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Does Bank Concentration Lead to Concentration in Industrial Sectors?

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Abstract

This paper explores the effect of banking market structure on the market structure of industrial sectors. It asks whether concentration in the banking market promotes the formation of industries constituted by a few, large firms, or rather, whether it facilitates the continuous entry of new firms, thus maintaining unconcentrated market structures across industries. Theoretical arguments could be made to support either hypotethical scenario. Empirical evidence is derived from a sample of 35 manufacturing industries in 17 OECD countries, adopting a methodology that allows controlling for other determinants of industry market structure common across industries or across countries. Bank concentration is found to enhance industries' market concentration, especially in sectors highly dependent on external finance. Such effect is however weaker in countries characterized by higher overall financial development.

JEL Classification Codes: L2, G2, G3

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1 Introduction

Recently, the economic role of banking market power has been the subject of analysis of a significant number of both theoretical and empirical contributions. Challenging the customary view that competition in the banking industry is unequivocally beneficial to social welfare, authors have suggested that concentration of market power may in fact enhance the role of banks as information producers in their lending activity and their willingness to establish close lending relationships with their client firms.

The empirical literature has been directed mainly at the effects of bank concentration on growth performances, either of industrial sectors or of the economy at large.[1] This paper explores empirically a new dimension of analysis by investigating the effect of bank concentration on the *market structure* of industrial sectors. Does concentration of market power in the banking industry lead banks to concentrate funding toward a few firms of large size, or rather, does bank concentration foster entry of new firms over the life cycle of an industry, thus contributing to the maintenance of an unconcentrated market structure?

Empirical evidence has been gathered on the effect of bank concentration on average firm size in 35 manufacturing sectors in 17 OECD countries. It shows that the average size of firms in sectors more dependent on external sources of finance is disproportionately larger in countries with a more concentrated banking industry. The evidence also indicates that such effect is heterogeneous across countries, with the effect being weaker in countries with stronger indicators of overall financial development.

The effect of banking market structure on the market structure of industrial sectors is not a priori obvious. Theoretical priors can be proposed suggesting effects working in either direction. For instance, Petersen and Rajan [21] argue that banks with market power facilitate access to credit to young and unknown firms knowing that they will be capable of extracting future rents from those firms that eventually become profitable. Extending this line of reasoning, one could then posit that, at later stages the bank may have an incentive to continue the lending relationship with the older clients while constraining the access to credit of new entrants, since, by increasing market competition, the newcomers would undermine the profitability of industry incumbents. This theoretical argument would then suggest that bank concentration should enhance industry concentration, especially in sectors that are at relatively more advanced stages along their life cycle. A separate line of argumentation, still leading to the same conclusion, would maintain that managers of banks in concentrated markets may have very close relationships with incumbent clients and may be lead by

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[1] Details on this literature are provided below.

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strategic decisions, not necessarily related to bank's own profit maximization, to continue support of incumbents at the expense of prospective entrants. Anecdotal corroboration to this proposition comes, for example, from Lamoreaux [16]'s historical analysis of New England banking through the nineteenth century, showing how in that period "kinship networks" regulated the flow of bank lending to entrepreneurs. Haber [13] observes a similar behavioral pattern among Mexican's banks in the late nineteenth century.

In direct contrast with this reasoning, one could argue that in fact banks' ultimate goal of profit maximization should lead to the opposite strategy of continuously favoring new entrants that, endowed with higher return projects and more innovative technologies, may replace the old incumbents and guarantee higher bank profits. According to this alternative hypothesis, bank concentration should then contribute to industry competition.

The effect of bank concentration on industry market structure is therefore theoretically ambiguous. Meanwhile, little empirical evidence exists to support either prior. Available historical studies, albeit limited by their focus on specific countries, periods and socio-institutional circumstances, give the general impression that bank concentration should be associated with concentrated industries. For example, in his study of Italian industrialization in the late nineteenth century, Cohen [9] describes 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". Capie and Rodrik-Bali [6], note that the intense process of consolidation that characterized British banking in the early 1890's clearly preceded that observed in other industrial sectors. In his work cited above, Haber [13] reports a very close connection between a highly concentrated Mexican banking sector and an equally highly concentrated textile industry. More generally, in his study on banking in early stages of industrialization, Cameron [4] states that "...Competition in banking is related to the question of competition in industry. In general the two flourish – and decline – together. Whether this phenomenon is a joint by-product of other circumstances, or whether it results from the decline or restriction of competition among banks, is a matter worthy of further research. It is a striking coincidence, in any case, that industrial structure–competitive, oligopolistic, or monopolistic–tends to mirror financial structure."

Informed by these historical references and by theoretical uncertainty, the goal of the study is then to derive broad empirical evidence which could corroborate either effect of bank concentration on industry concentration.

The paper contributes directly to the literature on the economic role of banking market structure. On the theoretical side, Pagano [20] and Guzman [12] suggest that banking

market power reduces equilibrium credit, thereby generating a negative effect on economic growth. Petersen and Rajan [21], on the other hand, argue that banks in concentrated markets have greater incentives to fund young firms with no record of past performance. Meanwhile, Shaffer [23] maintains that the average quality of a bank's loan portfolio declines as the number of banks competing in the market increases. Cao and Shi [5], Dell'Ariccia [10] and Manove, Padilla and Pagano [18] claim that the incentives for banks' screening are higher if they have market power. Cetorelli and Peretto [8] identify simultaneously a negative role of banking market power on credit quantities and a positive role associated with a more efficient screening. Among the empirical contributions, Petersen and Rajan [21] have confirmed that bank concentration is associated with greater credit availability to younger firms. Shaffer [23] finds a negative impact of bank concentration on economic growth. The impact on the growth in the number of new firms has instead been found to be either positive (Bonaccorsi and Dell'Ariccia [3]) or negative (Black and Strahan [2]). Finally, Cetorelli and Gambera [7] find evidence of an overall negative impact on industry growth, although with sectors highly dependent on external finance actually benefiting from being in countries with concentrated banking.

None of these contributions focus on the effect of banking market structure on the market structure of industrial sectors, however. Thus, the present paper complements and extends this literature.

