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Finance, Firm Size, and Growth

Although research shows that financial development accelerates aggregate economic growth, economists have not resolved conflicting theoretical predictions and ongoing policy disputes about the cross-firm distributional effects of financial development. Using cross-industry, cross-country data, the results are consistent with the view that financial development exerts a disproportionately positive effect on small firms. These results have implications for understanding the political economy of financial sector reform.

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ALTHOUGH RESEARCH SHOWS that financial development accelerates economic growth (Levine 2006), economists have not resolved conflicting theoretical predictions about the distributional effects of financial development. Some

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theories imply that financial development disproportionately helps small firms. If small firms find it more difficult to access financial services due to greater information and transaction costs, then financial development that ameliorates these frictions will exert an especially positive impact on small firms (Cestone and White 2003, Galor and Zeira 1993). In contrast, if fixed costs prevent small firms from accessing financial services, then improvements in financial services will disproportionately help large firms (Greenwood and Jovanovic 1990, Haber, Razo, and Maurer 2003). In this paper, we seek to provide empirical evidence to help resolve this debate.

Besides assessing theoretical disputes, policy considerations motivate our study of the distributional effects of financial development. For example, if financial development helps small firms more than large ones, then even if financial development helps all firms, large firms might oppose reforms that diminish their comparative power.[1] Rather than analyzing political lobbying by firms, we examine the more basic question of whether financial development has distributional effects. In addition, governments and development agencies spend billions of dollars per year subsidizing small firms, with the expressed goals of stimulating growth, reducing poverty, and encouraging entrepreneurship. Research, however, suggests that (i) subsidizing small firms does not have these beneficial effects (Beck, Demirgüç-Kunt, and Levine 2005), while (ii) improving the financial system accelerates growth and alleviates poverty (Levine 2006, Beck, Demirgüç-Kunt, and Levine 2007). In this paper, we test whether financial development exerts a disproportionately positive effect on small firms.

We examine whether industries that have a larger share of small firms for technological reasons grow faster in economies with well-developed financial systems. As formulated by Coase (1937), firms should internalize some activities, but size enhances complexity and coordination costs. Thus, an industry's "technological" firm size depends on that industry's particular production processes, including capital intensities and scale economies. After computing an estimate of each industry's technological share of small firms, we use a sample of 44 countries and 36 industries in the manufacturing sector to examine the growth rates of different industries across countries with different levels of financial development. If "small-firm industries"—industries naturally composed of small firms for technological reasons—grow faster than "large-firm industries" in economies with more developed financial systems, this suggests that financial development boosts the growth of small-firm industries more than large-firm industries. In contrast, we might find that financial development disproportionately boosts the growth of large-firm industries or that financial development fosters balanced growth.[2]

1. A large literature examines the political economy of financial policies, e.g., Kroszner and Stratmann (1998), Kroszner and Strahan (1999), Rajan and Zingales (2003), Pagano and Volpin (2005), and Perotti and von Thadden (2006).

2. Besides the argument that financial development disproportionately helps large firms because small firms are cut off from financial development, Petersen and Rajan (1994, 1995) show that local banking monopolies foster close ties between banks and small firms that ease credit constraints. Therefore, financial development that intensifies competition and loosens these ties might hurt small firms. On a global scale, Gozzi, Levine, and Schmukler (2008) show that when financial development lowers barriers to firms accessing international capital markets, it has predominantly helped large firms.

More specifically, we use a difference-in-differences approach to examine whether financial development enhances economic growth by easing constraints on industries that are technologically more dependent on small firms. We first measure an industry's "technological" composition of small firms relative to large firms as the share of employment in firms with less than 20 employees in the United States in 1992. Assuming that financial markets are relatively frictionless in the United States, we therefore identify each industry's "technological" share of small firms in a relatively frictionless financial system. Then, we extensively test the validity of this benchmark measure of technological Small Firm Share by (i) using data from the United States in 1958 to compute Small Firm Share, (ii) measuring Small Firm Share at different stages of the U.S. business cycle, (iii) computing technological Small Firm Share from different countries, and (iv) defining small firms differently.

The results indicate that small-firm industries grow disproportionately faster in economies with well-developed financial systems. This does not imply that financial development slows the growth of large firms. Rather, financial development exerts a particularly positive growth effect on small-firm industries. Furthermore, our analyses suggest that large-firm industries are not the same as industries that rely heavily on external finance. Rajan and Zingales (1998) show that industries that are technologically more dependent on external finance grow disproportionately faster in economies with better developed financial systems. When controlling for cross-industry differences in external dependence, we continue to find that financial development disproportionately accelerates the growth of industries that are composed of small firms for technological reasons.

We also show that the level of financial development affects industrial composition. In countries with greater financial development, small-firm industries represent a greater proportion of total manufacturing value added than in countries with lower levels of financial development. Thus, financial development disproportionately boosts both the growth rate of small-firm industries and the level of value added contributed by small-firm industries to total value added.

The results also provide information regarding which particular characteristics of small-firm industries account for their greater sensitivity to financial development. One possibility is that small firms are more informationally opaque than large firms, so that financial improvements that lower the marginal costs of acquiring information disproportionately facilitate the flow of capital to small firms. Another possibility is that small firms rely more on intangible assets, so that financial innovations that reduce the need for collateral ease credit constraints on small firms more than large ones. A different possibility is that the results are spurious and arise only because small-firm industries enjoyed greater growth opportunities than large-firm industries over the sample period. From this perspective, financially more developed economies were simply better at exploiting these growth opportunities that happened to be concentrated in small-firm industries. If these potential characteristics of small-firm industries are driving the results, then our findings should vanish when we control for them.

The results indicate that financial development still exerts a disproportionately positive impact on small-firm industries even when controlling for cross-industry differences in informational opacity, asset intangibility, industry concentration, and growth prospects. This suggests that financial development affects small-firm industries beyond opacity, collateral, and growth prospects. Although we do not have direct measures of firms' access to financial services, these findings are consistent with the view that financial development makes it affordable for more small firms to purchase financial services. Accordingly, the results suggest that financial development influences the extensive margin by allowing new small firms to access financial services as well as facilitating the intensive margin by improving financial services for those already using the financial system.[3]

Our paper complements recent empirical work on finance and firm size. Three influential papers examine individual countries or regions. Guiso, Sapienza, and Zingales (2004) find that financial development helps small firms more than large firms in Italy. Cetorelli and Strahan (2006) find that uncompetitive local banking markets in the United States represent a barrier to the entry of new firms because the new firms have difficulty accessing credit. Kumar, Rajan, and Zingales (2001) assess the impact of different country and industry characteristics on industry size distribution across 15 European countries. Our work builds on this research. Rather than focusing on one country or region, or one characteristic of financial development such as competition, we examine a broad cross section of countries and test whether overall financial development influences small-firm industries differently from large-firm industries. Thus, we do not examine whether financial reforms influence the distribution of firms in a country because (i) there are very limited cross-country data on the distribution of firm sizes and (ii) theory stresses the link between financial market imperfections and small firms, not necessarily the link between finance and entire distribution of firm sizes in an economy. We instead examine whether industries that are naturally composed of small firms for technological reasons perform better in countries with well-developed financial systems. Our research also complements that work by Beck, Demirgüç-Kunt, and Maksimovic (2005), who use survey data to assess the relationship between the financing obstacles that firms report they face and firm growth. They find that the negative impact of reported obstacles on firm growth is stronger for small firms than large firms and stronger in countries with underdeveloped financial systems.[4] Their study has the advantage of using cross-country, firm-level data, but it has the disadvantage of relying on survey responses

3. Although Beck, Demirgüç-Kunt, and Maksimovic (Forthcoming) show that small firms finance a higher percentage of investment with external finance in countries with stronger property rights protection, we do not have direct evidence on fixed costs or on whether a higher proportion of small firms accesses financial services in more financially developed economies. Thus, we can only draw the cautious conclusion that the results are consistent with the view that financial development lowers the fixed costs of accessing financial services with disproportionately positive ramifications on small firms.

4. Beck, Demirgüç-Kunt, and Maksimovic (2006) find that financial development reduces constraints on firms choosing their optimal sizes.

regarding the obstacles that firms encounter. We use a different methodology that assesses whether industries that are naturally composed of small firms grow faster in countries with better-developed financial systems. Our research provides complementary information on whether financial development fosters aggregate growth by disproportionately facilitating the growth of small-firm industries.

