, bank concentration had a positive, high correlation with income per capita. In that case, the finding of a positive and significant bank concentra-

[12]We also ran a regression where we included external financial dependence by itself as a regressor. In order to do that, however, we had to exclude the industry dummy variables. Such a regressor was not significant while all other coefficients were unchanged.

tion interaction, especially when the bank development interaction is insignificant, could simply capture this positive association between external financial dependence and the level of economic development. However, we do not think this is a matter of concern, since there is actually no correlation in the data between bank concentration and income per capita (see Table III).

We also add a squared term of bank concentration to check for non-linearity. As the results in column (e) of Table V show, bank concentration has in fact a slight inverted-U effect. The interpretation for this result is actually provided by what we learn from the sector-specific analysis: intuitively, at low levels of concentration only the sectors that have the lowest need to establish a lending relationship receive the maximum benefit, in that the deadweight loss from rent extraction is minimal but the potential informational gains from establishing lending relationships are also minimal. Conversely, at high levels of concentration only the sectors that are highly dependent on banks will benefit. The non-linearity seems to suggest that at intermediate values of concentration the overall growth potential of the entire economy is the highest, since sectors in an intermediate range of the distribution of external finance benefit substantially, and those at the extremes of the distribution of external finance are not highly penalized.

We evaluate the magnitude of the total effect of bank concentration on economic growth, decomposed in the first-order, economy-wide effect and the second-order, sector-specific ones. More precisely, we calculate the effect on growth of sectors with different levels of external financial dependence if we went from a level at the 25th percentile to one at the 75th percentile of the distribution of bank concentration. As we did above, we perform this calculation based on the estimation results of the regression in column (b) of Table V. The economy-wide effect is a negative 2.6 percent. For the sector at the 25th percentile of the distribution of external financial dependence (Wood products),

the sector-specific effect is a positive 0.8 percent.[13] The net effect for such sector is thus around minus 1.7 percentage points.[14] If we perform this calculation for other sectors, the second order effect becomes stronger as the intensity of external financial dependence increases.[15] Indeed, the net effect actually turns positive for those sectors at the upper tail of the distribution.[16]

V. Statistical Robustness Tests

We now turn to present a large battery of robustness tests, for which we focus on the specification in equation (3). Nevertheless, the reader must rest assured that all the pertinent robustness tests have also been conducted on the first-order effect, also shown to be very robust. When relevant, we do mention or report the result of tests carried out on the equation (2) model specification.

Table VI about here

Table VI reports in column (a) the estimation results for the benchmark equation (3). The share of total value added in manufacturing remains negative and significant, and the interaction between external dependence and bank development positive and significant. The coefficient of the interaction between external financial dependence and bank concentration is still positive and significant at the five percent level.

Based on the results of this model specification, the sector at the 25th percentile of the external financial dependence distribution would receive a positive effect translating

[13]The distribution of external financial dependence for young firms has virtually identical mean and median. The median is equal to 0.66 and the mean equal to 0.67.

[14]Based on the estimates of column (d) regression, the first-order effect would be a negative 4.5 percent and the second-order effect a positive one percent, with a net effect of around minus 3.5 percentage points. Remember, however, the remarks in Footnote 11 about sample size.

[15]For example, for the sector at the 75th percentile of the distribution (Ship), the second order effect, calculated on column (b) coefficients, is estimated to be a positive 1.9 percent, bringing the net effect to minus 0.7 percentage points.

[16]For example, based on column (b) coefficients, the net effect of bank concentration would be positive for sectors such as Glass, Professional goods and Drugs.

in 0.9 percent of higher growth in going from a country at the 25th percentile of the distribution of bank concentration to a country at the 75th percentile. A sector at the 75th percentile would receive instead a positive effect of two percent higher growth. These results confirm the robustness of those obtained with the model specification of equation (2). Recall, however, that all sectors are also subject to the negative economy-wide effect, which is not identifiable with this model specification. The information on the different sector-specific effect allows us to gauge the impact of bank concentration on the size distribution across industrial sectors. Specifically, we learn that the growth differential between an industrial sector at the 75th percentile and one at the 25th percentile of the distribution of external financial dependence for younger firms, if we were going from a country at the 25th percentile of the distribution of bank concentration to a country at the 75th percentile is estimated to be about $2 - 0.9 = 1.1$ percentage points on an annual basis. Again recalling that the average growth over all sectors is 3.6 percent, this redistribution effect of bank concentration appears to be economically significant.

A. Do the Results Depend on the Choice of the Concentration Measure?

We first check whether the three-bank ratio calculated over the 1989 to 1996 period is an adequate measure of concentration. In column (b) of Table VI, the concentration measure is the rank of the three-bank ratio, while in column (c) is the high-low concentration dummy for the three-bank ratio.[17] In column (d) we use the five-bank ratio, to check that the results would not depend on the arbitrary choice of computing the concentration measure as the sum of the market shares of the top three banks only. The strong similarity of the results obtained with these alternative measures suggests that

[17]For the calculation of the concentration dummy, countries were divided between those with a value of the ratio below and those above a value equal to 0.70, which is what would be considered high concentration, for example, in the U.S. banking industry (see, e.g., Calem and Carlino (1991)). An alternative specification, which gave unchanged results and is not reported in the table, divided the countries around the median of the distribution (0.57).

the three-bank ratio computed for the 1989 to 1996 period is a reliable measure for our analysis.

In what follows we therefore continue to present regression results using the three-bank concentration ratio calculated over the 1989 to 1996 period as our benchmark measure of banking market structure.

B. Omitted Variables

We test whether the term of interaction of bank concentration is significant when we omit the bank development interaction from the basic model specification. The results, reported in column (a) of Table VII, show that the concentration variable remains positive and significant at the ten percent level.[18]

Table VII about here

Subsequently, we check whether the bank concentration interaction variable is still significant after controlling for the relative importance of alternative sources of external finance. We therefore start by adding the interaction between external dependence and the size of stock market capitalization over GDP. The coefficient is expected to have a positive sign. The results in Table VII, column (b), show that this coefficient is indeed positive, although not significant. The bank concentration term is still positive and significant at the five percent level, with an estimated coefficient close in magnitude to the one in the baseline regression (column (b), Table VI).