2 Methodology and model specification

In a recent contribution, Kumar, Rajan and Zingales [15] classify theories of the firm as technological, organizational and institutional and test several implications of those theories regarding possible determinants of industry firm size. They identify several industry-specific and country-specific factors. For instance, the degree of capital intensity, the amount of employed human capital and the R&D intensity are all possible characteristics, among many others, that are likely to affect an industry's market structure. Likewise, the quality of the judicial system, the set of laws and regulation and the level of economic and financial development are some of those "environmental" factors, common across industries in a country, which are also likely determinants of firm size.

This paper adopts a methodology that allows testing the validity of the theoretical priors regarding the effect of bank concentration on industry firm size controlling for the simultaneous influence of other industry and country factors. As Rajan and Zingales [22] observed, industrial sectors differ from one another, for technological reasons, in terms of

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the degree of dependence on external sources of finance. Then, it must be the case that whichever the sign of the relationship between bank concentration and industry firm size, such effect should be especially strong for sectors that more than others rely on external finance: If bank concentration leads to the funding of few, large firms, sectors that are highly dependent on external finance should exhibit, all else equal, firms of larger size if they are located in countries characterized by high bank concentration. The exact opposite should be true if instead bank concentration were associated with unconcentrated industries. By identifying the differential effect of bank concentration across industries, i.e., by analyzing the effect of the interaction between bank concentration and industry external financial dependence, it is possible to control directly for other industry and country determinants of average firm size.

In fact, this methodology should also take into account factors that could determine simultaneously banking market structure and other industries' market structure. For example, the size of a country is a likely determinant of market structure across all industries. If we were trying to identify the effect of bank concentration on an inter-industry average measure of firm size, then we would question whether any result would simply indicate an underlying effect of country size on both market structures. By focusing instead on the differential effect of bank concentration across industries, we reduce the likelihood that such a common factor could be the driving force explaining the results. Indeed, while we have been able to establish a well defined theoretical linkage between bank concentration and industries at high external financial dependence, which we can test, it is less obvious why the size of a country should be only affecting this subset of industries.

The study makes a more sophisticated use of sector specific information. From the theoretical underpinnings we gather that bank concentration may play a role on industries market structure by privileging or not clients with which they already have ongoing relationships. Hence the effect on industry concentration should be found focusing on those industrial sectors whose *mature* firms are more dependent on external finance. If the effect is found to be negative, it would suggest that even in sectors where mature firms are especially dependent on external finance, banks still allow entry of new firms, thus reducing the concentration of market shares among old incumbents. If the effect is found to be positive, this would be evidence that bank concentration indeed contributes to increasing concentration in industrial sectors.[2]

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[2]Another reason justifying the focus on the external financial dependence of more mature firms is presented in section 3.2.

The econometric analysis is conducted using the following model specification:

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\begin{aligned}
Average\ firm\ size_{j,k} \quad = \quad & Constant + \Delta_1 \cdot Industry\ Dummies_j + \qquad\qquad (1)\\
+ \quad & \Delta_2 \cdot Country\ Dummies_k + \\
+ \quad & \delta_3 \cdot Share\ of\ total\ manufacturing\ v.a._{j,k} + \\
+ \quad & \delta_4 \cdot External\ dependence_j \cdot Bank\ concentration_k + \\
+ \quad & Error_{j,k.}
\end{aligned}
$$

Industry average firm size is computed as the natural logarithm of the ratio of total value added and number of establishments of sector j in country k. Industry and country dummies correct for industry and country fixed effects. The share of total manufacturing value added of sector j in country k is a control variable that should capture factors that determine the market structure of one particular sector in a certain country (e.g., the choice of specialization in production in a specific sector in a given country). In studies of cross-sector industrial growth, the share variable consistently predicts that sectors that had grown substantially in the past, and therefore are already relatively large, grow less in the future (see Rajan and Zingales [22] and Cetorelli and Gambera [7]). Theories of an industry's life-cycle predict that a sector that has already grown substantially should experience less intensive firm entry (see, e.g., Klepper [14]). Therefore, in our study, a larger sector should be expected to have a larger average firm size, hence δ_3 should have a positive sign. Finally, the interaction term captures the effect of bank concentration in country k across sectors characterized by different levels of dependence on external sources of finance. In the benchmark specification of the model, the external dependence refers to that of the mature firms in each sector j. As mentioned earlier, from the theoretical background the effect of banking market structure on industries market structure could be either positive or negative. Therefore the sign of δ_4 is a priori ambiguous.

3   Data set

The data on industry market structure is collected from the 1995 Industrial Structure Statistics data set of the OECD. It contains information on manufacturing sectors at four digit ISIC level for 22 countries for the years 1986-1994. From this source I have obtained the series for sectoral value added and number of establishments and computed the measure of average firm size from the 1994 data or from the most recent year available, typically one or two years earlier. In addition, average yearly growth rates in value added and in

number of establishments were also calculated. This data set has then been merged with that used by Cetorelli and Gambera [7], in turn containing data from Rajan and Zingales [22]. The matching of the two data sets produced complete information for a total of 35 manufacturing sectors in 17 OECD countries. Bank concentration is the average between 1989 and 1995 of the sum of the market shares of the three largest banks in each country (see Cetorelli and Gambera [7] for details). The measure of external financial dependence is computed for the decade 1980-1990, and it is calculated on U.S. industrial sectors. Rajan and Zingales [22] argue that the "dependence of U.S. firms on external finance [is] a good proxy for the demand for external funds in other countries" (Rajan and Zingales [22], p. 563–65). The additional variables used in robustness tests are also for the 1980's decade or from the early 1990's and they are described when introduced in the presentation of the results. Table 1 presents summary statistics for all the variables used in the study. Table 2 shows the pattern of firm size and external financial dependence across industrial sectors. The measure of firm size for each sector in that table is an average across countries. Similarly, Table 3 shows the pattern of firm size and of bank concentration across countries. The measure of firm size for each country in this other table is an average across sectors.

3.1   Comments on the measure of average firm size

As mentioned above, firm average size is computed as the natural logarithm of the ratio of total value added and number of establishments of sector j in country k. Two possible caveats are in order. First, such synthetic measure does not provide information regarding the distribution of market shares within the sector. However, this is to my knowledge the best measure of industry market structure available at a sufficiently disaggregated level (four digit ISIC code) for a significant cross section of countries. Kumar, Rajan and Zingales [15] have used a more sophisticated measure of average firm size exploiting available information on the size distribution across firms in a sector. However, such information is only available for industrial sectors at two digits ISIC codes. The trade off is therefore between a better measure of industry market structure and a worse level of disaggregation across sectors. Because the sought effects of banking market structure are based on rather "micro-based" mechanisms, linking bank conduct with individual firms in a sector, the use of a greatly disaggregated data set seems to be a more appropriate choice.

