

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

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

## **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.

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 size 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 promotes the growth of those industries that are more in need of external finance by facilitating credit access to firms, especially younger ones. However, we also find evidence of a general deadweight loss associated with banking market concentration (i.e., affecting all industrial sectors indiscriminately), which instead depresses growth.

We believe 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 impacting negatively on growth. Pagano [23], 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 [20, 21] and Petersen and Rajan [24] 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 [15], 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 [11] 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 [29] 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 [21] 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. Yet the normative implications regarding the regulation of the banking industry are clearly of central importance to policy-making, a fact which provides a primary motivation for our study. 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.<sup>1</sup>

This paper contributes to the recent line of empirical research on financial intermediation and growth. Following the original contributions by Goldsmith [16], Gurley and Shaw [17], McKinnon [22] and Shaw [28], economists in recent years have returned to this problem. Among the newer contributions, King and Levine [18] 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

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<sup>1</sup>Petersen and Rajan [24] 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 in more concentrated banking markets firms are less credit constrained, and younger firms are charged lower loan rates. Shaffer [27], on the other hand, finds evidence on cross-sectional U.S. data that household income grows faster in markets with a higher number of banks. Our analysis differs from these contributions for the following reasons. First, we perform a cross-country study. Second, while the authors worked in a cross-sectional dimension, we also exploit cross-industry variability to better identify the effects of bank market power on growth. In addition, as we describe in greater detail in the paper, we also explore the role of the government in the banking sector, the impact of regulatory constraints on banks, market contestability and the relationship between bank concentration and industry concentration.

sector experienced faster growth in the following thirty years. Also using cross-country regression analysis, Levine and Zervos [19] make an important refinement by showing the joint, independent relevance for growth of both banks and capital markets. Meanwhile, Rajan and Zingales [25] render an innovative contribution to the field by using a cross-industry, cross-country data set. 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.<sup>2</sup> 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 uses the same methodological approach as Rajan and Zingales to test the importance of banking market structure for growth. We ask the following question: for a given level of development of the banking sector, what is the impact of bank concentration on industries' demand for external funding, and consequently, on their growth? 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 one should expect that firms in sectors especially dependent on external finance should suffer more, and therefore grow less, when faced with a concentrated banking sector. On the other hand, if bank concentration enhances the formation of lending relationships, then one should expect that precisely those firms in industries especially dependent on external finance should benefit more when faced with a concentrated banking sector. We therefore test whether industries that are highly dependent on external finance will grow relatively slower or faster in countries where the banking sector is more concentrated.

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<sup>2</sup>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).

More precisely, 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 Rajan and Zingales data set provides separate information on 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, based on cross-country, cross-industry regression analysis, 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.

However, our empirical study does not end with the analysis of the effects of the interaction between bank concentration and firms' dependence on external finance. In contrast to Rajan and Zingales, we also evaluate a *first-order* effect of bank concentration on industry growth. Regardless of particular characteristics of firms and industrial sectors, we ask whether concentration *per se* has, on average, a positive or negative effect on growth.<sup>3</sup> We find that such effect *depresses* growth in all sectors indiscriminately.

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, resulting in a reduction in the total quantity of loanable funds, exactly as conventional wisdom would suggest. However, subjecting to more careful scrutiny

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<sup>3</sup>Rajan and Zingales did not really need to test the first-order effect of financial development, since this is what all other cross-country contributions had thoroughly analyzed before.

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 2 and 3 contain the illustration of the two models used for hypothesis testing. In section 4 we describe the data set. The results for the basic model specification are presented in section 5, while section 6 contains a battery of robustness tests. Section 7 presents the results for the extended model, where we estimate the first-order effect of bank concentration. In section 8 we present various refinements of the analysis, while section 9 elaborates on the several policy implications associated with the results of our investigation and presents concluding remarks.

## 1 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. The positive effect derives, as we mentioned above, 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 [24], 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.

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 8.

## 2 Basic Model

The first model we test empirically extends the Rajan and Zingales specification. We write our basic growth equation as,

$$\begin{aligned}
 Growth_{j,k} &= Constant + \beta_1 \cdot Country\ Indicators & (1) \\
 &+ \beta_2 \cdot Industry\ Indicators \\
 &+ \beta_3 \cdot Industry\ share\ of\ manufacturing\ value\ added_{j,k} \\
 &+ \beta_4 \cdot (External\ dependence_j \cdot Bank\ development_k) \\
 &+ \beta_5 \cdot (External\ dependence_j \cdot Bank\ concentration_k) \\
 &+ Error_{j,k},
 \end{aligned}$$

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. Bold coefficients indicate vectors.

The indicator variables correct for country- and industry-specific characteristics, thus allowing the isolation of any effect specifically associated with the development of the banking sector and, more importantly for us, its market structure.

The  $j$  industries in the data set all belong to manufacturing.<sup>4</sup> Similar to the role played by income per capita 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 the so-called “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,  $\beta_3$  is expected to have a negative sign.

External dependence measures the external financial needs of firms in a specific industry  $j$ . As anticipated in the introduction, we focus on the external financial needs of younger firms (those less than 10 years old). For comparison, we also present results regarding more mature firms.

The Rajan and Zingales conjecture predicts a positive sign for  $\beta_4$ : industries more in need of external funding will grow faster in countries with a more developed banking sector.

Finally, we add the interaction between external financial dependence and bank concentration. The focus of our empirical exploration is on the sign and significance of  $\beta_5$ . 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  $\beta_5$  is a priori ambiguous. In fact, one cannot rule out a priori the possibility that the two theoretical effects, although both existing, may actually cancel each other out, and

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<sup>4</sup>As Rajan and Zingales note, this is done “...in order to reduce the dependence on country-specific factors, like natural resources...” ([25, p. 567]).

thus encourage, in the event of statistically non-significant findings, a false rejection of the model. This is a potential problem for our analysis, since we would be unable to discern whether a non-significant finding should be interpreted as the result of two opposing effects, or whether we should conclude that bank concentration simply does not have any effect on the growth of specific categories of firms and sectors.<sup>5</sup>

Keeping this remark in mind, *any* finding of significance of  $\beta_5$ , whether positive or negative, should be interpreted as a strong finding in favor of either theoretical stance.

### 3 Extended model

The approach we have outlined so far enables us to identify an interaction effect of bank concentration with the external financing needs of younger firms. Such analysis does not allow us to learn about a possible first-order, direct effect of bank concentration on growth, that is, the effect that would result from including in equation (1) the *level* of bank concentration by itself.

