LAW ENFORCEMENT AND FIRM FINANCING: THEORY AND EVIDENCE

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Abstract
This paper investigates the economic effects on firms' policies of differences in law enforcement. We find that in judicial districts where trials are longer, bank financing is more costly and firms are smaller. However, we do not find any significant relation between law enforcement and firms' leverage ratio. We rationalize our results within a two- region dynamic general equilibrium model with asymmetric information and collateralized credit contracts. We find that a stronger enforcement of creditors' rights not only improves credit conditions (partial equilibrium effect), but also fosters individual capital accumulation (general equilibrium effect). In line with this theoretical prediction, we find a positive relation between individual savings and quality of legal enforcement. (JEL: E20, K40, G32)

1. Introduction

A recent literature investigates the role of legal institutions in the development of financial markets and in shaping firms' characteristics, such as capital structure, size of the firm, availability and cost of external financing, and ownership concentration. However, most of this evidence is based on cross-country analyses, where it is difficult to separate the effects of differences in law from those of differences in enforcement (La Porta et al. 1997, 1998; La Porta, de Silanes, and Shleifer 1999; Kumar, Rajan, and Zingales 1999; Giannetti 2003, among others).

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In this paper, we isolate the economic effects of differences in the degree of legal enforcement of creditor rights on firm decisions. We exploit domestic variability in the behavior of courts, using statistical information on the performance of 50 judicial districts in Spain. More specifically, we measure the efficiency of a judicial district either by the average length of trials concluded, or by the ratio of trials concluded after one year to the total number of proceedings concluded.

We find that in less efficient judicial districts bank financing is costlier and firms are smaller in size, after controlling for several firm characteristics, for the degree of banking concentration, for regional economic development, and for unobserved heterogeneity. However, we do not find any significant effect of law enforcement on the firms' leverage ratio.

We document that the distortions generated by an ill-functioning legal system are not only statistically significant, but also economically relevant. We quantify these effects by a hypothetical experiment. Attributing to the worst judicial district the highest quality of law enforcement in our sample, firm size would increase by 14% and the cost of bank credit would be lowered by about 16%.

We propose a theoretical explanation for these results, based on a two-period overlapping-generations model. In the first period, the individual has no initial wealth but can work and save. In the second period, he can only choose how to invest his savings. Two alternatives are available: A bank deposit or a risky entrepreneurial project. If he decides to become an entrepreneur, he applies for a bank loan. Following Holmstrom and Tirole (1997), we introduce moral hazard by assuming that the outcome of the project depends on the unobservable effort of the entrepreneur. He needs to invest his own savings (down payment) in the project in order for the bank to grant its credit. We consider a fully collateralized credit contract and assume that default is costly, the costs depending on the behavior of courts. Inefficient courts reduce the recovery value of collateral assets.[1] Finally, we divide this economy into two regions with perfectly integrated capital markets and segmented labor markets, differing only in the behavior of courts. In this framework we show that, at the steady-state equilibrium, firms located in regions with stricter enforcement of the right to seize collateral assets have access to less costly external finance and are larger in size. However, the leverage ratio does not differ between the two regions.

According to our model, the driving force is the interaction between partial and general equilibrium effects. The partial equilibrium effect works through the credit contract relation: Better legal protection of the creditor's rights increases the recovery value of collateral assets in bankruptcy and relaxes the bank's participation constraint. The availability of external finance for a given amount of

1. Anecdotal evidence suggests that the inefficient behavior of Spanish courts has economic effects on creditors, because it can reduce the liquidation value of collateral assets (see the Spanish National Report of the European Commission, 2003).

entrepreneur's initial wealth increases, and so does the profitability of the project. The general equilibrium effect works through adjustments in labor markets, where wages rise in the region with better legal protection. Higher wages have two contrasting effects: On the one hand, they reduce entrepreneurial profits, offsetting the initial partial equilibrium benefit of better enforcement; this mechanism would explain why we do not find cross-sectional differences in leverage ratios. On the other hand, they foster individuals' capital accumulation and increase the entrepreneur's saving (down payment). A larger down payment tempers moral hazard and allows the entrepreneur to increase external financing and total profits.

We perform an additional empirical test to check whether the economic mechanism behind our empirical results may indeed be saving accumulation. Data on individual savings from Spanish household accounts at the regional level offer empirical support. We show that individuals working in the regions where trials are shorter save more than in regions with longer trials.