Another potential caveat in the measure of average firm size is that the data is available for number of establishments rather than number of firms. To check on the reliability of the measure of average firm size computed using number of establishments, I have proceeded as follows. First, for each of the 17 countries in the data set, I have calculated the ranking of

average firm size across sectors. For industry specific reasons, e.g. economies of scale, one would expect a "natural" ordering in firm size across sectors, and this ordering should be kept across countries. This is confirmed by observing the matrix of pairwise rank correlations displayed in the first block of rows of Table 4. The correlations are all very large and highly significant. Next, the 1995 volume of the Industrial Structure Statistics reported information on number of firms, instead of number of establishments, for two additional countries, New Zealand and Portugal. I have then computed for these two additional countries the measures of average firm size and the corresponding ranking across sectors. These rankings were then compared with those computed for the countries in the data set. As shown in the bottom rows of Table 4, the pairwise correlations between the rankings for New Zealand and Portugal – computed using information on number of firms – and those for the other countries – computed using information on number of establishments – are remarkably large and very significant. This indicates that there is a close correspondence between the measure of average firm size calculated using information on establishments and that using information on firms.[3]

Another piece of evidence on the reliability of our measure of average firm size comes from a comparison with a measure of industrial mark-ups estimated for manufacturing sectors in a number of countries by Martins, Scarpetta and Pilat [19][4]. One should expect to find a positive correlation between the two measures: larger firm size should be associated with higher market concentration, hence greater potentials for higher mark-ups. Confirming this prior, the correlation between our measure of average firm size and the mark-ups estimates is 0.36 and highly significant.[5] Moreover, a regression of mark-ups on average firm size, controlling for industry and country fixed effects, produced a positive and significant coefficient for the average firm size variable, and an $R^2 = 0.49$.

The results of these tests should confirm that our measure of average firm size is a proper indicator of industry market structure. A reinforcement on the reliability of such indicator will also come implicitly from the results of some of the robustness tests to the basic specification of the model. This remark will be pointed out in the presentation of the results in section 4.4.

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[3]A similar comparison was also made using the ranks based directly on number of establishments and those based on number of firms. The pairwise correlations, not reported, were also found to be very large and highly significant.

[4]The overlap in data was for 11 countries and 27 manufacturing sectors.

[5]A correlation with the logarithm of the number of establishments by itself is -0.47, also highly significant and consistent with expectations.

3.2 Other observations about the data set

The data set has some characteristics that makes it well suited for the analysis at hand. First, the countries in the data set are all developed economies with limited variability in terms of income per capita levels.[6] The cross-country similarity in the dimension of economic development should imply that the same industrial sectors are at similar stages of their respective life cycle, thus implying a plausible degree of homogeneity across sectors in different countries. This fact is important in that, as mentioned above, the information on sectors' external financial dependence, which is common for the same sectors across countries, is calculated on U.S. data. The underlying assumption in making use of this industry variable is that sectors across countries should be at comparable stages, in terms of their life cycle and technology adoption, to those in the United States, an assumption that should especially hold with this data set.

An additional consideration is that the industrial sectors in the data set all belong to manufacturing, i.e., these are rather traditional sectors adopting established production technologies. By all means this observation does not intend to imply lack of technological changes in those sectors. More simply, the combined fact that these are prevalently traditional sectors in developed economies should imply that such sectors have already past the typical infant industry stage, normally characterized by the entry of many young firms (again, see Klepper [14]), and they are instead likely to be constituted by a dominant proportion of more mature firms. This observation reinforces the justification for focusing on the external financial needs of mature firms when we analyze the effect of banking market structure on average firm size.

4   Empirical results

We begin with a first round exploration of the data by regressing average firm size on industry and country dummies. The residuals from this regression were clustered separating sectors characterized by low dependence on external finance from those highly dependent, based on whether they are in countries with low or high bank concentration. Low versus high reflects values below or above the median in the respective distributions of external financial dependence and bank concentration. For each of the four clusters of regression residuals, mean values were then computed and they are reported in Table 5. For countries with low bank concentration, the residual firm size of the most dependent sectors is negative,

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[6]Turkey and Mexico are two exceptions, and excluding these countries from the data set will represent one of the tests of robustness presented later on.

while that for the least dependent sectors is positive. Instead, in countries with high bank concentration, sectors highly dependent on external finance have positive residual firm size, while those at low dependence have negative residual firm size. It appears from this simple representation of the data that the difference in firm size between sectors above and those below the median of external financial dependence is definitely greater in countries with high bank concentration. This first piece of evidence hints that bank concentration may favor market concentration in sectors that are potentially more dependent on bank finance.[7] The remainder of the paper presents estimation results based on the model specification (1), in the attempt to establish "hard" evidence that would confirm or reject this first finding.

4.1 Benchmark results

Column (a) of Table 6 presents the results of the basic regression of the model in equation (1). The dependent variable is the logarithm of average firm size of sector j in country k, while the interaction term is between the level of external financial dependence of mature firms in sector j and the 3-bank ratio in country k. The industry and the country indicator variables are included in the regressions but their estimates are not reported in the Table. Unless otherwise reported, these variables remain the same throughout the analysis. As the Table shows, sectors whose share of total manufacturing value added is greater, are also, as expected, characterized by a larger average firm size. The estimated effect of bank concentration, in the benchmark model and in all the robustness tests, is not affected by the exclusion of this regressor.

Focusing on the bank concentration interaction, the estimation results show a positive and significant coefficient for it, indicating that, controlling for industry and country specific factors, sectors highly dependent on external finance have firms of disproportionately larger average size if they are in countries with high bank concentration.

In principle, the positive and significant coefficient of the interaction could simply indicate that bank concentration has no relationship with firm size and that sectors highly dependent on external finance are simply characterized by firms of greater average size. However, it turns out that highly dependent sectors are actually characterized by *lower* average firm size than low-dependent sectors. Comparing the mean values, the average firm size of sectors above the median of the distribution of external financial dependence is 26% smaller than sectors below the median.[8] If anything, this should dampen the effect of bank

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[7]A similar indication is obtained looking at the mean residuals calculated from a regression in which the most and the least dependent sectors (top 3 and bottom 3) were excluded.