It is possible that the negative effect of bank concentration would impact all firms in all sectors of production, *regardless* of firms' age or their degree of dependence from external funding. Therefore, the simultaneous estimation of both the first-order effect of bank concentration and the interaction with external financial dependence is an attempt to identify simultaneously the two separate effects.

The drawback of this procedure, however, is that bank concentration varies among countries but obviously has no variability across industries within a country. Therefore we cannot identify the direct effect using the specification of equation (1), which includes country indicator variables. In order to allow identification, and at the same time reduce the impact of country-specific effects, we modify the basic model by removing the country indicator variables and replacing them with a vector of control

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<sup>5</sup>It is worth noting, however, that even this second conclusion would have policy implications.

variables customarily used in cross-country growth studies.

The extended model specification is as follows:

$$\begin{aligned}
 Growth_{j,k} &= Constant + \gamma_1 \cdot Industry\ Indicators & (2) \\
 &+ \gamma_2 \cdot Controls_k \\
 &+ \gamma_3 \cdot Industry\ share\ of\ manufacturing\ value\ added_{j,k} \\
 &+ \gamma_4 \cdot Bank\ development_k \\
 &+ \gamma_5 \cdot (External\ dependence_j \cdot Bank\ development_k) \\
 &+ \gamma_7 \cdot Bank\ concentration_k \\
 &+ \gamma_8 \cdot (External\ dependence_j \cdot Bank\ concentration_k) \\
 &+ Error_{j,k}.
 \end{aligned}$$

In this extended specification of the model we have included the level of bank concentration, as well as the level of bank development. We focus on the sign and magnitude of both  $\gamma_7$  and  $\gamma_8$ . The vector of country control variables is described in greater detail in the presentation of the empirical results.

## 4 Data

The empirical analysis relies on our augmented version of the Rajan and Zingales data set.<sup>6</sup> 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 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.

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<sup>6</sup>The data set was kindly made available by the authors.

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” (see Rajan and Zingales [25, pp. 563–65] for details). The measure of bank development in their data set is the commonly used ratio between domestic credit to the private sector and GDP. 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 2).

We augment the data set to include indicators 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 1989–1996. For each country we have then computed the concentration ratios for every year in the sample for which there was exhaustive information (for some countries in some years, not all bank balance sheets were reported, thus making the computation unreliable). For each country we have then computed averages over time, which constitute our measures of bank concentration. Table 1 contains the list of countries in the data set and the corresponding indicators of bank concentration.

We were unable to find data going back earlier than 1989. Since the growth variable refers to the decade 1980–1990, 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 prior by analyzing for each country the pattern of variability of the concentration ratios calculated for the 1989–1996 period. We found that indeed such ratios are remarkably stable over time. For example, we

calculated the range for the 3-bank concentration ratio in each country. The cross-country median range of variation in the 1989–1996 period was only 3 percentage points. Even more telling, in about 70 percent of the countries (27 out of 41) the 3-bank ratio had a variation over time of less than 5 percentage points.<sup>7</sup> To our knowledge, there are no reasons to believe that such stability over the 1989–1996 period should not also be found in the contiguous 1980–1990 period.

Second, we follow the suggestion of Cameron [9], McKinnon [22] and Shaw [28], also highlighted in Bencivenga and Smith [4], that differences across countries in the market structure of the credit sector seem to depend primarily on legislation and government regulation. While government regulation of the financial sector certainly adjusts to economic conditions, it seems plausible that rigidities and lags in policy response make the assumption of exogeneity of the banking market structure acceptable in our case. We also present a test of endogeneity in section 8.

We also constructed the series of the rank of the 3-bank and the 5-bank concentration ratios. In other words, we allow for the possibility that the averages calculated over the 1989–1996 period are possibly different from the ones we would have calculated for the 1980–1990 period, but we require that countries keep their relative position in the ranking. This is a less stringent condition than requiring that concentration ratios remained unchanged. Finally, we calculate an indicator variable (high-low concentration) as an additional alternative to our 3-bank and 5-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 indicator constructed on 1989–1996 averages is very likely to be similar to the one we

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<sup>7</sup>As a term of comparison, the cross-country average 3-bank ratio in our sample is approximately 55 percent.

would have constructed for the 1980–1990 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.

## 5 Empirical results from the basic model

Table 4 reports in column (a) the results of the basic Rajan and Zingales specification, here reported as a benchmark, and then in column (b) the results for equation (1), using the 3-bank ratio as indicator of bank concentration. In both regressions the dependent variable is the average growth in value added for each sector in each country, and external financial dependence is that of the younger firms in the data set. Unless otherwise noted, the dependent variable and the indicator of external finance will remain the same in all of the following regressions.

In the first regression, as expected, the share of total value added in manufacturing is negative and significant, and the interaction between external dependence and bank development is positive and significant. In the second regression, the coefficients of these variables maintain the same sign and significance. In addition, the coefficient of the interaction between external financial dependence and bank concentration is positive and significant at the five percent level. In view of the discussion presented in section 2 regarding the potential cancelling out of two opposing effects of bank concentration, this finding suggests that the positive effect must be relatively strong. This result indicates that the positive impact of bank concentration on growth is not uniform across industries: some will benefit more than others. Consequently, bank concentration has an important redistributive effect across industries. We elaborate further on this point and the related policy implications in the following sections.

In order to gauge the economic significance of the bank concentration variable, we perform a standard comparative dynamics exercise. Specifically, we calculate 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. The growth differential effect is estimated to be about 1.2 percentage points on an annual basis.<sup>8</sup> Considering that the average growth over all sectors is 3.6 percent (see Table 2), this effect is actually rather large.

## 6 Robustness tests

### 6.1 Do the results depend on the choice of the concentration indicator?

We first check whether the 3-bank ratio calculated over the 1989–1996 period is an adequate indicator of concentration. In column (c) of Table 4, the concentration indicator is the rank of the 3-bank ratio, while in column (d) is the high-low concentration dummy for the 3-bank ratio.<sup>9</sup> In column (e) we use the 5-bank ratio, to check that the results would not depend on the arbitrary choice of computing the concentration indicator as the sum of the market shares of the top three banks only. The strong similarity of the results obtained with these alternative indicators suggests that the 3-bank ratio computed for the 1989–1996 period is a reliable indicator for our analysis.

