Small firms, growth and financial constraints

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Abstract

This paper analyses the impact of different sources of finance on the growth of firms. Using panel data from Spanish manufacturing firms for the period 2000-2006, we investigate the effects of internal and external finances on firm growth. In particular, we examine three dimensions of these financial sources: a) the performance of the firms' capital structure in accordance with firm size; b) the effects of internal and external financial sources on growth performance; c) the combined effect of equity, external debt and cash flow on firm growth. We find that low-growth firms are sensitive to cash flow and short-term bank debt, while high-growth firms are more sensitive to long-term debt. Furthermore, equity capital seems to reduce barriers to external finance. Our main conclusion is that during the start-up phase, firms are unable to increase their financial leverage and so their capital structure fails to promote correct investment strategies. However, as their equity capital increases, alternative financial mechanisms, in particular long-term debt, become available, which have a positive impact on firm growth.

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1. Introduction

Empirical research examining firm growth emphasises the importance of sectoral, territorial and individual factors, but attention to financial factors in this literature has been somewhat scarce. Three reasons would seem to account for this neglect. First, the field of industrial organization has traditionally ignored corporate finance and vice versa. Second, an increasing number of studies have chosen to analyse firm growth as a theoretical production function and, as such, have paid scarce attention regarding to the strategic relationships that might exist between financial decisions and output market decisions. And, third, scholars have only very recently acquired access to panel data that can provide information about production factors and financial flows at the firm level. The combined effect of these three trends has served to limit the analysis of the effects of financial factors on firm's growth.

Here, we seek to examine the effect of internal and external finance on firm's growth. More specifically, we distinguish between firm sizes so as to provide empirical evidence of the differential impact of these financial channels. During a firm's infancy the availability of finance tends to be extremely limited. In this start-up phase, a firm's ability to capture financial resources is usually restricted to equity capital and bank debt, while its capacity for leverage is also limited. As the firm establishes itself, however, it gains access to resources from its own productive activity - commercial borrowings, internal cash flow - and sources of external finance. The firm's ability to accede to these latter varies with macroeconomic environment and with microeconomic factors related to the territorial environment and the firm's individual characteristics.

A firm's ability to obtain external finance is a key factor in its development, growth and survival. According with Aghion *et al.* (2007), access to external finance improves market selection by allowing small firms to be more competitive. Additionally, financial accessibility significantly facilitates the post-entry growth of firms. In addition, Winker (1999) and Savignac (2008), among others, report that credit constraints have a negative impact on innovation expenditures and overall investment; and Carpenter and Petersen (2002), in a study of 1,600 small US firms, find that asset growth is constrained by the availability of internal finance. Finally, Musso and Schiavo (2008), in a study of almost 15,000 French manufacturing firms, conclude that access to external financial resources has a positive impact on firm growth.

In this paper we are interested in analysing the effects of different sources of finance on sales growth at the firm level, with particular attention to small firms, given the increasing recognition that they are gaining in the promotion of regional development (Acs, 1999). Although it is the large firms that tend to capture a larger share of employment and economic activity, small firms can act as catalysts for the development of local industrial

sectors. In fact, in recent decades the share of small firms in the economy has increased due to growing global competition, greater uncertainty, and technological advances (Audretsch *et al.* 2002). However, there is a general consensus that such firms suffer from a serie of financial constraints.

In recent years, the larger financial constraints with which small firms have to contend have been the focus of many studies. In general, a well-developed finance system will seek to facilitate a firm's access to productivity-enhancing investments. However, even in well-developed financial systems, such as the Spanish one, small firms may be constrained and be more markedly sensitive to the possibilities of accessing external finance.

The aim of this paper is to improve our understanding of the way in which access to financial sources can affect the capacity of small firms to increase their sales. We use an extensive database for Spanish manufacturing firms that includes balance sheet data from the Mercantile Register between the years 2000 and 2006. In order to provide quantitative evidence regarding the performance of a firm's growth determinants we use quantile regressions to analyse manufacturing industries. Quantile regressions capture the different marginal effects of a firm's growth determinants on firm growth (Koenker and Basset, 1978) and offer a different approach to the analysis of firm performance.

Our main findings can be summarised as follows. First, we show that firms with low growth rates are more sensitive to the access of internal sources of finance. Second, our results suggest that access to external sources is crucial in order to increase these growth rates. Third, equity capital may be a signal for external borrowers and may reduce information asymmetries. As the weight of the ratio of equity to assets increases, the firm's ability to accede to bank debt increases; in other words, financial leverage increases when share prices are high. Four, cash flow and short-term bank debt are of great importance when firms are small and their growth rates are low. Here, the Spanish case is particularly interesting as it has a market structure characterised by firms that are smaller than their European counterparts and which have a smaller capacity to grow. As such, the study sheds some light on the role played by various sources of finance on the growth of Spanish manufacturing firms.

The paper is structured as follows. In section 2 we give an overview of the determinants of financial development and firm growth. Section 3 presents our data. Section 4 discusses our econometric model. Our results are presented in section 5, while the final section draws together our main conclusions.

2. Finance and firm growth

Empirical studies emphasize the crucial role played by financial development on economic growth. However, access to broad, comprehensive

databases at the firm-level has given rise to contributions within the field that emphasize the fact that the asymmetries in access to finance are dependent on firm size. This section analyses the theoretical arguments that underpin the relationship between finance and growth at the macro- and microeconomic levels.

2.1. Financial development and economic growth

The literature examining the impact of finance on economic growth is extensive. In line with the approach proposed by Schumpeter, most studies report a positive effect of financial services on growth. The Schumpeterian argument holds that services provided by the financial sector, via the appropriate allocation of capital and risk in the economy, play a positive role in economic growth. Empirical evidence at the aggregate level has been provided from an early date by various authors. For example, Goldsmith (1969) found a temporal link between economic growth and financial development for 35 countries during the period 1860-1963. Today there exists a growing body of literature analysing this link between growth and the financial sector, but doubts remain as to the direction of this causation. So, it is unclear as to whether finances are an important catalyst of economic growth, or rather the causation runs in the opposite direction as proposed by Robinson (1952). She and other scholars have argued that the relationship is in fact the inverse of Say's law. In the words of Robinson (1952) "*where enterprise leads, finance follows*".