In column (c) of Table VII we report the results of a regression where we add the interaction between external dependence and the logarithm of per-capita income in 1980. There is a concern that the interaction term of bank development in our basic specification may be proxying for the general level of economic development of a country. The

[18]We note a decrease in the estimated coefficient, from 0.063 to 0.048. This is likely to be the result of an omitted variable bias. Performing a bias analysis (see, e.g., Berndt (1991, p. 322) it is indeed confirmed that the omission of the bank development variable determines a downward bias on the coefficient of bank concentration.

simple correlation between bank development and per-capita income, 0.56 (reported in Table III), may justify this concern. The coefficient of the bank concentration interaction remains positive and is significant at the ten percent level. Confirming the existence of some collinearity, the bank development and the income interaction terms have the expected sign but neither is significant.[19]

Finally, we add to the basic regression the interaction between external financial dependence and the measure of accounting standards. The expected sign for this term of interaction is positive. Column (d) in Table VII presents the results of this augmented specification of the model. The coefficient of bank concentration is still positive and significant, even though the size of the estimated coefficient decreases from 0.063 to 0.035. The two coefficients, however, are not immediately comparable, again due to the fact that by including the accounting standard variable the number of observations decreases from 1150 to 984.[20]

C. Outliers

A general concern is that the results based on these growth regressions could be driven by the exceptional performance of some countries (for example, Southeast Asian countries) or certain industrial sectors in particular countries, which could not be fully captured by the inclusions of the country and sector dummies. This should not affect our analysis, since the sample in the Rajan and Zingales data set does not include countries such as Taiwan or Hong Kong. In addition, the series of growth in value added censors from above sectors that, on average, grew more than 100 percent annually in the 1980 to 1990 period. To be sure, we run a regression dropping the censored observations

[19]If we run an equation (3) regression where we replace the bank development interaction term with the income level interaction term, the bank concentration interaction maintains its sign, significance and magnitude as well.

[20]If we run the equation (3) regression on the restricted sample excluding records for these countries, the coefficient of the bank concentration variable is equal to 0.042, significant at the one percent level. As pointed out earlier, we choose to present our basic results based on the larger sample, in order to minimize informational losses and sample bias.

altogether.[21] The results, reported in column (e) of Table VII, show that the bank concentration interaction becomes significant at the one percent level, although with a smaller coefficient. The coefficient of the bank development interaction, significant now at the ten percent level only, decreases as well.

In addition, we evaluate whether the results are sensitive to high and low values in the distribution of young firms' external financial dependence. We use a dummy variable to separate sectors above the median from those below the median of the distribution of external financial dependence and redefine the bank concentration interaction term accordingly. The results of this regression are reported in column (f) of Table VII. They show that the interaction term is positive and highly significant while the dummy variable term is not significantly different from zero. This is interpreted as confirming that the effect of bank concentration is stable across the entire sample.

VI. Economic Robustness Tests

A. Tests on Mature Firms

We also investigate the role of bank concentration for the financial needs of the more mature firms in the data set, that is, establishments more than ten years old. As we mentioned earlier, the external financial needs of this category of firms are much lower than for younger ones. Moreover, the problem of information acquisition on established firms is less severe than for younger firms. Therefore, focusing specifically on mature firms, we might expect a less important effect of bank concentration on industrial growth.

In the first column of Table VIII we report the results of the third model specification, this time calculating the terms of interaction using the external financial dependence of mature firms.

Table VIII about here

[21] We thank Rob Bliss for suggesting this and other outlier tests.

The bank concentration term is still positive and significant. However, the economic effect on growth is half the size of that determined on young firms: the growth differential between an industrial sector at the 75th percentile and one at the 25th percentile of the distribution of external financial dependence for mature firms, if we were going from a country at the 25th percentile of the distribution of bank concentration, to a country at the 75th percentile, is estimated to be about 0.5 percentage points on an annual basis. This is much lower (the difference is statistically significant) than the growth differential for young firms, which, as reported above, is instead 1.1 percentage points.

Among the mature firms, those that have already grown substantially and are well established are likely to receive minor benefits from a banking relationship, and are therefore more likely to be exposed to the rent extraction activity of a concentrated banking sector. Therefore, we perform an additional test on mature firms, splitting the sample between large and small sectors, i.e., those sectors in each country that had a share of value added in manufacturing *above* the country median, and those *below*. Columns (b) and (c) of Table VIII report the results for the two subsets. The bank concentration interaction term continues to be positive and significant for the sectors below the median. For sectors above the median the coefficient is positive but no longer significant.

In summary, bank concentration appears to have a positive effect on growth of sectors that are more in need of external finance. Consistent with theory, the economic impact is more pronounced for younger firms than for more mature ones. The dominating positive effect of bank concentration seems to disappear only when we focus on a particular subset of the more mature firms.

B. Market Contestability

Concentration ratios are widely used in empirical analysis to proxy for competitive

conduct.[22] However, the potential weakness of this measure is that if markets are contestable, market structure does not necessarily affect conduct. In a cross-country study, market contestability can be gauged in terms of the ability of foreign banks to access domestic markets. We can test whether the actual presence of foreign banks affects the relationship between bank concentration and industry growth using data on the share of total domestic assets owned by foreign banks (taken from Demirgüç-Kunt and Levine (1999)), and on the fraction of foreign banks over the total number of banks (taken from Claessens, Demirgüç-Kunt and Huizinga (1998)). Admittedly, such measures may not capture the effect on the conduct of domestic banks of a potential threat of entry, which is what contestability is more about. On the other hand "the threat of foreign bank entry may not be credible in the absence of actual entry" (Claessens, Demirgüç-Kunt and Huizinga (1998, p. 7)).

