Which Firms Benefit More from Financial Development?

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Abstract

We test whether more developed financial systems are better at tackling asymmetric information proxied by firm age and size. Comparing the growth effect of financial development (FD) across firms of different type, we find that FD disproportionately fosters the growth of young companies, while there is relatively little evidence of differences in the effect across firms of different size. The disproportionate gains from FD for youngest firms are concentrated among firms with lower shares of equity capital on total assets—the firms that rely highly on external finance availability.

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1. Introduction

It has long been recognized that there is a pervasive positive cross-country correlation between the level of a country's financial development and its level of economic activity (e.g., Goldsmith, 1969, or King and Levine, 1993), with causality possibly running both ways. Finance theory surveyed in Levine (1997) contends that financial development can foster corporate growth because financial intermediaries play a key role in overcoming market frictions due to moral hazard and asymmetric information. These frictions give rise to financial constraints and represent a fundamental source of external finance costs, which ought to be lowered through financial development. Efficient financial institutions provide external finance even to informationally opaque businesses, that is to firms with little information available on their economic and financial status.

There is much survey evidence suggesting that small and young firms from both developed and developing countries are constrained in their access to external finance.[1] Applying the logic of finance theory, it is therefore likely that company size or age serve as effective proxies for the extent of market frictions, particularly the extent of information asymmetries, that firms face.[2] Under this assumption, small and young firms are likely to benefit disproportionately from the development of financial institutions and markets. Yet, so far there is relatively little research asking whether this is the case. In this study, we measure the extent to which the development of national financial systems boosts the growth rate of small and young firms more than that of large and old firms.

We follow much of the recent finance-and-growth research and apply (a variant of) the Rajan

[1] We discuss this literature in Section 2, where we also argue that evidence based on non-subjective data is needed to complement the survey-based findings.

[2] Young firms are affected by information asymmetry because they have short history. The reason why size is related to information asymmetry could be that the costs for financial intermediaries of evaluating a request for external financing by a small company may exceed the benefits. It is not clear how the extent of moral hazard varies with firm size; see Martin and Sayrak (2003) for a recent survey. The banking literature usually relates opaqueness to firm age and size; recent examples are Berger et al. (2001) and Berger et al. (2002).

and Zingales (1998) identification strategy. This strategy was developed to avoid the fundamental identification problem of measuring the effect of finance on growth, which would call for isolating the part of the variation in financial development that is unrelated to unobservable current and future growth opportunities.[3] Rajan and Zingales assume that different industries have a different, technologically determined need for external finance. They form a proxy for this need based on several assumptions and regress industry growth from a sample of countries on country and industry fixed effects as well as on the *interaction* between a measure of industry external finance dependence and a proxy for country financial development. Their regressions suggest that industries predicted to be in greater need of external finance grow faster in countries with more developed financial markets, conditional on all (potentially unobservable) country- and industry-specific factors driving growth.

Clearly, this strategy can also be applied to compare the impact of financial development on firms facing a differential degree of informational opaqueness, such as firms of different size or age. We expect that, due to information asymmetries, small and young firms are on average more financially constrained than larger and older companies. Using size or age as a proxy for information asymmetry substitutes for an overt quantification of the firm-specific extent of financial constraints. We therefore measure the growth effect of the interaction between a firm's age (size) and a country's level of financial development. In short, we apply the Rajan-Zingales strategy *at the firm level*.[4]

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[3] Few studies are able to solve this identification problem. Finding a valid instrument for country-level financial development is difficult, as is securing large enough samples in order to avoid small-sample biases of instrumental variable estimators. Guiso et al. (2004b) solve the identification problem by looking within a country and focusing on historically predetermined variation in local financial development. They suggest that small firms grow faster in regions of Italy that feature more developed credit markets, which is consistent with small firms being more constrained than large firms in their operation and growth through access to external finance. Theirs is an important finding, but it addresses only within-country differences in financial development.

[4] The recent study by Beck et al. (2004) also focuses on the interaction of financial development with firm size. However, they measure size at industry level, while we use company-level indicators. The implications of this difference

This approach helps to uncover the *mechanism* of the finance-growth effect in a novel way. In the Rajan-Zingales framework, the mechanism is based on external sources of finance being more costly than internal ones. Hence, lowering the overall costs of external finance benefits disproportionately those firms that face higher need of external finance (for industry-specific, presumably technological reasons). In contrast, in our study the mechanism consists of lowering the relative costs of external finance for businesses that are more informationally opaque because of their size or age. Our mechanism is therefore closely tied to the underlying fundamental source of external finance costs: information asymmetry. It corresponds to the screening and evaluation process performed by financial intermediaries deciding upon granting external finance.

Relying on a large firm-level data set covering EU-15 firms with more than 100 employees or more than 20 million Euro of total assets between 1995 and 2003, the Amadeus database, we regress firms' average value-added growth rates on an interaction of firms' size or age with several dimensions of country-level financial infrastructure. We hesitate to use a linear specification of the interaction of financial development indicators with firm size and age because it is not clear that information asymmetry decreases proportionately with firms' age or size and because we wish to impose few functional form restrictions. Hence, we interact financial development with indicators of a firms' position in quintiles of the firm size or age distribution.[5] Our regressions further condition on a set of firm-level pre-determined controls and a full set of country and industry dummies. We therefore ask whether, for example, Greek financial institutions differ significantly from those of the UK in their ability to overcome information asymmetry (identify profitable projects) of young and/or small companies relative to their ability to provide external finance for projects of older

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are discussed in Section 2.

[5] Similar to the approach of Beck et al. (2004) or Rajan and Zingales (1998), ours is therefore a group-level interaction approach. However, our groups are formed based on firm-level information (firm size or age), whilst the previous literature relied on interactions based on group-level (industry) average characteristics.

and/or larger companies.

We find little significant difference in the effect of financial development across firms of different size. On the other hand, using the oldest companies as the benchmark group, there is strong evidence of a disproportionate positive effect of financial development on all except perhaps the youngest firms. Specifically, we recover an inverted-U shape of the interaction between age and financial development, such that firms of approximately median age appear to benefit the most from financial development.

Next, we explore several alternative explanations for the age shape of the financial-development growth effect. A key explanation is that freshly incorporated companies in less financially developed countries adjust to the state of financial systems by having unusually high shares of equity capital in total assets. They therefore do not need as much external finance in early stages of company existence, which helps to explain why, in our basic specifications, very young firms appear to benefit less from financial development. Indeed, among those youngest companies that have low shares of equity capital in total assets, there is a strong disproportionate effect of financial development. We conclude that financial development fosters growth of young companies even within a set of some of the most developed countries of the world.

The structure of the paper is as follows: In the next section we relate our approach to the existing literature. Section 3 presents our methodology while Section 4 describes the data. Section 5 covers the empirical analysis and Section 6 summarizes the findings.

2. Relationship to the Existing Literature

In firm surveys, small and young companies in both the developed and developing world report having less access to external finance than larger and older companies.[6] Survey responses are

[6] Age and size explain a large share of the variation in firms' self-reported financing obstacles in the World Business Environment Survey, which covers much of the developing world (Beck et al., 2006). Similarly, the presence of financial

also used to ask about the effect of financing obstacles on firm growth. For example, Beck et al. (2005) suggest that the effect that the difference in financial development across a wide set of both developed and developing countries has on a firms' growth is strongest for the smallest companies. It is widely held that the main reason why small and young firms report lower access to external financing and benefit disproportionately from financial development is their information opaqueness. Firm survey evidence is thus consistent with the notion that financial development reduces the negative effects of information asymmetry and offers an effective way of promoting small firm growth—an important conclusion from a policy standpoint.[7]

Yet, it is imperative that these conclusions based on firms' subjective assessments are compared to those reached with non-subjective data. For example, it is not clear that firms of different age compare their unsatisfied need for external finance against the same benchmark; it could be that such firms differ in their ability to evaluate the potential gains from using additional external finance.[8] Further, the estimation of growth consequences of self-assessed financial constraints is plagued by potential reverse causality problems if firms that fail to grow (and remain small) because of internal problems tend to blame financial intermediaries for failing to provide external finance.

Unfortunately, it is fundamentally difficult to form a valid firm-level indicator of financial constraints. These constraints are difficult to measure because they arise from the interaction of the quality of a financial system, a firm's inherently unobservable growth opportunity, and financing-

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constraints is negatively related to firm age in the survey of Italian firms studied by Angelini and Generale (2005).

[7] See also Bergell and Udell (1998) for an early discussion of small-firm finance and Beck and Demirguc-Kunt (2006) for a recent survey of this topic.

[8] Along similar lines, investment-cash flow sensitivities could be higher for smaller and/or younger firms in comparison to larger and more mature firms because (i) financial constraints are more binding for small and young firms or (ii) such firms learn from their cash flow about their uncertain growth prospect.

related firm-level indicators, which firms can adjust based on expected financing needs.[9] On the other hand, it is still possible to ask about differences in the growth impact of financial development across firm types—differences that likely correspond to degrees of information asymmetry—by applying a variant of the Rajan-Zingales strategy described in the Introduction.

We do so using firm size and age, arguing that they proxy for information asymmetries firms face when acquiring external financing. We provide novel evidence on the age-related differences in the growth effect of financial development. On the other hand, ours is not the first study to focus on the differences in this growth effect by firm size. Beck et al. (2004) measure these differences at industry level. They use cross-industry, cross-country data from 44 countries and 36 manufacturing industries and focus on the interaction between financial development indicators and US industries' share of employment by firms with less than 20 employees. They employ industry-induced variation in firm size, as such variation is likely to be related to industry technology differences and not to firm-specific unobservables,[10] and find that industries with a higher share of very small firms in the US grow faster when served by more developed financial systems.[11]

However, the reliance on industry-level indicators may not be innocuous to the estimation of the size-related differences in the growth effect of financial development. Beck et al. (2004) choose to concentrate on an industry's share of very small firms. They therefore do not explore the size shape of the finance-growth relationship and effectively assume that the same specific size threshold (having 20 employees) explains the severity of size-related market frictions in all industries. Further,

[9] Hajivassiliou and Savignac (2007) illustrate the endogeneity of traditional firm proxies for financing constraints based on firm wealth or accumulated profits.

[10] Their use of industry-level data is no doubt also the consequence of the lack of reliable firm-level data for the wide set of countries they analyze.

[11] Although we contrast our estimation methodology with that employed by Beck et al. (2004), our findings are not comparable to theirs because Beck et al. (2004) focus on very small firms (with less than 20 employees) in developing countries, while we study firms with at least 100 employees or more than 20 million Euro of total assets (see Section 4 for data description) in some of the most developed countries.

the existence of substantial dispersion of firm size within industries implies that their industry growth-rate averages are based on firms of all sizes. Even two industries that exhibit a similar share of very small companies do not necessarily share a similar firm size distribution. In other words, any strategy that uses an industry indicator for firm size implies size miss-classification for a significant share of firms, which ultimately underlie industry-level growth rates.

These technical considerations motivate our application of the Rajan-Zingales strategy at the firm level.[12] Using firm-level measures of size and growth improves precision and allows us to trace out the finance-growth effect differences across firms of different size. Using firm-level data also allows us to compare estimates based on different sources of size variation: within- as well as across-industry.[13]

Another potential problem with the Beck et al. (2004) approach is that it is not clear that countries at widely different levels of economic development, such as those included in their sample of 44 economies, will share similar size structure of their industries in absence of differences in financial development—an assumption invoked in their approach.[14] In this study, we compare the growth experience of firms across a set of highly comparable economies. We analyze firms operating in the EU-15 'single market' under harmonized product market regulation. The high degree of similarity of the analyzed firms in terms of both growth opportunities and technology contrasts with much of the existing finance-growth literature. It assists in correctly measuring the finance-growth relationship. For example, using industry fixed effects to control for common industry growth shocks is highly

[12] We also believe that using firm-country comparisons is a natural extension of the Rajan and Zingales (1998) strategy, which itself shifted the focus from cross-country comparisons to country-industry comparisons.

[13] Across-industry variation in size is likely to be driven by technology and hence unrelated to firm unobservables. We therefore test for the importance of using across- as opposed to within-industry size variation. It is less clear that industry differences in age are driven by technology.

[14] The evidence on similarity of industry firm size across countries is based on the most developed economies (e.g., Kumar et al., 1999).

realistic within the EU-15 group.[15] Fortunately for our empirical exercise, significant differences persisted in financial system development across the EU-15 economies at the time of the start of the 'single market', despite extensive product market integration, as documented by, e.g., Guiso et al. (2004a) or Allen et al. (2006).

3. Methodology

Our goal is to investigate differences in the effect of financial development on corporate growth across firms of different age or size. Applying the Rajan and Zingales (1998) framework, we ask about these differences using linear regressions of average firm value-added growth rates on (i) a set of firm-level control variables including age and size, (ii) country and industry fixed effects, and (iii) the interaction of a country's level of financial development with selected firm-level characteristics: age and/or size. In line with the existing literature, we therefore control for all observable as well as unobservable industry- and country-level determinants of growth.

We view the establishment of the EU 'single market', which harmonized product market regulation, as an opportunity to compare the growth performance of firms that increasingly face similar growth opportunities—those of the harmonized EU-15-wide market. Investment that would allow firms to benefit from these opportunities is likely to take place in the early stages of the 'single market' formation. Hence, our indicators of financial development are measured as of the beginning of the 'single market' in 1993.[16] Similarly, our firm-level controls are measured as close to this benchmark as possible—as of the beginning of the firm data. Put simply, we control for the starting position of firms entering the 'single market' and measure the difference that initial financial development makes for their growth.

[15] For recent evidence on EU business cycle synchronization see Camacho, et al. (2005). In Bena and Jurajda (2007), we confirm the presence of 'synchronized' EU-15 growth patterns at industry level.

[16] We investigate the sensitivity to the timing of the measurement of financial development in Section 5.2.

A basic regression specification, which asks whether firms of different age or size grow at different rates across financial systems of differential depth, is of the following form:

$$G_{ijk} = \alpha + \beta \left(FD_i * Z_{ijk} \right) + Z_{ijk}\eta + \gamma_i + \delta_j + X_{ijk}^{'}\zeta + \epsilon_{ijk}, \tag{1}$$

where G_{ijk} denotes the time-averaged growth rate of the real value added of firm k in industry j in country i, and where FD_i corresponds to a measure of country financial development. The variable Z_{ijk} represents firm size (age) and is entered as both a base effect and in the financial-development interaction. Country and industry dummies are denoted as γ_i and δ_j, respectively, and we also condition on a set of firm-specific initial-period characteristics X_{ijk} including firm age (size), firm financial indicators such as leverage, tangibility and collateralization, as well as an indicator for quoted companies and a set of indicators for company concentration of ownership and legal form.