It might be that, in line with the argument forwarded by Lucas (1988), the role of finances has been overemphasized, but recent evidence suggests that financial services are critical for economic growth. Financial markets and institutions facilitate the allocation of financial resources, manage the risk and facilitate investment in innovative projects. At the firm level, finances exert a major influence on the development of firms and innovative activities. Thus, Rajan and Zingales (1988b) argue that the financial system has two primary goals: to place risks where they are best borne, and to channel resources to their most productive uses. Proper empirical work in assessing the relationship between financial development and the real economy began with King and Levine (1993a,b,c). Those authors reported cross-country evidence suggesting that financial development affects economic growth by fostering productivity improvements (Love, 2003). However, few studies have subsequently analysed the impact of financial development on productivity at the firm level.

A number of authors (Brito and Mello, 1995; Beck *et al.*, 2006) have emphasised the importance of being able to access external finance. First, access to finance plays a key role in the general business environment, potentially serving as a constraint on both firm entry and performance. Further, it is also clearly important to foster a competitive business environment that permits the entry of new and innovative entrepreneurs resulting in the Schumpeterian process of "creative destruction" rather than

maintaining a large stock of SMEs with a low turnover (Beck *et al.*, 2006). Second, taking into account joint financial and production decisions helps to provide a better understanding of the key drivers of entry-exit decisions, as well as the firms' post-entry performance (Brito and Mello, 1995).

Several models have defined, from a theoretical perspective, the mechanism by which the financial system affects productivity. Here, three principals arguments have been forwarded. The leading argument is that better access to finance increases a firm's investment in productivity-enhancing projects. Such projects are more easily undertaken when there are liquid financial markets given that investors can sell their shares if they need to recover their savings before the project matures (Levine, 1991; Bencivenga *et al.*, 1995). Furthermore, financial markets may help by evaluating prospective entrepreneurs, mobilizing savings to finance the most promising investment projects and diversifying the risks associated with these innovative activities (King and Levine, 1993c). Additionally, perfect credit markets increase the propensity to engage in long-term productivity-enhancing investment by decreasing the level of liquidity risk involved in those investments (see Aghion *et al.*, 2007). As a consequence, the presence of financial constraints results in lower productivity.

At the macro level, the empirical evidence focuses on the relationship between finance development and productivity. Recent evidence (Levine *et al.*, 2000; Beck *et al.*, 2000) is drawn from panel techniques that support the existence of a causal relationship between financial development and economic growth (i.e., growth in real GDP per capita, and productivity growth). For example, King and Levine (1993b,c) find that financial development has a positive effect on productivity. Beck *et al.* (2000) show that financial intermediaries help economic growth through more efficient resource allocation rather than through investments or savings. Adopting a macroeconomic approach, Akerloff (1970), Jaffe and Russell (1976), Stiglitz and Weiss (1981), Greenwald and Stiglitz (1990), Petersen and Rajan (1994) and Brito and Mello (1995) show how information asymmetries result in financial constraints. Finally, Ayyari *et al.* (2007) use a large panel of firms in 47 developing countries to show that external finance increases innovation.

To sum up, the empirical evidence shows that an improvement in the financial system and its further development will increase economic growth at the country level. However, the mechanism by which finance affects economic growth is explained by the firms' capacity to increase their productivity. Spain makes an interesting case since it has a well-developed financial system but encounters difficulties when seeking to enhance its productivity.

2.2. Small firms and financial constraints

In financial markets, information asymmetries represent a critical barrier in gaining access to finance[1]. However, the financial structure is not independent of firm size. In fact, firm size is a key variable in the analysis of financial restrictions (Beck *et al.*, 2005).

Thus, in general, large and small firms do not have equal opportunities in accessing external sources of finance. So while the presence of both large and small firms is important for market competition and, hence, for economic growth, in order to ensure industrial dynamics, firms must have access to financial markets. However, problems of agency costs, information asymmetries and fixed transaction costs result in capital market imperfections.

The firms that are typically most severely affected by these imperfections are small firms, as their internal information can be rather opaque or, at least, not as public as it is in the case of their larger counterparts. Small firms seeking small loans face higher transaction costs and higher risk premiums since they are more opaque and have less collateral to offer (Beck and Demirguc-Kunt, 2006). Similar results have been found by Beck *et al.* (2005, 2006) and Schiffer and Weder (2001). Schiffer and Weder (2001) confirm that small firms have to confront higher barriers to their growth. Likewise, Beck *et al.* (2005, 2006) confirm that size, age and foreign-ownership are good predictors of the existence of barriers to growth.

Oliveira and Fortunato (2006) find that small firms face greater financial constraints and that these have a negative impact on their growth. Audretsch and Elston (2002, 2006) also show that medium-sized firms face greater financial constraints than large firms. Birks and Ennew (1996) report that young firms are more financially constrained. Müller and Zimmermann (2008) also observe that SMEs face additional disadvantages. First, small firms cannot exploit scale economies in the same way as large firms can. Second, they face more financial constraints. These authors claim that since young companies have not accumulated sufficient cash flow and are unable to rely on bank financing, they have to depend on the original equity investment of their owners[2].

In general, analyses of the effects of financial constraints on firm performance have focused on distinct aspects: firm investment (Fazari *et al.*, 1988; Lang *et al.*, 1996; Cleary, 1999, 2006; Alti, 2003; Almeida and Campello, 2007;), firm growth (Carpenter and Petersen, 2002; Beck *et al.*,

[1] In order to solve some of these puzzles, corporate finance theory has extended the analysis to three strands of the literature: the free cash flow theory (agency costs), the trade-off theory (tax) and the pecking order theory (information asymmetries). However, we are not interested here in examining these theories.