[8]A negative correlation between average firm size and external financial dependence is also found by

concentration on firm size.

Bank concentration thus seems to contribute to the formation of concentrated industrial sectors. This finding is consistent with theoretical priors suggesting that banks with market power may have the tendency to preserve relationships with their older clients, which grow larger, at the expense of potential new entrants.

4.2   Endogeneity

A concern that may rise in this specification of the model is on the possible endogeneity of bank concentration. As mentioned above, banking market structure may affect industries market structure by establishing close ties with incumbent firms that may be detrimental to new entrants, especially those firms more in needs of external finance. We could not exclude that a reverse mechanism may also be present or that both market structures be determined by a common factor. For example, it may be that the observed relationship is identified because in some countries there is concentration of economic powers in the hands of groups (political entities, individual families, the government at large), who have interests in some sectors of productions and can also control the credit flows from the financial industry. The results of the analysis could be affected if, in fact, concentration of economic powers in sectors at high external financial dependence could also extend to the banking industry, via increasing concentration of market power. Alternatively, one could posit that banking market structure simply adjusts endogenously to best fit the cross-industry characteristics of a country. For example, a given country could specialize in highly dependent sectors, and those sectors in that country could be highly concentrated for reasons other than factors related to the market structure of the banking industry. Suppose also that these sectors require heavy and indivisible capital investments. Consequently, the banking industry, whose sources of revenue would depend especially from the industrial sectors that mostly require external finance, should be highly concentrated in order to accommodate the funding needs of those sectors.

The effort required to envision possible channels of endogeneity and reverse causality in the relationship between bank concentration and industries market structure speaks to the strength of the methodology adopted in this study. While we have clear theoretical priors to justify and therefore test a possible relationship between bank concentration and industry concentration in sectors highly dependent on external finance, the opposite direction of causality is much harder to justify. In any case, as also pointed out in Cetorelli and

Kumar, Rajan and Zingales [15].

Gambera [7], the market structure of the banking industry is typically determined by several independent factors which would have little to do with the market structure of other industries. For example, the market structure of the banking sector is a favorite policy variable controlled by the regulator to prevent excessive surplus extraction, or for reasons related to the safety and soundness of the industry.

Beyond this line of discussion, the concerns regarding the potential endogeneity of the market structure of the banking sector are resolved by using instrumental variables (IV) estimation. The following variables were selected as instruments. First, a measure of regulatory restrictions on the banking industry. This cross-country indicator, assembled by Barth, Caprio and Levine [1], gives a quantitative assessment of the restrictions on banks to be active participants in other markets. For example, wether a bank is allowed or not to hold equity participations of non-financial companies, and vice versa, or whether or not a bank can operate in the insurance market. It is likely that the regulatory environment should have an impact on the market structure of the banking industry. A second instrument is an indicator of the legal origins of a country (see La Porta [17]), where the presumption is that different legal origins are responsible for different set of rules and regulations that may have had an impact on the market structure of the banking industry. The regression results in column (b) of Table 6 show that the coefficient of the interaction variable remains positive and significant, and in fact the point estimate increases.

4.3 Outliers

A first set of robustness tests were run attempting to identify outliers. To check that the main findings are not affected by extreme values in the external dependence distribution, the benchmark regression was run excluding from the sample the three least dependent sectors and the three most dependent sectors. As shown in column (a) of Table 7, the bank concentration interaction term maintains a positive and significant coefficient, with a point estimate that actually jumps up from 0.84 to 2.40. This is presumably due to the fact that, as noted above, there is a negative relationship between external financial dependence and average firm size, so that cutting the extremes of the external financial dependence distribution tilts up the coefficient of the interaction term.[9]

Similarly, another regression was run excluding from the sample the countries with the three lowest levels and the three highest levels of bank concentration. As shown in column

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[9]Nonetheless, it is still the case that even with the truncated distribution, sectors above the median in external financial dependence have smaller average firm size than those below the median (about 17% smaller rather 26% as in the case with no truncation).

(b) of Table 7, the bank concentration interaction maintains an unchanged coefficient and remains significant.

As another test of outliers influence, the Cook's D statistic was calculated from the benchmark regression, and the same regression was then re-run after dropping the observations corresponding to the top 1% of the Cook's D distribution (5 observations). Column (c) reports the results of such regression, showing that the coefficient of the bank concentration interaction term remains significant, although with a point estimate reduced to 0.73.[10]

As mentioned earlier, one advantage of this data set is the similarity across countries in terms of economic development conditions. However, Turkey and Mexico, each with less than 4,000 U.S. dollars, appear as clear outliers in the cross-country distribution of income per capita, as compared with the other countries, whose lowest value in income per capita begins at above 10,000 U.S. dollars. The underlying assumption that the same sectors across countries are at similar stages in their life cycle is less plausible for these two countries. Column (d) of Table 7 reports the results of the basic model specification in which the observations related to Turkey and Mexico were dropped. The coefficient of the bank concentration interaction is remarkably stable, and it maintains a high level of significance.

Still with the intent of verifying homogeneity in the data set, another regression was run excluding from the sample non-European countries. The results, displayed in column (e) of Table 7, show that the bank concentration interaction is still significant, although with a lower point estimate.

Another possible consideration is that the average firm size may appear high in some sectors just because those sectors have experienced a substantial boost in value added growth in recent years and entry of new firms has not followed yet. For example, in the data set, the median value in value added growth rate is 4.3%, and the top 10% of the sectors-countries reported a yearly growth rate above 23%. The identified relationship between the bank concentration interaction and average firm size could potentially be the result of a predominance of these high-growth sectors among those ones highly dependent on external finance. A first observation of the data set reveals that the high-growth sectors are rather evenly distributed between sectors below and sectors above the median of the external financial dependence distribution. Nevertheless, a regression was run in which sectors that experienced growth rates in the top 10% of the distribution (59 sectors-countries) were

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[10]Another regression, not reported, in which the observations corresponding to the top 5% of the Cooks D distribution were cut off (a total of 26 observations), still showed a highly significant bank concentration interaction, with an estimated coefficient of 0.62).

excluded from the sample. As the results in column (f) of Table 7 shows, the coefficient of the bank concentration interaction is still highly significant and approximately the same in size.[11]