However, Equation (1) implicitly assumes that the degree of information asymmetry varies proportionately with firms' age or size, which may be a restrictive assumption. In order to impose as little structure as possible on the key interaction relationship of our regressions, we therefore use a semi-parametric specification that interacts a country's level of financial development with a step-function in firm's age or size. More specifically, we interact FD_i with a set of indicators for the firm's position in one of the quintiles or deciles of the age or size distribution, measured again as of the beginning of our data:

$$G_{ijk} = \alpha + \sum_{v=1}^{V} \beta_v \left(FD_i * I_{ijkv} \right) + \eta_v + \gamma_i + \delta_j + X_{ijk}^{'}\zeta + \epsilon_{ijk}, \tag{2}$$

where the set of binary indicator variables I_{ijkv} denotes the position of a firm in one of the quintiles (deciles) of the firms' age or size distribution, depending on the question we ask, while the fixed effects η_v capture the average growth rate of firms of the corresponding size or age group.

4. Data

We work with data from a set of countries where industries face highly synchronized shocks and share a highly similar technology content of industrial classification—the countries of the EU's 'single market'—during the 1995-2003 period, which covers the first years of the market's operation before its extension to post-communist countries. Firm-level financial statements and descriptive data, which allow us to compare the growth experience of highly similar firms residing in different countries, come from the Amadeus database. Country-level measures of financial development come primarily from the World Bank. We introduce these data sources in this section and complement the description with detailed tables in the Data Appendix.

4.1. Firm-Level Data

We use firm-level data from the Amadeus (Analyse MAjor Databases from EUropean Sources) database, created by Bureau Van Dijk from standardized commercial data collected by about 50 vendors across Europe. Among the key advantages of the data from our perspective is that they cover both listed and unlisted firms of a wide variety of size and age categories and that they provide corporate descriptive statistics including growth together with a detailed source-of-finance accounts. In principle, the database should cover most public and private limited companies,[17] although coverage varies by country and generally improves over time. The firm and industry coverage of these data is an order of magnitude better compared to other existing firm samples as argued by Gomez-Salvador et al. (2004).

These data have been tapped in the finance-growth literature only recently, by Guiso et al. (2004a) to estimate Rajan-Zingales type regressions relying on US measures of industry external finance dependence, and by Klapper et al. (2006) to study firm entry. Our selection of the analysis-

[17] There are exceptions to the rule. For example, small and medium size German firms are not legally forced to disclose (Desai et al., 2003).

ready sample follows the choices made by these two studies. Similar to Guiso et al. (2004a), we use the 'TOP 250 thousand' module of the Amadeus data,[18] which we downloaded in December 2006. Following Klapper et al. (2006) we use only unconsolidated statements to avoid double counting, and we also exclude all legal forms other than the equivalent of public and private limited liability corporations due to the uneven coverage of partnerships, proprietorships and other minor legal forms. Definitions of key variables and a listing of the included legal forms of firms by country are provided in the Data Appendix, in Tables DA.1 and DA.2, respectively.

The dataset is drawn from EU-15 countries that were part of the European Internal Market in 1995: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and United Kingdom. Similar to Guiso et al. (2004a), we exclude Luxembourg, because its financial sector is statistically anomalous, and we lose Ireland due to missing firm-level information. Firm coverage in the Amadeus data is incomplete before 1995 and after 2003 so we use only observations from 1995-2003.[19] Another reason why we do not use pre-1995 data is that Finland, Austria and Sweden joined the EU only in that year.

Following Rajan and Zingales (1998) and Guiso et al. (2004a), we focus on manufacturing industries (NACE 15 to 37). We exclude firms with missing total assets as well as non-active firms. We also omit from the analysis growth observations falling outside of the 5-to-95 percentile range

[18] Firms selected as TOP 250,000 had to meet at least one of the following inclusion criteria: For UK, Germany, France, and Italy operating revenue at least 15 million euros, total assets at least 30 million euros, or the number of employees at least 150. For all other countries operating revenue at least 10 million euros, total assets at least 20 million euros, or the number of employees at least 100.

[19] Some firms are not present in the data for the whole period. In order to avoid potential biases from the combination of differential improvements in firm coverage across countries with time-changing aggregate growth rates, we replace the firm-level average growth rates available in the data with residuals from a regression of all observed firm-level annual growth rates on year dummies. Further, in order to lower noise in the average growth rates, we rely only on companies that report value added for at least 5 years.

of firms' value added growth rate and firms with significant state ownership.[20] Since Greek firms do not report value added, we used sales as a surrogate for them.[21]

Table 1 shows the final number of firm average value-added growth observations used in the study for each country,[22] together with simple firm-level descriptive statistics corresponding to these observations.[23] Next, Appendix Figures A.1 and A.2 present the EU-15-wide as well as the country-specific distribution of firm age and size, respectively. The firm size distribution is skewed, as expected. The firm coverage varies across countries; specifically, firm size in Germany is affected by non-reporting of small firms. Nevertheless, the data provide extensive coverage of most of the EU-15 economies and represent the best firm-level EU data source available to date.

4.2. Financial Development Indicators

Data on financial development are drawn from the World Bank's Financial Structure and Economic Development Database (March 2005 version) described in detail in Beck et al. (2000). To make our results comparable with those in the literature we use a number of measures of finance activity to proxy financial development. We start with the traditional measures of activity in the credit and stock markets, namely the ratio of private credit to GDP (PCDMBANKOFINSTGDP) and the ratio of stock market capitalization and stock market total value traded to GDP (STMCAPGDP and STMTVTGDP, respectively). We also rely on a measure of total country-level finance activity

[20] Specifically, we drop firms in which the state is as an ultimate owner of at least 10 percent of shares or a direct owner of at least 10 percent of shares. There is virtually no sensitivity to the choice of the percentage threshold.

[21] See Guiso et al. (2004) for the use of sales instead of value added. We check for the sensitivity of excluding Greece from the analysis in Section 5.2.

[22] The presence of negative value-added growth rates complicates taking a compounded average. The reported growth rates therefore correspond to simple time averages of annual real value-added growth rates of the sampled companies taken over the 1995-2003 period.

[23] The primary reason why only about 15 thousand firms remains in our data from the 'TOP 250 thousand' Amadeus module is that we drop services and focus on manufacturing companies.

equal to the sum of (i) stock market capitalization, (ii) bank credit to the private sector and (iii) domestic debt securities issued by the private sector. This summary measure (Total Capitalization) is taken from Hartmann et al. (2006) and is expressed, again, as a fraction of country-level GDP. All proxies for financial development are averaged over the years 1990-1994, that is, as of the establishment of the 'single market'.[24]

In addition to volume-of-finance-activity measures of financial development, we also use a proxy for the institutional quality of financial markets. Specifically, we follow Beck et al. (2004) and use an indicator of the 'quality of accounting standards' (ACCOUNT), produced by International Accounting and Auditing Trends (Center for International Financial Analysis & Research, Inc.). This indicator rates companies' 1990 annual reports on the basis of their inclusion or omission of 90 items in the balance sheets and income statements and ranges from 0 to 90.

All five indicators of financial development are summarized across our EU countries in Table 2.[25] It is clear that despite the extensive integration of EU-15 national product markets up to 1994, there is still substantial diversity in the degree of financial development across the EU-15. The coefficient of variation is particularly high for our measures of stock-market activity. The bottom panel of Table 2 presents correlations (with statistical significance levels) among our different measures of financial development. The correlations suggest that these measures, although closely related, are nevertheless meaningfully different.

[24] We rely on time averages to avoid year-to-year fluctuations. In Section 5.2, we check for the sensitivity to using measures of financial development based on a later period.

[25] A detailed definition of each measure is provided in the Data Appendix Table DA.1.

5. Results

5.1. Basic Estimates

Our analysis of average firm-level value-added growth rates covering 1995-2003 asks about age- and size-related differences in the effect of financial development on corporate growth following the introduction of the EU-15 'single market'. We estimate linear growth regressions conditioning on country and industry fixed effects, firm-specific controls, and the interaction of country financial development with a step function in firm size and/or age, as described in Equation (2) in Section 3. More specifically, we use industry dummies based on the 3-digit ISIC classification and rely on the following set of firm-level controls: age, size, leverage, tangibility, collateralization, share of equity capital on total assets (equity endowment) and indicators of being quoted, legal form type and ownership concentration; these controls are measured as of the first year a firm enters the sample. We drop firm observations falling outside of the 5-to-95 percentile range of value-added growth. The semi-parametric step-function interaction specifications are based on quintiles of the age or size distribution and allow for a non-proportional relationship between information asymmetry and firm size or age; they define the base (comparison) group as consisting of companies in the top 20% of the size or age distribution. We expect the growth rates of smaller and younger firms to be more sensitive to financial development because of information asymmetries.[26]

The basic set of results is presented in Table 3, which lists coefficients of interest: both firm age and size quintile base effects and the interactions of these base step functions with national financial

[26] One may expect very large and/or old firms to have access to international sources of finance and thus be less sensitive to differences in the development of national financial markets, which provides additional motivation for the use of the interaction of financial development with a step function in size or age. We can alternatively use median-age and median-size firms as the base group. Such specification checks whether country unobservables as well as financial development levels affect large and old companies differently from those at the median age and size. We have compared the main results presented in this paper to those (unreported) ones where we alternatively use the near-median firms as the base group. The two batteries of results were fully consistent.

development indicators. Each column corresponds to the choice of a particular indicator of financial development. The base size effect (at the bottom of the table), which consists of four size quintile steps, is precisely estimated and suggests, as expected, that smaller firms, in terms of total assets, on average grow substantially faster than larger companies. The size-growth gradient appears to be somewhat convex—the group of smallest companies grows particularly fast. Similarly, we recover a downward sloping age-growth gradient as the estimated base age step-function coefficients suggest that youngest companies grow on average faster than older ones.

The upper half of Table 3 presents the interactions with financial development. We estimate a decidedly non-linear shape of the age-financial development interaction. The youngest companies in our data appear not to benefit from the development of financial systems more than the oldest companies. On the other hand, companies located towards the center of the age distribution benefit disproportionately. The inverted-U age shape of the financial-development growth effect is remarkably similar across our different measures of financial development.

In contrast to the age interaction with financial development indicators, the interaction of company size (groups) is not significant in Table 3, irrespective of the type of financial development measure we use. Not only are the interaction coefficients statistically insignificant, they are also small, negative and similar in magnitude across the company size groups. In short, we detect no size-related differences in the growth effect of financial development.

5.2. Initial Robustness Checks

To provide initial robustness checks, we estimate several simple variants of the growth regressions of Table 3. First, we use decile steps in age or size instead of the quintile-step specification. Figure 1 visually presents both size- and age-financial development interactions (graphs on the left), as well as the base size and age effects (graphs on the right). The top (bottom) two graphs show parameter estimates corresponding to the size (age) groups. The decile age-finance interactions underscore

the presence of an inverted-U age shape of the effect of financial development. Similarly, the decile specifications confirm the earlier finding of little evidence for the presence of a differential growth effect of finance across firms of different size, ceteris paribus.

Second, we estimate the age and size interactions separately. Table 3 conditioned on both age and size interactions simultaneously because of the obvious correlation between size and age. In an alternative specification, we re-estimate Equation (2) with only one of the interactions at a time. Such specification is potentially questionable because it is not clear to what extent the age interaction is merely a proxy for the size interaction and vice versa. However, we obtain coefficients that are near identical to those presented in Table 3. (These results are presented in Appendix Table A.1.) The finding of no finance-size interaction is therefore robust to allowing age-related size differences to help estimate the size interaction, which is reassuring. These results also suggest that, in the subsequent analysis, we can focus on specifications with only the age-finance interactions.

Third, we replace the semi-parametric step-function interactions with fully parametric specifications. Estimates based on linear (Equation (1)) and cubic interactions for either age or size are presented in Appendix Table A.2. The results based on linear interactions between financial development and firm size or age are confusing and suggestive of misspecification. The coefficient estimates suggest that larger firms benefit less from financial development compared to smaller companies, but we cannot precisely estimate the underlying base effect of company size on its growth, which is disturbing given the well-established negative relationship between a firm's size and its rate of growth.[27] The estimates of the linear age interaction coefficients are mostly positive, which contradicts much of the survey evidence discussed in Section 2. Clearly, these puzzling results are the consequence of forcing the interaction relationship to be linear. This is confirmed by the cubic specification estimates, which strongly support the presence of an inverted-U age interaction effect,

[27] For example, Dunne et al. (1989) show that employment growth rates of US manufacturing firms decline with both company age and size.

and which also show little consistent evidence of significant size-related differences in the effect of financial development.

Fourth, a natural extension of our basic approach is to ask about the importance of the *combination* of small size and young age for the interplay between information asymmetries and financial development. Hence, we also estimate a size-age-financial development interaction. We use a relatively parsimonious specification of this 'triple' interaction in that we allow the quintile age-financial development interaction to be different for companies of below-median and above-median size. As before, the base comparison group consists of the oldest companies. The estimates (presented in Appendix Table A.3) suggest that a similar inverted-U age-financial development interaction is present for both small (below median size) and large (above median size) companies. Again, company size appears to play little role.

Fifth, we also use an alternative estimation technique. In Appendix Table A.4, we present results based on a median regression. Up to now, we have avoided the influence of value-added growth outliers, present in any company-level financial data, by symmetrically excluding extreme values of growth rates from our linear 'mean' regressions. Here, we therefore alternatively employ median regressions, which are robust to outliers by design and allow us to use all available growth rate data (that is, even observations of average growth rates falling outside the 5-to-95 percentile range). The estimated coefficients are quantitatively highly similar to those presented in Table 3. The only cost of using a median regression is that we lose statistical significance of the inverted-U interaction parameters in most of the estimated specifications.[28] We conclude that our basic results are robust to a battery of robustness checks motivated by data-related as well as econometric questions.[29]

[28] The clustered standard errors we report are bootstrapped.

[29] We have performed several additional robustness checks, in addition to those presented in the Appendix, with little effect on the parameters of interest: (i) We replaced industry fixed effects with industry-country dummies. (ii) We replaced financial-development indicators averaged over 1990-1994, i.e., before significant progress in EU financial integration, with those averaged over 1995-1998, i.e., before the introduction of the common currency in most of the

5.3. Interpreting the Basic Estimates

Our initial robustness checks confirm both the lack of the size interaction effect and the inverted-U shape of the age-related differences in the growth effects of financial development. What could be the underlying process that results in the inverted-U age shape of the financial development effect? Taking our estimates at face value, what does it mean that the highest benefits from financial development are experienced by median-aged firms—about 18 years after incorporation? One possibility is that the youngest firms are so informationally opaque that they have no access to external finance even in the most developed financial systems. As firms age, they gain access to external financing and, as a consequence, get closer to realizing their full growth potential. More financially developed systems start providing external financing earlier in company life. Figure 2 illustrates this hypothesis. It plots a hypothetical distance from full growth potential (normalized to 1) of companies over their life cycle caused by suboptimal access to external financing driven by age-related information opaqueness.[30] It also shows the difference between the growth path of a company across economies characterized by high and low development of financial systems, i.e., the growth gap related to financial development. This gap corresponds to the age shape of the financial development growth effect we measure in this paper; it takes an inverted-U shape.[31]

EU-15 economies. (iii) We excluded Greece, the country for which only sales but no value added data was available. (iv) We used alternative definitions of the dependent variable: First, we replaced mean value-added growth rates with median value-added growth rates. Second, we used sales instead of value added to define company growth.