Our paper has several original features. First, our data set is unique, because it allows us to isolate the effects of law enforcement from the content of the law, exploiting the varying efficiency of Spanish judicial districts in a single legal framework. Spanish rules on credit relations are the same nationwide, but, as we show in the paper, enforcement differs considerably from one judicial district to another. Related papers have mostly used cross-country analyses and measured differences in the content of the law (e.g., La Porta et al. 1997, 1998; La Porta, de Silanes, and Shleifer 1999; Modigliani and Perotti 1997; Kumar, Rajan, and Zingales 1999; Giannetti 2003). An important weakness of cross-country studies is that indicators of judicial inefficiency are strongly negatively correlated with income, and their significance often vanishes when income is controlled for. In our paper, this is not the case. The sample correlation between the length of trials and the level of economic activity by judicial district (measured by per capita GDP) is, if anything, slightly positive, suggesting that more economically developed judicial districts—those with higher income—provide somewhat weaker (rather than stronger) law enforcement. In line with this preliminary finding, all our empirical results are robust to the inclusion of per capita regional income (current and past values, in level or in growth rates). As a consequence, the coefficient of the legal variable does not pick up correlated regional differences in economic factors.

Our data set also features information at the firm level obtained from the Survey on Spanish Firm Strategies.[2] This survey provides very detailed yearly balance-sheet data—including yearly flow of bank financing and its cost—for about 1,700 large, medium-sized, and small firms (listed and unlisted) operating

2. Other related papers, like Cristini, Moya, and Powell (2001) and Jappelli, Pagano, and Bianco (2005), use aggregate data at the regional level.

in all 17 Spanish regions.[3] These two data sources provide new evidence on firm policies. In line with descriptive international evidence (Rajan and Zingales 1995; Booth et al. 2001), we find that variability in leverage ratios is not explained by differences in creditor rights protection. We show a negative correlation between law enforcement and cost of credit and a positive one between law enforcement and firm size. Our analysis is more robust to endogeneity issues thanks to the use of micro-data, because decisions at firm level are less likely to affect the macroeconomic performance or the cost of law enforcement. In addition, all our results hold after controlling for industry characteristics, for the business cycle and for regional differences beyond the economic heterogeneity already captured by per capita GDP.

An additional contribution of this paper is to offer a theoretical explanation for our findings, using a market equilibrium model of corporate finance rather than a partial equilibrium setting. Embedding a modified version of the Holmstrom and Tirole (1997) model in a dynamic general equilibrium framework allows us to capture not only the partial equilibrium effects related to increments in the degree of law enforcement—improvements in credit conditions—but also important general equilibrium effects, such as wage adjustments and changes on individual capital accumulation. These effects, which have been overlooked in the corporate finance literature to date, are crucial to account for our empirical findings and also to explain the ambiguous evidence on the relation between legal institutions and leverage ratios.[4]

Finally, the paper also adds to the literature on the relation between investor protection and capital accumulation. The paper most resembling ours in this respect is Castro, Clementi, and MacDonald (2004). In line with them, we introduce investor protection in a simple extension of the two-period overlapping generations model of capital accumulation. However, whereas they focus on the effect of investor protection on growth, we are more interested in its effect on corporate decisions. In their model, agents are risk-averse and investor protection affects the agent's optimal risk sharing by determining the cost of hiding resources. In our model, agents are risk-neutral and investor protection affects the recovery value of collateral assets in bankruptcy and thus relaxes the bank's participation constraint.

The remainder of the paper is organized as follows. In Section 2, we describe the data and present our main empirical findings. In Section 3, we propose a

3. This survey was conducted by the Fundación Empresa Publica yearly from 1990 to 1999.

4. Most of the work investigating the implications of investor protection for corporate decisions has been done in a static partial equilibrium setting, with few exceptions among which are Himmelberg, Hubbard, and Love (2002) and Shleifer and Wolfenzon (2002). Besides using a different theoretical framework, they mostly investigate the relation between shareholder protection and ownership concentration. To our knowledge, Shleifer and Wolfenzon were the first to embed a model of corporate finance similar to ours in a general equilibrium setting. However, besides other differences, they use a static framework, which does not allow us to capture the effects of legal protection on capital accumulation.

general equilibrium model to explain our results. In Section 4, we investigate the effects of differences in law enforcement on the behavior of firms. In Section 5, we go back to the data to test some of the mechanisms implied by the model. Section 6 concludes.