Data show a limited presence of foreign banks in most of the countries in the sample. For instance, the median share of assets owned by foreign banks is six percent (the 75th percentile is 14 percent). At the same time, in terms of the number of foreign banks over the total, perhaps a better indicator of the potentials for entry, the median fraction is a more substantial 24 percent. The relatively low weight of foreign banks in most countries may be due to the existence of administrative barriers to entry that were or still are in place in developing countries, where hostility toward foreign institutions can be traced back to the experience of colonialism (Vittas (1992)). Such restrictions are found in developed countries as well. For example, prior to 1993, countries that are now members of the European Union (EU) significantly restricted the entry of foreign banks. Such restrictions are still in place with respect to banks from non-EU countries.[23]

[22]Recent developments in empirical industrial organization have proposed alternative measures of market power, which could be used instead of the traditional concentration ratios (see, e.g., Bresnahan (1991). Such measures are identified through econometric estimation of industry's demand and supply conditions. The major drawback of such an alternative approach is the need for extensive data, which is only available for the most developed countries.

[23]One can also argue that besides regulatory restrictions, informational barriers play an important

We generate a dummy variable equal to one for countries with both a three-bank ratio *and* a foreign share of bank assets above their medians. These are countries where, given the relatively high presence of foreign banks, a high concentration ratio may overestimate the actual degree of monopoly power. We run an equation (3) regression where we add the product of the dummy with the concentration interaction term. The results, in column (a) of Table IX, show that the concentration interaction alone is still positive and significant, while the dummy term is not.

Table IX about here

This suggests that even if the concentration measure may be biased upward in some countries, such bias is not driving the main findings.[24]

C. Under-reporting Bias

We use data of foreign banking penetration to take into account another potential source of bias in the concentration variable. As described in Section III, the concentration ratios are calculated using the IBCA data set. Such a data set collects balance sheet items for all banks that report such information. While the percentage of banks reporting is very high, it is still possible to introduce a bias due to under-reporting. In particular, Beck, Demirgüç-Kunt and Levine (1999) observe that "...[using these data] the concentration measure might be biased upwards for developing countries, if foreign and large banks are more likely to report than domestic and smaller banks." To ad-

role as well in preventing a banking market from being contestable. The existence of informational barriers is discussed, and evidence is provided, e.g., in Berger, Bonime, Covitz and Hancock (1999). Some casual evidence is also provided by the observation that despite the removal of the aforementioned regulatory barriers to entry among EU countries, the actual presence of banks from other EU countries is still very limited, averaging about five percent of total bank assets across country (European Central Bank (1999)).

[24]As an alternative test, we dropped the records for those countries altogether and ran a regression on the restricted sample. We also repeated these tests with different cutoffs in the bank concentration and foreign share distributions, and we also used the proportion of foreign banks in place of foreign share. Similar tests of robustness were also performed on the equation (2) model specification. The results, available upon request, are in all instances qualitatively identical, indicating an effect of bank concentration on industrial growth robust to the issue of market contestability.

dress this problem, we generate a dummy variable equal to one for countries below the median in per-capita GDP and above the median in the foreign bank share, in order to isolate those countries where the concentration measure is more likely to be biased due to under-reporting. We then run regressions adding the product of the dummy with the bank concentration interaction term. While the bank concentration term alone remains significant, the dummy term is not significant, suggesting that the under-reporting bias is not a problem (see column (b), Table 9).[25]

D. Using Measures of Bank Efficiency

We use interest margins and overhead costs as alternative measures of competition. Using cross-country data from Demirgüç-Kunt and Huizinga (1998), we find that the concentration measure is not correlated with either variable (see Table III). We run regressions using either one in place of bank concentration, but we do not find significant results. An explanation is that interest margins and overhead costs are measures of bank efficiency that, in a cross-country analysis, are likely to be affected by country-specific factors. Consistent with this argument, Demirgüç-Kunt and Huizinga (1998), in a cross-country analysis find that, in fact, factors such as macroeconomic conditions, bank taxation, deposit insurance, legal structure, and other institutional indicators are very important in the determination of interest margins and overhead costs. They also confirm that bank concentration, at the cross-country level, is only mildly related to interest margins and to overhead costs. Hence, trying to trace information on bank competitive conduct via interest margins or overhead costs is in this case likely to yield spurious results. For instance, relatively higher margins in one country do not necessarily imply relatively higher banking market power.

[25]The same results are obtained using the proportion of foreign banks in place of foreign share.

VII. Refinements and Extensions

A. State-owned Banks

Another potential criticism of our use of the concentration ratios is that in some countries a large proportion of banks is owned by the government. In such cases, where the same subject owns many banks, those banks might act as a cartel. As a consequence, the concentration measure in some countries could underestimate the actual market power. At the same time, it is also plausible to argue that public banks may not necessarily be profit maximizers and may not have an incentive to establish lending relationships with potentially profitable enterprises.

Beck, Demirgüç-Kunt and Levine (1999) and Demirgüç-Kunt and Levine (1999) collect cross-country information on state ownership in the banking sector. We generate a dummy variable equal to one if the share of state-owned banks is above a certain threshold to single out countries with a significant government presence in the banking sector.[26] Then we test for a non-linear response to the concentration interaction term in the case where state ownership is particularly high. The coefficient of the product of the dummy and the concentration interaction term is negative, significant and almost the same in absolute value as the concentration interaction term alone (column (c) in Table IX). Hence, the positive effect of bank concentration appears to be offset in countries with a dominant government presence in the banking industry.

To explore further, we also run regressions where we add the interaction between external financial dependence and state ownership. The concentration interaction term is still significant, with a slightly decreased coefficient. The state ownership interaction is negative and significant (column (d) in Table IX). Interestingly enough, in the extended model specification we notice that even the level of bank development turns

[26]We set the threshold at 50 percent, 60 percent and 70 percent, obtaining virtually identical results. The regression described in the text is that with the threshold at 60 percent.

insignificant when we control for the degree of state ownership (column (e) in Table IX), thus suggesting a general negative impact associated with the presence of the state in the credit market.

B. Bank Powers

The effect of bank monopoly power may differ depending on the regulatory environment in which banks operate in a country. As mentioned in Section I, if a bank were allowed to finance firms through equity, then even under perfect competition it would have an incentive to establish close relationships. Hence, in a world where banks are less constrained in their financing choices, we may expect the positive effect of banking concentration on growth to be less important.

Barth, Caprio and Levine (2000) compile information across countries on the restrictions for banks in terms of their ability to write contracts. They summarize this information in a quantitative indicator ranging from one (broadest powers) to four (narrowest powers). We add to the model an interaction between this measure of bank powers and financial dependence. The bank concentration interaction remains highly significant, while the bank development interaction loses significance.