[30] We assume that access to external finance is the causal mechanism that relates financial development to company growth. See, e.g., Giannetti and Ongena (in press) for direct evidence on financial development causing higher use of external finance, which, in turn, increases company growth.

[31] A theoretical model that would generate the pattern outlined in Figure 2 is one in which: (i) corporate growth increases with a firm's external finance use, (ii) the debt capacity of the firm increases as its opaqueness decreases, and (iii) more developed financial institutions are more efficient at overcoming information asymmetries. The model of Tirole (2006), p. 171, section 4.4, would have most of these features if one were to identify the model's distinction between observable and unobservable outside growth opportunity with the distinction between high and low financial development, respectively.

Returning to the basic results in Table 3, we note that the age interaction coefficients imply economically substantial differences in growth effects of financial development across firms of different age. Specifically, the estimated coefficients imply that moving from the minimum to the maximum value of our volume-of-finance-activity measures increases the average annual growth rate of a firm of median age (corresponding to the third quintile of the age distribution) compared to an otherwise comparable firm of age above the 80th age percentile by about 2 percentage points. For example, when considering the total capitalization interaction coefficient, the 2.6 percentage-point effect corresponds to comparing a 20 year old firm to a 40 year old company across the UK and Greece. The estimated difference in growth effects is about twice as large when we replace volume-of-finance-activity measures with our proxy for institutional development—the accounting standards index.

Turning attention to the size results, how can one interpret the finding of no size-related differences in the effect of financial development? Our results are consistent with small firms being small not because of inadequate access to external finance, but because of having already reached their optimum size or because of internal problems. Of course, it could be that important size-related asymmetries arise only for very small firms that do not satisfy our sample inclusion criteria, i.e., firms with fewer than 100 employees and less than 20 million Euro of total assets.

In the next Section, we ask whether the lack of the size-related differences in the finance-growth relationship is connected with our use of firm-level data. In the rest of the paper, we then provide evidence useful for interpreting the estimated inverted-U age shape of the financial development effect. We ask whether it is likely to correspond to age-related information asymmetries or to other age-related variables affecting access to external financing. We also ask what explains the lack of a disproportionate financial-development growth effect for the youngest companies.

5.4. Comparing Within- to Across-Industry Size Variation

The size-finance interactions in Table 3 are based on variation in firms' size that is driven by both across-industry technological differences and within-industry firm-level size differences. However, using within-industry differences in firm size as a source of identification raises an important concern. Companies that do not grow because of internal problems, and so remain smaller relative to a typical firm in their industry, may not be able to benefit from financial development. In other words, to interpret the estimates based on within-industry size variation as corresponding to information asymmetry, one assumes that deviations of company size from the respective industry mean size are unrelated to firms' unobservables directly affecting growth, but are related to firms' access to external finance.[32] It is therefore important that we compare results based on within-industry size variation to findings based on across-industry (technology related) size variation, which is unlikely to be related to firm unobservables.

In Table 4, we estimate across-industry size interactions similar in spirit to those estimated by Beck et al. (2004). Specifically, the top panel of Table 4 presents a set of linear size-financial development interaction coefficients based on the EU-15-wide *industry median size* measured at the ISIC 3-digit industry level. That is, we replace the firm's size measure with company size typical of the firm's industry. All specifications include country and industry fixed effects and they also condition on firm-level controls used in specifications reported in Table 3. The estimated interaction coefficients of interest are always negative, but never reach conventional levels of statistical significance. Even though these regressions employ company-level data, they implicitly measure the relationship between industry size (interacted with financial development) and industry growth rates.[33] One potential problem with this approach is that even unusually small or large firms, relative to

[32] See Kumar et al. (1999) for evidence on differences in industry-specific typical firm size.

[33] Obviously, the industry growth averages are formed conditional on the effects of firm-level characteristics.

the industry typical size, are used to estimate the relationship between industry size and industry growth rate. To check for the importance of this measurement error, we exclude unusually small and unusually large firms, relative to industry typical size, from the estimation. These results, which rely only on firms that fall within the 40-60 percentile industry-specific size range, are presented in the second set of coefficients in the top panel of Table 4. The estimated parameters suggest that there is little relationship between corporate growth rates and the interaction of industry size with country financial development.

In the bottom part of Table 4, we re-introduce within-industry variation in firm size by interacting financial development with *firm-specific* size. However, we do so only for the companies that fall within the 40-60 percentile size range used in the previous specification.[34] Although based on firm-specific information (on both size and growth), such regressions correspond mainly to across-industry size comparisons. In the linear interaction specification, we obtain positive size interaction estimates that are, however, very imprecise. When using our basic step-function interaction specification, we obtain noisy estimates that are qualitatively similar to those presented in Table 3.

In sum, we find no evidence of a differential effect of financial development on firms of different size, irrespective of the type of size variation we employ. The fact that solely across- and solely within-industry comparisons lead to the same conclusion is reassuring. The notion that size-related unobservables are not causing our size-finance interactions based on within-industry size differences to be insignificant is further supported by unreported regressions, in which we repeat the basic estimation of the size interaction coefficients from Table 3 after omitting our set of firm-level controls from the regressions. The interaction parameters of interest are not materially affected, which, to the extent that company observables and unobservables are correlated, is consistent with unobservables having only negligible effect on our estimation.[35]

[34] We obtain highly similar evidence when using a 30-70 percentile range instead.

[35] Similar comparisons have been employed in the analysis of gender or racial discrimination, e.g., by Hirsch and

5.5. Age and Intangibles

An important concern with the interpretation of the financial development interaction estimates as corresponding to information asymmetries has to do with the potentially different reliance of young firms on intangible assets. If financial development reduces the need for collateral or tangible assets, this may disproportionately improve access to external finance for those companies that use intangibles heavily. If young firms use intangibles more than old ones do, then our estimates thus far could correspond to the effect of intangibles, not to a reduction in the importance of information asymmetries with financial development.

To check for this alternative interpretation, we proceed in two steps. First, we estimate regressions (available upon request) of company tangibility on our basic set of firm-level control variables including size and age. We find that younger (as well as smaller) companies actually display a statistically significantly higher share of tangible assets.[36] Second, in Table 5 we compare the age shape of the financial development effect across firms with low (below median) and high (above median) share of tangible assets.[37] We recover the familiar inverted-U age interactions with financial development for both groups of companies. In fact, by allowing the estimation to differentiate between low- and high-tangibility companies, the disproportionate growth benefit from financial development of median-aged companies compared to the oldest firms is highly similar across the two groups that differ in their share of tangible assets. The estimates are also highly comparable to those presented in Table A.1.[38]

Schumacher (1992). See also Altonji et al. (2005) for estimation of binary treatment effects that use the extent of selection on observed characteristics as a guide to the extent of selection on unobservables.

[36] It could be that those young companies that are constrained in their access to finance (presumably because of information asymmetries), use a high share of tangible assets in order to improve their access to external finance.

[37] We also allow the base quintile age growth gradient to be different for companies of below-median and above-median tangibility and we directly control for the growth gap among low- and high-tangibility firms.

[38] In order to check to what extent young age proxies for more than different asset intangibility, we also estimated

5.6. Within-Industry Relative Age

Our regressions are estimated based on simple (absolute) measures of firms' age or size. Specifically, our basic regressions interact financial development indicators with years since company incorporation and with company total assets expressed in a common currency. To interpret these basic estimates as corresponding to the effect of information asymmetries, one implicitly assumes that the degree of information asymmetry varies with size and age to the same (potentially non-linear) degree in different industries. However, if financial intermediaries use a different technology to evaluate projects of firms in different industries, i.e., industry-specific screening techniques, it is possible that the size (age) benchmark against which one measures the degree of information asymmetry differs across industries. A firm, which is young in absolute terms, could still be relatively old within its industry.

It may be that what matters for information asymmetry is the deviation of a given firm from the typical industry-specific size or age. We therefore form an alternative measure of age and size based on relative within-industry differences, where each firm's size or age is expressed as the percentage deviation from the industry median size or age.[39] The relative measure results in substantially different size and age rankings, i.e., the classification of firms into age or size groups. When assigning firms to quintiles of the firm size (age) distribution, we assign 28% (18%) of companies to a different quintile when using the absolute instead of the relative within-industry measure.

In Table 6, we ask whether those firms that are ranked differently based on the absolute and the relative within-industry age measure experience differential effects of financial development. The top panel of the Table presents the base age step function together with the interaction between

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the age-financial development interaction jointly with an interaction of financial development with an asset tangibility measure. The age-financial development interaction was similar.

[39] Clearly, the *base* size (age) growth effects in our main specifications are already based on relative within-industry measures since conditioning on industry dummies transforms the data into deviations from industry averages.

the age step function and financial development indicators, similar to that presented in Table 3. In addition, we ask whether the age-finance interaction is different for those firms that are ranked as younger based on the within-industry comparison compared to the simple (absolute) age quintile ranking. If these relatively young firms are subject to strong information asymmetry despite being old in absolute terms, we would expect that the peak of the inverted-U shape for these firms will occur at higher absolute age level.[40] In other words, in order to gain access to external finance, these firms must get older in terms of the industry-specific age ranking, even if they appear old in an all-industry comparison. This is indeed what we find in the top panel of Table 6, where the size of the median-age step in the financial-development interaction is lower while the next, fourth quintile step is much higher for the relatively young companies.

The bottom panel of the Table then asks the same question for the relatively old firms, i.e., those companies that appear young based on absolute age, but are relatively old in terms of their industry age distribution. For these companies, we would expect that the peak of the inverted-U interaction will occur earlier. The results confirm our expectations in that there is little of a disproportionate effect for these firms in the fourth absolute age quintile, which happens to be the fifth and last age quintile for them in terms of within-industry age rankings. Furthermore, the inverted-U shape for the relatively old firms is relatively flat across the second and third absolute age quintile, instead of having a strong peak at the third quintile step.

In sum, we find this evidence supportive of the notion that relative within-industry age rankings, as opposed to absolute age comparisons, are related to access to external finance. Given that financial intermediaries are well known to segment their operations by industries, we find this evidence suggestive of within-industry relative age (company history) being related to the degree of information asymmetry.[41]

[40] To see this effect in Figure 2, assume that these firms are of younger 'effective' age than they appear.

[41] In unreported specifications, we find little effect of controlling for firms' relative within-industry size position.

5.7. Equity Endowment of Youngest Companies

Our initial expectation, based on finance theory and survey evidence, was that there would be disproportionately high effect of financial development on growth of the youngest companies because they are strongly affected by information asymmetries. It is therefore important to understand why we find less evidence for a disproportionate effect of financial development on the youngest companies compared to those of near-median age. In this Section, we investigate one explanation based on adjustment of firms to financial system development at the moment of incorporation. The hypothesis is that startups in less financially developed economies expect that after incorporation it may be hard (or take longer) to raise additional external finance; hence, these startups are likely to incorporate only if they can marshal an unusually high amount of initial equity (in comparison to otherwise similar startups in more financially developed systems). Such firm adjustment to financial development would then make the youngest companies in less financially developed economies temporarily less sensitive to their respective financial environments, which is consistent with our estimated interactions coefficients.

To provide evidence on this hypothesis, we ask whether the share of equity capital on total assets, which we refer to as equity endowment, differs for otherwise similar newly incorporated companies across different financial systems. The top panel of Table 7 reports estimates of interest from regressions of company equity endowment on our set of firm characteristics, including age and a dummy for being within one year of incorporation. We also interact our indicators of financial development with the dummy for freshly incorporated firms. As always, we control for a set of industry and country fixed effects. Conditional on the effect that financial development has on equity endowment of all firms, which is absorbed in the country dummies, we ask whether the age gradient of equity endowment differs across countries at different levels of financial development. Specifically, we focus on the equity endowment difference between the startups and all older compa-

nies. The coefficients on the interaction between the startup indicator (Incorporation) and financial development are all negative and some are statistically significant, while the base startup effect is positive and significant, as expected. (These findings are not affected by the specification of the base age effect.) In comparison to older companies, startups feature an unusually high share of equity on total assets, but this gap between startups and older firms is smaller in more financially developed economies, consistent with our hypothesis.

The implications of such adjustment to national financial development for our estimation of age-related growth effect differences are clearly visible in the second panel of Table 7, where we present estimates from our standard firm growth regressions. The novelty is that we now allow the age-finance interaction to be different for firms with equity endowment below the 30th percentile of the equity endowment EU-15-wide distribution. In simple terms, we interact the age-finance interaction with a dummy indicator for having low equity endowment, i.e., a dummy for higher external finance use.[42] The results are striking. Focusing on the youngest companies with low share of equity capital on total assets, i.e., recently incorporated firms that are likely to need external finance to grow, we find a strong and statistically significant age-finance interaction coefficient. The difference in the age shape of the financial development effect related to equity endowment disappears over company life, such that by median age (i.e., about 18 years after incorporation) company equity endowment is not related to financial development growth effects. (This is consistent with less need for adjustment to financial systems quality among the older companies, which have better access to external finance.) The estimated disproportionate growth effect for the youngest firms with low equity endowment is sometimes as large or larger than that recorded at the peak of the inverted-U age-finance interaction estimated earlier. Hence, it is likely that the reason why we are not able to find strong disproportionate growth effects of financial development for *all* youngest companies has

[42] Firms with low equity endowment rely on external finance availability as only a small fraction of their total assets is financed through equity.

to do with the selective entry of more equity-endowed firms in less financially developed countries.

5.8. Firm Entry and Exit

One other potential explanation for the finding of no disproportionate effect of financial development on the youngest companies is related to the effects of financial development on firm entry. A poor financial system may prevent firms from reaching their optimal size and the measurement of such corporate growth effect is the object of our analysis. However, a poor financial system may also prevent entry of profitable companies. Our analysis of firm growth is therefore complementary to that of Klapper et al. (2006), who study the effect that a country's business environment and institutions have on entry of new firms.[43] Applying the Rajan-Zingales identification strategy at industry level, they find, among other results, that firm entry is higher in industries predicted to be in more need of external finance (using the measure of external finance need proposed by Rajan and Zingales, 1998) in countries that have a higher level of financial development. Klapper et al. (2006) also suggest, similar to other existing studies, that entrants are on average larger in countries with a lower level of financial development.[44]

Our study focuses on the growth effects of financial institutions after firm entry (incorporation). It is therefore important that we consider the implications for our estimation of the potentially different (unobservable) growth potential of firms entering in countries that differ in their degree of financial development. The differences in firm entry processes across countries varying in their degree of financial development could induce differences in unobservable entrant quality in our sample. As a hypothetical example, if entering companies in the highly financially developed UK environment are on average of lower growth potential than entrants in less financially developed

[43] Their study is based on the same data we use, the Amadeus database. They effectively assume that entry of a firm into the database corresponds to (a random sample of) entry in the population of firms.