2. The Empirical Evidence

2.1. Data

2.1.1. Legal institutions in Spain. Several institutional features of Spain make our data set unique. First, the rules on credit relations are the same nationwide, but enforcement differs considerably between judicial districts. Spain is a civil-law country, so the main function of the judicial system is enforcing the law. Spanish law regulates criminal and civil offenses separately. There are no special courts in Spain in charge of bankruptcy proceedings. Such cases are tried in ordinary civil courts. We accordingly examine, here, civil trials, which are crucial in defaults. The competent court is that of the borrower's district of residence. Spain is divided into 50 judicial districts, corresponding to the provinces. The provinces are grouped into 17 regions, of which 7 (Asturia, Baleares, Cantabria, Madrid, Murcia, Navarra, and Rioja) have one judicial district, and the other 10 have between 2 (Canarias and Extremadura) and 9 (Castilla-Leon). Table 1 matches judicial districts with regions in Spain.

We get the data on civil trials concluded by judicial district from an annual survey by the National Institute of Statistics (INE), for the years 1990–1998. Civil judicial statistics classify trials concluded into four duration classes: less than two months, 2–6 months, 6–12 months, and more than a year. We use the data for a sub-sample of civil trials that excludes a large number of cases not related to financial contracts (matrimony, paternity, inheritance, juvenile courts, and labor). This sample does not consist exclusively of bankruptcy proceedings, but we assume that the duration of the trials included is closely correlated with that of bankruptcy cases. Based on this information, we construct two indicators of law enforcement by district and year. The first is the average length of trials in days, obtained by multiplying the average length in each duration class by the proportion of trials in that class (the last duration class being open, we assume an average length of these trials of two years).[5] Given the lack of information about the precise timing pattern of trials, we assume uniform frequency distribution within each class. The second measure is the proportion of trials concluded that took more than 12 months, a rough gauge of the probability of having a long trial. Enforcement cost is directly related to both measures. Longer trials increase

5. Anecdotal evidence suggests that our measure of length is conservative, because trials in this category typically last longer.

TABLE 1. Legal variables and economic activity by judicial district.

Judicial Districts 1	Corresponding Regions 2	Length of Trials (No. of Days) 3	Prob. Long Trial (%) 4	GDP Index 5
1. Almeria	*Andalucia*	204.79	9.21	0.70
2. Cadiz	*Andalucia*	135.89	3.42	0.59
3. Cordoba	*Andalucia*	69.70	0.0	0.56
4. Granada	*Andalucia*	373.91	37.29	0.56
5. Huelva	*Andalucia*	195.07	9.63	0.66
6. Jaen	*Andalucia*	99.54	0.0	0.59
7. Malaga	*Andalucia*	166	5.02	0.60
8. Sevilla	*Andalucia*	269	21.11	0.61
9. Huesca	*Aragon*	92.26	0.0	0.90
10. Teruel	*Aragon*	51.76	0.0	0.86
11. Zaragoza	*Aragon*	193.78	7.41	0.91
12. Asturias	*Asturias*	248.15	16.08	0.73
13. Baleares	*Baleares*	343.78	28.28	1.07
14. Las Palmas	*Canarias*	298.10	21.05	0.70
15. Tenerife	*Canarias*	332.82	0.29	0.80
16. Cantabria	*Cantabria*	234.91	9.06	0.78
17. Avila	*Castilla-y-Leon*	115.43	0.0	0.68
18. Burgos	*Castilla-y-Leon*	173.17	3.86	0.87
19. Leon	*Castilla-y-Leon*	117.3	0.12	0.66
20. Palencia	*Castilla-y-Leon*	123.23	0.0	0.71
21. Salamanca	*Castilla-y-Leon*	41.58	0.0	0.71
22. Segovia	*Castilla-y-Leon*	146	1.96	0.79
23. Soria	*Castilla-y-Leon*	74.79	0.09	0.82
24. Valladolid	*Castilla-y-Leon*	346.50	35.62	0.81
25. Zamora	*Castilla-y-Leon*	85.09	0.22	0.64
26. Albacete	*Castilla-La-Mancha*	134.87	4.06	0.60
27. Ciudad Real	*Castilla-La-Mancha*	129.91	2.48	0.66
28. Cuenca	*Castilla-La-Mancha*	101.08	0.41	0.63
29. Guadalajara	*Castilla-La-Mancha*	170.28	0.0	0.99
30. Toledo	*Castilla-La-Mancha*	138.30	1.92	0.68
31. Barcelona	*Catalunia*	287.63	19.69	0.96
32. Gerona	*Catalunia*	121.25	2.0	1.06
33. Lleida	*Catalunia*	58	0.03	0.64
34. Tarragona	*Catalunia*	153.8	4.43	1.21
35. Alicante	*Comunidad Valenciana*	297	24.35	0.72
36. Castellon	*Comunidad Valenciana*	147.84	1.19	0.92
37. Valencia	*Comunidad Valenciana*	353.41	36.36	0.84
38. Badajoz	*Extremadura*	114.94	1.19	0.48
39. Caceres	*Extremadura*	164.97	7.09	0.68
40. Coruna	*Galicia*	278.19	22.22	0.66
41. Lugo	*Galicia*	60.96	0.0	0.94
42. Pontevedra	*Galicia*	91.32	0.89	0.62
43. Ourense	*Galicia*	128.95	0.02	0.62
44. Madrid	*Madrid*	453.48	47.41	1
45. Murcia	*Murcia*	186.52	8.22	0.72
46. Navarra	*Navarra*	157.38	0.08	0.98
47. Alava	*Pais Vasco*	92.90	0.09	1.02
48. Guipuzcoa	*Pais Vasco*	225.54	0.98	0.98
49. Vizcaya	*Pais Vasco*	337.57	27.0	0.90
50. Rioja	*Rioja*	94.68	0.68	0.91