1. DATA

To assess whether (i) financial development boosts the growth of small-firm industries more than large-firm industries and whether (ii) financial development boosts the level of output accounted for by small-firm industries, we construct a new cross-country, cross-industry database. We compile data on (i) the relative size and growth rates of each industry across countries, (ii) each industry's technological firm size, and (iii) country-level indicators of financial development. This section describes these key variables. Furthermore, in robustness tests presented below, we construct, define, and use additional information on industry and country traits. The data cover 44 countries and 36 industries in the manufacturing sector. Tables 1 and 2 present descriptive and summary statistics.

1.1 Industry Growth Rates and Shares

$\text{Growth}_{i,k}$ equals the average annual growth rate of real value added of industry k in country i over the period 1980 to 1990. The data are from the Industrial Statistics Yearbook database. When we extend the measurement period to 2000, the sample is reduced by one-third because of missing observations for several countries and industries. Nevertheless, we demonstrate the robustness of these findings to (i) expanding the estimation period from 1980–90 to 1980–2000 and (ii) examining $\text{Growth}_{i,k}$ over the period 1990–2000.

Industry $\text{Share}_{i,k}$ is the share of industry k in total manufacturing value added of country i. Thus, besides testing whether financial development has differential effects on the growth rate of large- and small-firm industries by examining $\text{Growth}_{i,k}$, we also examine whether financial development shapes the level of industrial output patterns by examining Industry $\text{Share}_{i,k.}$ Specifically, we test whether a country's level of financial development shapes the cross-sectional distribution of industries by increasing the proportion of value added accounted for by small-firm industries.

Although we examine Industry $\text{Share}_{i,k}$, we focus on $\text{Growth}_{i,k}$ for two reasons. First, building on Rajan and Zingales (1998), a large literature examines the relationship between financial development and industry growth. This provides a natural framework for our analyses and facilitates comparisons, so that we identify an independent relationship between financial development and the growth rates of small-firm

TABLE 1

FIRM SIZE DISTRIBUTION IN THE UNITED STATES IN 1992

ISIC	Industry name	S5	S10	S20	S100
311	Food manufacturing	0.56	1.68	3.82	13.77
313	Beverage industries	0.60	1.76	4.04	14.75
314	Tobacco manufactures	0.09	0.20	0.30	1.49
321	Manufacture of textiles	0.40	1.17	2.81	13.43
322	Manufacture of wearing apparel, except footwear	1.30	3.60	8.18	31.74
323	Manufacture of leather and products of leather	1.94	4.78	10.45	36.89
324	Manufacture of footwear	0.31	0.81	1.61	7.40
331	Manufacture of wood and wood and cork products	4.20	11.20	21.37	47.31
332	Manufacture of furniture and fixtures	1.57	4.19	9.09	28.74
341	Manufacture of paper and paper products			3.03	16.16
342	Printing, publishing, and allied industries	3.64	9.16	16.32	35.80
352	Manufacture of other chemical products	0.87	2.68	5.80	17.67
353	Petroleum refineries	0.05	0.18	0.36	1.90
354	Manufacture of miscellaneous products of petroleum and coal	1.26	3.93	9.26	29.80
355	Manufacture of rubber products	0.38	1.21	3.15	13.23
356	Manufacture of plastic products not elsewhere classified	0.69	2.24	6.09	27.19
361	Manufacture of pottery, china, and earthenware	2.30	4.91	8.80	26.52
362	Manufacture of glass and glass products	1.15	2.82	5.05	13.92
369	Manufacture of other nonmetallic mineral products	1.87	5.88	14.17	40.78
371	Iron and steel basic industries	0.20	0.59	1.62	8.05
372	Nonferrous metal basic industries	0.50	1.78	4.76	18.65
381	Manufacture of fabricated metal products	1.28	4.07	9.98	33.87
382	Manufacture of machinery except electrical	2.15	6.37	13.68	34.60
383	Manufacture of electrical machinery apparatus, and appliances	0.50	1.48	3.44	14.18
384	Manufacture of transport equipment	0.18	0.54	1.21	4.20
385	Manufacture of professional and scientific equipment	0.68	1.87	4.01	12.88
390	Other Manufacturing Industries	3.54	8.72	16.95	43.48
3211	Spinning, weaving, and finishing textiles	0.26	0.73	1.91	9.14
3411	Manufacture of pulp, paper, and paperboard			0.14	1.29
3511	Manufacture of basic industrial chemicals except fertilizers	0.29	0.89	1.75	6.51
3513	Manufacture of synthetic resins, plastic materials, and fibers	0.11	0.31	0.66	3.17
3522	Manufacture of drugs and medicines	0.26	0.86	2.10	8.09
3825	Manufacture of office, computing, and accounting machinery	0.48	1.32	2.85	10.43
3832	Manufacture of radio, television, and communication equipment	0.57	1.40	3.09	11.67
3841	Ship building and repairing	1.73	3.58	6.56	16.35
3843	Manufacture of motor vehicles	0.32	1.00	2.28	8.04
Average		1.07	2.88	5.85	18.42

NOTES: This table shows employment shares by firm size bin in the United States by ISIC Revision 2 industries. Sx is the industry's share of employment by firms with less than x employees, and is calculated using data from the U.S. Census on all U.S. firms for the year 1992. Employment shares are expressed in percentages of total number of employees.

industries relative to large-firm industries above and beyond the effects established by past work. Second, focusing on growth links helps link our paper to an extensive body of theoretical and empirical work on the finance-growth relationship. As reviewed by Levine (2006), many theoretical models predict that a higher level of financial development will induce a faster rate of economic growth, not just an increase in the level of economic development. Thus, a higher level of financial development might exert a disproportionately positive effect on the growth rate of particular types of industries, such as industries naturally composed of small firms facing high informational asymmetries. This further motivates our focus on $\text{Growth}_{i,k}$. Moreover, all of the results are confirmed with Industry $\text{Share}_{i,k}$.

1.2 Measure of Small Firm Share

We construct measures of each industry's "natural" or technological share of small firms based on an extensive body of research on the theory of the firm. As discussed, for example, by Coase (1937) and Sutton (1991), differences in productive technologies influence an industry's technological firm size. To get a proxy measure of each industry's natural or technological share of small firms, therefore, we need a benchmark

TABLE 2

SUMMARY STATISTICS

Variable	Mean	Median	St. dev.	Minimum	Maximum
Panel A. Country-industry variables					
Growth in real value added	0.034	0.029	0.099	−0.447	1.000
Industry share in value added	0.016	0.009	0.021	0.000	0.224
Panel B. Industry variables					
Small Firm Share (empl<5)	0.011	0.006	0.011	0.001	0.042
Small Firm Share (empl<10)	0.029	0.018	0.027	0.002	0.112
Small Firm Share (empl<20)	0.059	0.039	0.053	0.001	0.214
Small Firm Share (empl<100)	0.184	0.14	0.13	0.013	0.473
Small Firm Share in 1997	0.054	0.034	0.045	0.002	0.195
Small Firm Share in 1958	0.061	0.038	0.061	0.001	0.269
Small Firm Share in UK	0.010	0.009	0.009	0.000	0.037
Small Firm Share in Germany	0.048	0.040	0.040	0.002	0.151
External financial dependence	0.319	0.231	0.406	−0.451	1.492
Intangibility	0.625	0.460	0.810	0.020	4.540
Sales growth	0.045	0.042	0.037	−0.037	0.129
Rating splits	0.539	0.552	0.113	0.308	0.786
R^2	0.224	0.214	0.075	0.089	0.474
Concentration	43.719	40.443	12.863	23.000	81.500
Panel C. Country variables					
Private credit	0.425	0.341	0.270	0.073	1.173
Liquid liabilities	0.487	0.447	0.234	0.142	1.342
Market turnover	0.157	0.109	0.164	0.001	0.712
Per capita GDP	7.791	7.860	1.334	4.793	9.573
Property rights	3.966	4.000	0.879	2.000	5.000
Legal efficiency	7.704	7.375	2.012	2.500	10.000
Financing obstacles	2.575	2.593	0.421	1.691	3.267