[44] Alfaro and Charlton (2006) provide similar evidence. Beck and Demirguc-Kunt (2006) survey the literature on the interplay between financial systems and firm size distribution.

Greece, then the higher effect of financial development on growth of young companies may be obscured by this sample selection on unobservable growth potential.

However, we believe that this issue does not significantly affect our estimation. First, our estimation controls for the difference in growth rates of firms of different sizes; hence, to the extent that growth potential at entry is proxied by size at entry (as in Beck and Demirguc-Kunt, 2006), our estimation is unlikely to be affected by the higher fraction of larger entrants in less financially developed countries.

Second, we use the 'TOP 250 thousand' module of the Amadeus data, which means that we do not study the growth of very small entrants. More specifically, our data cover firms with an operating revenue of at least 10 million Euro or total assets above 20 million Euro or more than 100 employees (or any combination of these conditions). The fact that we analyze post-entry growth of firms of a certain minimum size ought to minimize selection effects that remain after conditioning on size, i.e., growth potential differences of entrants of identical size across different financial systems.[45]

Third, to provide tantalizing first-step evidence on the importance of the size-related sample selection criteria for dealing with potentially different unobservables at firm entry, we re-estimated our main specifications after excluding from the data all firms in the bottom quintile of the EU-15-wide firm size distribution. This corresponds to imposing even stricter firm selection criteria in terms of size than those used by the 'TOP 250 thousand' module of the Amadeus data. The estimates, available on request, were highly similar to those presented in Table 3, suggesting that potential differences in firm quality at entry are not related to firm size, given the use of the 'TOP 250 thousand' data module.

So far we have discussed the implications of firm entry being affected by financial development for

[45] Our presentation of the argument about selectivity is based on the unobservable quality of projects (growth potential). A similar line of argument could be built around the degree of information opaqueness, such that a Greek entrant may be expected to feature a lower level of opaqueness compared to the average entering UK company.

our estimation. By the same token, however, it is also possible that a selective exit of companies from our sample related to the level of financial development affects our estimation. For example, it could be that a highly developed financial system "weeds out," through competitive pressure, companies that would survive in a less financially developed environment.[46] In this regard, we note that our estimation is based on average (or median) growth rates during our sample period. As a result, companies that disappear from our data towards the end of the sample frame are still represented in the data. We have also re-estimated our main specifications based on two alternative samples, which differ in the degree of survival-related sample selection. First, we omitted all companies that disappear from the Amadeus database before the end of our data in 2003. Such *additional* sample selection ought to magnify any sample selection bias, but we obtain results (available upon request), which are fully consistent with those based on our main sample. Second, we additionally include companies that have less than 5 annual value-added observations available in the Amadeus database during our sample period.[47] Again, there was little difference in the estimates when compared to our main results.

6. Conclusion

By applying the Rajan-Zingales strategy at firm level, we measure the ability of national financial systems to foster corporate growth through tackling information asymmetry as proxied by firm size and age. We study the effects of financial development on firm growth conditional on firms having reached a certain minimum size (having at least 100 employees or more than 20 million Euro of total assets), such that we capture these effects after the initial selection of projects at entry has taken

[46] Indeed, our preliminary analysis suggests that a firm is more likely to exit from Amadeus databases between 1997 and 2003 if it operates in a more financially developed environment and that this exit 'gap' is larger across countries for younger and smaller companies. However, given that there is little information on the reason for exit from the database (e.g., bankruptcy, merger, non-reporting), we hesitate to draw conclusions.

[47] Such companies were not used in all of our estimation so far, see note n. 19.

place. Our estimation contrasts the growth performance of comparable companies operating within the EU-15 'single market', where they face harmonized product market regulation and common industry structure of growth opportunities, but where they must cope with significantly different national financial systems.

Using both across-industry and within-industry comparisons, we find little evidence of a differential effect of financial development on firms of different size, conditional on firms being of a certain minimum size. Since we do not study very small firms, our findings are not inconsistent with the notion that financial market development benefits very small firms disproportionately, as suggested recently by the study of firm entry by Klapper et al. (2006). Taken at face value, our evidence implies that small firms are small for reasons unrelated to financial system development. This would weaken the rationale for the support for small and medium-sized enterprises (SMEs) provided by the EU, which classifies into the SME category those firms with fewer than 250 employees and balance sheet totals below 43 million Euro, i.e., many of the small firms present in our data.

Our main finding is that firms of approximately median age benefit more from financial development in comparison to old firms. In fact, we estimate an inverted-U shape for the age-financial development interaction, which is consistent with very young firms having relatively little access to the financial systems of EU-15 economies. When exploring alternative explanations for the lack of disproportionate growth effects of financial development among the youngest companies, we find that freshly incorporated firms in less financially developed countries typically have unusually high shares of equity capital in total assets. This temporarily 'protects' these entrants from the lack of external financing implied by less developed financial systems. Consequently, when focusing on those youngest companies that have low shares of equity capital, there is a disproportionate positive effect of financial development, consistent with the notion that more developed financial systems are better at tackling age-related information asymmetry. Financial development therefore appears

to offer an effective way of promoting the growth of young firms even within a set of comparable highly developed economies.

Using volume-of-finance-activity measures[48] we find that moving from the least to the most developed financial system within the EU-15 results in a value-added growth rate advantage of a median-aged firm over a firm positioned in the top quintile of the age distribution of about 2 percentage points. The age-related difference in the effects of institutional quality, proxied here by a measure of accounting standards, is at least as large. Similar growth effects are experienced by those very young companies that are not rich in equity capital.

Finally, there is some evidence that information asymmetry is related not only to absolute age of firms, but also to their relative, within-industry age. Such finding is consistent with the existence of industry-specific screening techniques used by financial institutions to evaluate requests for external finance. The age benchmark against which one measures the degree of information asymmetry may be different across industries.

[48] We note that our use of volume-of-finance indicators of financial development implies that our findings are consistent with the notion that *deeper* financial markets are more *efficient* in overcoming information asymmetry. Wurgler (2000) and Braun (2006) imply that deeper financial systems display better allocative efficiency.

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Table 1

Corporate Descriptive Statistics by Country: Firm Data over 1995-2003

	Size			Age			Growth			N
	Mean	Median	S.D.	Mean	Median	S.D.	Mean	Median	S.D.	
Austria	120.4	45.8	308.1	19.3	10.0	22.4	0.021	0.013	0.167	122
Belgium	71.4	15.3	243.8	22.4	17.0	20.1	0.010	0.001	0.096	1,367
Finland	57.2	15.0	177.4	20.5	10.0	22.7	0.048	0.037	0.110	499
France	109.1	19.5	765.6	29.3	23.0	25.0	0.024	0.014	0.086	1,488
Germany	381.0	78.1	1632.1	33.2	19.0	33.9	0.002	-0.007	0.087	473
Greece	23.5	9.0	62.8	16.3	14.0	14.1	0.062	0.050	0.089	658
Italy	49.3	17.8	324.7	20.1	16.0	15.7	0.030	0.020	0.083	4,599
Netherlands	204.8	28.5	878.2	35.7	30.0	28.5	-0.001	-0.015	0.088	174
Portugal	54.7	17.6	208.0	27.5	22.0	21.7	0.004	-0.010	0.083	211
Spain	46.0	15.5	168.0	21.6	18.0	17.0	0.053	0.047	0.082	2,375
Sweden	70.2	11.9	345.6	33.3	28.0	25.6	0.045	0.039	0.093	983
UK	89.4	18.8	379.6	28.7	22.0	25.1	0.057	0.052	0.109	2,230

Note: The number of firm observations in the sample, N, corresponds to observations with non-missing average value-added growth rate. Size (total assets) is in millions of US dollars. Age is the number of years since firm incorporation. Growth is the average real value-added growth rate over 1995-2003. Size is measured as of the first year a firm enters the sample while Age is as of 1995. Before computing these statistics we remove growth outliers (we use only the 5-to-95 percentile range of average firm value-added growth rate) and firms with less than 5 years of value-added data available. See the Data Appendix for complete definitions and sources of variables.

Table 2
Financial Development: The EU-15 over 1990-1994

	Private Bank Credit	Market Capitalization	Total Capitalization	Market Value Traded	Accounting Standards
		Basic Statistics			
Mean	0.86	0.31	1.35	0.13	0.64
Median	0.89	0.22	1.45	0.07	0.63
S.D. / Mean	0.38	0.80	0.33	0.94	0.20
Min	0.32	0.10	0.51	0.03	0.36
Max	1.41	0.97	2.25	0.45	0.83
Min Country	Greece	Austria	Greece	Greece	Portugal
Max Country	Netherlands	UK	UK	UK	Sweden
N	12	12	12	12	12
		Correlations			
Private Bank Credit	1.00				
Market Capitalization	0.57*	1.00			
Total Capitalization	0.71**	0.79***	1.00		
Market Value Traded	0.64**	0.90***	0.80***	1.00	
Accounting Standards	0.60**	0.57*	0.67**	0.51*	1.00

Note: We first compute the country average of each financial development measure in the period 1990-1994 (the exceptions is Accounting Standards, which correspond to 1990). Second, we present the Mean, Median, Coefficient of Variation, Min, and Max of the country averages from the first step across EU-15 countries. Denmark, Ireland, and Luxembourg are not included in this EU-15 comparison as they do not enter our firm-level analysis. The reported country-level financial development variables are used as explanatory variables in our regressions. See the Data Appendix for complete definitions and sources of variables.

Table 3

Financial Development (FD) and Corporate Growth: Age and Size Quintile Groups

	Private Bank Credit	Market Capitalization	Total Capitalization	Market Value Traded	Accounting Standards
FD * Age Q1	-0.004	0.009**	0.002	0.010	0.009
	(0.007)	(0.004)	(0.004)	(0.009)	(0.025)
FD * Age Q2	0.013**	0.015***	0.007**	0.030***	0.044**
	(0.005)	(0.002)	(0.002)	(0.005)	(0.018)
FD * Age Q3	0.020**	0.023***	0.015***	0.042***	0.088***
	(0.008)	(0.005)	(0.003)	(0.008)	(0.018)
FD * Age Q4	0.010**	0.007**	0.007**	0.014**	0.040***
	(0.003)	(0.003)	(0.002)	(0.005)	(0.010)
FD * Size Q1	-0.020	-0.007	-0.007	0.013	-0.038
	(0.033)	(0.021)	(0.012)	(0.036)	(0.096)
FD * Size Q2	-0.021	-0.010	-0.009	-0.008	-0.065
	(0.023)	(0.014)	(0.010)	(0.023)	(0.062)
FD * Size Q3	-0.018	-0.008	-0.006	-0.011	-0.050
	(0.013)	(0.008)	(0.006)	(0.014)	(0.036)
FD * Size Q4	-0.008	-0.001	-0.002	0.002	-0.019
	(0.007)	(0.003)	(0.003)	(0.006)	(0.024)
Age Q1	0.027***	0.020***	0.020***	0.022***	0.018
	(0.005)	(0.003)	(0.005)	(0.002)	(0.016)
Age Q2	0.006	0.012***	0.007*	0.012***	-0.013
	(0.004)	(0.002)	(0.003)	(0.002)	(0.012)
Age Q3	-0.007	0.001	-0.011**	0.003	-0.050***
	(0.005)	(0.002)	(0.004)	(0.002)	(0.012)
Age Q4	-0.007*	-0.002	-0.008**	-0.001	-0.026***
	(0.003)	(0.002)	(0.004)	(0.002)	(0.007)
Size Q1	0.100***	0.086***	0.094***	0.082***	0.110
	(0.030)	(0.012)	(0.020)	(0.013)	(0.066)
Size Q2	0.057**	0.043***	0.052***	0.040***	0.082*
	(0.020)	(0.009)	(0.016)	(0.009)	(0.043)
Size Q3	0.036**	0.023***	0.030**	0.022***	0.054*
	(0.012)	(0.006)	(0.011)	(0.006)	(0.025)
Size Q4	0.014**	0.008**	0.011*	0.007**	0.020
	(0.006)	(0.003)	(0.005)	(0.003)	(0.016)
N	14,874	14,874	14,874	14,874	14,874
adjusted R^2	0.21	0.21	0.21	0.21	0.21

Note: The dependent variable is the time average of annual firm-level real value-added growth rates of manufacturing firms in the period 1995-2003. The Table reports estimates obtained by interacting financial development measures with two step functions, one based on a firm's position in quintiles of the firm age distribution, the other based on quintiles of the firms' size. Estimates are based on the absolute measure of firm age (the number of years since a firm's incorporation as of 1995) scaled down by 100 and the absolute measure of firm size (total assets in millions of US dollars). All country-level financial development variables are predetermined.

We also include (non-reported here) firm-level control variables: Leverage, measured as long-term debt plus current liabilities divided by total assets; Tangibility, measured as fixed assets divided by total assets; Collateralization, defined as fixed assets plus inventories plus accounts receivables divided by total assets; Trade credit, measured as accounts payables divided by total assets; and Equity endowment, measured as equity capital divided by total assets. Tangibility, Collateral, and Trade Credit are measured as the percentage deviation from the respective industry median on a 3-digit ISIC level and are scaled down by 10,000. Age and Size (as well as all other firm-level control variables) come from the first year a firm enters the sample and remain fixed over time. We also include indicators for ownership concentration, a dummy for quoted firms, and a dummy for firms that have a Private Limited Company legal form.