Table X about here

The bank powers interaction is not significant (column (a) of Table X).[27] We also add both bank powers alone and the interaction to the equation (2) model. Both bank concentration alone and its interaction are highly significant while the bank powers variables are not significant (column (b) of Table X).

As an additional test on the equation (2) model we also include an interaction of the level of bank concentration with bank powers, to see if the first-order negative effect

[27] We also generate a dummy variable equal to one if bank powers are very broad (below the median). We then add the product of the dummy and the concentration-dependence interaction to the regression. This new term is also not significant.

of concentration on industrial growth differs across countries with different regulatory restrictions. One could argue, for example, that if banks were allowed to operate in multiple lines of business, they would face increasing cross-markets competitive pressure that could reduce their ability to extract rent. The result (column (c), Table X) shows, however, that this interaction is not significant as well. In sum, there is not evidence from this data set that bank regulatory restrictions have a direct impact on the relationship between banking market structure and growth.

C. Does Bank Concentration Lead to Industry Concentration?

Another relevant issue is whether bank concentration causes financially dependent industries to become concentrated, thus enabling firms to earn monopoly profits. Banks may act as a barrier to entry by privileging incumbents, with whom they already established relationships, over new entrants.[28] Since we measure industrial growth in terms of value added, under such a scenario we could observe positive growth due to an increase in profits and not necessarily in production, with important welfare implications.

The Rajan and Zingales data set contains information on growth in the number of establishments and growth in the average size of existing establishments that can be used to test this hypothesis. If bank concentration induces industry concentration, and thus industry monopoly profits, then we should find that in those sectors that are more dependent on external finance there is a relatively slower growth in the number of new establishments, and in association with it a relatively faster growth in the average size of existing establishments. In our model specification, this implies that the hypothesis that bank concentration induces industry concentration is consistent with the finding that the interaction between bank concentration and external financial dependence is negative and significant in a regression with growth in number of establishments as

[28]In his study of Italian industrialization at the turn of the past century, Cohen (1967, p. 363) reports the relation between a quasi-monopolistic banking industry and "...the emergence of concentration of ownership and control in the new and rapidly growing sectors of the industrial structure."

dependent variable, and positive and significant in a regression with growth in average size as dependent variable.

We first run regressions with growth in number of establishments as the dependent variable. The results in column (d) of Table X show that while the level of concentration is negative and significant, the interaction term is positive and significant. Column (e) shows that the interaction term remains positive and significant even when we drop the regressors in level and we can introduce country dummies.

We then use growth in average size as the dependent variable. The results of these regressions are reported in column (f) and (g) of Table X. In both model specifications the interaction term is never significant. Overall, the evidence does not support the argument that bank concentration may enhance industry concentration. The results thus indicate that growth in value added is a good proxy for growth in output.

VIII. Concluding Remarks

Important recent contributions have established with reasonable confidence that financial development, characterized by a sizeable banking sector, matters for economic growth. The next important step in the research agenda involves delving deeper into the *micro* details governing the actual functioning of the finance-growth nexus. Beyond a "black-box" characterization of the banking sector, implicit in focusing on its relative size only, there is a much more complex web of banks and other institutions interacting in the credit markets. The various attributes of such a system are likely to have a qualifying impact on the finance-growth relationship. The market structure of the banking industry, reflecting its competitive conditions, is, in our opinion, one such attribute.

The findings in our paper suggest a non-trivial impact of bank concentration on industrial growth. There is evidence that bank concentration has a first-order negative effect on growth. This finding is consistent with the theoretical prediction that higher

bank concentration results in a lower amount of credit available in the economy *as a whole*. Regardless of their external financial dependence, this effect is common to all industrial sectors. However, we also find evidence that bank concentration has a *heterogeneous* effect across industries. In particular, sectors that are more dependent on external finance enjoy a beneficial effect from a concentrated banking sector. This positive effect could actually more than compensate the direct, negative effect on quantities. This finding supports models predicting that concentration of market power in banking facilitates the development of lending relationships, which have in turn an enhancing effect on firms' growth.

The main insights of this study are that first, at least maintaining the focus on the effects on industrial growth, there does not seem to be a Pareto-dominant policy regarding the optimal banking market structure: competition in banking does not necessarily dominate monopoly, and vice versa. Second, depending on the level of bank concentration, and ceteris paribus, individual industries will grow at different speeds. Therefore, banking market structure plays an important role in shaping the cross-industry size distribution within a country. Moreover, since bank concentration plays a more substantial role for growth by facilitating credit access of younger firms, and to the extent that investment by younger firms is more likely to introduce innovative technologies, banking market structure should have an impact on the pace of technological progress.

The results of the paper have relevance for developing countries, where government-sponsored programs, such as development banks (see Armendariz de Aghion (1999)) or micro banking (see Morduch (1999)), which affect credit market structure, aim at providing the conditions for convergence to higher levels of welfare. Yet, our findings are also relevant for developed countries where we witness important regulatory reforms and significant structural transformations of the banking industry.

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Table I
List of Countries and Bank Concentration Ratios

For each country we calculated the sum of market shares (measured in total assets) of the three and the five largest banks. The data on individual banking institutions for each country in the sample, are from the IBCA-BankScope 1997 CD for the period 1989–1996. The values reported are averages over the sample period. Note that data about the United States are not used in any of the regressions; we report them only for sake of completeness.