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<sup>8</sup>According to our data, the sector at the 25th percentile of the distribution of external financial dependence for young firms is Wood Products, while the sector at the 75th percentile is Metal Products. Countries clustered at the 25th percentile of the distribution of the 3-bank concentration ratio are Brazil, India, Philippines and Turkey, while countries at the 75th percentile are Costa Rica, Pakistan, and Sweden. The analysis thus suggests that the Metal Products industry would grow 1.2 percentage points faster than the Wood Product industry, per year, in real terms in, say, Sweden as compared to Turkey.

<sup>9</sup>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. Winer [31], Calem and Carlino [8]). 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).

In what follows we therefore present regression results using the 3-bank concentration ratio calculated over the 1989–1996 period as our benchmark indicator of banking market structure.

## 6.2 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 5, show that the concentration variable remains positive and significant at the ten percent level.<sup>10</sup>

Subsequently, we check whether the bank concentration interaction variable is still significant after controlling for the relative importance of alternative sources of external finance. To the basic specification of the model we add 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 5, 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 4).

In column (c) of Table 5 we report the results of a regression where we add the interaction between external dependence and the logarithm of income per capita in 1980. There is a general 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 simple correlation between bank development and the income variable, 0.55 (reported in Table 3), may justify this concern. The coefficient of the bank concentration variable remains positive and is significant at the ten percent level. Confirming

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<sup>10</sup>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 [6, p. 322]) it is indeed confirmed that the omission of the bank development variable determines a downward bias on the coefficient of bank concentration.

the existence of some collinearity, the bank development and the income interaction terms have the expected sign but neither is significant.<sup>11</sup>

Finally, we add to the basic regression the interaction between external financial dependence and a measure of accounting standards, an index reflecting the standards of disclosure of firms' annual reports (see Rajan and Zingales for details [25, 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 theoretical argument for a positive role of bank monopoly power for growth suggests that such a role would be especially important if information costs were relevant. The expected sign for this term of interaction is positive. Column (d) in Table 5 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 0.032. The two coefficients, however, are not immediately comparable. As one can see from the table, by including the accounting standard variable the number of observations decreases substantially, from 1150 to 984. This is due to the fact that this variable is missing for eight countries.<sup>12</sup> Perhaps because of collinearity, the other two terms of interaction in the regression have the expected sign but are not significant.

### 6.3 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 coun-

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<sup>11</sup>If we run a baseline regression where we replace the bank development interaction term with the income level interaction term, the bank concentration variable maintains its sign, significance and magnitude as well.

<sup>12</sup>The eight countries are: Bangladesh, Costa Rica, Jordan, Kenya, Morocco, Pakistan, Sri Lanka, and Zimbabwe. If we run the baseline 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. We choose to present our basic results based on the larger sample, in order to minimize informational losses (8 countries out of 41 represent a rather significant 20%). Moreover, since the 8 countries are all developing countries, we want to avoid sample bias.

tries) or certain industrial sectors in particular countries, which could not be fully captured by the inclusions of the country and sector indicator variables. 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 1980–1990 period. To be sure, we run a regression dropping the censored observations altogether.<sup>13</sup> The results, reported in column (e) of Table 5, show that the bank concentration variable becomes significant at the 1 percent level, although with a smaller coefficient. The coefficient of the bank development interaction, significant now at the 10 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 redefined the bank concentration interaction term accordingly. The results of this regression are reported in column (f) of Table 5. 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.

## 6.4 Tests on mature firms

As a final round of exploration of the basic model specification, we investigate the role of bank concentration for the financial needs of the more mature firms in the data set, that is establishments more than 10 years old. One may expect that relationship lending would be less important for older, already well-established, firms. As we mentioned earlier, the external financial needs of this category of firms is indeed much lower than

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<sup>13</sup>We thank Rob Bliss for suggesting this additional robustness test.

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, if not negative, effect of bank concentration on industrial growth.

In the first column of Table 6 we report the results of the basic specification, this time calculating the terms of interaction using the external financial dependence of mature firms. The bank concentration term is still positive and significant. However, the 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. As reported above, the growth differential for young firms is instead 1.2 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 performed an additional test on mature firms, splitting the sample between those sectors in each country that had a share of value added in manufacturing *below* and those *above* the country median. Columns (b) and (c) of Table 6 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.

## 7 Results from the extended model: First- and second-order effects

In table 7 we report the results of regressions based on the specification in equation (2), in which we add one control variable at a time. The dependent variable is growth in value added, and external financial dependence is that of the younger firms. The country control variables are the logarithm of per capita income in 1980, stock market capitalization over GDP in 1980, the accounting standards indicator, and a measure of the level of human capital. The first three variables were described earlier. The level of human capital, another typical regressor in growth equations, is measured as average number of school years in population over 25 (as in Barro and Lee [1]). Of course, the level of bank development is an additional control variable itself.

All the control variables have the sign that one would expect to find in any cross-country growth equation.<sup>14</sup> The main result to highlight is that bank concentration by itself has a negative and significant coefficient, while the interaction term coefficient remains positive and significant. The two effects of bank concentration are robust to the inclusion of the various control variables.

The combined results, consistent with the theoretical priors, suggest that bank concentration has a direct negative effect on growth, which, on average, affects all sectors and all firms indiscriminately. At the same time, there is a positive and substantial effect of bank concentration through the role played in providing funds to firms in those sectors that are more in need of external finance.

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<sup>14</sup>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 indicator variables. Such regressor was not significant while all other coefficients were unchanged.

We evaluate the magnitude of the total, *net* effect of bank concentration on economic growth. More precisely, we calculate the effect on growth evaluated at the mean of the distribution of external financial dependence for young firms, if we went from a level of bank concentration at the 25th percentile to one at the 75th percentile of the distribution.<sup>15</sup> We perform this calculation based on the estimation results of the regressions in columns (b) and (d) of Table 7. The one in the second column has the highest number of controls that still allow the sample size to remain unchanged, with 1150 observations. The regression in the fourth column has the largest number of controls but the inclusion of accounting standards and human capital among the regressors brings the sample size down to 950 observations, with a loss of 9 of the original countries in the data set.<sup>16</sup> The net effect on growth based on the estimated coefficients in the second column regression is a negative 1.5 percentage points. The effect based on the estimated coefficients in the fourth column regression is instead a negative 2.3 percentage points.<sup>17</sup> We should not take these numbers at face value, since the extended model specification is more exposed to a potential omitted variable bias, due to the removal of the country-indicator variables. However, the overall evidence suggests that the net effect is, on average, negative, but what also matters is that for those sectors at the upper tail of the distribution of external financial dependence for young firms, the net effect is actually positive.<sup>18</sup>

We also add a squared term of bank concentration. As the results in column (e) of Table 7 show, this term is positive and significant, thus confirming that the

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<sup>15</sup>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.