See the Data Appendix for complete definitions and sources of variables. All specifications are linear regressions with outliers removed (using the 5-to-95 percentile range of the dependent variable). We also remove firms with less than 5 years of value-added data available. We always control for 3-digit-ISIC industry and country dummies, not shown. Robust standard errors (clustered at country level) are reported in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Table 4

Financial Development (FD) and Corporate Growth: Using Across-Industry Size Variation

	Private Bank Credit	Market Capitalization	Total Capitalization	Market Value Traded	Accounting Standards
			All Firms		
FD * Industry Size	-0.419	-0.509	-0.271	-1.150	-2.059
	(0.548)	(0.382)	(0.265)	(0.777)	(1.548)
Firm Size	-0.003	-0.004*	-0.003	-0.003	-0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
N	14,740	14,740	14,740	14,740	14,740
adjusted R^2	0.10	0.10	0.10	0.10	0.10
			Firms Near Industry Median Size		
FD * Industry Size	-0.294	0.459	0.144	0.783	-0.006
	(0.706)	(0.557)	(0.411)	(1.212)	(1.915)
Firm Size	-0.757	-0.743	-0.751	-0.740	-0.753
	(0.453)	(0.456)	(0.455)	(0.455)	(0.455)
N	3,006	3,006	3,006	3,006	3,006
adjusted R^2	0.10	0.10	0.10	0.10	0.10
			Firms Near Industry Median Size		
FD * Firm Size	0.014	0.796	0.520	1.217	0.793
	(0.700)	(0.734)	(0.466)	(1.355)	(2.305)
Firm Size	-0.764	-0.993**	-1.453*	-0.893**	-1.276
	(0.654)	(0.463)	(0.741)	(0.430)	(1.556)
N	3,006	3,006	3,006	3,006	3,006
adjusted R^2	0.10	0.10	0.10	0.10	0.10
			Firms Near Industry Median Size		
FD * Firm Size Q1	-0.008	-0.016	-0.009	-0.032	-0.025
	(0.017)	(0.009)	(0.009)	(0.018)	(0.035)
FD * Firm Size Q2	-0.011	-0.032***	-0.022***	-0.058**	-0.053
	(0.022)	(0.007)	(0.007)	(0.019)	(0.061)
FD * Firm Size Q3	-0.006	-0.012	-0.004	-0.022	-0.029
	(0.018)	(0.009)	(0.010)	(0.017)	(0.038)
FD * Firm Size Q4	-0.002	-0.019**	-0.010	-0.040**	-0.014
	(0.020)	(0.007)	(0.007)	(0.014)	(0.062)
Firm Size Q1	0.016	0.015	0.023	0.015	0.027
	(0.018)	(0.009)	(0.016)	(0.008)	(0.025)
Firm Size Q2	0.016	0.018**	0.038***	0.015	0.042
	(0.018)	(0.008)	(0.012)	(0.009)	(0.039)
Firm Size Q3	-0.000	-0.001	0.001	-0.002	0.014
	(0.017)	(0.007)	(0.016)	(0.006)	(0.027)
Firm Size Q4	0.002	0.007	0.015	0.006	0.010
	(0.014)	(0.004)	(0.011)	(0.004)	(0.039)
N	3,006	3,006	3,006	3,006	3,006
adjusted R^2	0.10	0.10	0.10	0.10	0.10

Note: The top panel of the Table reports estimates from linear specifications, in which we interact financial development variables with industry median firm size (on ISIC 3-digit level). In all specifications we control for the set of firm-level control variables used in Table 3. The second set of results is analogous to the first one, except that we only use companies falling into the 40-60 percentile range of industry-specific size distributions. This sub-sample is then used in the bottom panel, where we interact financial development with firm-level size. Firm size is measured using total assets in millions of US dollars as of the first year a firm enters the sample and remains fixed over time.

All specifications are linear regressions with outliers removed (using the 5-to-95 percentile range of the dependent variable). We also remove firms with less than 5 years of value-added data available. We always control for 3-digit-ISIC industry and country dummies, not shown. Robust standard errors (clustered at ISIC 3-digit-level in the first two panels, clustered at firm level in the third panel, and clustered at country level in the last panel) are reported in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Table 5

Financial Development (FD) and Corporate Growth: Age Quintile Groups by Tangibility (TAN)

	Private Bank Credit	Market Capitalization	Total Capitalization	Market Value Traded	Accounting Standards
FD * Age Q1 * TAN low	-0.003	0.001	0.001	0.012	0.035
	(0.017)	(0.010)	(0.006)	(0.019)	(0.058)
FD * Age Q2 * TAN low	0.020**	0.015***	0.006	0.032**	0.076**
	(0.007)	(0.004)	(0.004)	(0.011)	(0.026)
FD * Age Q3 * TAN low	0.035**	0.042***	0.025***	0.082***	0.144***
	(0.013)	(0.004)	(0.003)	(0.009)	(0.044)
FD * Age Q4 * TAN low	0.029**	0.030***	0.023***	0.060***	0.111***
	(0.010)	(0.005)	(0.004)	(0.009)	(0.032)
FD * Age Q1 * TAN high	-0.006	0.020**	0.001	0.026	0.016
	(0.013)	(0.007)	(0.010)	(0.019)	(0.047)
FD * Age Q2 * TAN high	0.015	0.026***	0.011	0.054***	0.054
	(0.012)	(0.004)	(0.007)	(0.011)	(0.041)
FD * Age Q3 * TAN high	0.036**	0.038***	0.024***	0.072***	0.138***
	(0.012)	(0.004)	(0.003)	(0.010)	(0.041)
FD * Age Q4 * TAN high	0.016**	0.012**	0.007	0.020*	0.066***
	(0.007)	(0.005)	(0.004)	(0.010)	(0.020)
TAN low	0.002	0.001	0.002	0.001	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Age Q1 * TAN low	0.043**	0.040***	0.039***	0.039***	0.017
	(0.014)	(0.005)	(0.008)	(0.006)	(0.039)
Age Q2 * TAN low	0.015*	0.025***	0.021***	0.026***	-0.020
	(0.008)	(0.004)	(0.006)	(0.005)	(0.020)
Age Q3 * TAN low	-0.010	0.004	-0.017**	0.007**	-0.078**
	(0.009)	(0.003)	(0.006)	(0.003)	(0.029)
Age Q4 * TAN low	-0.019**	-0.006*	-0.027***	-0.004	-0.069***
	(0.007)	(0.003)	(0.006)	(0.002)	(0.021)
Age Q1 * TAN high	0.038***	0.027***	0.032**	0.030***	0.023
	(0.007)	(0.006)	(0.011)	(0.004)	(0.030)
Age Q2 * TAN high	0.017*	0.019***	0.014	0.021***	-0.008
	(0.008)	(0.004)	(0.008)	(0.004)	(0.026)
Age Q3 * TAN high	-0.010	0.005	-0.015***	0.007*	-0.074**
	(0.007)	(0.004)	(0.004)	(0.003)	(0.026)
Age Q4 * TAN high	-0.009	-0.000	-0.006	0.001	-0.041**
	(0.008)	(0.004)	(0.008)	(0.004)	(0.015)
N	14,874	14,874	14,874	14,874	14,874
adjusted R^2	0.12	0.12	0.12	0.12	0.12

Note: The Table reports estimates of a triple-interaction specification, in which we multiply the interaction of financial development measures with a step function based on firms' position in quintiles of the firm age distribution by a dummy variable for 'Low tangibility' firms (those with below-median tangibility) or by a dummy variable for 'High tangibility' firms (those with above-median tangibility). Estimates are based on the absolute measure of firm age (the number of years since a firm's incorporation as of 1995) scaled down by 100. See Table 3 notes for a list of additional firm-level control variables and the Data Appendix for definitions of variables. All specifications are linear regressions with outliers removed (using the 5-to-95 percentile range of the dependent variable). We also remove firms with less than 5 years of value-added data available. We always control for 3-digit-ISIC industry and country dummies, not shown. Robust standard errors (clustered at country level) are reported in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Table 6

Financial Development (FD) and Corporate Growth: Absolute vs. Relative Age Quintile Groups

	Private Bank Credit	Market Capitalization	Total Capitalization	Market Value Traded	Accounting Standards
	Industry-wise Relatively Younger Firms				
FD * Age Q2 * Relat_Young	-0.012	-0.011	-0.007	-0.029	-0.018
	(0.011)	(0.020)	(0.005)	(0.050)	(0.010)
FD * Age Q3 * Relat_Young	-0.009	-0.015*	-0.004	-0.037*	-0.006
	(0.005)	(0.008)	(0.003)	(0.018)	(0.007)
FD * Age Q4 * Relat_Young	0.014***	0.036***	0.009***	0.072***	0.018***
	(0.004)	(0.003)	(0.002)	(0.007)	(0.004)
FD * Age Q5 * Relat_Young	0.001	0.010	0.001	0.023	-0.001
	(0.005)	(0.008)	(0.003)	(0.017)	(0.006)
FD * Age Q1	-0.006	0.012	0.000	0.019	0.019
	(0.013)	(0.008)	(0.008)	(0.019)	(0.040)
FD * Age Q2	0.017	0.022***	0.009	0.046***	0.060
	(0.010)	(0.004)	(0.006)	(0.011)	(0.033)
FD * Age Q3	0.036**	0.041***	0.025***	0.080***	0.139***
	(0.013)	(0.004)	(0.003)	(0.009)	(0.042)
FD * Age Q4	0.021**	0.016***	0.013***	0.030***	0.083***
	(0.007)	(0.004)	(0.003)	(0.007)	(0.021)
Age Q1	0.041***	0.033***	0.036***	0.034***	0.024
	(0.010)	(0.005)	(0.009)	(0.004)	(0.027)
Age Q2	0.016*	0.022***	0.018**	0.023***	-0.010
	(0.008)	(0.004)	(0.008)	(0.004)	(0.023)
Age Q3	-0.010	0.005	-0.016***	0.007**	-0.075**
	(0.008)	(0.003)	(0.004)	(0.003)	(0.027)
Age Q4	-0.014**	-0.003	-0.016**	-0.001	-0.054***
	(0.006)	(0.003)	(0.006)	(0.003)	(0.015)
N	14,874	14,874	14,874	14,874	14,874
adjusted R^2	0.12	0.12	0.12	0.12	0.12
	Industry-wise Relatively Older Firms				
FD * Age Q1 * Relat_Old	-0.019**	-0.027**	-0.009**	-0.066**	-0.024**
	(0.007)	(0.009)	(0.004)	(0.024)	(0.008)
FD * Age Q2 * Relat_Old	-0.005	-0.010	-0.004	-0.014	-0.009
	(0.007)	(0.009)	(0.003)	(0.015)	(0.008)
FD * Age Q3 * Relat_Old	-0.011	-0.019**	-0.006*	-0.040**	-0.014*
	(0.006)	(0.007)	(0.003)	(0.013)	(0.007)
FD * Age Q4 * Relat_Old	-0.027***	-0.039***	-0.015***	-0.083***	-0.035***
	(0.003)	(0.011)	(0.002)	(0.026)	(0.004)
FD * Age Q1	-0.006	0.013*	0.001	0.022	0.019
	(0.013)	(0.007)	(0.008)	(0.017)	(0.040)
FD * Age Q2	0.017	0.022***	0.009	0.045***	0.061
	(0.011)	(0.004)	(0.006)	(0.011)	(0.034)
FD * Age Q3	0.037**	0.042***	0.025***	0.081***	0.141***
	(0.013)	(0.004)	(0.003)	(0.009)	(0.042)
FD * Age Q4	0.026***	0.024***	0.016***	0.047***	0.090***
	(0.007)	(0.004)	(0.003)	(0.009)	(0.022)
Age Q1	0.042***	0.033***	0.036***	0.034***	0.025
	(0.010)	(0.005)	(0.009)	(0.004)	(0.027)
Age Q2	0.016*	0.022***	0.017*	0.023***	-0.011
	(0.009)	(0.004)	(0.008)	(0.004)	(0.023)
Age Q3	-0.010	0.004	-0.016***	0.007**	-0.075**
	(0.008)	(0.003)	(0.004)	(0.003)	(0.027)
Age Q4	-0.015**	-0.003	-0.017**	-0.002	-0.054***
	(0.006)	(0.003)	(0.006)	(0.003)	(0.015)
N	14,874	14,874	14,874	14,874	14,874
adjusted R^2	0.12	0.12	0.12	0.12	0.12

Note: The Table reports estimates of a triple-interaction specification, in which we multiply the interaction of financial development measures with a step function based on firms' position in quintiles of the absolute firm age distribution by a dummy variable for 'Relatively Younger' firms (top panel) or by a dummy variable for 'Relatively Older' firms (bottom panel). 'Relatively Younger' is an indicator of a firm being assigned to a lower quintile of firm age distribution when using the relative measure of firm age (the percentage deviation of a firm's age from the industry median firm age on a 3-digit ISIC level) compared to the quintile obtained by using the absolute firm age distribution. Analogously, 'Relatively Older' is an indicators of a firm being assigned to a higher quintile of firm age distribution when using the relative measure of firm age compared to the quintile obtained by using the absolute firm age distribution.

See Table 3 notes for a list of additional firm-level control variables and the Data Appendix for definitions of variables. All specifications are linear regressions with outliers removed (using the 5-to-95 percentile range of the dependent variable). We also remove firms with less than 5 years of value-added data available. We always control for 3-digit-ISIC industry and country dummies, not shown. Robust standard errors (clustered at country level) are reported in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Table 7
Financial Development (FD) and Equity Endowment (EE)