Country	3-Bank	5-Bank	Country	3-Bank	5-Bank
Australia	0.60	0.80	Korea	0.28	0.44
Austria	0.42	0.55	Malaysia	0.44	0.54
Bangladesh	0.62	0.75	Mexico	0.53	0.66
Belgium	0.49	0.73	Morocco	0.57	0.79
Brazil	0.40	0.50	Netherlands	0.77	0.88
Canada	0.57	0.84	New Zealand	0.75	0.99
Chile	0.45	0.62	Norway	0.60	0.74
Colombia	0.35	0.54	Pakistan	0.71	0.90
Costa Rica	0.71	0.82	Peru	0.64	0.76
Denmark	0.74	0.82	Philippines	0.40	0.56
Egypt	0.58	0.73	Portugal	0.46	0.63
Finland	0.85	0.98	Singapore	0.61	0.83
France	0.28	0.44	South Africa	0.69	0.90
Germany	0.27	0.39	Spain	0.34	0.50
Greece	0.79	0.91	Sri Lanka	0.75	0.89
India	0.40	0.51	Sweden	0.71	0.94
Israel	0.79	0.94	Turkey	0.41	0.56
Italy	0.24	0.38	United Kingdom	0.50	0.65
Japan	0.21	0.32	United States	0.15	0.20
Jordan	0.87	0.94	Venezuela	0.47	0.62
Kenya	0.59	0.72	Zimbabwe	0.78	0.97

Table II
Descriptive Statistics of Data Set

Growth in value added is the average (compounded) rate of growth of real value added for each industrial sector in each of the countries between 1980 and 1990. Growth in the average size of firms is growth in the ratio of value added to the number of firms. The fraction of value added is industry j's share of manufacturing value added in country k; three-bank and five-bank are the concentration ratios of the banking sector of each country as explained in Table I; external financial dependence measures refer respectively to the borrowing needs of all establishments (all), of establishments less than ten years old (young), and of establishments ten years and older (old). Accounting standards is an index ranking the amount of disclosure of companies' annual reports for each country. Bank development is the ratio of private domestic credit to GDP. Human capital is the average for 1980 of the years of schooling attained by the population over 25 years of age. Interest margin is banks' net interest income divided by total assets (1988 to 1995). Overhead costs is the ratio of banks' overhead costs to total assets (1988 to 1995). Bank powers is a measure of regulatory restrictions on bank activities in the 1990s. Foreign bank share is the ratio of foreign bank assets to total bank assets (1988 to 1995). Number of foreign banks is the ratio of the number of foreign banks to the total number of banks (1988 to 95). State ownership is the share of assets of state-owned banks over total commercial bank assets. Total GDP is in 1997 U.S. dollars calculated using the World Bank Atlas method. Rule of law is an indicator of the extent to which laws are enforced.

Variable	Num. Obs	Mean	Std. Dev.	Min	Max
$Growth\ in\ value\ added_{j,k}$	1150	0.036	0.092	-0.447	1.000
$Growth\ in\ average\ size_{j,k}$	990	0.024	0.090	-0.536	0.410
$Growth\ in\ number_{j,k}$	992	0.012	0.068	-0.414	0.758
$Fraction\ of\ value\ added_{j,k}$	1150	0.015	0.020	0.000	0.224
$3-bank\ ratio_k$	1150	0.538	0.176	0.210	0.870
$5-bank\ ratio_k$	1150	0.691	0.184	0.320	0.990
$External\ dependence\ all_j$	1150	0.338	0.371	-0.146	1.491
$External\ dependence\ young_j$	1150	0.665	0.619	-1.535	2.058
$External\ dependence\ old_j$	1112	0.018	0.299	-1.330	0.393
$Accounting\ standards_k$	984	0.610	0.138	0.240	0.830
$Bank\ development_k$	1150	0.384	0.202	0.068	0.856
$Log\ per\ capita\ GDP_k$	1150	7.923	1.302	4.793	9.572
$Stock\ market\ capitalization_k/GDP_k$	1150	0.202	0.306	0.000	1.624
$Human\ capital_k$	1106	6.109	2.743	1.681	12.141
$Interest\ margin_k$	1442	3.889	2.419	1.400	13.600
$Overhead\ costs_k$	1442	3.654	2.208	1.300	10.200
$Bank\ powers_k$	1363	2.171	0.642	1.000	3.500
$Foreign\ bank\ share_k$	1283	0.116	0.147	0.000	0.620
$No.\ of\ foreign\ banks_k$	1479	0.258	0.187	0.000	0.850
$State\ ownership_k$	1011	0.334	0.325	0.000	0.980
$Population_k$	1584	71.545	149.282	3.000	962
$Total\ GDP_k$	1584	585.202	1378.334	4.000	7783
$Rule\ of\ law_k$	1085	7.101	2.612	2.08	10

Table III
Correlations between Concentration Measures and Selected Variables

Stock market/GDP is the ratio between stock market capitalization and GDP in 1980; Log per capita GDP is the log of per capita GDP in 1980; Accounting standards is a measure of the quality of accounting and disclosure levels of businesses; Bank development is the ratio of private domestic credit to GDP; three-bank and five-bank are the concentration ratios of the banking sector of each country as explained in Table I. Interest margin is banks' net interest income divided by total assets (1988 to 1995). Overhead costs is the ratio of banks' overhead costs to total assets (1988 to 1995); State ownership is the share of assets of state-owned banks over total commercial bank assets; foreign presence is the ratio of foreign bank assets to total bank assets (1988 to 1995); Bank powers is a measure of regulatory restrictions on bank activities in the 1990s. Foreign bank share is the ratio of foreign bank assets to total bank assets (1988 to 1995).

Variables	$Stock$	GDP	$Accounting$	$Bank$	$3-Bank$	$5-Bank$
$Stock\ market_k/GDP_k$	1.000					
$Log\ per\ capita\ GDP_k$	0.175*	1.000				
$Accounting\ standards_k$	0.444*	0.587*	1.000			
$Bank\ development_k$	0.169*	0.560*	0.259*	1.000		
$3-bank\ ratio_k$	0.142*	-0.057	0.172*	-0.270*	1.000	
$5-bank\ ratio_k$	0.213*	-0.015	0.224*	-0.288*	0.972*	1.000

Variables	$Interest$	$Overhead$	$State$	$Foreign$	$Powers$	$3-Bank$
$Interest\ margin_k$	1.000					
$Overhead\ costs_k$	0.847*	1.000				
$State\ ownership_k$	0.066	0.098	1.000			
$Foreign\ presence_k$	0.245*	0.395*	-0.023	1.000		
$Bank\ powers_k$	0.352*	0.317*	-0.049	0.240*	1.000	
$3-bank\ ratio_k$	0.024	-0.020	-0.132*	0.125*	-0.250*	1.000

* indicates that the correlation is different from zero at the 1 percent significance level.