A related, yet somewhat reversed, consideration could be made observing that the average firm size may appear *low* in some sectors because those sectors have experienced substantial entry of new firms in recent years that has not yet translated in value added growth. Then the same reasoning as above could apply to question the observed relationship between the bank concentration interaction and average firm size.[12] In the data set, the median value in growth in number of establishments is -1.1%, but the top 10% of sectors-countries reported a growth in number of establishments above 7%. As for growth in value added, sectors that experienced high growth in number of establishments are evenly distributed across sectors at different level of external financial dependence. A regression was run where sectors with growth in number of establishments in the top 10% of the distribution (30 sectors-countries) were excluded from the sample. As shown in column (g) of Table 7, the bank concentration interaction remains significant with about the same point estimate.[13]

4.4 Does bank concentration proxy for indicators of financial development?

A possible concern is that the market structure of the banking sector may vary at different stages of financial or institutional development. Consequently, the relationship identified between the bank concentration interaction and average firm size could actually underlie a fundamental relationship between industry market structure and general conditions of development of the financial sector. To test the robustness of the benchmark result to this argument, regressions were run by adding to the basic model specification terms of interaction between external financial dependence and a number of variables characterizing a country's financial sector at large. These variables are a measure of the level of development of the banking sector, one of general financial development, a measure of development of capital markets, and one of the general level of efficiency of the judicial system.

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[11]Similar regressions, not reported here, were run dropping sectors ranging from the top 20% in the value added growth distribution (15% growth rate and above) to the top 1% (81% growth rate and above). They all yielded qualitatively similar results.

[12]Another reason to identify high-growth sectors is that such sectors may still be in relatively earlier stages of their life cycle and therefore may not be considered as mature as the others.

[13]The result remains robust to changes in the cut off point (regressions with cut off point between 20% in the growth rate in number of establishments (3%) and 1% (26%) were run yielding qualitatively similar results).

With a more developed banking sector, firms should have a broader access to sources of investment funds. Consequently, sectors more in need of external finance should experience more firm entry in countries with a more developed banking industry, thus implying a negative coefficient for the bank development interaction term. If bank concentration varies at different stages of bank development, then it might be that the significant role of bank concentration identified in the interaction term may simply indicate that highly dependent sectors display higher average firm size (slower firm entry) in countries with a lower level of bank development. Consequently, by adding to the benchmark regression the interaction of external dependence with bank development, the bank concentration interaction term may become insignificant. Column (a) of Table 8 presents the result of a regression where the interaction between external financial dependence and the level of bank development in each country was added. The measure of bank development is the commonly used ratio between domestic credit to the private sector and gross domestic product. The result shows that the bank concentration interaction remains positive and significant, with a basically unchanged coefficient, while the bank development interaction is not significant.

However, the overall availability of credit to firms may depend on the level of development of the entire financial industry. Rajan and Zingales [22] have argued successfully that a measure of the quality of accounting standards is a good proxy of the general conditions of development in financial markets. Accounting standards is an index reflecting the quality of disclosure of firms' annual reports (see Rajan and Zingales [22], p. 571). The poorer such standards, the higher the information cost that financial markets have to sustain to determine the quality of an entrepreneur. Following the argument made above, by adding the interaction with accounting standard (which should display a negative sign), the bank concentration interaction may lose significance. As the results in column (b) show, the accounting standard interaction is indeed negative and significant, but the bank concentration interaction coefficient remain positive and significant and actually the point estimate increases considerably, from 0.84 to 1.13.

Another important variable regarding characteristics of the financial industry, which may also have an important effect on the bank concentration findings, is an indicator of development of capital markets. If it is true that market concentration may allow banks to discriminate between older clients at the expenses of new entrants, such role should depend on the overall ability of those newer firms to access external finance directly on capital markets. Hence, we should expect that in countries with more developed capital markets, highly dependent sectors should experience more firm entry. Again, if levels of bank concentration simply reflects different stages in the development of financial markets, the bank

concentration interaction may lose significance in a regression where we add the interaction with a measure of capital markets development. The results in column (c) show that an interaction term where capital market development is measured by stock market capitalization is indeed negative and significant. Yet, the bank concentration interaction coefficient remains positive and significant and actually unaltered with respect to the benchmark case.

Finally, the characteristics defining the legal environment in a country are also likely to have an effect on the financial system (see La Porta et al. [17]) and through this on the market structure of the banking industry. Hence, indirectly, indicators of judicial efficiencies may also have an impact on industrial sectors' market structure through the same channels discussed above. Column (d) presents the results of a regression in which an interaction term with a measure of the extent to which laws are enforced in a country (see Rajan and Zingales [22] for details) is added. This interaction is negative and significant but the bank concentration interaction term remains positive and significant.

4.5 Is the effect heterogeneous across countries?

The robustness tests presented in the previous section indicate that bank concentration appears to have a significant effect on industry market structure that is independent from that of variables proxying for the general level of development of the financial industry. A complementary, yet separate question, however, is whether the effect of bank concentration identified by the interaction term differs depending on whether a country is characterized by a high or low level of financial development. More precisely, column (a) of Table 9 presents the benchmark regression of column (a) of Table 6, with the additional inclusion of the bank concentration interaction multiplied by a dummy equal to one for countries above the median in the level of bank development. The baseline interaction term is significant and maintains an unchanged coefficient. The dummy interaction instead is not significantly different from zero. This result indicates that the level of bank development is not an important discriminant to identify a possible cross-country heterogeneity in the effect of bank concentration on industry market structure.

Column (b) repeats the same regression this time adding the bank concentration interaction multiplied by a dummy isolating countries with a high level of accounting standards. This regression shows that the baseline interaction term is still positive and significant, and the dummy interaction is negative and also significant. Focusing on the size of the two coefficients, it appears that the effect of bank concentration on firm size varies substantially across countries: With respect to the baseline interaction term, the magnitude of the effect is estimated to be approximately 60 percent weaker in countries characterized by a

higher overall level of financial development ($\frac{1.143-0.448}{1.143}$). Moreover, the coefficient of the baseline bank concentration interaction actually increases from 0.838 (the point estimate in the benchmark regression of column (a), Table 6) to 0.99. Separating countries according to their level of financial development reveals how much stronger the effect of bank concentration is where firms have more constrained access to alternative sources of external funding.