[2] In line with Cabral and Mata (2003), the disadvantages cause the firm size distribution (FSD) to be right skewed.

2005; Audretsch and Elson, 2006; Fagiolo and Luzzi, 2006; Oliveira and Fortunato, 2006; Hutchinson and Xavier, 2006; Coad, 2008), firm innovation (Himmelberg and Petersen, 1994; Hyytinen and Toivanen, 2005; Savignac, 2008; Mohnen *et al.*, 2008) and firm size distribution (Angelini and Generale, 2008[3]; Cabral and Mata, 2003). In general, these studies demonstrate that small firms are more severely affected than their larger counterparts by financial constraints.

At the micro level, recent empirical evidence has been presented. Using panel data on French manufacturing firms, Musso and Schiavo (2008) propose a new approach for identifying and measuring the degree of financial constraints faced by firms and they use it to investigate the effect of these constraints on firm survival and development. These authors found that (1) financial constraints significantly increase the probability of exiting the market, (2) access to external financial resources has a positive effect on the growth of firms in terms of sales, capital stock and employment, (3) financial constraints are positively related to productivity growth in the short-run. We interpret this last result as a sign that firms suffering constraints need to cut costs in order to generate the resources they cannot raise on the financial markets. When using a dataset for a panel of Bulgarian firms to study the empirical relationship between access to external finance and productivity, Gatti and Love (2008) find that access to credit has a significant positive impact on firm productivity in Bulgaria. In the case of Italy, Nucci *et al.* (2004) report evidence pointing to the causal effect of financial structure on a firm's propensity to innovate and on its productivity. Furthermore, these authors show that the relationship between leverage and productivity is non-linear, being dependent on some firm-specific characteristics such as the share of short-run bank debt and the lower liquidity in relation to total assets.

However, there is little evidence regarding the relationship between firm size, growth and financial sources at the firm level. Here, we assume that the mechanism that improves the technical change is provided by the access to internal and external financial sources.

3. Data and summary statistics

The data for this study comprise an exhaustive sample of Spanish manufacturing firms including many annual variables expressed individually between 2000 and 2006. Our data are provided by the SABI (*Sistema de Análisis de Balances Ibéricos*) database which compiles information from the Mercantile Register. In this paper our data were

[3] Recently, Angelini and Generale (2008) have found that among OECD countries, the FSD of non-constrained firms virtually overlaps that of the entire sample, suggesting that the overall impact of financial constraints on the FSD is modest. The difference is more pronounced in a sample of firms from non-OECD countries. Thus, they conclude that financial constraints cannot be considered the main determinant of the FSD evolution in developed economies.

gathered for a specific set of manufacturing industries, namely all two-digit industrial groups in the NACE classification (manufacturing industries comprising 15 to 36 sectors). The SABI database has certain advantages when compared to other Spanish databases. First, it offers exhaustive data at the firm level and, second, it is a database in which there is information on nearly the whole firm population.

The initial sample comprised 104,706 manufacturing firms and 453,707 observations. We applied a depuration process and the empirical work only considered the active firms, while those that were failing (either because of bankruptcy or because they were being absorbed) during the period 2000-2006 were not selected. After applying these filters, our sample was reduced to 98,572 firms. In the second step, we eliminated firms that presented disproportionate growth rates, which reduced the sample to 97,046 firms. Finally, since firms with few employees are usually hereditary societies without any economic activity, it is convenient to restrict the sample to firms with three or more workers. Thus, the eventual sample was made up of 59,420 firms and 391,228 yearly observations. This data set included annual information on firm performance, capital structure, and firm size. The panel is unbalanced in the sense that firms can enter the sample after the year 2000.

Table 1
Summary statistics
Year 2006

	Workers	Firm age	Equity / assets	Cash flow / assets	Short-term debt /assets	Long-term debt/assets
Obs.	59420	59420	59420	59410	59407	56545
Mean	23.60	14.36	10.40	3.97	58.05	18.69
Standard deviation	99.63	10.38	0.27	1.29	2.21	0.96
Skewness	60.73	1.85	65.15	-112.34	129.65	154.56
Kurtosis	5761.01	9.61	7823.05	15560.21	20570.74	27002.24
Perc. 10	4	3	0.0059	-0.0116	0.2034	0.0000
Perc. 25	5	7	0.0148	0.0279	0.3308	0.0125
Perc. 50	10	12	0.0446	0.0624	0.5103	0.1048
Perc. 75	21	19	0.1234	0.1077	0.7100	0.2741
Perc. 90	43	27	0.2589	0.1649	0.8869	0.4736

Note: authors' own based on SABI database.

Table 1 reports descriptive statistics for firm size, firm age and financial structure at the end of the year 2006. In order to control for the volume of the firm, we use financial variables scaled by total assets. On average, the surviving firms in our sample employ 23.60 workers and have been operating for 14.38 years. On average, firms are highly leveraged: 58.05% of the financial sources in their total assets are short-term debt. Long-term debt also plays an important role being recorded at 18.69% of total assets. Therefore, its seems that firms have more difficulties in obtaining a higher

ratio of internal resources such as cash flow and equity in order to finance their projects. Furthermore, in general, the variables are highly skewed to the right. The exception is the ratio of cash flow, which presents a right tail. Finally, the kurtosis indicates that the distribution is highly peaked on all the financial variables.

However, the financial sources differ depending on firm age and size. In order to finance their projects (long-term assets, technological and innovative activities), firms turn to internal sources (equity and their other own resources, cash flow) and external debt. Access to external financial sources depends not only on the financial system but also on the firm's individual characteristics.