Table IV
The Average Effect of Bank Concentration on Industrial Growth

The dependent variable in all columns is the average (compounded) rate of growth of real value added for each industrial sector in each country between 1980 and 1990. The fraction of value added is industry j's share of manufacturing in country k. Bank development is the ratio of private domestic credit to GDP. Bank concentration is the three-bank ratio. Human capital is the average for 1980 of the years of schooling attained by the population over 25 years of age. Missing values in the accounting standards variable restrict our sample when such variable is used as a regressor (the countries that are dropped are: Bangladesh, Costa Rica, Jordan, Kenya, Morocco, Pakistan, Sri Lanka, and Zimbabwe). Similarly, the inclusion of the measure of human capital implies that records about Egypt are dropped from the sample. This explains the difference in the number of observations. Heteroskedasticity-consistent standard errors are reported in parentheses. The Durbin-Wu-Hausman statistic tests the null hypothesis that the use of instrumental variables does not change the estimation outcome. We report IV estimates when the test is rejected at the 10 percent level or less. Instruments are: rule of law, legal origin, total GDP, and population. Industry dummy variables are included in all regressions, but we do not report their coefficient estimates. Note that country dummy variables are not included in these regressions.

Regressors	(a)	(b)	(c)	(d)
$Fraction\ of\ value\ added_{j,k}$	-0.875***	-0.876***	-0.395***	-0.303**
	(0.260)	(0.260)	(0.140)	(0.141)
$Bank\ development_k$	0.074***	0.066***	0.072***	0.058***
	(0.016)	(0.016)	(0.012)	(0.014)
$Bank\ concentration_k$	-0.038**	-0.048***	-0.052***	-0.117***
	(0.017)	(0.017)	(0.011)	(0.016)
$Log\ of\ per\ capita\ GDP_k$	-0.016***	-0.016***	-0.023***	-0.025***
	(0.003)	(0.003)	(0.003)	(0.004)
$Stock\ market\ capitalization_k/GDP_k$		0.031***	0.023***	0.029***
		(0.006)	(0.007)	(0.007)
$Accounting\ standards_k$			0.067***	0.109***
			(0.024)	(0.027)
$Human\ capital_k$				0.004**
				(0.002)
R^2	0.127	0.137	0.201	0.223
$Observations$	1150	1150	984	950
$Durbin-Wu-Hausman$	0.60	0.13	1.57	8.73***

* indicates rejection of the null at the 10 percent significance level, ** indicates 5 percent significance level, and *** indicates 1 percent significance level.

Table V
Economy-Wide and Sector-Specific Effects of Bank Concentration on Industrial Growth

The dependent variable in all columns is the average (compounded) rate of growth of real value added for each industrial sector in each country between 1980 and 1990. The fraction of value added is industry j's share of manufacturing in country k; external financial dependence refers to the borrowing needs of establishments *less* than ten years old. Bank development is the ratio of private domestic credit to GDP. Bank concentration is the three-bank ratio. Human capital is the average for 1980 of the years of schooling attained by the population over 25 years of age. As mentioned in the note to Table IV, missing values in the accounting standards variable restrict our sample when such variable is used as a regressor (the countries that are dropped are: Bangladesh, Costa Rica, Jordan, Kenya, Morocco, Pakistan, Sri Lanka, and Zimbabwe). Similarly, the inclusion of the measure of human capital implies that records about Egypt are dropped from the sample. This explains the difference in the number of observations. Heteroskedasticity-consistent standard errors are reported in parentheses. The Durbin-Wu-Hausman statistic tests the null hypothesis that the use of instrumental variables does not change the estimation outcome. We report IV estimates when the test is rejected at the 10 percent level or less. Instruments are: rule of law, legal origin, total GDP, and population. Industry dummy variables are included in all regressions, but we do not report their coefficient estimates. Note that country dummy variables are not included in these regressions.

Regressors	(a)	(b)	(c)	(d)	(e)
$Fraction\ of\ value\ added_{j,k}$	-0.888***	-0.889***	-0.398***	-0.305**	-0.274**
	(0.260)	(0.259)	(0.138)	(0.139)	(0.137)
$Bank\ development_k$	0.043**	0.035*	0.064***	0.053***	0.085***
	(0.018)	(0.018)	(0.016)	(0.019)	(0.022)
$External\ dependence_j \cdot Bank\ development_k$	0.047**	0.047**	0.012	0.008	0.009
	(0.024)	(0.024)	(0.017)	(0.018)	(0.019)
$Bank\ concentration_k$	-0.077***	-0.088***	-0.079***	-0.149***	0.243*
	(0.017)	(0.017)	(0.014)	(0.021)	(0.136)
$Squared\ bank\ concentration_k$					-0.367***
					(0.133)
$External\ dependence_j \cdot Bank\ concentration_k$	0.059**	0.060**	0.040***	0.048**	0.049**
	(0.030)	(0.029)	(0.015)	(0.021)	(0.021)
$Log\ of\ per\ capita\ GDP_k$	-0.016***	-0.016***	-0.023***	-0.025***	-0.028***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
$Stock\ market\ capitalization_k/GDP_k$		0.031***	0.023***	0.029***	0.020**
		(0.006)	(0.007)	(0.007)	(0.008)
$Accounting\ standards_k$			0.067***	0.109***	0.123***
			(0.024)	(0.027)	(0.029)
$Human\ capital_k$				0.004**	0.005**
				(0.002)	(0.002)
R^2	0.133	0.144	0.204	0.226	0.192
$Observations$	1150	1150	984	950	950
$Durbin-Wu-Hausman$	0.69	0.16	1.04	4.40**	7.27***

* indicates rejection of the null at the 10 percent significance level, ** indicates 5 percent significance level, and *** indicates 1 percent significance level.