Informative results are also delivered by the regression where we add the dummy interaction for countries with high market capitalization. As column (c) shows, the dummy term is negative and significant. This result indicates that, in fact, in countries where firms have potentially broader access to capital markets the effect of bank concentration on firm size is about 45 percent smaller. Similar to what shown above, the coefficient of the baseline bank concentration interaction also increases, reinforcing the fact that the role of bank concentration on firm size is enhanced when alternative sources of finance are lacking.

Another regression was run adding the dummy interaction for countries with a higher judicial efficiency. As shown in column (d), even in this case the dummy term is negative and significant, being evidence that in countries with higher judicial efficiency the effect of bank concentration on firm size is reduced. As the coefficients show, this effect is approximately 50 percent weaker in such countries. As in the previous regressions, the coefficient of the baseline bank concentration interaction increases considerably, confirming a substantially heterogeneous effect of bank concentration across countries.

These robustness tests have delivered two important conclusions. First, it is less likely that the finding about the relationship between bank concentration and average firm size be due to alternative economic explanations. Second, the effect of bank concentration on firm size is of heterogeneous magnitude across countries. This result indicates that where the conditions for firm entry are more favorable, due to higher financial development, the effect of bank concentration is much weaker. At the same time, performing regressions where countries are differentiated along such dimensions show that the effect in countries with poorer financial development attributes is actually magnified.

Not of secondary importance, the tests also provide reassurance on the reliability of the measure of average firm size as an indicator of industry market structure: taking each and everyone of them separately, the regressions in the last two tables establish empirical evidence on additional theoretical priors related to factors affecting industry market structure that are independent from considerations related to bank concentration. In other words, the fact that various indicators of financial development and judicial efficiency are significantly – and plausibly – related to our measure of average firm size, reduces the likelihood that

the measure of average firm size is just a "random" sequence of values which just happens to be significantly related with bank concentration.

4.6 Economic effect of bank concentration on average firm size

Bank concentration thus seems to have a significant effect on the market structure of industrial sectors, by contributing to increase the average firm size in sectors especially dependent on external finance. This conclusion has interesting welfare implications. Banking market structure would seem to have a role in the determination of market power in industries where they provide most credit. By affecting the pattern of entry of new firms potentially endowed with better technologies, and that of exit of older and perhaps less productive ones, banking market structure should also have an effect on the pace of industries' technological progress.

We can also gauge the economic magnitude of the effect of banking market structure on industry market structure. From the set of estimates presented in the previous sections, we learn that, for example, the firm size differential between a sector at the 25th percentile of the distribution of external financial dependence and one at the 75th percentile of the same distribution, in going from a country at the 25th percentile of the distribution of bank concentration to one at the 75th percentile, ranges between about a 5% and a 16% change around the mean of the distribution of average firm size. While this study cannot quantify the potential effect on the degree of market power in industrial sectors determined by such increase in firm average size, it is still the case that the effect of bank concentration on industry market structure is economically important.

5 Conclusions

This paper has investigated a new dimension of analysis of the economic role of banking market structure. The results show a significant relationship between banking market structure and the market structure of industrial sectors. Evidence from a cross-industry, cross-country panel indicates that, controlling for industry and country fixed effects, firms in sectors more in need of external finance are of disproportionately larger size if they are in countries whose banking sector is more concentrated. This is true even despite the fact that sectors more in need of external finance are actually characterized, on average, by smaller firms than sectors that are less dependent on external finance. This result is consistent with theoretical priors suggesting that banks with market power may concentrate lending to fewer firms with whom they have already established long lasting relationships,

thus restricting credit access to newer entrants. At the same time, further investigation has also shown that the effect of bank concentration is heterogenous across countries, with the effect weaker in magnitude in countries with more developed financial markets and a more efficient legal structure.

Elucidating the nature of the relationship between banking market structure and industries' market structure enhances our overall understanding of the role of banks in the economy. To the extent that bank concentration leads to more or less concentrated industries, this analysis exposes a potential link between characteristics of the banking industry and firms' conduct in other industrial sectors. For example, depending on market structure, firms may have different pricing strategies for their products, or different incentives in technology adoption. These considerations point to novel directions of analysis of the impact of banking market structure on social welfare.

Moreover the analysis refines our knowledge about the effects of bank concentration on growth. As Rajan and Zingales [22] have shown, the same performance in value added growth could be achieved either due to the entry of new firms in that sector or due to the growth of incumbent firms. Therefore, very different market structures could result in similar patterns of value added growth. However, the growth of few firms, resulting in increasing concentration, may translate into rising profits (which would be counted in value added) but not necessarily into higher production. Both the economic significance and the normative implications associated with observing growth due to increasing profits versus increasing output are likely to be very different.

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Table 1: SUMMARY STATISTICS

Variable	Obs.	Mean	Std. Dev.	Min	Max
Average Firm Size	581	1.365	1.368	-3.619	6.387
Share of Value Added	581	0.034	0.035	0.000	0.187
Growth Value Added	581	0.085	0.195	-1.479	1.117
Growth Number of Establishments	583	-0.011	0.105	-1.386	0.441
External Financial Dependence	578	0.012	0.302	-1.330	0.394
Bank Concentration	595	0.519	0.202	0.210	0.850
Bank Development	595	0.474	0.210	0.141	0.856
Accounting Standard	595	66.000	8.958	51.000	83.000
Bank Powers	595	2.044	0.502	1.250	3.250
Stock Market Capitalization	595	0.150	0.136	0.009	0.460
Rule of Law	595	8.791	1.676	5.000	10.000
Legal Origins	595	2.529	1.037	1.000	4.000
GDP per capita	595	2.887	0.715	1.134	3.683

Firm average size is computed as the natural logarithm of the ratio of total value added and number of establishments of sector j in country k. The share of value added is sector j's share of manufacturing value added in country k. Growth in value added is the average rate of growth of real value added for each industrial sector in each country between 1989 and 1994. For some sectors in some countries the time period may be different depending on data availability. Similarly, growth in number of establishments is the average rate of growth in numebr of establishments for each industrial sector in each country between 1989 and 1994 or closer period available. External financial dependence relates to mature companies (more than ten years old), and is the fraction of capital expenditures not financed with cash flow from operations. It is measured on U.S. listed companies during the 1980's. Bank concentration is the sum of market shares (measured in total assets) of the three largest banks in each country. The data on individual banking institutions are from the IBCA-BankScope 1997 CD for the period 1989–1996. The values reported are averages over the sample period. Bank development is the ratio of private domestic credit to GDP. Accounting standards is an index ranking the amount of disclosure of companies' annual reports for each country. Bank powers is a measure of regulatory restrictions on bank activities in each country. Stock market capitalization is the ratio between stock market capitalization and GDP in each country. Rule of law is a measure of judicial efficiency in each country. Legal origins is an indicator of the origin of a country's legal system. GDP per capita is the logarithm of income per capita in each country.