	Small Firm Share	Small Firm Share (empl<5)	Small Firm Share (empl<10)	Small Firm Share (empl<100)	Small Firm Share in 1997	Small Firm Share in 1958	Small Firm Share UK
Panel D. Cross-industry correlation of measures of firm size							
Small Firm Share (empl<5)	0.96**						
	(0.00)						
Small Firm Share (empl<10)	0.99**	0.99**					
	(0.00)	(0.00)					
Small Firm Share (empl<100)	0.95**	0.87**	0.91**				
	(0.00)	(0.00)	(0.00)				
Small Firm Share in 1997	0.89**	0.85**	0.88**	0.86**			
	(0.00)	(0.00)	(0.00)	(0.00)			
Small Firm Share in 1958	0.89**	0.81**	0.86**	0.88**	0.86**		
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
Small Firm Share in UK	0.54**	0.55**	0.54**	0.57**	0.34	0.40*	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.07)	(0.02)	
Small firm share in Germany	0.70**	0.70**	0.71**	0.71**	0.60**	0.64**	0.82**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

(*Continued*)

TABLE 2
CONTINUED

	Small Firm Share	External dependence	Sales growth	Intangibility	Rating splits	R^2
Panel E. Cross-industry correlation of industry characteristics						
External dependence	−0.16					
	(0.38)					
Sales growth	−0.16	0.76**				
	(0.39)	(0.00)				
Intangibility	0.41*	0.12	0.34*			
	(0.02)	(0.51)	(0.05)			
Rating splits	−0.24	−0.09	−0.10	−0.19		
	(0.21)	(0.66)	(0.61)	(0.33)		
R^2	−0.03	−0.14	−0.20	−0.21	0.06	
	(0.87)	(0.44)	(0.27)	(0.25)	(0.75)	
Concentration	−0.57**	−0.06	0.18	−0.18	0.13	−0.28
	(0.00)	(0.75)	(0.32)	(0.32)	(0.50)	(0.13)

NOTES: This table reports summary statistics and correlations for the main variables in our analysis. *Country-industry variables:* Growth in real value added is average growth in real value added over the period 1980–90 by country and ISIC industry. Industry share in value added is the industry's share in total value added of the country's manufacturing sector in 1980. *Industry variables:* Small firm share is the industry's share of employment by firms with less than 20 employees, and is calculated using data from the U.S. Census on all U.S. firms for the year 1992. Small firm share (empl<x) is the industry's share of employment by firms with less than x employees, and is calculated using data from the U.S. Census on all U.S. firms for the year 1992. Small firm share in 1997 is the industry's share of employment by firms with less than 20 employees, and is calculated using data from the U.S. Census on all U.S. firms for the year 1997. Small firm share in 1958 is the industry's share of employment by firms with less than 20 employees, and is calculated using data from the U.S. Census on all U.S. firms for the year 1958. Small firm share in the United Kingdom is the industry's share of employment by firms with less than 20 employees in the United Kingdom and is calculated using firm-level data from Amadeus on all limited liability firms in the United Kingdom with 10 or more employees for the year 1997. Small firm share in Germany is the industry's share of employment by firms with less than 20 employees in Germany, and is calculated using firm-level data from Amadeus on all limited liability firms in Germany with 10 or more employees for the year 1997. External financial dependence is a measure of the industry's dependence on external finance, from Rajan and Zingales (1998). Intangibility is a measure of the industry's dependence on intangible assets from Claessens and Laeven (2003), and is calculated as the ratio of intangible assets to fixed assets of U.S. firms over the period 1980–90. Sales growth is an industry measure of sales growth from Fisman and Love (2007) and is calculated as real annual growth in net sales of U.S. firms over the period 1980–90. Rating splits is the industry-average ratio of bond issues with split ratings between S&P and Moody's from Morgan (2002). A higher score indicates more industry-opaqueness. R^2 is industry-average R^2 from Durnev, Morck, and Yeung (2004). A higher score indicates more stock return synchronicity and thus less informative pricing. Concentration is the four-firm concentration ratio for U.S. firms from the 1992 U.S. Census (in%). The industry measures are based on U.S. data, unless otherwise noted. *Country variables:* Private Credit is claims by financial institutions on the private sector divided by GDP in 1980. Liquid liabilities are liquid liabilities to GDP in 1980. Market turnover is total value of trades to total value of shares averaged in 1980. Per capita GDP is the logarithm of the country's real GDP per capita in 1980. Legal efficiency is the measure of the country's efficiency of the legal system used by La Porta et al. (1998) and is an average for the years 1980–83. Property rights is a measure of the country's protection of property rights from the Heritage Foundation and is an average for the years 1995–99. Financing obstacles is the country-average of firm financing obstacles in 1999 from WBES. Panel D presents the cross-industry correlation matrix of alternative measures of firm size. *p*-values are between brackets. Panel E presents the cross-industry correlation matrix of industry characteristics. *p*-values are between brackets. * indicates significance at 5% level; ** indicates significance at 1% level.

economy with relatively few market imperfections and policy distortions, so that we capture, as closely as possible, only the impact of cross-industry differences in production processes, capital intensities, and scale economies on cross-industry firm size.

We start by using the United States to form the benchmark measure of an industry's technological share of small firms. This relies on the assumption that U.S. financial markets are relatively frictionless. Since the United States has one of the most developed financial systems in the world by many measures (Demirgüç-Kunt and Levine 2001), it represents a natural benchmark for providing a ranking of each industry's technological share of small firms. Furthermore, the perfect benchmark country has relatively frictionless markets and few policies distorting firm size beyond the financial sector. For instance, differences in human capital, market size, contract enforcement, and overall institutional development may influence industrial firm size beyond technological factors (Lucas 1978, You 1995). Thus, the ideal benchmark economy not

only has relatively frictionless financial markets; it has relatively frictionless markets in general. Again, the United States is a reasonable initial benchmark. The United States has the full spectrum of human capital skills. Furthermore, comparative studies of U.S. and European labor markets suggest that the United States has many fewer policy distortions. Moreover, the U.S. internal market is huge and—given its size—it is comparatively open to international trade. Many studies also point to the United States as having a superior contracting environment and well-developed institutions (Barth, Caprio, and Levine 2006).

The empirical methodology does not require that the United States has perfect financial markets, labor markets, contracting systems, or institutions. Rather, we require that policy distortions and market imperfections in the United States do not distort the ranking of industries in terms of the technological share of small firms within each industry. Thus, we begin with the following benchmark measure of each industry's technological share of small firms.

Small Firm Share_k equals industry k's share of employment in firms with less than 20 employees in the United States and is obtained from the 1992 Census. We measure Small Firm Share in 1992 because the U.S. Census did not start collecting comprehensive firm size distribution data at the firm level until 1992. For a less refined categorization of firms by employment size, the data extend back to 1958. We confirm the findings with the 1958 data. In our baseline regressions, we use Small Firm Share as the measure of each industry's "natural" or "technological" share of small firms.

Table 1 lists the Small Firm Share for each industry in the sample. The Small Firm Share has a mean of 6% but varies widely from 0.1% in manufacturing of pulp, paper, and paperboard to 21% in wood manufacturing.[5] We omit three industries with fewer than 10 firms for each size bucket (Tobacco (ISIC 314), Petroleum refineries (ISIC 353), and Pulp and paper (ISIC 3411)) because the low number of observations may impede an accurate estimate of the natural Small Firm Share. Nevertheless, the paper's findings hold when including these three industries.

Below, we present a large battery of sensitivity analyses of the benchmark measure of Small Firm Share. We use different measures of Small Firm Share, different benchmark years from the United States, different benchmark countries, and different cutoffs for the definition of a small firm. We also control for numerous industry traits, including asset tangibility and opacity, sales growth, and dependence on external finance. We further condition on country characteristics, including the level of economic development, labor market frictions, market size, and barriers to firm entry.

1.3 Indicator of Financial Development

Ideally, one would like indicators of the degree to which the financial system ameliorates information and transactions frictions and facilitates the mobilization

5. Note that the share of small firms among all firms in the United States is substantially higher than for the subset of listed enterprises. From the Compustat database, the share of small listed manufacturing firms is only 0.009%. Thus, it is not useful to only consider listed firms to assess which firm characteristics drive the results.

and efficient allocation of capital. Specifically, we would like indicators that capture the effectiveness with which financial systems research firms and identify profitable projects, exert corporate control, facilitate risk management, mobilize savings, and ease transactions. Unfortunately, no such measures are available across countries. Consequently, we rely on a traditional measure of financial development that existing work shows are robustly related to economic growth.