Table VI
Tests of Robustness, Focusing on the Interaction of Bank Concentration and Young Firms' Financial Needs

The dependent variable in all regressions is the average (compounded) rate of growth of real value added for each industrial sector in each of the countries between 1980 and 1990. The fraction of value added is industry j's share of manufacturing value added in country k; external financial dependence refers to the borrowing needs of establishments *less* than ten years old. Banking development is the ratio of private domestic credit to GDP. Column (a) uses the three-bank ratio (as defined in the text) as a measure of banking concentration. In column (b) bank concentration is the rank of the three-bank ratio, column (c) uses a high-low concentration dummy, while column (d) has the five-bank concentration ratio. The high-low dummy is equal to one for the countries with a high value of concentration (≥ 0.7) and zero otherwise. Alternative estimation, with the dummy for countries below or above the median (0.57), yielded virtually unchanged results and is not reported in the table. Other regressors included are country dummies and industry dummies, but we do not report their coefficient estimates. Heteroskedasticity-consistent standard errors are reported in parentheses. The Durbin-Wu-Hausman statistic tests the null that the use of instrumental variables does not change the estimation outcome. We report IV estimates when the test is rejected at the 10 percent level or less. Instruments are: rule of law, legal origin, total GDP, and population.

	3-Bank	Rank	High/Low	5-Bank
Regressors	(a)	(b)	(c)	(d)
$Fraction\ of\ value\ added_{j,k}$	-0.905***	-0.906***	-0.903***	-0.903***
	(0.285)	(0.285)	(0.286)	(0.285)
$External\ dependence_j \cdot Bank\ development_k$	0.049**	0.046**	0.031*	0.045**
	(0.022)	(0.022)	(0.019)	(0.021)
$External\ dependence_j \cdot Bank\ concentration_k$	0.063**	0.088**	0.019*	0.085**
	(0.029)	(0.041)	(0.010)	(0.035)
R^2	0.288	0.287	0.286	0.288
$Observations$	1150	1150	1150	1150
$Durbin-Wu-Hausman$	0.48	0.41	0.73	0.22

* indicates rejection of the null at the 10 percent significance level, two asterisks indicates 5 percent significance level, and three asterisks indicates 1 percent significance level.

Table VII
Tests of Robustness, Continued

The dependent variable in all regressions is the average (compounded) rate of growth of real value added for each industrial sector in each country between 1980 and 1990. The fraction of value added is industry j's share of manufacturing in country k; external financial dependence refers to the borrowing needs of establishments *less* than ten years old. Banking development is the ratio of private domestic credit to GDP. Bank concentration is the three-bank ratio. Accounting standards is an index ranking the amount of disclosure of companies' annual reports for each country. Because of missing values in accounting standards, the inclusion of accounting standards in column (d) causes all records referring to the following countries to be dropped: Bangladesh, Costa Rica, Jordan, Kenya, Morocco, Pakistan, Sri Lanka, and Zimbabwe. Column (e) is our baseline regression (as in column (a) of Table VI), but we exclude the observations where the dependent variable was censored at growth = 100 percent per year. The regression in column (f) includes $High$, a dummy variable equal to one when a sector's external financial need is above the median (0.60). Other regressors included are country dummies and industry dummies, but we do not report their coefficient estimates. Heteroskedasticity-consistent standard errors are reported in parentheses. The Durbin-Wu-Hausman statistic tests the null hypothesis that the use of instrumental variables does not change the estimation outcome. We report IV estimates when the test is rejected at the 10 percent level or less. Instruments are: rule of law, legal origin, total GDP, and population.

	Omitted variables				Outliers	
Regressors	(a)	(b)	(c)	(d)	(e)	(f)
$Fraction\ of\ value\ added_{j,k}$	-0.887***	-0.914***	-0.905***	-0.296**	-0.816***	-0.905***
	(0.287)	(0.286)	(0.285)	(0.147)	(0.260)	(0.286)
$External\ dependence_j \cdot Bank\ development_k$		0.045**	0.028	0.005	0.033*	0.049**
		(0.022)	(0.030)	(0.012)	(0.017)	(0.023)
$External\ dependence_j \cdot Bank\ concentration_k$	0.048*	0.059**	0.058*	0.035**	0.036***	0.076***
	(0.026)	(0.029)	(0.033)	(0.014)	(0.014)	(0.028)
$External\ dependence_j \cdot Stock\ market_k/GDP_k$		0.012				
		(0.010)				
$External\ dependence_j \cdot Log\ of\ per\ capita\ GDP_k$			0.005			
			(0.005)			
$External\ dependence_j \cdot Accounting\ Standards_k$				0.032		
				(0.022)		
$High_j \cdot External\ dependence_j \cdot Bank\ concentration_k$						-0.017
						(0.038)
R^2	0.284	0.288	0.289	0.416	0.327	0.288
$Observations$	1150	1150	1150	984	1148	1150
$Durbin-Wu-Hausman$	0.69	0.45	0.58	0.00	0.14	0.50

* indicates rejection of the null at the 10 percent significance level, ** indicates 5 percent significance level, and *** indicates 1 percent significance level.

Table VIII
Regressions with Financial Needs of Old Establishments

The dependent variable in all regressions is the average (compounded) rate of growth of real value added for each industrial sector in each country between 1980 and 1990. In all regressions, the fraction of value added is industry j's share of manufacturing in country k; external financial dependence refers to the borrowing needs of establishments *more* than ten years old. Bank development is the ratio of private domestic credit to GDP. Bank concentration is the three-bank ratio. The first column is a regression of the entire sample; the second regression only considers sectors whose share of value added in manufacturing in their country is above the median, while the third column reports a regression of sectors whose share of value added is below the median. Other regressors included are country dummies and industry dummies, but we do not report their coefficient estimates. Heteroskedasticity-consistent standard errors are reported in parentheses. The Durbin-Wu-Hausman statistic tests the null that the use of instrumental variables does not change the estimation outcome. We report IV estimates when the test is rejected at the 10 percent level or less. Instruments are: rule of law, legal origin, total GDP, and population.

	All firms	Large sectors	Small sectors
Regressors	(a)	(b)	(c)
$Fraction\ of\ value\ added_{j,k}$	-0.898***	-0.661***	-5.945***
	(0.282)	(0.235)	(1.790)
$External\ dependence_j \cdot Bank\ development_k$	0.114***	0.303***	0.091**
	(0.037)	(0.108)	(0.045)
$External\ dependence_j \cdot Bank\ concentration_k$	0.100**	0.023	0.120*
	(0.048)	(0.090)	(0.066)
R^2	0.282	0.507	0.351
$Observations$	1112	535	577
$Durbin - Wu - Hausman$	0.60	2.56	0.08

* indicates rejection of the null at the 10 percent significance level, ** indicates 5 percent significance level, and *** indicates 1 percent significance level.