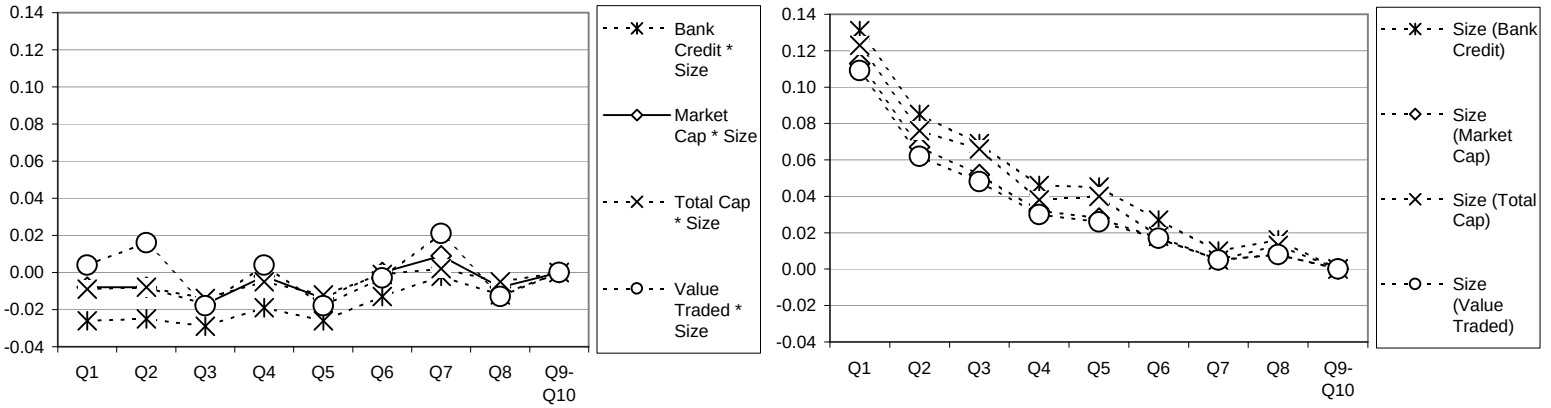
	Private Bank Credit	Market Capitalization	Total Capitalization	Market Value Traded	Accounting Standards
Financial Development and Equity Endowment: Newly Incorporated Firms					
FD * Incorporation	-0.047	-0.058**	-0.030	-0.136**	-0.106
	(0.028)	(0.022)	(0.017)	(0.053)	(0.083)
Incorporation	0.065**	0.047***	0.069**	0.046***	0.098
	(0.026)	(0.015)	(0.026)	(0.013)	(0.060)
Age	-0.100***	-0.100***	-0.100***	-0.100***	-0.100***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
N	14,740	14,740	14,740	14,740	14,740
adjusted R^2	0.14	0.14	0.14	0.14	0.14
Financial Development and Corporate Growth: Age Quintile Groups by Equity Endowment					
FD * Age Q1 * Low EE	0.016	0.035***	0.010*	0.079***	0.017
	(0.012)	(0.010)	(0.006)	(0.017)	(0.013)
FD * Age Q2 * Low EE	0.018**	0.024**	0.011**	0.051**	0.022**
	(0.007)	(0.008)	(0.003)	(0.018)	(0.009)
FD * Age Q3 * Low EE	0.001	0.003	0.000	0.007	-0.004
	(0.007)	(0.009)	(0.003)	(0.018)	(0.008)
FD * Age Q4 * Low EE	-0.001	-0.003	-0.000	-0.006	-0.004
	(0.004)	(0.004)	(0.002)	(0.007)	(0.005)
FD * Age Q1	-0.015	-0.002	-0.004	-0.011	0.006
	(0.010)	(0.006)	(0.006)	(0.016)	(0.034)
FD * Age Q2	0.003	0.007	0.002	0.016	0.029
	(0.010)	(0.007)	(0.005)	(0.016)	(0.031)
FD * Age Q3	0.032**	0.035***	0.024***	0.067***	0.139***
	(0.012)	(0.008)	(0.003)	(0.015)	(0.041)
FD * Age Q4	0.021***	0.020***	0.014***	0.038***	0.085***
	(0.006)	(0.004)	(0.003)	(0.008)	(0.020)
Low EE	0.007**	0.009***	0.007***	0.009***	0.008***
	(0.003)	(0.001)	(0.002)	(0.001)	(0.003)
Age Q1	0.045***	0.034***	0.038***	0.035***	0.030
	(0.009)	(0.005)	(0.008)	(0.004)	(0.025)
Age Q2	0.022**	0.024***	0.022***	0.024***	0.005
	(0.008)	(0.004)	(0.007)	(0.004)	(0.021)
Age Q3	-0.007	0.005	-0.014***	0.008**	-0.074**
	(0.008)	(0.003)	(0.004)	(0.003)	(0.027)
Age Q4	-0.013**	-0.003	-0.015**	-0.001	-0.052***
	(0.006)	(0.003)	(0.006)	(0.003)	(0.014)
N	14,874	14,874	14,874	14,874	14,874
adjusted R^2	0.12	0.12	0.12	0.12	0.12

Note: Top panel: The dependent variable is the fraction of firm's equity capital on total assets—Equity endowment (EE). Incorporation is a binary variable equal to unity if a firm enters the sample with age 0 or 1. Bottom panel: The dependent variable is the time average of annual firm-level real value-added growth rates of manufacturing firms in the period 1995-2003. The panel reports estimates of a triple-interaction specification, in which we multiply the interaction of financial development measures with a step function based on firms' position in quintiles of the firm age distribution by a dummy variable for 'Low equity endowment' firms (those with below 30th percentile of Equity endowment). Estimates are based on the absolute measure of firm age.

In both panels, Equity endowment is measured as of the first year a firm enters the sample and remains fixed over time. See Table 3 notes for a list of additional firm-level control variables and the Data Appendix for definitions of variables. All specifications are linear regressions with outliers removed (using the 5-to-95 percentile range of the dependent variable). We also remove firms with less than 5 years of value-added data available. We always control for 3-digit-ISIC industry and country dummies, not shown. Robust standard errors (clustered at country level) are reported in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Financial Development (FD) and Corporate Growth: Age and Size Decile Groups

Size Decile Groups



Age Decile Groups

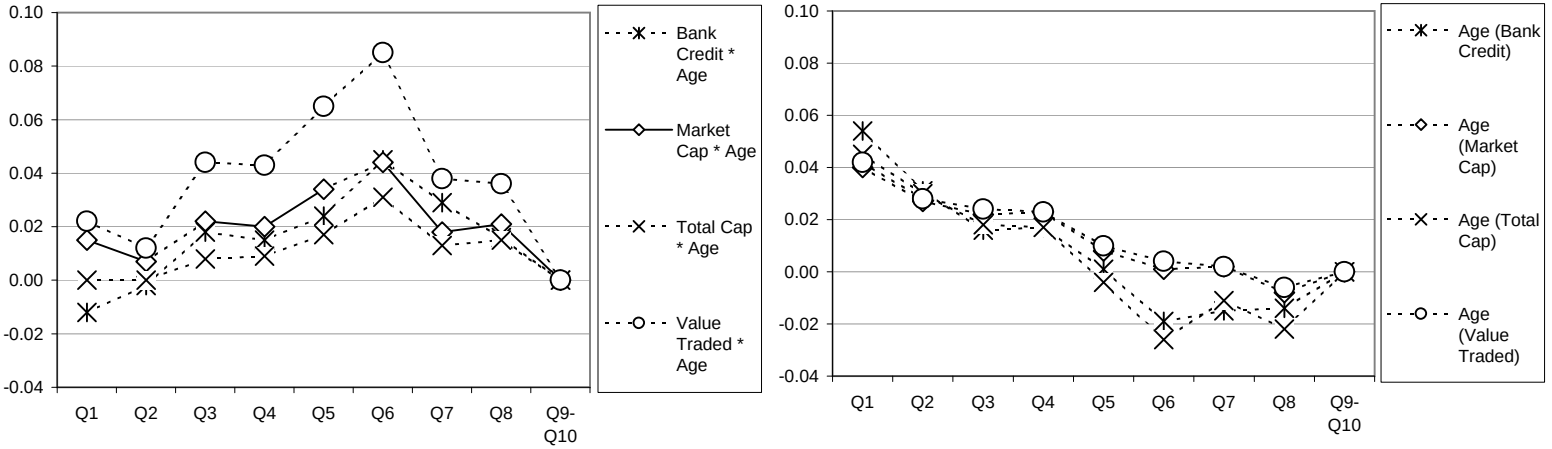


Figure 1

Note: The left two graphs of the Figure report estimates obtained by interacting financial development measures with a step function based on (i) a firm's position in deciles of the firm size distribution (top left graph) and (ii) the corresponding age effect (bottom left graph). The two graphs on the right report the respective base effects. Age (the number of years since a firm's incorporation as of 1995) is scaled down by 100 while Size (total assets) is in millions of US dollars. See Table 3 notes for a list of additional firm-level control variables and the Data Appendix for definitions of variables. All specifications are linear regressions with outliers removed (using the 5-to-95 percentile range of the dependent variable). We also remove firms with less than 5 years of value-added data available. We always control for 3-digit-ISIC industry and country dummies.

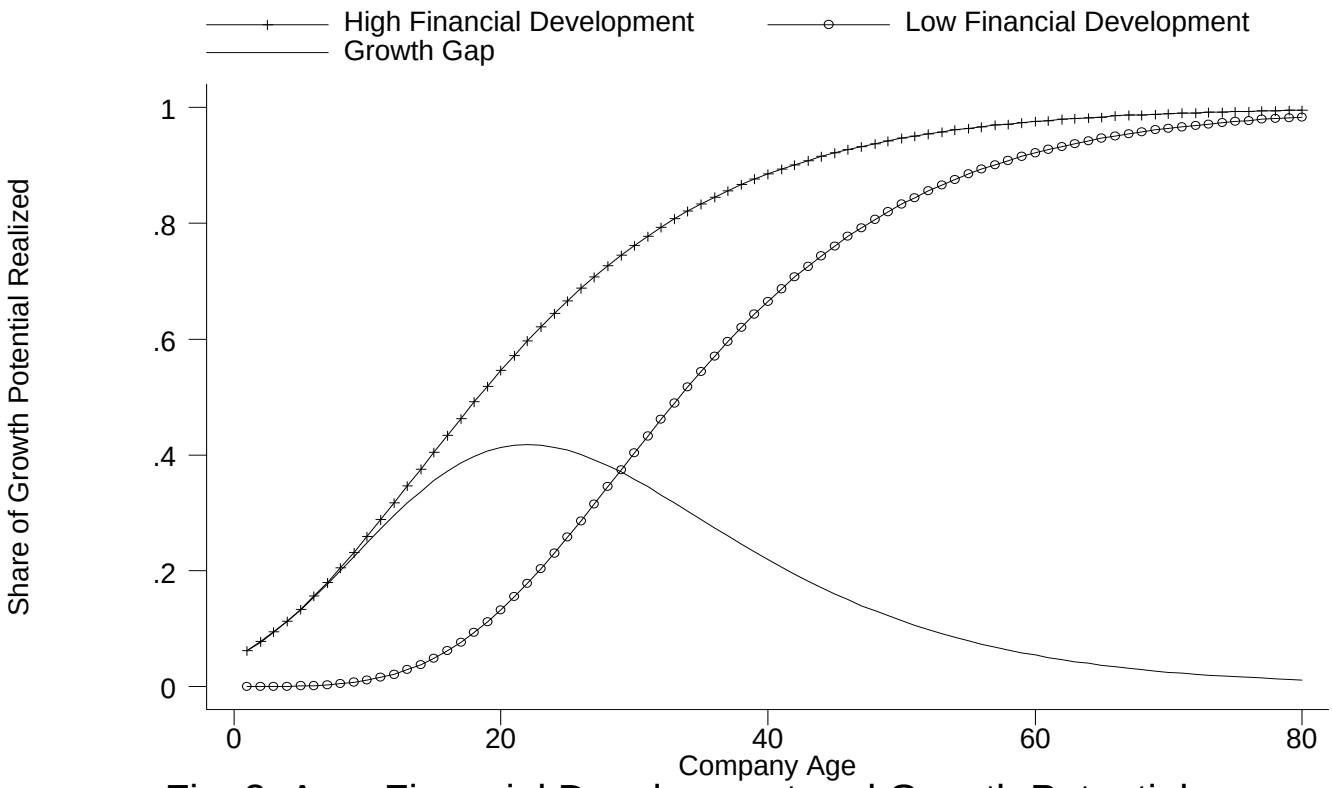


Fig. 2: Age, Financial Development and Growth Potential

Table A.1
Financial Development (FD) and Corporate Growth: Age/Size Quintile Groups

	Private Bank Credit	Market Capitalization	Total Capitalization	Market Value Traded	Accounting Standards
	Firm's Position in Quintile of the Size Distribution				
FD * Size Q1	-0.022	-0.005	-0.007	0.017	-0.038
	(0.034)	(0.021)	(0.013)	(0.037)	(0.099)
FD * Size Q2	-0.022	-0.008	-0.009	-0.005	-0.062
	(0.023)	(0.013)	(0.010)	(0.023)	(0.063)
FD * Size Q3	-0.019	-0.006	-0.006	-0.009	-0.046
	(0.013)	(0.008)	(0.006)	(0.014)	(0.037)
FD * Size Q4	-0.007	0.001	-0.001	0.003	-0.015
	(0.007)	(0.003)	(0.003)	(0.006)	(0.024)
Size Q1	0.102***	0.086***	0.094***	0.081***	0.109
	(0.030)	(0.012)	(0.021)	(0.013)	(0.067)
Size Q2	0.056**	0.041***	0.050**	0.039***	0.079*
	(0.020)	(0.009)	(0.016)	(0.008)	(0.043)
Size Q3	0.036**	0.022***	0.028**	0.021***	0.051*
	(0.012)	(0.006)	(0.011)	(0.006)	(0.026)
Size Q4	0.013*	0.007**	0.009	0.006**	0.017
	(0.006)	(0.003)	(0.006)	(0.003)	(0.016)
N	14,740	14,740	14,740	14,740	14,740
adjusted R^2	0.20	0.20	0.20	0.20	0.20
	Firm's Position in Quintile of the Age Distribution				
FD * Age Q1	-0.006	0.011	0.000	0.018	0.019
	(0.013)	(0.007)	(0.008)	(0.018)	(0.040)
FD * Age Q2	0.016	0.021***	0.009	0.044***	0.060
	(0.010)	(0.004)	(0.006)	(0.011)	(0.034)
FD * Age Q3	0.035**	0.039***	0.025***	0.075***	0.139***
	(0.013)	(0.004)	(0.003)	(0.009)	(0.042)
FD * Age Q4	0.022***	0.018***	0.014***	0.035***	0.081***
	(0.007)	(0.004)	(0.003)	(0.007)	(0.021)
Age Q1	0.041***	0.033***	0.036***	0.034***	0.024
	(0.010)	(0.005)	(0.009)	(0.004)	(0.027)
Age Q2	0.016*	0.022***	0.017**	0.023***	-0.010
	(0.009)	(0.004)	(0.008)	(0.004)	(0.023)
Age Q3	-0.010	0.005	-0.016***	0.007**	-0.074**
	(0.008)	(0.003)	(0.004)	(0.003)	(0.027)
Age Q4	-0.014**	-0.003	-0.015**	-0.001	-0.051***
	(0.006)	(0.003)	(0.006)	(0.003)	(0.014)
N	14,874	14,874	14,874	14,874	14,874
adjusted R^2	0.12	0.12	0.12	0.12	0.12

Note: The top panel reports estimates obtained by interacting financial development measures with a step function based on a firm's position in quintiles of the firm size distribution while the bottom panel reports estimates obtained by interacting financial development measures with a step function based on a firm's position in quintiles of the firm age distribution. Age (the number of years since a firm's incorporation as of 1995) is scaled down by 100 while Size (total assets) is in millions of US dollars. See Table 3 notes for a list of additional firm-level control variables and the Data Appendix for definitions of variables. All specifications are linear regressions with outliers removed (using the 5-to-95 percentile range of the dependent variable). We also remove firms with less than 5 years of value-added data available. We always control for 3-digit-ISIC industry and country dummies, not shown. Robust standard errors (clustered at country level) are reported in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.2
Financial Development (FD) and Corporate Growth: Parametric Specification