Private Credit_i equals the value of credits by financial intermediaries to the private sector divided by GDP for country i. It captures the amount of credit channeled through financial intermediaries to the private sector. Levine, Loayza, and Beck (2000) show that Private Credit is a good predictor of economic growth. In our baseline regression, we measure Private Credit in the initial year of our estimation period, 1980 (or the first year in which data are available), to control for reverse causation. Since using initial values instead of average values implies an informational loss, we also confirm the robustness of the results when using Private Credit averaged over the full period 1980–89 and employing instrumental variables to control for endogeneity. Data for Private Credit are from Beck, Demirgüç-Kunt, and Levine (2000). There is wide variation in Private Credit, ranging from 7% in Bangladesh to 117% in Japan. Below, we define and use several alternative indicators of financial development, including a measure of stock market development.

2. METHODOLOGY

To examine whether industries that are naturally composed of small firms grow faster than large-firm industries in countries with higher levels of financial development, we interact an industry characteristic—each industry's technological Small Firm Share—with a country-characteristic—the level of financial development. In describing the econometrics, we only discuss the interaction between financial development and Small Firm Share. In the actual implementation, we control for many interactions between country and industry characteristics.

Consider the following regression:

$$Growth_{i,k} = \sum_i \alpha_i \, Country_i + \sum_k \beta_k \, Industry_k + \gamma \, Industry \, Share_{i,k} + \delta \, (Small \, Firm \, Share_k \times FD_i) + \varepsilon_{i,k},$$

where $\text{Growth}_{i,k}$ is the average annual growth rate of value added, in industry k and country i, over the period 1980 to 1990. Country_i and Industry_k are country and industry dummies, respectively, and Industry $\text{Share}_{i,k}$ is the share of industry k in manufacturing in country i in 1980. Small Firm Share_k is the benchmark share of small firms in industry k, which in our baseline specification equals the share of employment in firms with less than 20 employees in the United States in 1992. FD_i is an indicator of financial development for country i, which equals Private Credit in our baseline regression. We include the interaction between the share of small firms in an industry and financial development. We do not include financial

development on its own, since we focus on within-country, within-industry growth rates. The dummy variables for industries and countries control for country- and industry-specific characteristics that might determine industry growth patterns. We thus isolate the effect that the interaction of Small Firm Share and Private Credit has on industry growth relative to country and industry means. By including the initial share of an industry we control for a convergence effect: industries with a large share might grow more slowly, suggesting a negative sign on γ. We include the share in manufacturing rather than the level since we focus on within-country, within-industry growth rates. We exclude the United States (the benchmark country) from the regressions.

The focus of our analyses is on the interaction between financial development and Small Firm Share; i.e., we focus on the sign and significance of δ. If δ is positive and significant, this suggests financial development exerts a disproportionately positive effect on small-firm industries relative to large-firm industries. This would suggest that financial development tends to ease growth constraints on small firms more than on large firms.

We conduct the regression analyses under alternative assumptions to assess the validity of the results. In the baseline regressions, we use ordinary least squares (OLS), which assumes that the error term is uncorrelated across both industries and countries. We then relax these restrictions and allow first for correlation across observations from the same industry and second for correlations across observations from the same country. We thus present standard errors based on clustering at both the industry- and country-level in Table 3.[6] For simplicity, we do not report standard errors based on industry- and country-clustering in the rest of the paper. However, all of the paper's findings are robust to clustering at the industry and country level and these results are available on request.

3. RESULTS, EXTENSIONS, AND SENSITIVITY TESTS

3.1 Main Results

The results presented in Table 3 indicate that small-firm industries (industries with technologically larger shares of small firms) grow faster in economies with better-developed financial intermediaries. The interaction of Private Credit with Small Firm Share enters positively and significantly at the 5% level in column (1). We also find that the coefficient on Industry Share enters negatively and significantly, suggesting some convergence in industrial composition. The results indicate that industries whose organization is based more on small firms than on large firms grow faster in countries with better-developed financial intermediaries.

6. Two-way clustering, at the country-industry level, is infeasible in this paper's econometric specification where (i) there are only country-industry observations, (ii) country and industry fixed effects are estimated, and (iii) the number of clusters is small, with 42 countries and 33 industries. Under these conditions, the asymptotic justification for the robustness of clustered standard errors does not hold (Cameron, Gelbach, and Miller 2006).

TABLE 3

FINANCIAL DEVELOPMENT, SMALL FIRM SHARE, AND GROWTH

	(1) Basic	(2) External dependence	(3) Clustering at industry level	(4) Clustering at country level	(5) Excluding industries with low share	(6) Other industry and country characteristics
Industry share in value added	−1.056**	−1.148**	−1.148**	−1.148*	−0.859**	−0.876**
	(0.284)	(0.282)	(0.334)	(0.442)	(0.195)	(0.256)
Private Credit × Small Firm Share	0.436*	0.567**	0.567**	0.567	0.698**	0.538*
	(0.187)	(0.194)	(0.184)	(0.306)	(0.196)	(0.228)
Private Credit × External dependence		0.166**	0.166**	0.166**	0.141**	0.085*
		(0.043)	(0.040)	(0.059)	(0.041)	(0.038)
Private Credit × Sales growth						0.415
						(0.408)
Private Credit × Rating splits						0.060
						(0.073)
Private Credit × R^2						0.003
						(0.177)
Private Credit × Concentration						0.000
						(0.001)
Property rights × Intangibility						0.005*
						(0.002)
Entry regulation × Small firm share						−0.761*
						(0.309)
Openness × Small Firm Share						0.000
						(0.002)
Per capita GDP × Small Firm Share						−0.068
						(0.053)
Observations	1,147	1,147	1,147	1,147	586	918
R^2	0.27	0.29	0.29	0.29	0.56	0.33
Differential in real growth rate (%)	1.10	1.43	1.43	1.43	1.76	1.36

NOTES: Dependent variable is average growth in real value added over the period 1980–90 by country and ISIC industry. Industry share in value added is the industry's share in total value added of the country's manufacturing sector. Private Credit is claims by financial institutions on the private sector divided by GDP in 1980. Small firm share is the industry's share of employment by firms with less than 20 employees, and is calculated using data from the U.S. Census on all U.S. firms for the year 1992. External dependence is a measure of the industry's dependence on external finance, from Rajan and Zingales (1998). The industry measures are based on U.S. data. The standard errors in regression (3) are adjusted for clustering at the industry-level. The standard errors in regression (4) are adjusted for clustering at the country-level. The regression in column (5) excludes industries below the median initial industry share in value added for each country. All regressions exclude industries with less than 10 firms in each size bucket; these are: Tobacco (ISIC 314), Petroleum refineries (ISIC 353), and Pulp and paper (ISIC 3411). Sales growth is an industry measure of sales growth from Fisman and Love (2007) and is calculated as real annual growth in net sales of U.S. firms over the period 1980–90. Intangibility is a measure of the industry's dependence on intangible assets from Claessens and Laeven (2003) and is calculated as the ratio of intangible assets to fixed assets of U.S. firms over the period 1980–90. Rating splits is the industry-average ratio of bond issues with split ratings between S&P and Moody's from Morgan (2000). A higher score indicates more industry-opaqueness. R^2 is industry-average R^2 from Durnev, Morck, and Yeung (2004). A higher score indicates more stock return synchronicity and thus less informative pricing. Concentration is the four-firm concentration ratio for U.S. firms from the 1992 U.S. Census. The industry measures are based on U.S. data. Per capita GDP is the logarithm of the country's real GDP per capita in 1980. Openness is the sum of exports and imports relative to GDP in 1980. Entry regulation is the cost of entry regulations as a share of per capita GDP in 1999 from Djankov et al. (2002). A higher score denotes more costly entry regulations. All regressions are estimated using OLS and include country and industry dummies, but these are not reported. Robust standard errors are in parentheses. *indicates significance at 5% level; **indicates significance at 1% level.