Table IX
Contestability, Under-Reporting, and State Ownership

The dependent variable in all columns is the average (compounded) rate of growth of real value added for each industrial sector in each country between 1980 and 1990. The fraction of value added is industry j's share of manufacturing in country k; external financial dependence refers to the borrowing needs of establishments *less* than ten years old. Bank development is the ratio of private domestic credit to GDP. Bank concentration is the three-bank ratio. High Foreign & High Bank Concentration is a dummy variable equal to one for countries with both a three-bank ratio *and* a foreign share of bank assets above their median. High Foreign & Low per-capita GDP is a dummy variable equal to one for countries below the median in per-capita GDP and above the median in the foreign bank share. State measures the share of assets of state-owned banks over total commercial bank assets. High State is a dummy variable equal to one if the share of state-owned banks is above 60 percent. Industry- and country-dummy variables are included in columns (a) through (d), but we do not report their coefficient estimates. In column (e) also per-capita GDP, stock market capitalization, and accounting standards are used as country controls (because the country dummies are excluded), but we do not report their estimates. Heteroskedasticity-consistent standard errors are reported in parentheses. The Durbin-Wu-Hausman statistic tests the null hypothesis that instrumental variables do not change the estimation outcome. We report IV estimates when the test is rejected at the 10 percent level or less. Instruments are: rule of law, legal origin, total GDP, and population.

	Contestability	Under-reporting	State ownership		
Regressors	(a)	(b)	(c)	(d)	(e)
$Fraction\ of\ value\ added_{j,k}$	-0.802**	-0.810**	-1.003***	-1.008***	-0.371***
	(0.335)	(0.334)	(0.364)	(0.366)	(0.137)
$Bank\ development_k$					0.020
					(0.020)
$Ext.\ dep._j \cdot Bank\ development_k$	0.030*	0.022	0.046*	0.034	0.011
	(0.017)	(0.018)	(0.024)	(0.023)	(0.020)
$Bank\ concentration_k$					-0.060***
					(0.015)
$Ext.\ dep._j \cdot Bank\ concentration_k$	0.044**	0.037**	0.048***	0.035**	0.041***
	(0.019)	(0.018)	(0.016)	(0.016)	(0.015)
$High\ Foreign\ \&\ High\ Bank\ Concentration_k \cdot Ext.\ dep._j$	-0.015				
	(0.027)				
$High\ Foreign\ \&\ Low\ per\ capita\ GDP_k \cdot Ext.\ dep._j$		-0.020			
		(0.027)			
$State_k$					0.014
					(0.011)
$Ext.\ dep._j \cdot State_k$				-0.035***	-0.023***
				(0.012)	(0.009)
$High\ State_k \cdot Ext.\ dep._j$			-0.056**		
			(0.025)		
R^2	0.253	0.253	0.238	0.236	0.173
$Observations$	952	952	741	741	635
$Durbin-Wu-Hausman$	1.57	0.36	0.27	0.38	2.29

* indicates rejection of the null at the 10 percent significance level, ** indicates 5 percent significance level, and *** indicates 1 percent significance level.

Table X
Bank Powers and Industry Concentration

The dependent variable in columns (a) through (c) is the average (compounded) rate of growth of real value added for each industrial sector in each country between 1980 and 1990. The dependent variable in columns (d)–(e) is growth in number of firms, and in columns (f)–(g) is growth in average firm size. The fraction of value added is industry j's share of manufacturing in country k; external financial dependence refers to the borrowing needs of establishments *less* than ten years old. Bank development is the ratio of private domestic credit to GDP. Bank concentration is the three-bank ratio. Bank powers is a measure of regulatory restrictions on bank activities in the 1990s. Heteroskedasticity-consistent standard errors are reported in parentheses. The Durbin-Wu-Hausman statistic tests the null that the use of instrumental variables does not change the estimation outcome. We report IV estimates when the test is rejected at the 10 percent level or less. Instruments are: rule of law, legal origin, total GDP, and population. Industry- and country-dummy variables are included in columns (a), (e), and (g), but we do not report their coefficient estimates. In columns (b), (c), (d) and (f), per-capita GDP, stock market capitalization, accounting standards, and bank development are used as country controls (because the country dummies are excluded), but we do not report their estimates.

	Bank powers			Growth in No.		Growth avg. size	
Regressors	(a)	(b)	(c)	(d)	(e)	(f)	(g)
$Fraction\ of\ value\ added_{j,k}$	-0.360**	-0.387***	-0.382***	0.038	-0.212	-0.572**	-0.940***
	(0.146)	(0.139)	(0.140)	(0.137)	(0.172)	(0.244)	(0.361)
$External\ dependence_j \cdot Bank\ development_k$	0.012	0.014	0.003	0.025	0.023	-0.010	0.005
	(0.012)	(0.017)	(0.018)	(0.020)	(0.015)	(0.015)	(0.017)
$Bank\ concentration_k$		-0.111***	-0.113***	-0.143***		0.015	
		(0.022)	(0.027)	(0.032)		(0.031)	
$External\ dependence_j \cdot Bank\ concentration_k$	0.039***	0.052**	0.036*	0.058**	0.048**	-0.009	0.021
	(0.015)	(0.021)	(0.021)	(0.029)	(0.021)	(0.026)	(0.018)
$Bank\ Powers_k$		-0.004					
		(0.005)					
$External\ dependence_j \cdot Bank\ Powers_k$	-0.001	0.000	-0.007				
	(0.005)	(0.005)	(0.005)				
$Bank\ concentration_k \cdot Bank\ Powers_k$			0.012				
			(0.014)				
R^2	0.381	0.203	0.200	0.074	0.442	0.207	0.444
Observations	1035	984	984	876	961	876	990
$Durbin - Wu - Hausman$	0.34	2.34*	4.03***	25.08***	4.47**	7.57***	2.52

* indicates rejection of the null at the 10 percent significance level, ** indicates 5 percent significance level, and *** indicates 1 percent significance level.