The firm's ability to accede to financial sources varies in accordance with firm size and firm age. Small firms usually face greater difficulties in obtaining long-term bank debt and have limited equity capital. Small firms depend basically on internal cash-flow and commercial debt. Conversely, large firms access more easily long-term bank debt and engage in transactions with a larger number of banks. These differences are more marked among younger firms. For young firms (i.e., those operating for fewer than six years), the contribution made by equity capital is low as is access to long-term bank debt, while their access to short-term bank debt and commercial debt as a proportion of their overall liability is of great importance.

Table 2 shows the evolution in the corporate capital structure in our sample of Spanish manufacturing firms in the year 2006. During infancy, a firm's financial sources are restricted to the owner's contributions (equity capital) and those provided by financial and commercial borrowings. In our sample, for firms operating for fewer than six years, equity capital represents just 6.9% of their total liabilities, while commercial borrowings account for up to 71.1%. As the firm matures, its ability to accede to and diversify its financial sources increases. Among older firms, capital equity, long-term bank debt and cash flow acquire a more important role. For firms operating for more than 50 years, their equity capital is equivalent to 27.3%; their short-term bank debt is equal to 36.5%, and their long-term bank debt is equal to 11.2% of total liability. Furthermore, internal cash flow increases with a firm's age, in particular among those firms older than fifty years.

Additionally, capital structure also varies in accordance with firm size. Small firms accede more easily to financial sources related to their current economic activity. As a consequence, for those firms with fewer than ten workers, their internal cash flow and commercial borrowings are their two main financial sources. On average, for small firms, 61.69% of their external resources are obtained from commercial borrowings, while only 8.23% is long-term bank debt.

Table 2
Sources of financial funds by age and size
Year 2006

	Equity capital	Short term bank debt	Long term bank debt	Commercial borrowings	Cash Flow	Total liability
Total (62,259 firms)	1,202.10	1,622.38	578.17	4,148.97	248.00	7,551.62
	15.92%	21.48%	7.66%	54.94%		
By age						
0-5 years (13,346 firms)	432.25	960.4	414.22	4461.86	79.49	6,268.73
	6.90%	15.32%	6.61%	71.18%		
6-10 years (16,153 firms)	664.86	1,202.80	567.66	4,047.67	162.93	6,482.99
	10.26%	18.55%	8.76%	62.44%		
11-19 years (24,585 firms)	897.07	1,265.55	423.11	3,936.89	211.55	6,522.62
	13.75%	19.40%	6.49%	60.36%		
20-29 years (11,749 firms)	1,594.78	1,736.67	553.62	2,826.35	292.76	6,711.42
	23.76%	25.88%	8.25%	42.11%		
30-50 years (4,293 firms)	4,679.77	4,776.90	1,400.69	4,439.86	847.92	15,297.22
	30.59%	31.23%	9.16%	29.02%		
More than 50 years (697 firms)	13,117.50	17,450.53	5,389.79	11,820.16	2,685.30	47,777.98
	27.46%	36.52%	11.28%	24.74%		
By size						
3-9 workers (30,167 firms)	161.98	269.77	118.10	885.25	885.25	1,435.10
	11.29%	18.80%	8.23%	61.69%		
10-49 workers (26,969 firms)	875.37	1,112.53	388.18	2,008.41	164.93	4,384.49
	19.97%	25.37%	8.85%	45.81%		
50-249 workers (4,562 firms)	6,509.23	8,016.51	2,424.85	3,818.41	1,290.61	20,769.00
	31.34%	38.60%	11.68%	18.39%		
250 or more workers (561 firms)	45,620.18	65,107.33	22,412.21	23,926.84	10,508.03	157,066.56
	29.05%	41.45%	14.27%	15.23%		

Note: Mean in thousands of euros; weight as percentage of total liability.
Note: Rajan and Zingales (1995) define external finance as a fraction of total finance. In other words, it is the ratio of net external finance over the sum of cash-flow from economic activity and net external financing.
* Capital Equity also includes a firm's other own resources.
* Short-term bank debt is the liquid liability; long-term bank debt is the fixed liability
* External/total financing = (Short-term bank debt + long-term bank debt + Commercial borrowings) / (Capital equity + Other own resources + Short-term bank debt + long-term bank debt + Commercial borrowings);
* Total liability = Capital equity + Other own resources + Short-term bank debt + long-term bank debt + Commercial borrowings
Note: authors' own based on SABI database.

Conversely, as firm size increases, equity capital and bank debt acquire greater importance. In this sense, banks base their lending decisions on several considerations, including their exposure to bad risks and the likelihood that the value of their claims can be reduced by specific borrower actions. These concerns are especially relevant for firm growth loans since the risk of failure is greater among small and young firms. According to Myers (1977), banks may prefer lending on a short-term contract in order to gain control over the firm and its investment decisions, while long-term debt is more suited for firms that invest in projects that do not provide an immediate pay-off.

4. Theoretical framework

This section presents the theoretical model for our empirical estimations. Our model relaxes some of the neoclassical conditions: constant economies of scale, competitive markets and exogenous technical progress. Here, the representative firm "i" in year "t" depends on the labour, capital and intermediate materials and a measure of productivity that incorporates the product changes not explained by the previous factors. Given a continuous production function, changes in *output* are expressed in terms of,

$$dy_{i,t} = da_{i,t} + \beta_1 dn_{i,t} + \beta_2 dk_{i,t} + \beta_3 dm_{i,t} + u_{i,t} \qquad [1]$$

where $dy_{i,t}$, $dn_{i,t}$, $dk_{i,t}$, $dm_{i,t}$ and $da_{i,t}$ represent log growth rates in terms of sales, employment, capital stock, intermediate assets and technical change. As is usual, the technical change is neutral (in the sense of Hicks), and β are the elasticities of the *output* with reference to the productive factors.

If equation [1] presents constant economies of scale and market competitiveness, the production function is homogenous of degree one with respect to labour and capital, where $da_{i,t}$ is Solow's residual (1957) or the growth of total factor productivity (TFP). One of the main problems of this production function is that elasticities are non-observable, but under the previous assumptions, the output elasticity of productive factors may be measured by the contribution of the factorial rents to sales.