Given the influential findings of Rajan and Zingales (1998), we were concerned that there might be a large, negative correlation between industries that are naturally heavy users of external finance and industries that are naturally composed of small firms. If this were the case, then it would be difficult to distinguish between the finding that externally dependent industries grow faster in economies with well-developed financial systems and our result that small-firm industries grow faster in economies with well-developed financial systems. While there is a negative correlation between Small Firm Share and External Dependence, it is very small (-0.16) and insignificant as shown in Table 2, Panel E. This suggests that the industry characteristics explaining firm size distribution are not the same as the characteristics explaining technological dependence on external finance, and that the firm size channel we have identified is different from the external financial dependence channel.

The column (2) regression of Table 3 demonstrates the robust link between financial development, Small Firm Share, and industry growth when controlling for external dependence. As shown in column (2), the interaction between each industry's level of external dependence and financial development (Private Credit $\times$ External Dependence) enters positively and significantly. This indicates that industries that are naturally heavy users of external finance grow faster in economies with higher levels of financial development.

Moreover, column (2) shows that the interaction between each industry's technological Small Firm Share and financial development (Private Credit $\times$ Small Firm Share) enters positively and significantly when controlling for external dependence. Thus, we find that industries with technologically larger shares of small firms grow more quickly in countries with higher levels of financial development even when controlling for cross-industry differences in external dependence. In unreported regressions, we also tested whether the interaction between Private Credit and Small Firm Share varies across industries with different degrees of external dependence. The triple interaction term does not enter significantly and the interaction of Private Credit with Small Firm Share continues to enter significantly and positively. This result suggests that small firms consistently face high financing constraints, irrespective of whether they are in an industry with a naturally high or low demand for external finance.

The relationship between financial development, an industry's Small Firm Share, and industry growth is not only statistically, but also economically large. To illustrate the effect, we compare the growth of an industry with a relatively large share of small firms and an industry with a relatively low share of small firms across two countries with different levels of financial development. The last row in Table 3 (and subsequent tables) shows the growth difference between industries at the 25th and 75th percentiles of the Small Firm Share and countries at the 25th and 75th percentiles of Private Credit. Take the example of column (2). The estimation suggests that the furniture industry (75th percentile of Small Firm Share) should grow 1.4% per annum faster than the spinning industry (25th percentile of Small Firm Share) in Canada (75th percentile of Private Credit) than in India (25th percentile of Private Credit). Since the average growth rate in our sample is 3.4%, this is a relatively large effect.

To assess the robustness of the results, we relax assumptions concerning the distribution of the error term in the estimation equation. First, industry-specific shocks across all countries would invalidate the standard OLS assumption of independent errors. Thus, in column (3), we cluster at the industry level; i.e., we allow error terms to be correlated within industries but not across industries. As shown, this does not change the results. Second, country-specific shocks across all industries within a country would also invalidate the standard OLS assumption of independent errors. Thus, column (4) presents a regression with clustering at the country-level; i.e., we allow errors to be correlated within countries but not across countries. While the significance of the Small Firm Share-Private Credit interaction term decreases, the coefficient remains significant at the 7% level.[7]

We were also concerned that including industries that provide very little value added in countries could bias the results. Consequently, we excluded industries below the median share of value added for each country. These results are presented in column (5) of Table 3. With this subsample, financial development continues to exert a particularly large impact on small-firm industries.

3.2 Controlling for Different Country and Industry Characteristics

In this subsection, we control for additional country and industry traits. If financial development simply proxies for other country characteristics that interact with industry firm size to shape cross-industry growth rates, we might draw inappropriate inferences about the independent impact of the financial system on cross-industry growth rates unless we control for these other country characteristics. Similarly, by omitting key industry traits from the analyses, we might inappropriately interpret the results as relating to the natural firm size of industries rather than to other industry traits correlated with firm size. Thus, we control for numerous country and industry traits to gauge the robustness of the findings.

Based on a large and growing literature, we control for an array of country traits. First, we control for the interaction of Small Firm Share with GDP per capita since financial development might simply reflect overall development, as measured by GDP per capita, and not something particular about the financial system. If this is the case and overall development exerts a particularly beneficial effect on small firms, then we will draw inappropriate inferences about the impact of financial development on the growth of small-firm industries if we do not control for GDP per capita.[8] Second, industries that depend on relatively large firms may grow faster in economies with

7. The relationship between financial development and industry growth is robust to controlling for reverse causality by using legal origin and other historic and geographic characteristics of each country as instrumental variables, and when correcting the standard errors for clustering at the industry or country levels.

8. We also included a proxy for educational attainment and its interaction with Small Firm Share. A more educated population might be more conducive to the growth of industries composed of smaller (or larger) firms since technical, entrepreneurial, and managerial skills influence industrial organization and growth. Adding this additional term did not change the results on the interaction between financial development and Small Firm Share and did not enter independently significantly.

larger markets that allow them to exploit economies of scale more fully (Braun and Raddatz 2008). To test this, we include a proxy for market size: openness to international trade, which is measured as exports plus imports divided by GDP. Furthermore, using the size of the economy (GDP) as a proxy for market size rather than the trade yields the same results. Third, financial market frictions might be highly correlated with regulatory impediments to labor mobility and new firm formation. If this is the case, we might inappropriately interpret the results as applying to finance when they really apply to other frictions. For instance, Klapper, Laeven, and Rajan (2006) find that new firms are disproportionately hurt by regulatory impediments to labor mobility and high entry barriers. We therefore control for an interaction of Small Firm Share with Entry Regulation, which is the cost of registering an enterprise relative to GDP in 1999 (Djankov et al. 2002). Table 2 provides summary statistics on these country indicators.

Since a parallel literature examines how different industry traits affect cross-industry growth rates across countries, we also use this research to inform our robustness tests. First, if (i) financial development has a disproportionately positive effect on industries with good growth opportunities (Fisman and Love 2007) and (ii) small-firm industries just happened to enjoy good growth opportunities over the sample period, then we might erroneously infer that financial development exerts an especially positive impact on small firms. We therefore control for Sales Growth, which is calculated as real annual growth in net sales of U.S. firms over the period 1980 to 1989 using data from Compustat. Second, if (i) small firms rely heavily on intangible assets and (ii) strong private property rights are closely associated with financial development, then our findings may simply be confirming the results in Claessens and Laeven (2003). We therefore control for the interaction of Property Rights with the percentage of intangible assets in each industry, computed as the ratio of intangible assets to fixed assets of U.S. firms over the period 1980 to 1989 using data from Compustat. Third, differences in informational asymmetries might account for financial development's disproportionate influence on small-firm industries. To test this, we use two measures of the informational opacity of industries. First, Rating Splits measures disagreement between the two major bond rating agencies—Moody's and S&P—about the risk of U.S. firms, based on the bond ratings of almost 8,000 firms during the period 1983–93 (Morgan 2002). Greater disagreement suggests greater opacity. The second measure of informational opacity comes from Durnev, Morck, and Yeung (2004), who compute the degree to which individual stock prices move with average stock prices in an industry based on an R^2 measure of synchronicity, with higher R^2—greater synchronicity—as an indication that investors have a more difficult time discerning firm-specific differences. Fourth, the Small Firm Share might simply proxy for the degree of industry concentration and we therefore control for the interaction of Private Credit with the four-firm concentration ratio based on U.S. Census data. Table 2 provides summary statistics and partial correlations among these industry characteristics. Small Firm Share is significantly correlated only with the share of intangible assets (positively) and with industry concentration (negatively).

After controlling for all of these country and industry characteristics, we continue to find that financial development disproportionately boosts the growth rate of small-firm industries. The interaction of Private Credit with Small Firm Share enters positively and significantly at the 1% level in column (6) of Table 3. The interaction between Private Credit and External dependence also enters significantly.[9] Only two other interaction terms enter significantly. The interaction between Small Firm Share and Entry Regulation enters negatively and significantly. This suggests that regulations that impede entry are particularly harmful to industries that are naturally composed of small firms for technological reasons. Furthermore, the interaction between Intangibility and Property Rights enters positively and significantly, indicating that industries that are naturally characterized by a high proportion of intangible assets grow relatively faster in countries with comparatively well-functioning property rights systems.