	Private Bank Credit	Market Capitalization	Total Capitalization	Market Value Traded	Accounting Standards
			Size: Linear Specification		
FD * Size	0.002	-0.023***	-0.004	-0.025*	-0.040
	(0.014)	(0.007)	(0.006)	(0.014)	(0.025)
Size	-0.006	0.004	0.003	0.001	0.023
	(0.013)	(0.003)	(0.010)	(0.004)	(0.017)
N	14,740	14,740	14,740	14,740	14,740
R^2	0.11	0.11	0.11	0.11	0.11
			Size: Cubic Specification		
FD * Size	0.072***	-0.023	0.018	0.038	-0.033
	(0.024)	(0.016)	(0.012)	(0.032)	(0.066)
FD * $Size^2$	-0.018**	0.005*	-0.004	-0.019***	0.015
	(0.007)	(0.003)	(0.003)	(0.006)	(0.017)
FD * $Size^3$	0.001**	-0.000***	0.000	0.001***	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Size	-0.101***	-0.027***	-0.062***	-0.045***	-0.015
	(0.023)	(0.008)	(0.020)	(0.008)	(0.044)
$Size^2$	0.021***	0.004***	0.012**	0.010***	-0.004
	(0.007)	(0.001)	(0.005)	(0.002)	(0.011)
$Size^3$	-0.001***	-0.000	-0.000*	-0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	14,740	14,740	14,740	14,740	14,740
adjusted R^2	0.12	0.12	0.12	0.12	0.12
			Age: Linear Specification		
FD * Age	0.043***	-0.002	0.022***	0.008	0.017
	(0.013)	(0.012)	(0.008)	(0.023)	(0.038)
Age	-0.103***	-0.063***	-0.097***	-0.065***	-0.076***
	(0.012)	(0.006)	(0.012)	(0.005)	(0.026)
N	14,740	14,740	14,740	14,740	14,740
R^2	0.11	0.11	0.11	0.11	0.11
			Age: Cubic Specification		
FD * Age	0.336***	0.169**	0.197***	0.402**	0.917***
	(0.087)	(0.085)	(0.052)	(0.170)	(0.273)
FD * Age^2	-0.794***	-0.492**	-0.479***	-1.171**	-2.354***
	(0.243)	(0.229)	(0.144)	(0.458)	(0.739)
FD * Age^3	0.487***	0.329*	0.299***	0.798**	1.472***
	(0.185)	(0.168)	(0.109)	(0.339)	(0.545)
Age	-0.468***	-0.263***	-0.475***	-0.262***	-0.812***
	(0.074)	(0.036)	(0.075)	(0.033)	(0.182)
Age^2	0.872***	0.424***	0.907***	0.422***	1.812***
	(0.211)	(0.100)	(0.216)	(0.092)	(0.496)
Age^3	-0.469***	-0.207***	-0.500***	-0.208***	-1.065***
	(0.164)	(0.075)	(0.168)	(0.070)	(0.367)
N	14,740	14,740	14,740	14,740	14,740
adjusted R^2	0.12	0.12	0.12	0.12	0.12

Note: The top two panels report estimates obtained by interacting financial development measures with firm size while the bottom two panels report estimates obtained by interacting financial development measures with firm age. Age (the number of years since a firm's incorporation as of 1995) is scaled down by 100 while Size (total assets) is in millions of US dollars. See Table 3 notes for a list of additional firm-level control variables and the Data Appendix for definitions of variables. All specifications are linear regressions with outliers removed (using the 5-to-95 percentile range of the dependent variable). We also remove firms with less than 5 years of value-added data available. We always control for 3-digit-ISIC industry and country dummies, not shown. Robust standard errors (clustered at firm level) are reported in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.3
Financial Development (FD) and Corporate Growth: Age Quintile Groups by Firm Size

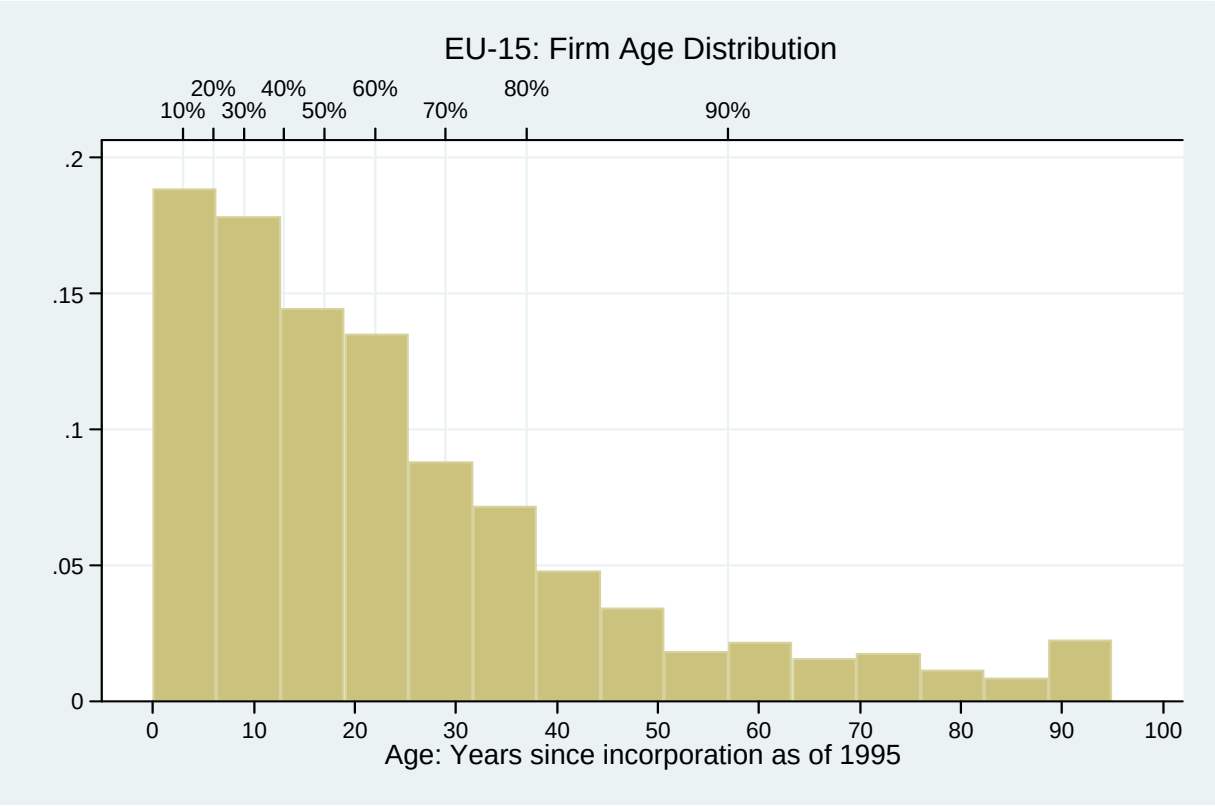
	Private Bank Credit	Market Capitalization	Total Capitalization	Market Value Traded	Accounting Standards
FD * Age Q1 * Small	-0.005	0.011	0.001	0.036	0.016
	(0.024)	(0.017)	(0.012)	(0.029)	(0.071)
FD * Age Q2 * Small	0.012	0.020**	0.011	0.052***	0.035
	(0.018)	(0.008)	(0.007)	(0.014)	(0.054)
FD * Age Q3 * Small	0.026*	0.028***	0.017***	0.063***	0.108**
	(0.014)	(0.004)	(0.004)	(0.010)	(0.037)
FD * Age Q4 * Small	0.014	0.009*	0.008*	0.027**	0.051
	(0.012)	(0.005)	(0.004)	(0.012)	(0.033)
FD * Age Q1 * Big	-0.000	0.011*	0.009*	0.010	-0.000
	(0.015)	(0.006)	(0.005)	(0.013)	(0.037)
FD * Age Q2 * Big	0.022**	0.016***	0.007	0.036***	0.074**
	(0.010)	(0.003)	(0.004)	(0.009)	(0.027)
FD * Age Q3 * Big	0.025*	0.033***	0.022***	0.055***	0.085*
	(0.013)	(0.007)	(0.005)	(0.010)	(0.041)
FD * Age Q4 * Big	0.019***	0.017***	0.013***	0.027***	0.067***
	(0.004)	(0.005)	(0.003)	(0.007)	(0.014)
Big	-0.031***	-0.031***	-0.031***	-0.031***	-0.032***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Age Q1 * Small	0.050**	0.042***	0.045**	0.041***	0.035
	(0.020)	(0.008)	(0.017)	(0.007)	(0.048)
Age Q2 * Small	0.024	0.027***	0.020*	0.027***	0.010
	(0.014)	(0.004)	(0.010)	(0.004)	(0.036)
Age Q3 * Small	-0.003	0.008**	-0.006	0.009**	-0.054*
	(0.011)	(0.003)	(0.006)	(0.003)	(0.025)
Age Q4 * Small	-0.011	-0.003	-0.010	-0.003	-0.034
	(0.011)	(0.004)	(0.008)	(0.004)	(0.023)
Age Q1 * Big	0.014	0.010**	0.000	0.012**	0.014
	(0.014)	(0.004)	(0.008)	(0.004)	(0.025)
Age Q2 * Big	-0.005	0.007*	0.002	0.007*	-0.036*
	(0.009)	(0.003)	(0.005)	(0.004)	(0.019)
Age Q3 * Big	-0.011	-0.002	-0.022***	0.001	-0.048*
	(0.008)	(0.003)	(0.006)	(0.003)	(0.026)
Age Q4 * Big	-0.012***	-0.002	-0.015**	-0.001	-0.041***
	(0.003)	(0.002)	(0.005)	(0.002)	(0.010)
N	14,874	14,874	14,874	14,874	14,874
adjusted R^2	0.17	0.17	0.17	0.17	0.17

Note: The Table reports estimates of a triple-interaction specification, in which we multiply the interaction of financial development measures with a step function based on firms' position in quintiles of the firm age distribution by a dummy variable for 'Small' firms (those with below-median total assets) or by a dummy variable for 'Big' firms (those with above-median total assets). Estimates are based on the absolute measure of firm age (the number of years since a firm's incorporation as of 1995) scaled down by 100. See Table 3 notes for a list of additional firm-level control variables and the Data Appendix for definitions of variables. All specifications are linear regressions with outliers removed (using the 5-to-95 percentile range of the dependent variable). We also remove firms with less than 5 years of value-added data available. We always control for 3-digit-ISIC industry and country dummies, not shown. Robust standard errors (clustered at country level) are reported in parentheses; *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

Table A.4
Median Regressions

	Private Bank Credit	Market Capitalization	Total Capitalization	Market Value Traded	Accounting Standards
FD * Age Q1	-0.009	0.004	-0.007	0.001	0.015
	(0.021)	(0.045)	(0.019)	(0.055)	(0.044)
FD * Age Q2	0.018	0.021	0.008	0.047	0.070*
	(0.015)	(0.027)	(0.014)	(0.033)	(0.039)
FD * Age Q3	0.013	0.017	0.011*	0.028	0.077***
	(0.011)	(0.022)	(0.006)	(0.023)	(0.022)
FD * Age Q4	0.006	0.007	0.005	0.010	0.049***
	(0.009)	(0.027)	(0.005)	(0.017)	(0.017)
FD * Size Q1	-0.007	0.007	-0.002	0.037	0.019
	(0.045)	(0.116)	(0.035)	(0.115)	(0.105)
FD * Size Q2	-0.004	0.004	-0.002	0.023	-0.010
	(0.025)	(0.069)	(0.021)	(0.062)	(0.071)
FD * Size Q3	-0.009	0.001	-0.001	0.011	-0.012
	(0.017)	(0.045)	(0.014)	(0.054)	(0.051)
FD * Size Q4	0.009	0.012	0.004	0.026	0.049*
	(0.012)	(0.022)	(0.009)	(0.036)	(0.028)
Age Q1	0.031	0.023*	0.034	0.024***	0.015
	(0.019)	(0.013)	(0.025)	(0.007)	(0.032)
Age Q2	0.002	0.009	0.005	0.010***	-0.030
	(0.012)	(0.007)	(0.018)	(0.003)	(0.026)
Age Q3	0.000	0.004	-0.005	0.006**	-0.041***
	(0.008)	(0.006)	(0.010)	(0.003)	(0.015)
Age Q4	-0.001	0.000	-0.005	0.001	-0.030**
	(0.009)	(0.007)	(0.008)	(0.003)	(0.012)
Size Q1	0.102**	0.094***	0.099*	0.090***	0.084
	(0.041)	(0.029)	(0.050)	(0.017)	(0.071)
Size Q2	0.047**	0.042**	0.045	0.041***	0.050
	(0.023)	(0.019)	(0.031)	(0.010)	(0.047)
Size Q3	0.031**	0.023*	0.024	0.022***	0.032
	(0.015)	(0.013)	(0.021)	(0.008)	(0.033)
Size Q4	0.006	0.008	0.007	0.009*	-0.020
	(0.010)	(0.007)	(0.014)	(0.004)	(0.018)
N	16,081	16,081	16,081	16,081	16,081
pseudo R^2	0.09	0.09	0.09	0.09	0.09

Note: Data and equation specification are the same as in Table 3. All specifications are median regressions. We include the value-added-growth outliers, which were not used in the previous tables (i.e., observations outside 5-to-95 percentile range of the dependent variable). See Table 3 notes for a list of additional firm-level control variables and the Data Appendix for definitions of variables. We remove firms with less than 5 years of value-added data available. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively, based on bootstrapped standard errors (reported in parentheses) clustered at the country level.