<sup>16</sup>The inclusion of the human capital variable causes all records of one additional country, Egypt, to be dropped. See comments in footnote 12.

<sup>17</sup>There is a substantial difference in magnitude depending on which regression estimates we use. However, if we calculate a 95% confidence interval for the net effect on growth using either regression estimates, we obtain virtually identical boundaries for both regressions, with estimated magnitudes ranging between a negative 3.8–3.9 percentage points and a positive 0.8–0.9 percentage points.

<sup>18</sup>For example, based on the regression results in column (b), the net effect of bank concentration would be positive for sectors such as Glass, Professional goods and Drugs.

effect of bank concentration on industrial growth is non linear. Intuitively, at low levels of concentration there is a 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 the deadweight loss is high, but the benefits from relationship lending are at their maximum. There is an intermediate range of values of concentration that seems to yield the worst scenario, since there is substantial rent extraction but banks do not have enough market power to gain from relationship lending.

## 8 Refinements

### 8.1 Market contestability

Concentration ratios are widely used in empirical analysis to proxy for firms' conduct.<sup>19</sup> 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 [13]), and on the fraction of foreign banks over the total number of banks (taken from Claessens, Demirgüç-Kunt and Huizinga [10]). 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

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<sup>19</sup>Recent developments in empirical industrial organization have proposed alternative measures of market power, which could be used instead of the traditional concentration measures (see, e.g., Bresnahan [7]). 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.

foreign bank entry may not be credible in the absence of actual entry” (Claessens, Demirgüç-Kunt and Huizinga [10, 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 6 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 could be traced back to the experience of colonialism (Vittas [30]). Such restrictions are found in developed countries as well. For example, prior to 1993, countries that are now members of the European Union significantly restricted the entry of foreign banks. Such restrictions are still in place with respect to banks from non-EU countries.<sup>20</sup>

We generate a dummy variable equal to one for countries with both a 3-bank ratio *and* a foreign share of bank assets above their median. 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 a baseline regression where we add the product of the dummy with the concentration interaction term. The results, in column (a) of Table 8, show that the concentration interaction alone is still positive and significant, while the dummy is not. This suggests that even if the concentration indicator is biased upward in some countries, such bias is not driving the main findings.<sup>21</sup>

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<sup>20</sup>One can also argue that besides regulatory restrictions, informational barriers play an important 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 *et al.* [5]. 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 5 percent of total bank assets across country (ECB [14]).

<sup>21</sup>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

## 8.2 Under-reporting bias

We use data of foreign banking penetration to take into account another potential source of bias in the concentration variable. As we described in section 4, the concentration ratios are calculated using the IBCA data set. Such 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 [3] observe that “...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 address this problem, we generated 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 indicator is more likely to be biased due to under-reporting. We then ran regressions of the basic model specification, 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 8).<sup>22</sup>

## 8.3 Using measures of bank efficiency

We used interest margins and overhead costs as alternative indicators of bank conduct. Using cross-country data from Demirgüç-Kunt and Huizinga [12], we found that the concentration indicator is not correlated with either variable. We ran regressions using either one in place of bank concentration, but we did not find significant results. An explanation is that bank conduct is what we are really trying to proxy for. However, interest margins or overhead costs are measures of performance, which is determined share. Similar tests of robustness were also performed on the extended model specification. The results, available upon request, were in all instances qualitatively identical, indicating an effect of bank concentration on industrial growth robust to the issue of market contestability.

<sup>22</sup>The same results were obtained using the proportion of foreign banks in place of foreign share.

by structure and conduct, but also by other factors. In a cross-country analysis such idiosyncratic factors are very likely to be important determinants of bank performance. Hence, trying to trace back information on bank conduct via interest margins or overhead costs is likely to yield spurious results. That is, a relatively higher margin in one country does not necessarily imply relatively higher market power. Consistent with this argument, Demirgüç-Kunt and Huizinga [12] have performed a cross-country analysis of interest margins and overhead costs and found that in fact country-specific factors such as macroeconomic conditions, bank taxation, deposit insurance, legal structure, and other institutional indicators are very important in their determination. They also show that bank concentration, at cross-country level, is only mildly related to interest margins and to overhead costs.

## 8.4 State-owned banks

Another potential criticism to 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 [3] and Demirgüç-Kunt and Levine [13] have collected 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. Then we test for a non-linear response to the concentration interaction term in the cases 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 8). 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 baseline 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 8). Interestingly enough, in the extended model specification we also notice that the level of bank development turns insignificant when we control for the degree of state ownership (column (e) in Table 8).

## 8.5 Bank powers

The effect of bank monopoly power may differ depending on the regulatory environment in which banks operate in a country. As we mentioned in section 1, 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 [2] 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 1 (broadest powers) to 4 (narrowest powers). We add to the specification of the basic model an interaction between this measure of bank powers and financial dependence, and both bank powers alone and the interaction to the extended model. In the basic model the bank concentration interaction remains highly significant, while the bank development interaction loses

significance. The bank powers interaction is not significant (column (a) of Table 9).<sup>23</sup>

In the extended model both bank concentration alone and the interaction are highly significant while the bank powers variables are not significant (column (b) of Table 9). As an additional test on the extended model we also include an interaction of the level of bank concentration with bank powers, to see if the first-order negative effect of concentration on industrial growth differs across countries with different regulatory restrictions. The result (column (c), Table 9) shows that this interaction is negative and significant. In terms of magnitude, however, the total first-order effect is unchanged.<sup>24</sup> Nevertheless, this is a refinement of our analysis. Specifically, the result suggests that the deadweight loss from bank concentration is strongest in countries with the most constrained regulatory environment.

## 8.6 Endogeneity

In light of our results, one could argue that bank concentration could endogenously adjust to a level optimal for each 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.<sup>25</sup> Moreover, even with the best intentions, the market structure of the banking sector is a favorite policy variable for reasons not necessarily

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<sup>23</sup>We also generate a dummy variable equal to 1 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.

<sup>24</sup>The coefficient of bank concentration alone goes from -0.08 to -0.04, but adding the product of the coefficient of the interaction between concentration and bank powers with the mean of bank powers, 2.5, we are back to approximately -0.08.