These results indicate that (i) Small Firm Share does not only reflect other industry characteristics and (ii) Private Credit does not simply reflect other national traits. Rather, we find an independent relationship between financial development and the relative growth rates of industries that are naturally composed of smaller firms for technological reasons. The robustness of Small Firm Share indirectly suggests that financial development operates at the extensive margin by allowing new small firms to access growth-enhancing financial services.

3.3 Alternative Definitions of a Small Firm

Table 4 indicates that the results are robust to using alternative definitions of a small firm below 20 employees. We use four different cutoffs to define a small firm: 5, 10, and 100 employees, respectively.[10] Table 1 lists Small Firm Share for the different definitions of a small firm, where Sx in the table indicates the industry's share of employment by firms with less than x workers. There is a high correlation among the different measures of Small Firm Share, and the average correlation is 91% (Table 2, Panel D). Not surprisingly, the correlation decreases with higher threshold measures of firm size. The correlation between S5 and S10 is 99%, but 87% between S5 and S100. Nevertheless, using different cutoffs provides additional robustness tests and more fully characterizes the relationship between cross-industry firm size,

9. As shown, the size of the coefficient on the interaction between Small Firm Share and Private Credit does not change much when including all of the industry and country control variables. Rather than including all of the control variables simultaneously as reported in regression (6), we also included them one at a time. When we only include the two interaction terms of Private Credit with External dependence and Entry barriers with Small Firm Share, we drive the coefficient on the interaction between Private Credit and Small Firm Share from 0.54 in regression 6 to 0.27, but it remains significant at the 5% level. The absolute value of the coefficient on the interaction term between Entry barriers and Small Firm Share also falls, from −0.76 in regression (6) to −0.63. While this suggests a relation between entry barriers and financial development, the regression results demonstrate that both financial impediments on firms and nonfinancial barriers to firm entry have independent, negative effects on small-firm industries.

10. Two industries (Manufacture of paper and paper products, and Manufacture of pulp, paper, and paperboard) drop from the sample due to missing U.S. Census data when using 5 or 10 employees as the cutoff.

TABLE 4

ALTERNATIVE MEASURES OF FIRM SIZE DISTRIBUTION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Industry share in value added	−1.159**	−1.164**	−1.148**	−1.128**	−1.106**	−1.173**	−1.106**	−1.127**
	(0.292)	(0.293)	(0.282)	(0.281)	(0.279)	(0.303)	(0.274)	(0.278)
Private Credit × External financial dependence	0.174**	0.174**	0.166**	0.164**	0.161**	0.182**	0.152**	0.159**
	(0.044)	(0.044)	(0.043)	(0.043)	(0.043)	(0.047)	(0.042)	(0.043)
Private Credit × Small firm share (empl < 5)	3.112**							
	(0.983)							
Private Credit × Small firm share (empl < 10)		1.275**						
		(0.383)						
Private Credit × Small firm share (empl < 20)			0.567**					
			(0.194)					
Private Credit × Small firm share (empl < 100)				0.192*				
				(0.084)				
Private Credit × Small firm share in 1958					0.451*			
					(0.178)			
Private Credit × Small firm share in 1997						0.804**		
						(0.278)		
Private Credit × Small firm share in UK							2.074*	
							(0.849)	
Private Credit × Small firm share in Germany								0.734**
								(0.273)
Observations	1,105	1,105	1,147	1,147	1,147	1,037	1,122	1,122
R^2	0.29	0.29	0.29	0.28	0.29	0.29	0.28	0.29
Differential in real growth rate (%)	1.48	1.40	1.43	1.36	1.57	1.82	0.76	1.07

NOTES: Dependent variable is average growth in real value added over the period 1980–90 by country and ISIC industry. Industry share in value added is the industry's share in total value added of the country's manufacturing sector. Private Credit is claims by financial institutions on the private sector divided by GDP in 1980. Small firm share (empl < x) is the industry's share of employment by firms with less than x employees, and is calculated using data from the U.S. Census on all U.S. firms for the year 1992. Small firm share in 1997 is the industry's share of employment by firms with less than 20 employees and is calculated using data from the U.S. Census on all U.S. firms for the year 1997. Small firm share in 1958 is the industry's share of employment by firms with less than 20 employees and is calculated using data from the U.S. Census on all U.S. firms for the year 1958. Small firm share in the United Kingdom is the industry's share of employment by firms with less than 20 employees in the United Kingdom and is calculated using firm-level data from Amadeus on all limited liability firms in the United Kingdom with 10 or more employees for the year 1997. Small firm share in Germany is the industry's share of employment by firms with less than 20 employees in Germany, and is calculated using firm-level data from Amadeus on all limited liability firms in Germany with 10 or more employees for the year 1997. External financial dependence is a measure of the industry's dependence on external finance, from Rajan and Zingales (1998). The industry measures are based on U.S. data. We include country and industry dummies, but these are not reported. Robust standard errors are in parentheses. *indicates significance at 5% level; **indicates significance at 1% level.

financial development, and growth. As expected, the significance of the interaction term between Private Credit and Small Firm Share dissipates if one defines a small firm as sufficiently large. In particular, when a small firm is defined as having up to 100 employees, the interaction between Private Credit and Small Firm Share becomes insignificant.

The economic size of the impact of financial development on industries with Small Firm Shares is robust to using definitions of Small Firm Share below 20 employees. Using the example above, moving from India (25th percentile Private Credit) to Canada (75th percentile Private Credit) benefits the industry at the 75th percentile of Small Firm Share relatively more than the industry at the 25th percentile of Small Firm Share. According to the estimated coefficients, this change induces a 1.4% growth differential between these two types of industries using 20 employees as the cutoff definition for a small firm. For example, the growth differentials are virtually identical (1.4% and 1.5% growth differential, respectively) when using 10 or 5 employees as alternative definitions of small firm in categorizing the technological level of Small Firm Share. Given that we control for the interaction of financial development with external financial dependence, these results suggest that small-firm industries benefit more than large-firm industries from financial development.[11]

3.4 Alternative Benchmark Measures of Small Firm Share from the United States

Next, we were concerned that the United States in 1992 might be an inappropriate benchmark for all the countries in our sample. Beyond financial sector distortions, there are other factors that may affect an industry's technological firm size. We have shown that the results hold when conditioning on many industry-specific and country-specific traits, including the level of economic development. But, these controls might not fully account for connections between the level of technological development and optimal firm size. To form an alternative benchmark, we want to choose a country with low financial sector distortions and a lower level of technological development than the United States in 1992.

Thus, to further test the robustness of the results, we use the United States in 1958 to form the benchmark measures of each industry's technological firm size. While we cannot measure Small Firm Shares in earlier periods for all employment size categories due to the data constraints mentioned above, we do have 1958 data on Small Firm Share for the 20-employee cutoff and report these in Table A1 in the Appendix. The correlation between Small Firm Shares in 1958 and 1992 is remarkably high, 90%, and significant at the 1% level. The average Small Firm Share decreases only slightly from 6.1% in 1958 to 5.9% in 1992, suggesting that firm size distributions are quite stable over time.

The results are robust to measuring Small Firm Share for U.S. industries in 1958 instead of 1992 (column (5) of Table 4). The interaction of the Small Firm Share

11. The results hold when using the industry rank order of the Small Firm Share rather than the actual Small Firm Share.

benchmark from 1958 with Private Credit enters positively and significantly at the 5% level. This further reduces concerns that the findings are driven by a peculiar feature of industrial firm size in the United States in 1992.

Furthermore, since the U.S. economy was just emerging from a recession in 1992, we check the results by using Small Firm Share for the United States in 1997, when the economy was in the middle of an economic boom. Table A1 in the Appendix lists these data. The correlation between the Small Firm Shares in 1992 and 1997 using the 20-employee cutoff is 90%, and significant at the 1% level. This suggests that firm size distribution across industries in the United States does not vary significantly over the business cycle. This paper's findings are also robust to measuring Small Firm Share for U.S. industries in 1997 instead of 1992. Column (6) of Table 4 reports the results when using the Small Firm Share across U.S. industries when using the 1997 Census and 20 employees as the cutoff. Using the 1997 data does not change our findings: the interaction of the Small Firm Share with Private Credit enters positively and significantly at the 5% level.