Table 2: PATTERN OF INDUSTRY STRUCTURE AND FINANCIAL DEPENDENCE ACROSS INDUSTRIES

ISIC code	Industrial sectors	Average Firm Size	External Financial Dependence
323	Leather	-0.18075	-1.33017
332	Furnitures and Fixtures	-0.07799	0.32917
322	Wearing Apparel	-0.06098	-0.02010
331	Wood Products	0.03113	0.24919
390	Other Manufacturing	0.10550	-0.05130
324	Footwear	0.28341	-0.57282
381	Metal Products	0.45290	0.04370
369	Non-Metallic Products	0.56688	0.15193
321	Textiles	0.63156	0.14100
342	Printing and Publishing	0.66766	0.13582
356	Plastic Products	0.67885	na
382	Non-Eletrical Machinery	0.77184	0.21660
361	Pottery, China etc.	0.80665	0.16338
385	Professional Goods	0.83971	0.19365
311	Food	0.99768	-0.05206
354	Petroleum and Coal Products	1.14540	0.16202
3841	Shipbuilding and Repairing	1.19241	0.04087
355	Rubber Products	1.41210	-0.12256
3825	Office and Computing machinery	1.42803	0.26072
362	Glass and Products	1.45144	0.03103
383	Electrical Machinery	1.53288	0.23002
341	Paper and Products	1.67399	0.10438
372	Non-Ferrous Metals	1.81682	0.07313
3843	Motor Veichles	1.91521	0.10957
3832	Radio, TV and Comm. Equipment	1.95406	0.39350
384	Transport Equipment	1.97077	0.16324
352	Other Chemicals	1.98283	-0.18361
371	Iron and Steel	2.13695	0.08709
313	Beverages	2.20023	-0.14638
3511	Basic Industrial Chemicals	2.20340	0.07534
3513	Synthetic Resins	2.27204	-0.22668
3411	Pulp, Paper and Board	2.38646	0.12680
3522	Drugs and Medicines	2.66263	0.02752
314	Tobacco	4.03306	-0.37546
353	Petroleum Refineries	4.47356	-0.02171

Average firm size is computed as the natural logarithm of the ratio of total value added and number of establishments of sector j in country k. External financial dependence relates to mature companies (more than ten years old), and is the fraction of capital expenditures not financed with cash flow from operations. It is measured on U.S. listed companies during the 1980's. The figures for firm size are calculated as simple averages for each sector across all countries. The sectors are sorted in ascending order of average firm size.

Table 3: PATTERN OF INDUSTRY STRUCTURE AND BANK CONCENTRATION ACROSS COUNTRIES

Country	Average Firm Size	Bank Concentration
Denmark	0.37679	0.74
Greece	0.42075	0.79
Spain	0.57741	0.34
Australia	0.67595	0.60
Korea	0.80249	0.28
United Kingdom	0.99690	0.50
Turkey	1.29616	0.41
Norway	1.39042	0.60
Japan	1.41951	0.21
Canada	1.64286	0.57
Finland	1.66608	0.85
Sweden	1.67558	0.71
Austria	1.80702	0.42
Italy	1.85512	0.24
Netherlands	2.04738	0.77
Mexico	2.26486	0.53
Germany	2.55841	0.27

Average firm size is computed as the natural logarithm of the ratio of total value added and number of establishments of sector j in country k. Bank concentration is the sum of market shares (measured in total assets) of the three largest banks in each country. The data on individual banking institutions are from the IBCA-BankScope 1997 CD for the period 1989–1996. The values reported are averages over the sample period. The figures for firm size are calculated as simple averages for each country across all industries. The sectors are sorted in ascending order of average firm size.

Table 4: RANK CORRELATIONS OF AVERAGE FIRMS SIZE

	aus	aut	can	fin	ger	gre	ita	jap	kor	mex	net	nor	spa	swe	tur	uk	den	nzd	por
aus	1																		
aut	0.76	1																	
can	0.92	0.79	1																
fin	0.78	0.77	0.81	1															
ger	0.64	0.73	0.68	0.65	1														
gre	0.89	0.78	0.85	0.81	0.63	1													
ita	0.75	0.79	0.77	0.74	0.79	0.78	1												
jap	0.77	0.75	0.72	0.79	0.68	0.73	0.78	1											
kor	0.85	0.79	0.81	0.73	0.78	0.79	0.85	0.86	1										
mex	0.56	0.63	0.62	0.59	0.65	0.59	0.71	0.55	0.63	1									
net	0.84	0.64	0.75	0.73	0.58	0.73	0.75	0.72	0.76	0.59	1								
nor	0.72	0.66	0.69	0.90	0.61	0.73	0.73	0.82	0.71	0.58	0.75	1							
spa	0.77	0.79	0.77	0.74	0.76	0.74	0.88	0.78	0.85	0.60	0.70	0.71	1						
swe	0.81	0.84	0.87	0.89	0.72	0.84	0.84	0.79	0.83	0.69	0.74	0.83	0.81	1					
tur	0.68	0.69	0.64	0.70	0.62	0.79	0.75	0.66	0.71	0.64	0.72	0.70	0.68	0.76	1				
uk	0.79	0.68	0.84	0.74	0.78	0.74	0.87	0.72	0.80	0.64	0.79	0.72	0.79	0.79	0.73	1			
den	0.81	0.64	0.8	0.74	0.61	0.78	0.72	0.77	0.83	0.46	0.72	0.70	0.70	0.80	0.70	0.80	1		
nzd	0.91	0.58	0.87	0.82	0.37	0.87	0.74	0.66	0.71	0.39	0.88	0.71	0.65	0.74	0.68	0.81	0.84	1	
por	0.82	0.81	0.77	0.74	0.59	0.81	0.75	0.73	0.79	0.51	0.76	0.66	0.78	0.81	0.82	0.74	0.79	0.80	1

The pairwise correlations in the first block of rows are based on the country ranks of average firm size, where average firm size is calculated using information on number of establishments. The correlations in the bottom rows are calculated for New Zealand and Portugal using information on number of firms.