<sup>25</sup>Rajan and Zingales [26] extensively elaborate on this argument.

related to industry growth.<sup>26</sup> 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 arguments, we address the issue of endogeneity using instrumental variables estimation. We begin by noticing that bank concentration should be negatively correlated with market size. As a proxy of market size we use total GDP (in US dollars) and confirm the existence of a negative and significant correlation with bank concentration (we also use population and geographical size as alternative proxies, with similar results). Then we use the market size variable as an instrument, finding that the concentration interaction term is still positive and significant.<sup>27</sup> This result is reported in column (d) of Table 9.

## 8.7 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).<sup>28</sup> Since we measure industrial growth in terms of value added, under such 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

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<sup>26</sup>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.

<sup>27</sup>We also tested that bank concentration is not just capturing a market size effect by adding to the basic model regression an interaction between total GDP and external financial dependence. The results, not reported in the paper, show bank concentration still significant while the market size interaction term not significant.

<sup>28</sup>In his study of Italian industrialization at the turn of the past century, Cohen [11] 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” (page 363).

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, we should find a negative relationship between the concentration-dependence interaction and growth in the number of establishments in those sectors that are more dependent on external finance. By the same token, we should find a positive association with growth in the average size of existing establishments.

We run regressions with growth in number of establishments as the dependent variable in both model specifications. The results in column (e) of Table 9 show that the concentration-dependence interaction is positive, but not significant in the basic model specification. Column (f) shows that the interaction is positive and significant in the extended model specification and the level of concentration is negative and significant. We calculate the net magnitude effect on growth in the number of establishments of going from a country at the 25th percentile to one at the 75th percentile in the distribution of bank concentration. For the sectors that are more financially dependent the net effect is positive.

We then use growth in average size as the dependent variable. The results of these regressions are reported in columns (g) and (h) of Table 9. In both model specifications the interaction term is never significant. In the extended model the level of bank concentration is negative and significant. Overall, the evidence does not support the argument that bank concentration may enhance industry concentration. The results also provide support for the contention that growth in value added is a good proxy for growth in output.

## 9 Concluding remarks and policy implications

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 banking 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 attributes.

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, on average, in a lower amount of credit available to firms. 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, which 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 findings suggest several important policy considerations. The first one is that, 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, regulation of the financial industry is intimately related to industrial policy. As we have shown, depending on the level of concentration of the banking industry, *ceteris*

paribus, individual sectors will grow at different speeds. Therefore, banking market structure plays an important role in shaping the cross-industry size distribution within a country. Related to this consideration, 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, regulators face an unexpected trade-off between the generally desirable effects of bank competition and the promotion of technological progress.

Additional policy implications follow from some of the refinements in section 8. We gain important policy insights, for example, from the analysis of the role of the government in the banking sector. If the results of this paper suggest a positive role of bank concentration for the development of certain industrial sectors, we also see that such role disappears in countries with a significant proportion of state-owned banks. An additional policy implication, with a broader scope than the one of the paper, is that actually even the mere size of the banking sector loses importance for economic growth. None of these results thus support the implementation of policies of “nationalization” of the banking industry.

Similarly relevant is the insight we can gain on the indirect role of regulatory restrictions on banks’ activity for economic growth. The results from the data suggest that broadening bank powers, thus allowing them to write equity contracts and to own non-financial firms, does not seem to diminish the importance of bank concentration to establish lending relationships, while it reduces banks rent extraction ability. If the policy maker intends to enhance the growth of sectors highly dependent on external finance, then a proper combination of regulatory measures would be to favor bank concentration and expand bank powers. A more thorough exploration of these issues, however, goes beyond the scope of the paper and is left for future research.

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Table 1: LIST OF COUNTRIES AND BANK CONCENTRATION RATIOS

| 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   |

NOTE: 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.

Table 2: DESCRIPTIVE STATISTICS OF DATA SET

| Variable   | Num. Obs | Mean     | Std. Dev. | Min    | Max    |
|--|----------|----------|-----------|--------|--------|
| <i>Growth in value added<sub>j</sub></i>                                 | 1150     | 0.036    | 0.092     | -0.447 | 1.000  |
| <i>Growth in average size<sub>j</sub></i>                                | 1100     | 0.020    | 0.102     | -0.093 | 0.410  |
| <i>Growth in number<sub>j</sub></i>                                      | 1169     | 0.014    | 0.079     | -0.414 | 0.944  |
| <i>Fraction of value added<sub>j,k</sub></i>                             | 1191     | 0.015    | 0.021     | 0.000  | 0.224  |
| <i>3 – bank ratio<sub>k</sub></i>  | 1333     | 0.552    | 0.180     | 0.210  | 0.870  |
| <i>5 – bank ratio<sub>k</sub></i>  | 1333     | 0.705    | 0.186     | 0.320  | 0.990  |
| <i>External dependence all<sub>j</sub></i>                               | 1333     | 0.348    | 0.379     | -0.146 | 1.491  |
| <i>External dependence young<sub>j</sub></i>                             | 1333     | 0.671    | 0.633     | -1.534 | 2.058  |
| <i>External dependence old<sub>j</sub></i>                               | 1293     | 0.022    | 0.300     | -1.330 | 0.394  |
| <i>Accounting standards<sub>k</sub></i>                                  | 1082     | 0.612    | 0.134     | 0.240  | 0.830  |
| <i>Bank development<sub>k</sub></i>                                      | 1333     | 0.376    | 0.198     | 0.069  | 0.856  |
| <i>Log per capita GDP<sub>1980,k</sub></i>                               | 1333     | 7.868    | 1.334     | 4.793  | 9.572  |
| <i>Stock market capitalization<sub>1980,k</sub>/GDP<sub>1980,k</sub></i> | 1333     | 0.204    | 0.300     | 0.000  | 1.624  |
| <i>Human capital<sub>1980,k</sub></i>                                    | 1279     | 6.050    | 2.812     | 1.681  | 12.140 |
| <i>Interest margin<sub>k</sub></i>                                       | 1442     | 3.889    | 2.419     | 1.400  | 13.600 |
| <i>Overhead costs<sub>k</sub></i>  | 1442     | 3.654    | 2.208     | 1.300  | 10.200 |
| <i>Bank powers<sub>k</sub></i>   | 1363     | 2.171    | 0.642     | 1.000  | 3.500  |
| <i>Foreign bank share<sub>k</sub></i>                                    | 1283     | 0.116    | 0.147     | 0.000  | 0.620  |
| <i>No. of foreign banks<sub>1980,k</sub></i>                             | 1479     | 0.258    | 0.187     | 0.000  | 0.850  |
| <i>State share<sub>k</sub></i>   | 1011     | 0.334    | 0.325     | 0.000  | 0.980  |
| <i>Population<sub>1997,k</sub></i>                                       | 1584     | 71.545   | 149.282   | 3.000  | 962    |
| <i>Surface<sub>k</sub></i>   | 1584     | 1326.462 | 2494.251  | 1.000  | 9971   |
| <i>Total GDP<sub>1997,k</sub></i>  | 1584     | 585.202  | 1378.334  | 4.000  | 7783   |