In our empirical research we are interested in analysing the relationship between growth rates and financial sources. In order to introduce the financial effects we incorporate the impact of internal and external financial sources on firm productivity. In other words,

$$da_{it} = \alpha + \beta_i X_i + v_{i,t}$$

where X is the firm's set of financial sources. Introducing these parameters in [1] we obtain an equation that includes economies of scale and the effect of financial sources on technical change,

$$dy_{i,t} = \alpha + \beta_1 dn_{i,t} + \beta_2 dk_{i,t} + \beta_3 dm_{i,t} + \beta_i X_{i,t} + v_{i,t} + \mu_{i,t} \qquad [2]$$

where β_i represents the output elasticity of the different financial sources. Thus, our contribution is to analyse the direct effect of financial sources on production growth at the firm level.

Econometric methodology

Here, we design a model to capture the direct impact of financial sources on a firm's production. The ability to gain access to financial sources may have an impact on the firm's capacity to bring about technical change. As has been pointed out in the literature, greater financial access may facilitate

investment in projects or innovations that can increase a firm's productivity. Thus, we focus our analysis on the relationship between the changes in a set of different inputs and the change in output by estimating a direct model that can capture the increase in investment. We are especially interested in observing the evolution in financial elasticity across the entire conditional distribution of production. We estimate the following linear regression model,

$$dy_{i,t} = \alpha + \beta_1 dn_{i,t} + \beta_2 dk_{i,t} + \beta_3 dm_{i,t} + \beta_4 Age_{i,t} + \beta_5 Equity_{i,t-1} + \ldots + \beta_6 CF_{i,t-1} + \beta_6 LTdebt_{i,t-1} + \beta_7 STdebt_{i,t-1} + \mu_i \quad [3]$$

where for each individual firm 'i', y is its production measured in terms of sales. The independent variables are as follows: n is the labour, k is the capital measured as fixed assets, m is the intermediate materials, and a is the technical measure. Both dependent and independent variables are calculated as log growth between period "t" and period "t-1". Given our assumption that part of the technical change is attributable to better access to financial sources, we include a set of financial variables: *Equity* is the value of equity divided by assets, *CF* is the value of cash flow divided by assets, *LTdebt* is the ratio of long-term debt divided by assets, *STdebt* is the ratio of short-term debt divided by assets, and *LnAge* is the logarithmic firm age measured as the difference between the current age and the year of creation. In order to capture the temporal displacement between financial flows on investment and production, we consider lagged financial variables in all our regressions.

The empirical literature measuring the presence of financial constraints is extremely broad and there is no consensus as to the identity of these variables. For example, some authors apply the ratio of cash flow to assets (Alti, 2003; Cleary, 1999; Fazzari et al., 1988; Almeida and Campello, 2004; Hutchinson and Xavier, 2006; Gilchrist and Himmelbert, 1995; Lang et al., 1996); the ratio of cash flow to sales (Fagiolo and Luzzi, 2006); the ratio of debt to assets (Petersen and Rajan, 2004); and the ratio of debt to profits (Coad, 2007). To the best of our knowledge, very few studies analyse the impact of different financial sources. Consequently, our analysis seeks to contribute to the empirical evidence regarding the linkages generated between financial sources. It is our claim that financial resources are complementary and as such act as a strategic tool in the firm's production decision.

In order to capture the different effects that financial sources might have on firms with low- and high-growth rates, we estimate Equation (1) using quantile regressions. The initial quantile regression method was proposed for application by Koenker and Bassett (1978) as an alternative to OLS when errors are not normally distributed. The central idea in quantile regression is to minimize the sum of absolute residuals by giving different weights to the quantiles being investigated. It is a powerful tool that, given a set of explanatory variables, can characterize the entire distribution of a

dependent variable in greater detail than OLS methods (see the survey in Koenker and Hallock, 2001). Quantile regression is useful in the study of firm productivity as the influence of a covariate may differ markedly between individuals with high, medium or low productivity levels. Thus, changes in a firm's financial sources may have a very different impact on the increase in its production depending on whether it belongs to a high, medium or low profit groups. Thus, quantile regressions reveal asymmetries in the data that cannot be detected by simple OLS estimations

Quantile regression was considered preferable to usual regression methods for several reasons. First, the standard least-squares assumption of normally distributed errors does not hold for our data, because the firms' growth rates follow a Laplace distribution and do not fulfil the principle of normality. Second, while conventional regressions focus on the average firm, quantile regression can describe the complete conditional distribution of the dependent variable. And third, quantile regression is more efficient at treating outliers and heavy-tailed distributions. In our case, the quantile regression procedure allows us to estimate a whole set of numbers (the conditional quantiles) which give a more complete picture of the underlying relationship between sources of finance and sales growth.

In addition, we include sector dummies and time dummies in order to control for specific industrial characteristics and different time periods that might serve as an incentive for an increase in production. On the one hand, industrial dummies control for those firms that experience a greater increment in production because of increased demand or the fact that they form part of growth industries. On the other hand, time dummies control for growth in production that is attributable to general economic growth.

Table 3.
Description of variables

Variable	Description
dy	Log difference of sales.
Production factors	
dn	Log difference of workers.
dk	Log difference of capital.
dm	Log difference of materials.
Financial variables	
Equity	Ratio of equity over assets (in the previous period).
CF	Ratio of cash flow over assets (in the previous period).
LTdebt	Ratio of log-term bank debt over assets (in the previous period).
STdebt	Ratio of short-term bank debt over assets (in the previous period)
Age	Log firm age during the previous year (in the previous period).
Other variables	
Sector dummies	Sector dummies identifying sectors at two-digit level.
Time dummies	Temporal dummies.

The explanatory variables are divided into two groups (Table 3). The first group comprises the production factors employed by the firm during the

year. The second group presents four variables related to the firm's financial sources: equity, cash flow, short-term bank debt and long-term bank debt. Finally, we add the important characteristic of the firm's age and the sector and time dummies.