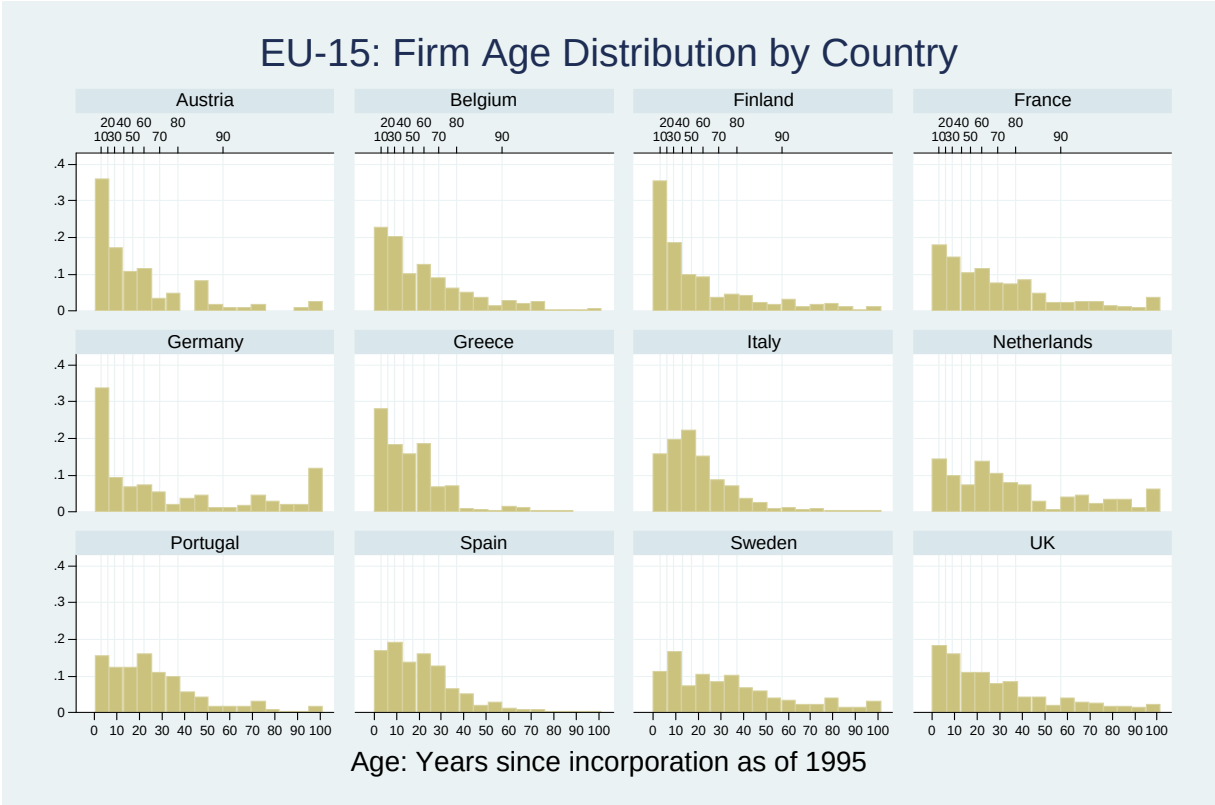
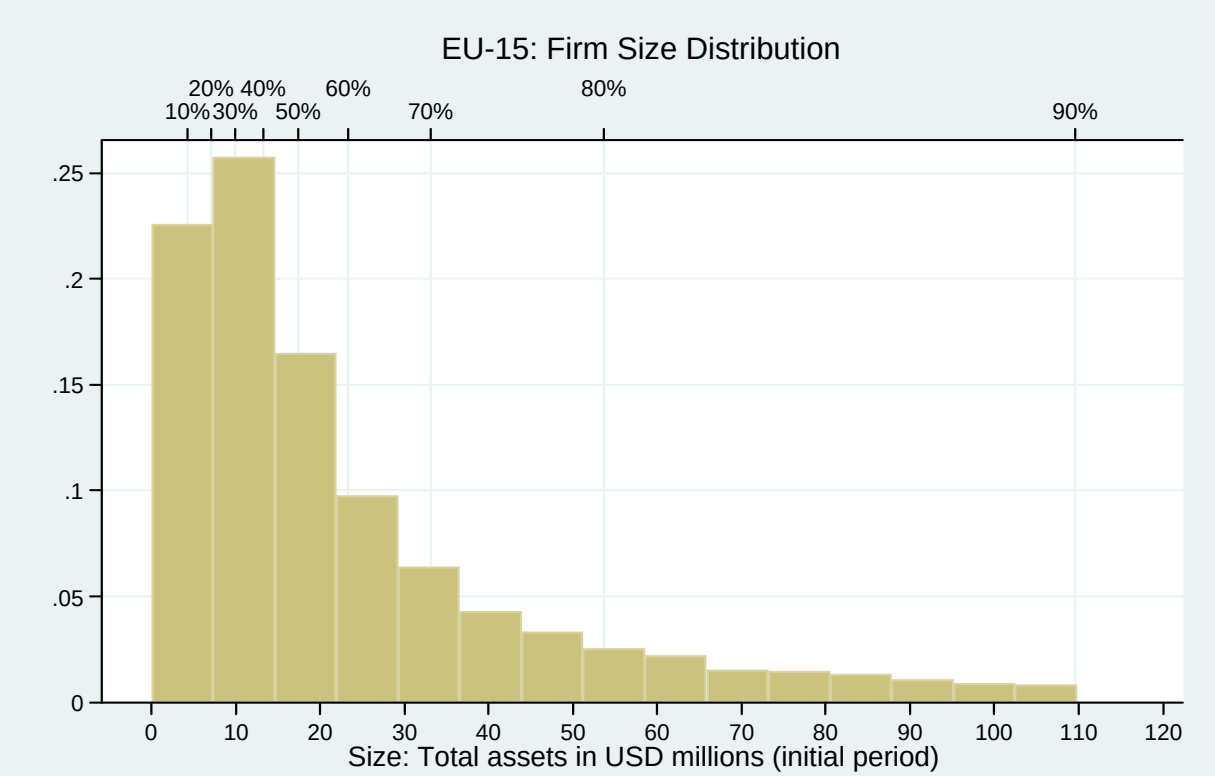


Figure A.1

Note: Age (the number of years since firm incorporation as of 1995) is measured along the horizontal axis. The upper horizontal axis of each graph indicates deciles of the EU-15-wide age distribution. Before plotting the histograms we remove growth outliers (we use only the 5-to-95 percentile range of average firm value-added growth rate) and firms with less than 5 years of value-added data available. See the Data Appendix for complete definitions and sources of variables.



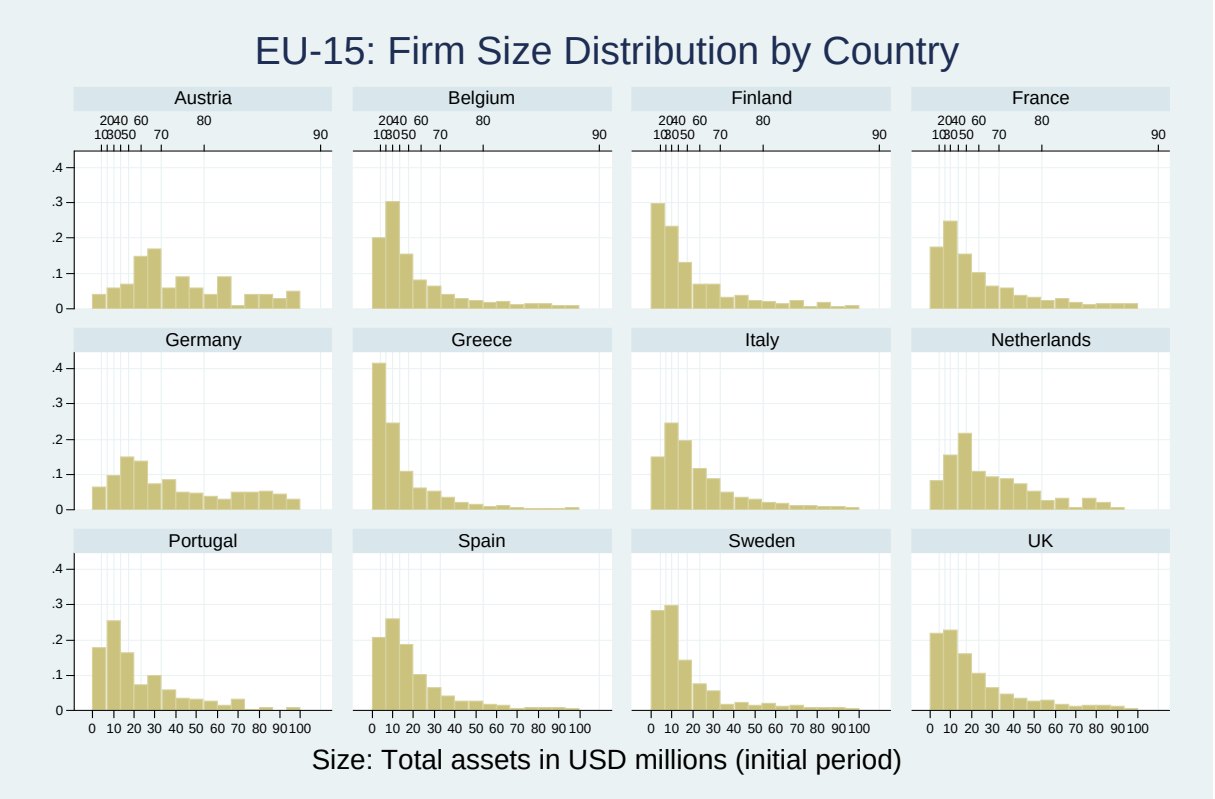


Figure A.2

Note: Size (total assets in millions of US dollars as of the first year a firm enters the sample) is measured along the horizontal axis. The upper horizontal axis of each graph indicates deciles of the EU-15-wide size distribution. Before plotting the histograms we remove growth outliers (we use only the 5-to-95 percentile range of average firm value-added growth rate) and firms with less than 5 years of value-added data available. See the Data Appendix for complete definitions and sources of variables.

Table DA.1
Definition of Variables

	Firm-level Variables
VA	Firm-level value-added in current prices deflated by PPI. As PPI we use Eurostat's not seasonally adjusted domestic output price index (in national currency) which covers total industry (excluding construction). Source: Amadeus.
VA_Growth	Annual firm-level growth rate of real value-added based on VA. The formula for VA_Growth we use is $(VA_t - VA_{t-1}) / ABS(½\ VA_t + ½\ VA_{t-1})$. In our estimations, we use residuals from regression of all observed firm-level annual growth rates (VA_Growth) on year dummies. Source: Amadeus.
VA_Avg	Simple average of the annual real firm-level value-added growth rates (VA_Growth) over the years a firm is available in the database for the period 1995-2003. Source: Amadeus.
VA_Med	Median of the annual real firm-level value-added growth rates (VA_Growth) over the years a firm is available in the database for the period 1995-2003. Source: Amadeus.
Age	The number of years since firm's incorporation (STATDATE - YEARINC) scaled down by 100. It is calculated as of 1995 and remains fixed over time. Source: Amadeus.
Size	Firm's total assets (TOAS) in millions of US dollars. We use IMF-IFS annual average exchange rates to convert total assets into US dollars. It is calculated as of the initial-period (the first year a firm enters the sample) and remains fixed over time. Source: Amadeus.
Leverage	Measured as a long term debt (LTDB) plus current liabilities (CULI) divided by total assets (TOAS). It is calculated as of the initial-period (the first year a firm enters the sample and remains fixed over time). Source: Amadeus.
Tangibility (TAN)	Tangibility is defined as fixed assets (FIAS) divided by total assets (TOAS). We use the percentage deviation of firm's tangibility from the industry median firm tangibility on 3-digit ISIC level, scaled down by 100. It is calculated as of the initial-period (the first year a firm enters the sample and remains fixed over time). Source: Amadeus.
Collateralization	Collateralization is defined as fixed assets (FIAS) plus inventories (STOK) plus accounts receivables (DEBT) divided by total assets (TOAS). We use the percentage deviation of firm's collateralization from the industry median firm collateralization on 3-digit ISIC level, scaled down by 100. It is calculated as of the initial-period (the first year a firm enters the sample and remains fixed over time). Source: Amadeus.
Equity Endowment (EE)	Firm's equity capital (CAPI) scaled by total assets (TOAS). It is calculated as of the initial-period (the first year a firm enters the sample) and remains fixed over time. Source: Amadeus.
Quoted	0/1 variable, equal 1 if the firm is publicly listed company and 0 otherwise. Source: Amadeus.
Private Limited Company	0/1 variable, equal 1 if the firm is 'Limited Liability Company' (Company whose capital is divided into shares which cannot be offered to the general public. The liability of its members is limited to the amount of their shares.) and 0 if the firm is 'Limited Company' (Company whose capital is divided into shares which can be offered to the general public and whose members are only liable for its debts to the extent of any amount unpaid on their shares.) Source: Amadeus.
Independence	Set of four 0/1 variables capturing firm's concentration of ownership structure (INDEPIND). INDEPIND_A equal 1 for a firm with no recorded shareholder with an ownership over 24.99% (either direct or total) and 0 otherwise. INDEPIND_B equal 1 for a firm with no recorded shareholder with an ownership percentage (direct or total) over 49.99%, but having one or more shareholders with an ownership percentage over 24.99% and 0 otherwise. INDEPIND_C equal 1 for a firm with a recorded shareholder with an ownership (direct or total) over 49.99% (also equal to 1 when firm indicates that the company has an Ultimate Owner) and 0 otherwise. INDEPIND_U equal 1 for a firm not falling into the categories A, B, or C indicating an unknown degree of independence. Source: Amadeus.
Incorporation	0/1 variable, equal 1 if the firm enters the sample with Age 0 or 1. Source: Amadeus.
	Financial Development Country-level Measures

PCDMBANKOFINSTGDP	Private credit by deposit money banks and other financial institutions to GDP. Average over the period 1990-1994. Source: The Word Bank Financial Structure and Economic Development Database.
STMCAPGDP	Stock market capitalization to GDP. Average over the period 1990-1994. Source: The Word Bank Financial Structure and Economic Development Database.
STMTVTGDP	Stock market total value traded to GDP. Average over the period 1990-1994. Source: The Word Bank Financial Structure and Economic Development Database.
Total Capitalization	The sum of (i) stock market capitalisation, (ii) bank credit to the private sector and (iii) domestic debt securities issued by the private sector to GDP. Average over the period 1990-1994. Source: Hartmann et al. (2006), Chart 1.
ACCOUNT	Index created by examining and rating companies' 1990 annual reports on their inclusion or omission of 90 items in balance sheets and income statements and published by the Center for International Financial Analysis & Research, Inc. The maximum is 90, the minimum 0 and we scaled it down by 100. Source: The Center for International Financial Analysis & Research, Inc.

Table DA.2
Legal Forms in the EU-15

Country	Limited Companies	Limited Liability Companies
Austria / Germany	Aktiengesellschaft (AG, AG & Co KG)	Gesellschaft mit beschraekter Haftung (GmbH, GmbH & Co KG, Einzelfirma)
Belgium	Naamloze Vennootschap (NV), Société Anonyme (SA)	Besloten Vennootschap, (E)BVBA; Société Privée a Responsabilité Limite, SPRL(U)
Denmark	Limited Company, Company with Limited Liability (A/S)	Private Limited Company (ApS)
Finland	Osakeyhtiö a Julkinen (OYJ)	Osakeyhtiö (OY)
France	Société Anonyme (SA)	Société a Responsabilité Limite (SARL)
Greece	SA	Limited liability company (EPE), Sole shareholder limited liability company
Italy	Societa Per Azioni (SPA)	Societa a Responsabilita Limitata (SRL, SCARL)
Netherlands	Naamloze Vennootschap (NV)	Besloten Vennootschap (BV)
Portugal	Sociedade Anónima (SA)	Sociedade por Quotas Responsibilidada Limitada (LDA)
Spain	Sociedad Anónima (SA)	Sociedad Limitada (SL)
Sweden	AB - Public Limited	AB - Private Limited
United Kingdom / Ireland	Guarantee; Public, A.I.M.; Public, investment trust; Public, not quoted; Public, quoted; Unlimited	Private

Note: In order to ensure comparability of sampled firms across countries, we include only companies from the two broad categories: Limited Companies (companies whose capital is divided into shares which can be offered to the general public and whose members are only liable for its debts to the extent of any amount unpaid on their shares) and Limited Liability Companies (companies whose capital is divided into shares which cannot be offered to the general public. The liability of its members is limited to the amount of their shares). We exclude partnerships (at least one partner is liable for the firm's debts), sole proprietorships (there is only one shareholder) and cooperatives. We follow Bureau van Dijk's grouping of the firms' types. See Klapper et al. (2006) for a similar approach.