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  $k$ ; 3-bank and 5-bank are the concentration ratios of the banking sector of each country as explained in table 1; 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 school attained by the population over 25 years of age. Interest margin is banks' net interest income divided by total assets (1988–95). Overhead costs is the ratio of banks' overhead costs to total assets (1988–95). 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 (1988–95). Number of foreign banks is the ratio of the number of foreign banks to the total number of banks (1988–95). State share is the share of assets of state-owned banks over total commercial bank assets. Total GDP is in 1997 US dollars calculated using the World Bank Atlas method.

Table 3: CORRELATIONS BETWEEN CONCENTRATION INDICATORS AND SELECTED VARIABLES

| Variables  | <i>Stock</i> | <i>GDP</i> | <i>Accounting</i> | <i>Bank</i> | <i>3 – Bank</i> | <i>5 – Bank</i> |
|--|--------------|------------|-------------------|-------------|-----------------|-----------------|
| <i>Stock market</i> <sub>1980,k</sub> / <i>GDP</i> <sub>1980,k</sub> | 1.000        |            |                   |             |                 |                 |
| <i>Log per capita GDP</i> <sub>1980,k</sub>                          | 0.160*       | 1.000      |                   |             |                 |                 |
| <i>Accounting standards</i> <sub>k</sub>                             | 0.441*       | 0.573*     | 1.000             |             |                 |                 |
| <i>Bank development</i> <sub>k</sub>                                 | 0.174*       | 0.553*     | 0.243*            | 1.000       |                 |                 |
| <i>3 – bank ratio</i> <sub>k</sub>                                   | 0.177*       | -0.092     | 0.182*            | -0.228*     | 1.000           |                 |
| <i>5 – bank ratio</i> <sub>k</sub>                                   | 0.242*       | -0.048*    | 0.235*            | -0.264*     | 0.970*          | 1.000           |

| Variables                            | <i>Interest</i> | <i>Overhead</i> | <i>State</i> | <i>Foreign</i> | <i>Powers</i> | <i>3 – bank</i> |
|--------------------------------------|-----------------|-----------------|--------------|----------------|---------------|-----------------|
| <i>Interest margin</i> <sub>k</sub>  | 1.000           |                 |              |                |               |                 |
| <i>Overhead costs</i> <sub>k</sub>   | 0.847*          | 1.000           |              |                |               |                 |
| <i>State ownership</i> <sub>k</sub>  | 0.066           | 0.098           | 1.000        |                |               |                 |
| <i>Foreign presence</i> <sub>k</sub> | 0.245*          | 0.395*          | -0.023       | 1.000          |               |                 |
| <i>Bank powers</i> <sub>k</sub>      | 0.352*          | 0.317*          | -0.049       | 0.240*         | 1.000         |                 |
| <i>3 – bank ratio</i> <sub>k</sub>   | 0.024           | -0.020          | -0.132*      | 0.125*         | -0.250*       | 1.000           |

NOTE: An asterisk indicates that the correlation is different from zero at the 1% significance level.

Table 4: BANK CONCENTRATION, YOUNG FIRMS' FINANCIAL NEEDS, AND GROWTH IN VALUE ADDED

| Regressors  | Rajan-Zingales       | 3-Bank               | Rank                 | High/Low             | 5-Bank               |
|---|----------------------|----------------------|----------------------|----------------------|----------------------|
|   | (a)                  | (b)                  | (c)                  | (d)                  | (e)                  |
| <i>Fraction of value added<sub>j,k</sub></i>                            | -0.904***<br>(0.286) | -0.905***<br>(0.285) | -0.906***<br>(0.285) | -0.903***<br>(0.286) | -0.903***<br>(0.285) |
| <i>External dependence<sub>j</sub> · Bank development<sub>k</sub></i>   | 0.034*<br>(0.019)    | 0.049**<br>(0.022)   | 0.046**<br>(0.022)   | 0.031*<br>(0.019)    | 0.045**<br>(0.021)   |
| <i>External dependence<sub>j</sub> · Bank concentration<sub>k</sub></i> |                      | 0.063**<br>(0.029)   | 0.088**<br>(0.041)   | 0.019*<br>(0.010)    | 0.085**<br>(0.035)   |
| $R^2$   | 0.283                | 0.288                | 0.287                | 0.286                | 0.288                |
| <i>Observations</i>   | 1150                 | 1150                 | 1150                 | 1150                 | 1150                 |

NOTE: 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) reproduces one of the original regressions from Rajan and Zingales. Column (b) uses the 3-bank ratio (as defined in the text) as a measure of banking concentration. In column (c) bank concentration is the rank of the 3-bank ratio, column (d) uses a high-low concentration dummy, while column (e) has the 5-bank concentration ratio. The high-low dummy is equal to one for the countries with a high value of concentration ( $\geq 0.7$ ) 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 indicators and industry indicators, but we do not report their coefficient estimates. Other regressors included are country indicators and industry indicators, but we do not report their coefficient estimates. Heteroskedasticity-consistent standard errors are reported in parentheses. One asterisk states that the variable is significant at the 10% level, two asterisks indicate significance at the 5% level, and three asterisks indicate 1% significance level.