We should stress the fact that all the financial variables are reported as a proportion of the firm's total assets. Equity capital and internal cash-flow constitute the firm's internal financial sources, while short- and long-term bank debt are the loans and credits it is granted by the banking sector. Finally, we include an age variable to measure the effect a firm's life cycle can have on its capital structure and the evolution of its financial sources.

5. Empirical results

The empirical results are presented below in two steps. First, Table 4 presents five conditional regression quantile results for $\theta = 0.10, 0.25, 0.50$ (hence the median), 0.75 and 0.90. Second, Table 5 offers the marginal effect on firm growth for five conditional regression quantiles depending on firm size. In order to facilitate the analysis of the effects of financial sources according to firm size, we classify firms in three groups: small firms, those employing between three and nine workers; medium-sized firms, those with between ten and 249 workers; and large firms, those with 250 or more employees.

Our initial analysis of the whole sample (Table 4) shows that equity has a negative impact on firm growth, but not significant in the lowest and highest quantiles, while variables such as cash flow and short-term debt have a positive impact. We should stress that the impact of both variables falls as we consider firms with higher growth rates. Greater access to long-term debt also has a significant and positive impact on firm growth, although it is not significant among those firms that grow at a lower rate (quantile 0.1). Furthermore, we should highlight the fact that in the case of those firms that present the highest growth rates, the impact of access to long-term debt is greatest. A firm's age also presents the expected outcome since it has a positive impact among the less productive firms, while its impact is negative among the more productive. Thus, we find a negative relationship between a firm's age and growth in sales.

In the case of the productive factors, the impact was as expected - significant and positive. However, we should stress that these effects differ from one quantile to another. In the case of growth in number of workers and capital, we observe a higher impact among firms with the highest growth rates. Meanwhile, the growth in expenditure on materials has an inverted U-shaped impact on growth in sales.

When we analyse the three groups according to firm size, interesting results emerge. Small firms are more sensitive to cash flow and short-term bank debt. The elasticity of both financial sources is high, especially, among those

firms that register moderate growth of sales. As we move across the quantile distribution, the elasticity of sales growth with respect to cash flow and short-term bank debt falls. Equity capital follows identical patterns to those of cash flow and short-term bank debt, but the impact on a firm's growth is more moderate. By contrast, long-term bank debt presents an inverse evolution. Firms that present expanding sales growth are more sensitive to long-term bank debt than firms that register more moderate rates of growth.

Table 4.
Quantile regression for the whole database.

Productive Factors	**Quantile 0.1**	**Quantile 0.25**	**Quantile 0.5**	**Quantile 0.75**	**Quantile 0.9**
$dn_{i,t}$	0.1157 (0.0027)*	0.1019 (0.0012)*	0.1097 (0.0007)*	0.1322 (0.0013)*	0.1697 (0.0031)*
$dk_{i,t}$	0.0384 (0.0014)*	0.0310 (0.0006)*	0.0317 (0.0004)*	0.0401 (0.0007)*	0.0566 (0.0015)*
$dm_{i,t}$	0.4456 (0.0016)*	0.4990 (0.0007)*	0.5254 (0.0004)*	0.5106 (0.0008)*	0.4672 (0.0020)*
Financial sources					
$Equity_{i,t-1}$	-0.0002 (0.0004)	0.0002 (0.0002)	-0.0005 (0.0001)*	-0.0010 (0.0002)*	-0.0007 (0.0005)
$CF_{i,t-1}$	0.0288 (0.0006)*	0.0216 (0.0003)*	0.0172 (0.0002)*	0.0164 (0.0004)*	0.0151 (0.0008)*
$LTdebt_{i,t-1}$	-0.0003 (0.0004)	0.0011 (0.0002)*	0.0021 (0.0001)*	0.0028 (0.0002)*	0.0042 (0.0005)*
$STdebt_{i,t-1}$	0.0363 (0.0011)*	0.0244 (0.0006)*	0.0170 (0.0004)*	0.0126 (0.0007)*	0.0108 (0.0013)*
$Age_{i,t-1}$	0.0128 (0.0006)*	-0.0004 (0.0004)	-0.0110 (0.0003)*	-0.0264 (0.0004)*	-0.0501 (0.0008)*
$Constant_t$	-0.0546 (0.0037)*	0.0435 (0.0020)*	0.1070 (0.0014)*	0.1959 (0.0023)*	0.3414 (0.0044)*
Sector dummies	Yes	Yes	Yes	Yes	Yes
Temporal dummies	Yes	Yes	Yes	Yes	Yes
R^2	0.4008	0.4268	0.4475	0.4494	0.4416
N	201143				

Note: The significance levels of the parameters are computed using bootstrapped standard errors (100 replications). Quantile regression coefficients can be interpreted as the marginal change in y at the θth conditional quantile due to a marginal change in a particular regressor, $\Delta Q_\theta (y_i | x_i) / \Delta x$.
, **, * significant at 1%, 5% and 10%.*

Our empirical results, therefore, reveal marked differences between their internal and external sources of finance and between their short- and long-term bank debt. In fact, there would appear to be a complementary effect between internal and external financial sources on sales growth. The impact of internal finances in relation to total assets is of relevance when firms present low sales growth, but the parameter decreases in importance as firms grow. The short-term bank debt parameter behaves in a similar manner to that of internal finance cash flow. However, long-term bank debt differs from cash flow and short-term bank debt. The long-term bank debt presents an increasing coefficient parameter that highlights the direct

relation between sales growth rates and previous access to long-term external finances.

When we compare the evolution in the financial coefficients of small and large firms, interesting results emerge (Table 5). For small firms' growth is more sensitive to sources of finance and their parameters are more sensitive than they are to those of large firms. In line with Clementi and Hopenhayn's (2006) model, the sensitivity of investment and growth to cash flow decreases with firm age and size. For large firms, the capital structure is characterised by a larger share of equity capital and long-term bank debt and a lower percentage of commercial debt. Large firms enjoy a more diversified capital structure which is more neutral with respect to their investment strategy and their growth performance.