3.5 Alternative Benchmark Countries

There may be concerns that the results are driven by the choice of the United States as the benchmark country. The United States has particular production technologies or distortions that yield different industry firm size traits. While it is unclear why this would produce the particular patterns documented above, we also conducted the analyses using different benchmark countries.

As shown in columns (7) and (8) of Table 4, the results hold when using the United Kingdom or Germany as the benchmark economy for computing each industry's technological Small Firm Share. We use Amadeus data for 1997 to calculate the Small Firm Share across industries for these countries. Amadeus is a commercial database maintained by Bureau Van Dijk containing financial statements and employment data for over 5 million firms in Europe. Unfortunately, the data on industrial firm size distribution are not as complete as the data for the United States.[12] Nevertheless, we continue to find that small-firm industries grow faster in countries with well-developed financial systems. The interaction of Small Firm Share in the United Kingdom and Germany and Private Credit enters positively and significantly at the 5% level, which again confirms this paper's core conclusion.

As an additional test, note that the results should vanish if we choose a country with a severely distorted distribution of firm sizes as the benchmark country. In this case, the benchmark would not provide a good proxy for the technological Small Firm Share and we should therefore not expect to obtain significant results. To test this,

12. Unlike for the U.S. Census, for the Amadeus dataset we only have complete data for enterprises above 10 employees so that our Small Firm Share for European countries is calculated as employment in enterprises between 10 and 20 employees relative to employment in enterprises with more than 10 employees. We only include limited liability companies in our calculations, since in most European countries unlimited liability companies are not required to file financial accounts (for further details, see Klapper, Laeven, and Rajan 2006). Also, we exclude industries with less than 20 firm-observations.

we choose Romania, which is a country that is still in a turbulent, transitional state with regard to industrial structure. We choose Romania, and not another transition economy, because Romania has the broadest coverage of firms of all the transition countries included in the Amadeus database. Consistent with our expectation, we do not find significant results with Romania as the benchmark country. In sum, the results using different benchmark countries to identify the Small Firm Share of each industry confirm this paper's findings.

3.6 Sensitivity to Alternative Measures of Financial Development

The findings are also robust to using an alternative measure of financial intermediary development. Specifically, we use Liquid Liabilities, which equals the liquid liabilities of the financial system (currency plus demand and interest-bearing liabilities of banks and nonbank financial intermediaries) divided by GDP. Unlike Private Credit, Liquid Liabilities simply measures the size of financial intermediaries and does not focus on the intermediation of credit to the private sector. As shown in Table 5, regression (1), the results hold when using Liquid Liabilities.

The results do not, however, indicate that small-firm industries grow faster in economies with more developed stock markets. Market Turnover equals the ratio of the value of stock transactions divided by market capitalization for each country's stock exchange. While the interaction with Small Firm Share is positive, it is not significant (Table 5 regression 2). These results hold when using stock market capitalization and value traded as alternative stock market indicators. Consistent with Petersen and Rajan (1995), small firms benefit more from services provided by financial intermediaries than services provided by stock markets. This result is not surprising because small firms tend to depend much more on banks than on stock markets.

Next, we use an indicator that does not directly measure the size or efficiency of the financial system, but instead measures the institutional foundations for financial development. Legal Efficiency measures the efficiency and integrity of a country's legal environment. Data are averaged over the period 1980–83 and are originally from Business International Corporation. As shown in column (3) of Table 5, the interaction between Legal Efficiency and Small Firm Share enters positively and significantly at the 5% level. Legal system improvements that improve financial contracting exert a particularly positive effect on small-firm industries. We confirm these findings with an alternative measure of legal system efficiency from International Country Risk Guide (ICRG).

Finally, we use a survey-based measure of firm financing constraints. World Business Economic Survey conducted a survey of different sized firms around the world in 1999. We use the answer to one question from this survey: "How problematic is financing for the operation and growth of your business?" Answers vary between 1 (no obstacle), 2 (a minor obstacle), 3 (a moderate obstacle), or 4 (a major obstacle)? We take the average of these answers across firms within each country and use this as an indicator of national financial development, where larger values imply lower development. There are problems with averaging across firms within a country

TABLE 5

ALTERNATIVE MEASURES OF FINANCIAL DEVELOPMENT AND ALTERNATIVE SAMPLE PERIODS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample period	1980–90	1980–90	1980–90	1980–90	1980–2000	1990–2000	1980–90	Excluding crises
Industry share in value added	−1.091**	−1.065**	−0.821**	−1.566**	−0.305	−0.340**	−1.353**	−0.435**
	(0.281)	(0.289)	(0.216)	(0.353)	(0.277)	(0.100)	(0.342)	(0.107)
Liquid liabilities × Small firm share	0.500*							
	(0.203)							
Liquid liabilities × External financial dependence	0.106**							
	(0.035)							
Market turnover × Small firm share		−0.033						
		(0.259)						
Market turnover × External financial dependence		0.072						
		(0.041)						
Legal efficiency × Small firm share			0.075**					
			(0.021)					
Legal efficiency × External financial dependence			0.012**					
			(0.003)					
Financing obstacles × Small firm share				−0.524**				
				(0.182)				
Financing obstacles × External financial dependence				−0.073**				
				(0.021)				
Private Credit × Small firm share					0.352*	0.088	1.044**	0.303*
					(0.147)	(0.100)	(0.306)	(0.153)
Private Credit × External dependence					0.088*	0.055**	0.147**	0.089**
					(0.035)	(0.019)	(0.053)	(0.028)
Observations	1,147	1,128	1,084	777	764	790	764	539
R^2	0.28	0.27	0.32	0.28	0.34	0.35	0.33	0.36
Differential in real growth rate (%)	1.09	0.04	1.83	1.96	0.89	0.32	2.64	1.09

NOTES: Dependent variable is average growth in real value added by country and ISIC industry computed over the period 1980–2000 in regression (5), over the period 1990–2000 in regressions (6) and (8), and over the period 1980–90 otherwise. Industry share in value added is the industry's share in total value added of the country's manufacturing sector in 1990 in regressions (6) and (8), and in 1980 otherwise. Private credit is the country's private credit to GDP in 1990 in regressions (6) and (8), and in 1980 otherwise. Liquid liabilities is liquid liabilities to GDP in 1980. Market turnover is total value of trades to total value of shares in 1980. Legal efficiency is the country's efficiency of the legal system (average for the years 1980–83), from La Porta et al. (1998). Financing obstacles is the country-average of firm financing obstacles in 1999 from WBES. Small firm share is the industry's share of employment by firms with less than 20 employees, and is calculated using data from the U.S. Census on all U.S. firms for the year 1992. External financial dependence is the industry's dependence on external finance, from Rajan and Zingales (1998). Regression (8) excludes countries that experienced a systemic financial crisis during the period 1990–2000, according to Honohan and Laeven (2005). We include country and industry dummies, but these are not reported. Robust standard errors are in parentheses. * indicates significance at 5% level; ** indicates significance at 1% level.

because each country may have different types of firms in terms of ownership, size, industrial composition, etc. Nevertheless, we find that financing constraints induce a disproportionately adverse effect on small-firm industries (Table 5, column (4)).

3.7 Sensitivity to Alternative Sampling Period

As a final robustness test, we test the sensitivity of our findings to different sample period of the dependent variable, industry growth. While the core sample includes 1,147 country-industry observations for the period 1980–90, an expansion of the sample period to 2000 results in a reduction of the sample by one-third to fewer than 800 country-industry observations because we lose data on several countries and industries. Nevertheless, the results in Table 4, columns (5) through (8) indicate that our main findings are robust to calculating industry growth over this longer period. The results in column (5) confirm a significant and positive coefficient on the interaction of Small Firm Share and financial development when using industry growth rates over the period 1980–2000. The regression in column (6) suggests that the relationship between financial development, Small Firm Share, and industry growth does not hold when limiting the sample to the 1990s, a result that is not due to smaller sample as the regression in column (7) shows where we re-run the baseline regression for the 1980s with the sample that we have available for the 1990s. However, the results in column (8) of Table 5 suggest that this is due to the financial crisis that several of our sample countries were going through in the late 1990s. Specifically, when we leave out Brazil, Finland, Indonesia, Japan, Korea, Malaysia, Mexico, Norway, Sweden, Turkey, and Venezuela and re-run the regression for the 1990s, we find a positive and significant interaction of Small Firm Share with Private Credit. When we leave out crisis countries from the basic regressions in Table 3, the main results are also unaltered.