Table 5: TESTS OF ROBUSTNESS

| Regressors  | Introducing more regressors |                      |                      |                     | Outliers             |                      |
|---|-----------------------------|----------------------|----------------------|---------------------|----------------------|----------------------|
|   | (a)                         | (b)                  | (c)                  | (d)                 | (e)                  | (f)                  |
| <i>Fraction of value added<sub>j,k</sub></i>  | -0.887***<br>(0.287)        | -0.914***<br>(0.286) | -0.905***<br>(0.285) | -0.296**<br>(0.147) | -0.816***<br>(0.260) | -0.905***<br>(0.286) |
| <i>External dependence<sub>j</sub> · Bank development<sub>k</sub></i>                       |                             | 0.045**<br>(0.022)   | 0.028<br>(0.030)     | 0.005<br>(0.012)    | 0.033*<br>(0.017)    | 0.049**<br>(0.023)   |
| <i>External dependence<sub>j</sub> · Bank concentration<sub>k</sub></i>                     | 0.048*<br>(0.026)           | 0.059**<br>(0.029)   | 0.058*<br>(0.033)    | 0.035**<br>(0.014)  | 0.036***<br>(0.014)  | 0.076***<br>(0.028)  |
| <i>External dependence<sub>j</sub> · Stock market<sub>1980,k</sub>/GDP<sub>1980,k</sub></i> |                             | 0.012<br>(0.010)     |                      |                     |                      |                      |
| <i>External dependence<sub>j</sub> · Log of per capita GDP<sub>1980,k</sub></i>             |                             |                      | 0.005<br>(0.005)     |                     |                      |                      |
| <i>External dependence<sub>j</sub> · Accounting Standards<sub>k</sub></i>                   |                             |                      |                      | 0.032<br>(0.022)    |                      |                      |
| <i>High<sub>j</sub> · External dependence<sub>j</sub> · Bank concentration<sub>k</sub></i>  |                             |                      |                      |                     |                      | -0.017<br>(0.038)    |
| <i>R<sup>2</sup></i>  | 0.284                       | 0.288                | 0.289                | 0.416               | 0.327                | 0.288                |
| <i>Observations</i>   | 1150                        | 1150                 | 1150                 | 984                 | 1148                 | 1150                 |

NOTE: 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 3-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 (b) of table 4), but we exclude the observations where the dependent variable was censored at growth = 100% 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 indicators and industry indicators, but we do not report their coefficient estimates. Heteroskedasticity-consistent standard errors are reported in parentheses. One asterisk states that the variable is significant at the 10% level, two asterisks indicate significance at the 5% level, and three asterisks indicate 1% significance level.

Table 6: REGRESSIONS WITH FINANCIAL NEEDS OF OLD ESTABLISHMENTS

| Regressors  | All firms            | Above median         | Below median         |
|---|----------------------|----------------------|----------------------|
|   | (a)                  | (b)                  | (c)                  |
| <i>Fraction of value added<sub>j,k</sub></i>                            | -0.898***<br>(0.282) | -0.661***<br>(0.235) | -5.945***<br>(1.790) |
| <i>External dependence<sub>j</sub> · Bank development<sub>k</sub></i>   | 0.114***<br>(0.037)  | 0.303***<br>(0.108)  | 0.091**<br>(0.045)   |
| <i>External dependence<sub>j</sub> · Bank concentration<sub>k</sub></i> | 0.100**<br>(0.048)   | 0.023<br>(0.090)     | 0.120*<br>(0.066)    |
| $R^2$   | 0.282                | 0.507                | 0.351                |
| <i>Observations</i>   | 1112                 | 535                  | 577                  |

NOTE: 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 3-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 indicators and industry indicators, but we do not report their coefficient estimates. Heteroskedasticity-consistent standard errors are reported in parentheses. One asterisk states that the variable is significant at the 10% level, two asterisks indicate significance at the 5% level, and three asterisks indicate 1% significance level.

Table 7: ESTIMATION OF THE TOTAL EFFECT OF BANK CONCENTRATION ON INDUSTRIAL GROWTH

| Regressors   | (a)                  | (b)                  | (c)                  | (d)                  | (e)                  |
|--|----------------------|----------------------|----------------------|----------------------|----------------------|
| <i>Fraction of value added<sub>j,k</sub></i>                             | -0.888***<br>(0.260) | -0.889***<br>(0.259) | -0.398***<br>(0.138) | -0.337**<br>(0.136)  | -0.354**<br>(0.138)  |
| <i>Bank development<sub>k</sub></i>                                      | 0.043**<br>(0.018)   | 0.035*<br>(0.018)    | 0.064***<br>(0.016)  | 0.066***<br>(0.016)  | 0.045**<br>(0.018)   |
| <i>External dependence<sub>j</sub> · Bank development<sub>k</sub></i>    | 0.047**<br>(0.024)   | 0.047**<br>(0.024)   | 0.012<br>(0.017)     | 0.007<br>(0.017)     | 0.007<br>(0.017)     |
| <i>Bank concentration<sub>k</sub></i>                                    | -0.077***<br>(0.017) | -0.088***<br>(0.017) | -0.079***<br>(0.014) | -0.105***<br>(0.015) | -0.347***<br>(0.072) |
| <i>Squared bank concentration<sub>k</sub></i>                            |                      |                      |                      |                      | 0.225***<br>(0.065)  |
| <i>External dependence<sub>j</sub> · Bank concentration<sub>k</sub></i>  | 0.059**<br>(0.030)   | 0.060**<br>(0.029)   | 0.040***<br>(0.015)  | 0.042***<br>(0.016)  | 0.041***<br>(0.016)  |
| <i>Log of per capita GDP<sub>1980,k</sub></i>                            | -0.016***<br>(0.003) | -0.016***<br>(0.003) | -0.023***<br>(0.003) | -0.025***<br>(0.004) | -0.023***<br>(0.004) |
| <i>Stock market capitalization<sub>1980,k</sub>/GDP<sub>1980,k</sub></i> |                      | 0.031***<br>(0.006)  | 0.023***<br>(0.007)  | 0.023***<br>(0.008)  | 0.029***<br>(0.008)  |
| <i>Accounting standards<sub>k</sub></i>                                  |                      |                      | 0.067***<br>(0.024)  | 0.119***<br>(0.027)  | 0.110***<br>(0.028)  |
| <i>Human capital<sub>k</sub></i>   |                      |                      |                      | 0.002<br>(0.002)     | 0.001<br>(0.002)     |
| <i>R<sup>2</sup></i>   | 0.133                | 0.144                | 0.204                | 0.232                | 0.238                |
| <i>Observations</i>  | 1150                 | 1150                 | 984                  | 950                  | 950                  |

NOTE: 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 3-bank ratio. Human capital is the average for 1980 of the years of school attained by the population over 25 years of age. As mentioned in the note to table 5, 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. Industry indicator variables are included in all regressions, but we do not report their coefficient estimates. Note that country indicator variables are not included in these regressions. One asterisk states that the variable is significant at the 10% level, two asterisks indicate significance at the 5% level, and three asterisks indicate 1% significance level.