How can we, therefore, interpret these results? What contribution can we make to the debate concerning the financial constraints placed on young small firms? The descriptive data included in Table 2 show that small firms, and, in particular, young, small firms, are underinvested and have limited access to external sources of finance. Among small firms, and again especially among young, small firms, commercial debt constitutes an important source of finance.

The Spanish evidence presented here is in line with a growing body of empirical literature presented in the debate concerning the existence of financial restrictions. Fazzari et al. (1988) were the first to introduce the concept of financial restrictions. According to Fazzari and co-authors, "*small and medium-sized firms are less likely to have access to impersonal centralized debt markets. [...] during periods of tight credit, small and medium-sized borrowers are often denied loans in favour of better-quality borrowers*." (Fazzari et al., 1988). For these authors, a firm's investment is directly related to changes in cash flow and its sensitivity reveals the presence of financial restrictions. These authors initiated a debate which is far from over. In this sense, Kaplan and Zingales (1997, 2000) develop a theoretical model which demonstrates that the sensitivity of cash flow to investment cannot be interpreted as the existence of financial restrictions.

Here, we consider the possibility that financial restrictions emerge not only through the relationship between growth and cash flow but also as an effect of other financial sources. In fact, the cost of external and internal sources of finance can affect the firm's financial structure. When a firm, and more specifically a small firm, experiences increasing difficulties in gaining access to external financial sources, its ability to finance its projects is conditioned by its capacity to obtain internal cash flow and commercial borrowings. The key point that we wish to highlight here is that financial decisions taken by a firm will affect its growth and, ultimately, its chances of survival.

Table 5.
Quantile regression for the whole database.

	Small firms					Medium-sized firms					Large firms				
Productive Factors	**Q0.1**	**Q 0.25**	**Q0.5**	**Q 0.75**	**Q 0.9**	**Q0.1**	**Q 0.25**	**Q0.5**	**Q 0.75**	**Q 0.9**	**Q0.1**	**Q 0.25**	**Q0.5**	**Q 0.75**	**Q 0.9**
$dn_{i,t}$	0.1220 (0.0045)*	0.0950 (0.0017)*	0.0936 (0.0012)*	0.1050 (0.0019)*	0.1375 (0.0049)*	0.1057 (0.0034)*	0.1048 (0.0016)*	0.1273 (0.0010)*	0.1654 (0.0015)*	0.2149 (0.0040)*	0.1104 (0.0309)*	0.1241 (0.0093)*	0.1282 (0.0074)*	0.1686 (0.0098)*	0.1982 (0.0316)*
$dk_{i,t}$	0.0399 (0.0024)*	0.0306 (0.0009)*	0.0300 (0.0006)*	0.0350 (0.0010)*	0.0445 (0.0026)*	0.0362 (0.0017)*	0.0310 (0.0008)*	0.0327 (0.0005)*	0.0426 (0.0007)*	0.0657 (0.0019)*	0.0096 (0.0141)	0.0119 (0.0046)*	0.0186 (0.0035)*	0.0302 (0.0045)*	0.0316 (0.0152)**
$dm_{i,t}$	0.4345 (0.0029)*	0.4790 (0.0010)*	0.5037 (0.0006)*	0.4876 (0.0012)*	0.4381 (0.0037)*	0.4518 (0.0020)*	0.5134 (0.0008)*	0.5426 (0.0005)*	0.5285 (0.0008)*	0.4857 (0.0025)*	0.6672 (0.0202)*	0.6977 (0.0055)*	0.7206 (0.0043)*	0.7160 (0.0061)*	0.7321 (0.0235)*
Financial sources															
$Equity_{i,t-1}$	0.0023 (0.0008)*	0.0010 (0.0004)*	0.0001 (0.0003)	-0.0018 (0.0005)*	-0.0046 (0.0010)*	-0.00002 (0.0004)	0.0002 (0.0002)	-0.0005 (0.0002)*	-0.0008 (0.0002)*	0.0004 (0.0005)	0.0008 (0.0020)	0.00002 (0.0009)	-0.0006 (0.0009)	-0.0011 (0.0011)	-0.0054 (0.0029)***
$CF_{i,t-1}$	0.0255 (0.0011)*	0.0204 (0.0005)*	0.0177 (0.0004)*	0.0185 (0.0007)*	0.0191 (0.0016)*	0.0291 (0.0007)*	0.0212 (0.0004)*	0.0170 (0.0016)*	0.0153 (0.0004)*	0.0124 (0.0010)*	0.0239 (0.0052)*	0.0147 (0.0018)*	0.0127 (0.0017)*	0.0117 (0.0020)*	0.0142 (0.0057)*
$LTdebt_{i,t-1}$	0.0001 (0.0008)	0.0023 (0.0004)*	0.0032 (0.0003)*	0.0038 (0.0005)*	0.0048 (0.0011)*	0.0002 (0.0004)	0.0009 (0.0002)*	0.0016 (0.0002)*	0.0020 (0.0002)*	0.0027 (0.0005)*	0.0003 (0.0019)	0.0008 (0.0007)	0.0004 (0.0008)	0.0011 (0.0009)	0.0005 (0.0025)
$STdebt_{i,t-1}$	0.0331 (0.0019)*	0.0214 (0.0009)*	0.0155 (0.0007)*	0.0122 (0.0011)*	0.0121 (0.0024)*	0.0384 (0.0013)*	0.0270 (0.0007)*	0.0185 (0.0005)*	0.0131 (0.0007)*	0.0077 (0.0016)*	0.0152 (0.0070)*	0.0135 (0.0030)*	0.0081 (0.0029)*	0.0051 (0.0036)	-0.0039 (0.0101)
$Age_{i,t-1}$	0.0030 (0.0013)**	-0.0067 (0.0006)*	-0.0159 (0.0005)*	-0.0314 (0.0008)*	-0.0566 (0.0018)*	0.0093 (0.0008)*	-0.0007 (0.0004)	-0.0084 (0.0003)*	-0.0198 (0.0004)*	-0.0382 (0.0010)*	0.0063 (0.0032)**	0.0016 (0.0014)	-0.0025 (0.0013)***	-0.0038 (0.0016)**	-0.0150 (0.0043)*
$Constant_t$	-0.0621 (0.0070)*	0.0415 (0.0033)*	0.1204 (0.0025)*	0.2198 (0.0040)*	0.3684 (0.0085)*	-0.0050 (0.0043)*	0.0563 (0.0024)*	0.0992 (0.0000)*	0.1652 (0.0025)*	0.2754 (0.0053)*	0.0197 (0.0301)	0.0177 (0.0119)	0.0496 (0.0117)*	0.0693 (0.0139)*	0.1171 (0.0370)*
R2	0.3948	0.4112	0.4251	0.4179	0.3956	0.4057	0.4414	0.4685	0.4772	0.4805	0.5298	0.5581	0.5862	0.6109	0.6336
N	82,471					116,325					2347				