Table 5: Residual Firm Size Net Of Industry and Country Fixed Effects

	Low Bank Concentration	High Bank Concentration
Low External Financial Dependence Sectors	+0.032	− 0.035
High External Financial Dependence Sectors	− 0.029	+0.038

Low and High external financial dependence sectors are those sectors respectively below or above the median of the external financial dependence distribution. Similarly, Low and High bank concentration refers to countries with a bank concentration measure below or above the median. The numbers in the table are mean values, calculated for each of the four clusters, of the residuals of a regression of average firm size on industry and country dummies.

Table 6: Benchmark Regressions

Regressor	(a)	(b)
Share of value added	10.188***	10.191***
	(0.996)	(0.996)
External dependence · Bank Concentration	0.838***	0.898*
	(0.334)	(0.480)
R^2	0.842	0.841
Observations	564	564

The dependent variable in all columns is average firm size. The share of value added is sector j's share of manufacturing in country k. External financial dependence for each sector j refers to the borrowing needs of mature establishments. Bank concentration is the 3-bank ratio in each country. The results reported in the first column are based on OLS regression. The second column uses instrumental variables to check for the possible endogeneity of bank concentration. The instruments were the measure of bank powers and the indicator of legal origins. Industry and country dummy variables are included in all regressions but the coefficient estimates are not reported. Heteroskedasticity-consistent standard errors are reported in parentheses. One asterisk indicates rejection of the null at the 10% significance level, two asterisks indicate 5% significance level, and three asterisks indicate 1% significance level.

Table 7: ROBUSTNESS TESTS. OUTLIERS

Regressor	(a)	(b)	(c)	(d)	(e)	(f)	(g)
Share of value added	10.542***	10.491***	9.365***	10.549***	10.743***	10.301***	9.949***
	(1.018)	(1.336)	(0.855)	(1.077)	(1.178)	(1.053)	(0.972)
External dependence · Bank Concentration	2.407**	0.813*	0.729**	0.893***	0.617*	0.799**	0.736**
	(1.106)	(0.485)	(0.316)	(0.345)	(0.334)	(0.338)	(0.330)
R^2	.827	.840	.867	.853	.845	.846	.840
Observations	466	429	558	498	396	545	507

The dependent variable in all columns is average firm size. The share of value added is sector j's share of manufacturing in country k. External financial dependence for each sector j refers to the borrowing needs of mature establishments. Bank concentration is the 3-bank ratio in each country. In column (a) the record for the three least dependent and three most dependent sectors were excluded from the regression. In column (b) the record for the three countries with the lowest and the highest bank concentration were excluded from the regression. In column (c) the records in the top 1% of the Cook's D distribution were excluded from the regression. In column (d) the records for Mexico and Turkey were excluded from the regression. In column (e) the records for the non-european countries were excluded from the regression. In column (f) the records in the top 10% of the distribution of growth in value added were excluded from the regression. In column (g) the records in the top 10% of the distribution of growth in number of establishments were excluded from the regression. Industry and country dummy variables are included in all regressions but the coefficient estimates are not reported. Heteroskedasticity-consistent standard errors are reported in parentheses. One asterisk indicates rejection of the null at the 10% significance level, two asterisks indicate 5% significance level, and three asterisks indicate 1% significance level.

Table 8: Robustness Tests. Proxying for Financial Development

Regressor	(a)	(b)	(c)	(d)
Share of value added	10.176***	10.401***	10.282***	10.484***
	(0.996)	(1.006)	(0.998)	(0.990)
External dependence · Bank Concentration	0.865***	1.128***	0.847**	0.995***
	(0.336)	(0.378)	(0.369)	(0.360)
External dependence · Bank Development	0.076			
	(0.379)			
External dependence · Accounting Standards		-0.019**		
		(0.009)		
External dependence · Capital Market Development			-1.272**	
			(0.598)	
External dependence · Rule of Law				-0.123***
				(0.050)
R^2	0.842	0.843	0.843	0.843
Observations	564	564	564	564

The dependent variable in all columns is average firm size. The share of value added is sector j's share of manufacturing in country k. External financial dependence for each sector j refers to the borrowing needs of mature establishments. Bank concentration is the 3-bank ratio in each country. Bank development is the ratio of private domestic credit to GDP. Accounting standards is an index ranking the amount of disclosure of companies' annual reports for each country. Stock market capitalization is the ratio between stock market capitalization and GDP in each country. Rule of law is a measure of judicial efficiency in each country. Industry and country dummy variables are included in all regressions but the coefficient estimates are not reported. Heteroskedasticity-consistent standard errors are reported in parentheses. One asterisk indicates rejection of the null at the 10% significance level, two asterisks indicate 5% significance level, and three asterisks indicate 1% significance level.

Table 9: Heterogeneous Effect across Countries

Share of value added	10.205***	10.340***	10.311***	10.473***
	(0.995)	(1.004)	(0.998)	(0.995)
External dependence · Bank Concentration	0.858**	1.143***	0.998***	1.481***
	(0.358)	(0.407)	(0.356)	(0.514)
External dependence · Bank Concentration · High Bank Dev.	-0.081			
	(0.214)			
External dependence · Bank Concentration · High Acc. Stan.		-0.448*		
		(0.239)		
External dependence · Bank Concentration · High Mkt. Cap.			-0.550**	
			(0.233)	
External dependence · Bank Concentration · High Law				-0.766**
				(0.374)
R^2	0.842	0.842	0.843	0.843
Observations	564	564	564	564

The dependent variable in all columns is average firm size. The share of value added is sector j's share of manufacturing in country k. External financial dependence for each sector j refers to the borrowing needs of mature establishments. Bank concentration is the 3-bank ratio in each country. High Bank Dev. is a dummy equal to one if bank development is above its median. High Acc. Stan is a dummy equal to one if accounting standards is above its median. High Mkt. Cap. is a dummy equal to one if stock market capitalization is above its median. High Law is a dummy equal to one if rule of law is above its median. Industry and country dummy variables are included in all regressions but the coefficient estimates are not reported. Heteroskedasticity-consistent standard errors are reported in parentheses. One asterisk indicates rejection of the null at the 10% significance level, two asterisks indicate 5% significance level, and three asterisks indicate 1% significance level.