Table 8: REFINEMENTS: CONTESTABILITY, UNDER-REPORTING, AND STATE OWNERSHIP

| Regressors   | Contestability      | Under-reporting     | State ownership      |                      |                      |
|--|---------------------|---------------------|----------------------|----------------------|----------------------|
|  | (a)                 | (b)                 | (c)                  | (d)                  | (e)                  |
| <i>Fraction of value added<sub>j,k</sub></i>                               | -0.802**<br>(0.335) | -0.810**<br>(0.334) | -1.003***<br>(0.364) | -1.008***<br>(0.366) | -0.371***<br>(0.137) |
| <i>Ext. dep.<sub>j</sub> · Bank development<sub>k</sub></i>                | 0.030*<br>(0.017)   | 0.022<br>(0.018)    | 0.046*<br>(0.024)    | 0.034<br>(0.023)     | 0.011<br>(0.020)     |
| <i>Ext. dep.<sub>j</sub> · Bank concentration<sub>k</sub></i>              | 0.044**<br>(0.019)  | 0.037**<br>(0.018)  | 0.048***<br>(0.016)  | 0.035**<br>(0.016)   | 0.041***<br>(0.015)  |
| <i>Bank concentration<sub>k</sub></i>                                      |                     |                     |                      |                      | -0.060***<br>(0.015) |
| <i>High Foreign&amp;High Bk. Conc.<sub>k</sub> · Ext. dep.<sub>j</sub></i> | -0.015<br>(0.027)   |                     |                      |                      |                      |
| <i>High Foreign&amp;High P.C. GDP<sub>k</sub> · Ext. dep.<sub>j</sub></i>  |                     | -0.020<br>(0.027)   |                      |                      |                      |
| <i>High State<sub>k</sub> · Ext. dep.<sub>j</sub></i>                      |                     |                     | -0.056**<br>(0.025)  |                      |                      |
| <i>External dependence<sub>j</sub> · State<sub>k</sub></i>                 |                     |                     |                      | -0.035***<br>(0.012) | -0.023***<br>(0.009) |
| <i>State<sub>k</sub></i>   |                     |                     |                      |                      | 0.014<br>(0.011)     |
| <i>Observations</i>  | 952                 | 952                 | 741                  | 741                  | 635                  |
| <i>R<sup>2</sup></i>   | 0.253               | 0.253               | 0.238                | 0.236                | 0.173                |

NOTE: 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 3-bank ratio. High Foreign&High Bank Concentration is a dummy variable equal to one for countries with both a 3-bank ratio and a foreign share of bank assets above their median. High Foreign&High 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%. Industry- and country-indicator variables are included in columns (a) through (d), but we do not report their coefficient estimates. In column (e) per-capita GDP, stock market capitalization, accounting standards, and bank development are used as country controls (because the country indicators are excluded), but we do not report their estimates. Heteroskedasticity-consistent standard errors are reported in parentheses. One asterisk states that the variable is significant at the 10% level, two asterisks indicate significance at the 5% level, and three asterisks indicate 1% significance level.

Table 9: REFINEMENTS: ENDOGENEITY, INDUSTRY CONCENTRATION, AND BANK POWERS

| Regressors  | Bank powers         |                      |                      | IV                   | Growth in No.      |                    | Growth avg. size    |                     |
|---|---------------------|----------------------|----------------------|----------------------|--------------------|--------------------|---------------------|---------------------|
|   | (a)                 | (b)                  | (c)                  | (d)                  | (e)                | (f)                | (g)                 | (h)                 |
| <i>Fraction of value added<sub>j,k</sub></i>                            | -0.360**<br>(0.146) | -0.400***<br>(0.139) | -0.413***<br>(0.139) | -0.906***<br>(0.285) | -0.14<br>(0.165)   | 0.012<br>(0.126)   | -0.876**<br>(0.379) | -0.564**<br>(0.240) |
| <i>External dependence<sub>j</sub> · Bank development<sub>k</sub></i>   | 0.012<br>(0.012)    | 0.011<br>(0.015)     | 0.018<br>(0.015)     | 0.057**<br>(0.025)   | 0.029**<br>(0.014) | 0.022<br>(0.017)   | 0.005<br>(0.017)    | -0.008<br>(0.021)   |
| <i>External dependence<sub>j</sub> · Bank concentration<sub>k</sub></i> | 0.039***<br>(0.015) | 0.039**<br>(0.017)   | 0.045***<br>(0.017)  | 0.097***<br>(0.034)  | 0.022<br>(0.017)   | 0.035*<br>(0.020)  | 0.02<br>(0.016)     | 0.001<br>(0.020)    |
| <i>Bank concentration<sub>k</sub></i>                                   |                     | -0.081***<br>(0.016) | -0.048**<br>(0.022)  |                      |                    | -0.035*<br>(0.019) |                     | -0.050**<br>(0.020) |
| <i>External dependence<sub>j</sub> · Bank Powers<sub>k</sub></i>        | -0.001<br>(0.005)   | -0.001<br>(0.005)    | 0.005<br>(0.005)     |                      |                    |                    |                     |                     |
| <i>Bank Powers<sub>k</sub></i>  |                     | -0.002<br>(0.005)    |                      |                      |                    |                    |                     |                     |
| <i>Bank concentration<sub>k</sub> · Bank Powers<sub>k</sub></i>         |                     |                      | -0.020*<br>(0.012)   |                      |                    |                    |                     |                     |
| <i>Observations</i>   | 1035                | 984                  | 984                  | 1150                 | 1015               | 892                | 991                 | 876                 |
| <i>R<sup>2</sup></i>  | 0.381               | 0.205                | 0.207                | 0.287                | 0.443              | 0.119              | 0.42                | 0.217               |

NOTE: The dependent variable in columns (a) through (d) 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 (e)–(f) is growth in number of firms, and in columns (g)–(h) 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 3-bank ratio. Bank powers is a measure of regulatory restrictions on bank activities in the 1990s. Column (d) is an instrumental-variables estimation, where total GDP is the instrument for bank concentration. Heteroskedasticity-consistent standard errors are reported in parentheses. Industry- and country-indicator variables are included in columns (a), (d), (e), and (g), but we do not report their coefficient estimates. In columns (b), (c), (f), and (h), per-capita GDP, stock market capitalization, accounting standards, and bank development are used as country controls (because the country indicators are excluded), but we do not report their estimates. One asterisk states that the variable is significant at the 10% level, two asterisks indicate significance at the 5% level, and three asterisks indicate 1% significance level.