Note: The significance levels of the parameters are computed using bootstrapped standard errors (100 replications). Quantile regression coefficients can be interpreted as the marginal change in y at the θth conditional quantile due to marginal change in a particular regressor, $\Delta Q_\theta (y_i | x_i) / \Delta x$.
, **, * significant at 1%, 5% and 10%.*

Decisions regarding the financial structure are of great consequence for small firms since they experience greater difficulties in accessing external financial sources. Such firms have to rely more heavily on their internal sources of finance, in particular cash flow and commercial borrowings. This result is consistent with the theory that information problems primarily affect small firms. The latter, which are typically undercapitalized, encounter increasing barriers impeding their access to external financial debt, especially for high-risk investment projects under conditions of asymmetric information. In order to invest in strategic projects (R&D and innovative activities), small firms usually increase their equity capital in order to give a signal to external borrowers that their projects involve a moderate risk (Magri, 2009).

Our results show that SMEs are more sensitive than larger firms to cash flow. The cash flow coefficient decreases monotonically with the firms' sales growth, indicating that cash flow plays an important role in moderating firm growth. Equity and short-term debt present similar parametric evolutions. In general, when firms have few options to obtain leverage their capital structure depends on internal financial sources and this has a negative impact on their investment, growth, profits and survival performance.

Conversely, long-term bank debt presents a monotonically increasing coefficient in small and medium-sized firms. This indicates that long-term financial sources enable a firm to carry out projects that present greater growth opportunities because of their technological or innovative nature.

6. Conclusions

This paper has examined the capital structure of Spanish manufacturing firms. In recent years, enhanced accessibility to a comprehensive database holding financial and economic information at the firm level has facilitated the analysis of the effect of financial services on these firms' investment strategies and growth patterns. Using a broad sample of firms we have observed the sensitivity shown by sales growth to internal and external sources of finance. We are unable to draw definitive conclusions, but there is sufficient evidence to suggest that the link between the firms' capital structure and their growth patterns is non-linear and readily understandable by applying traditional econometric methods.

Small Spanish firms present marked differences with respect to their larger counterparts. Studies conducted elsewhere show that small firms tend to be more dependent on internal resources and less reliant on bank loans. Further, small firms are more likely to generate cash flows and commercial debt than they are bank debt. This limitation on their external finances acquires greater relevance with firms in their start-up phase. Thus, young, small firms that are undercapitalized encounter greater barriers when

attempting to access finances, in particular long-term bank debt, and they also suffer information problems when seeking to finance their investments.

Our analysis of the effects of financial sources on firm growth indicates that the growth rates of small firms are more sensitive to these sources than are those of large firms. The cash flow and short-term bank debt parameters were found to be positive and to decrease as a firm gains higher growth rates. Equity capital offered only moderate elasticity, but a similar coefficient pattern, while long-term bank debt was found to be less sensitive with an increase being recorded as we moved across the quantile distribution.

In general, small firms are more sensitive than large firms to cash flow. In the case of Spain's small firms, the cash flow parameter was found to fall monotonically with the growth in their sales, but cash flow played a key role in firms that presented moderate growth rates. The equity capital and short-term bank debt parameters recorded a similar evolution. These results highlight the fact that firms with little relative ability to obtain leverage suffer from their limited access to long-term debt, which in turn has a negative impact on firm growth. Specifically, therefore, the corporate capital structure of young, small firms would seem to be biased toward internal sources of finance, which tends to limit their capacity to implement appropriate investment strategies. This restriction has a negative impact on the firms' technological level, and impacts negatively on their productivity and growth.

Equity capital among Spain's manufacturers was found to increase with a firm's age and size. A high percentage of equity among a firm's total financial sources is of great importance, since it eases information problems and eliminates barriers limiting access to bank loans. Further, a high proportion of long-term bank debt among these sources ensures an enhanced financing of its strategic projects. In contrast with a firm's other financial sources, the long-term bank debt shows a rising pattern across the quantile distribution. These results indicate the presence of a positive link between long-term financial sources and a firm's growth.

The implications of our results are, we believe, very clear. While internal cash flow may be indicative of the existence of financial constraints related to a firm's physical investment, its investment policy is not related to its short-term financial sources. It is essential that a new, small firm is able to gain progressive access to collateral equity, via owners and venture funds, so as to increase the amount of equity as a share of its overall financial funds. As a firm increases its equity capital, the barriers hindering access to bank loans progressively disappear and the firm encounters the optimum conditions for taking greater risks and implementing more ambitious projects. Likewise, access to external funds, in particular long-term debt, should guarantee that Spanish manufacturing firms are able to increase their capitalization and raise their levels of productivity. We believe our

results to have important implications and policy makers should be made aware of them.

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Graphs showing the effects of financial sources on sales growth