3.8 Analyzing Industry Shares Instead of Growth Rates

A positive relationship between financial development, Small Firm Share and industry growth should also be reflected in industry patterns. We therefore run regressions of the share of industry k in total manufacturing value added of country i in 1980 on an interaction of Small Firm Share and Private Credit, an interaction of External dependence and Private Credit and country and industry dummies. In these analyses, where the dependent variable is Industry $\text{Share}_{i,k}$, rather than $\text{Growth}_{i,k}$, we do not include the initial share as a regressor to focus on the relationship between financial development and the level of cross-industry value added.

The Table 6 regressions suggest that industries with a higher share of small firms represent a larger proportion of manufacturing in countries with better developed financial intermediaries. Column (1) presents a regression without the interaction of Private Credit with External Dependence, while column (2) adds this interaction term to the regression. Both interaction terms enter positively and significantly at the 1% level. As in the case of growth regressions, we next relax the restrictions on the error term structure. The regressions in columns (3) and (4) suggest that our findings hold when allowing for industry-level and country-level clustering of the error terms,

TABLE 6

FINANCIAL DEVELOPMENT, SMALL FIRM SHARE, AND INDUSTRY SHARE IN VALUE ADDED

	(1) Basic	(2) External dependence	(3) Clustering at industry level	(4) Clustering at country level	(5) Excluding industries with low share	(6) 1990 data	(7) Clustering at industry level	(8) Clustering at country level
Private Credit × Small firm share	0.118**	0.133**	0.133*	0.133**	0.134**	0.167**	0.167**	0.167*
	(0.031)	(0.031)	(0.056)	(0.038)	(0.049)	(0.035)	(0.044)	(0.077)
Private Credit × External dependence		0.020**	0.020*	0.020**	0.029**	0.028**	0.028**	0.028*
		(0.004)	(0.010)	(0.006)	(0.009)	(0.004)	(0.004)	(0.010)
Observations	1231	1231	1231	1231	618	1151	1151	1151
R^2	0.50	0.51	0.51	0.51	0.50	0.53	0.53	0.53
Difference in industry share in value added (%)	0.30	0.34	0.34	0.34	0.34	0.42	0.42	0.42

NOTES: Dependent variable is industry share in value added, calculated as the industry's share in total value added of the country's manufacturing sector in 1980 by country and ISIC industry. Private Credit is claims by financial institutions on the private sector divided by GDP in 1980. Small firm share is the industry's share of employment by firms with less than 20 employees, and is calculated using data from the U.S. Census on all U.S. firms for the year 1992. External dependence is a measure of the industry's dependence on external finance, from Rajan and Zingales (1998). The industry measures are based on U.S. data. The standard errors in regressions (3) and (7) are adjusted for clustering at the industry-level. The standard errors in regressions (4) and (8) are adjusted for clustering at the country-level. The regression in column (5) excludes industries below the median initial industry share in value added for each country. In regressions (6) to (8), we use share in value added in 1990 and private credit to GDP in 1990. All regressions exclude industries with less than 10 firms in each size bucket; these are: Tobacco (ISIC 314), Petroleum refineries (ISIC 353), and Pulp and paper (ISIC 3411). All regressions include country and industry dummies, but these are not reported. Robust standard errors are in parentheses. *indicates significance at 5% level; **indicates significance at 1% level.

respectively. In column (5), we restrict our sample to industries with a high share in manufacturing and confirm our findings of a positive relationship between Small Firm Share, Private Credit, and the share in total manufacturing. Columns (6) through (8) repeat the baseline regression using data for 1990 and allowing for industry-level and country-level clustering. In all cases, the findings are confirmed.

4. CONCLUSIONS

This paper finds that financial development boosts the growth of small-firm industries more than large-firm industries. Some theories of the firm argue that financial development is particularly beneficial to large firms. Others predict that financial development is especially important for lowering transaction costs and informational barriers that hinder small firm growth. Our findings support the view that underdeveloped financial systems are particularly detrimental to the growth of firms with less than 20 employees. Although we do not examine specific policies, the results indicate that improvements in the operation of the financial system will have cross-firm distributional effects, helping small-firms more than large ones. In future work, we plan to assess whether large firms oppose financial sector reforms that disproportionately benefit small firms.

APPENDIX

TABLE A1

FIRM SIZE DISTRIBUTION IN THE UNITED STATES IN 1958 AND 1997

		1958	1997			
ISIC	Industry name	S20	S5	S10	S20	S100
311	Food manufacturing	8.00	0.53	1.61	3.68	13.01
313	Beverage industries	9.47	0.80	2.22	4.70	16.38
314	Tobacco manufactures	0.98			0.55	3.03
321	Manufacture of textiles	3.72	0.44	1.23	2.95	13.29
322	Manufacture of wearing apparel, except footwear	10.50	1.53	4.40	10.04	34.42
323	Manufacture of leather and products of leather	11.35			10.17	31.95
324	Manufacture of footwear	0.84	0.52	1.18	2.18	10.29
331	Manufacture of wood and wood and cork products	26.92	3.80	9.90	19.50	43.78
332	Manufacture of furniture and fixtures	11.65	1.39	3.92	8.62	28.53
341	Manufacture of paper and paper products	5.16				
342	Printing, publishing, and allied industries	16.19	3.24	8.27	15.08	34.47
352	Manufacture of other chemical products	9.52	0.89	2.63	5.93	18.08
353	Petroleum refineries	0.13	0.04	0.09	0.21	1.60
354	Manufacture of miscellaneous products of petroleum and coal	14.30			9.01	27.90
355	Manufacture of rubber products	1.16	0.32	1.07	2.90	12.65

(*Continued*)

TABLE A1

CONTINUED

ISIC	Industry name	1958 S20	1997 S5	1997 S10	1997 S20	1997 S100
356	Manufacture of plastic products not elsewhere classified	11.99	0.63	2.03	5.44	25.23
361	Manufacture of pottery, china, and earthenware	3.64	2.34	5.31	9.42	26.95
362	Manufacture of glass and glass products	2.88				
369	Manufacture of other nonmetallic mineral products	13.42				
371	Iron and steel basic industries	0.50	0.16	0.46	1.20	7.73
372	Nonferrous metal basic industries	3.95	0.42	1.40	3.77	17.12
381	Manufacture of fabricated metal products	9.52	1.10	3.69	9.46	34.59
382	Manufacture of machinery except electrical	10.05	1.98	5.73	12.26	33.37
383	Manufacture of electrical machinery apparatus and appliances	2.43	0.45	1.31	3.07	12.78
384	Manufacture of transport equipment	0.80	0.46	1.32	3.05	12.55
385	Manufacture of professional and scientific equipment	3.65	0.44	1.12	2.29	7.56
390	Other manufacturing industries	13.14	0.78	2.17	4.73	15.34
3211	Spinning, weaving, and finishing textiles	1.00	0.61	1.46	2.85	10.00
3411	Manufacture of pulp, paper, and paperboard	0.26				
3511	Manufacture of basic industrial chemicals except fertilizers	0.65	0.38	0.87	1.83	7.23
3513	Manufacture of synthetic resins, plastic materials and fibers	0.65	0.19	0.43	1.11	5.86
3522	Manufacture of drugs and medicines	3.89	0.33	0.91	2.13	8.93
3825	Manufacture of office, computing, and accounting machinery	0.35	0.47	1.29	2.81	9.42
3832	Manufacture of radio, television, and communication equipment	0.57	0.51	1.34	3.00	11.50
3841	Ship building and repairing	5.73	2.12	4.63	8.01	19.44
3843	Manufacture of motor vehicles	0.83	0.31	0.87	1.91	6.97
Average		6.11	0.94	2.51	5.43	17.56

NOTES: This table shows small firm shares in the United States by ISIC Revision 2 industries. Sx is the industry's share of employment by firms with less than x employees, and is calculated using data from the U.S. Census on all U.S. firms for the year 1958 or 1997. Small firm shares are expressed in percentages of total number of employees.
SOURCE: Authors' calculations based on data from the U.S. Census Bureau. Data are for firms, not establishments.

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