Notes: Column (1) lists all the judicial districts in Spain. Column (2) maps judicial districts with regions. Columns (3) and (4) report our two proxies of law enforcement (length of trials and probability of having a trial lasting more than one year). Column (5) reports the ratio between the per-capita GDP of each judicial district and that of Madrid.

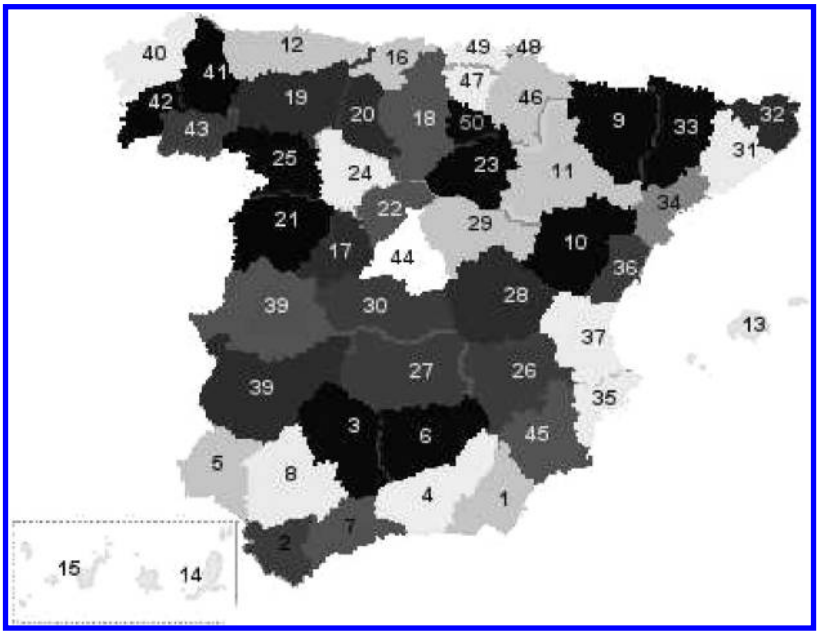

FIGURE 1. Cross-regional variation in length of trials. The figure contains a map of Spain with judicial districts having deeper shades of gray for increasing quality of law enforcement (decreasing average length of trials). Each number corresponds to a different judicial district (see Table 1, column (1), for the mapping between number and name of the district).

legal expenses, and until conclusion the creditor is exposed to the risk of asset substitution by the debtor and unexpected changes in the value of the collateral.

Our indicators of judicial efficiency vary considerably between districts and over time. Table 1 reports the sample average of the two legal variables for each district. Dispersion is very high. The average length of a trial is 373 days in Granada versus 58 days in Lleida, namely, almost seven times longer. This pattern is confirmed by the second proxy. In Avila, Teruel, or Huesca, the probability of having a long trial is zero, whereas in Madrid it is 47%. The map in Figure 1 illustrates the cross-sectional variability of law enforcement, with judicial districts having deeper shades of gray for increasing enforcement—decreasing average length. A potential reason for the strong cross-sectional variability could be that financial and human resources are allocated according to the number of residents in the district, which is probably not suited to capture the actual demand for justice, because it fails to take account of differences in the frequency of litigation and in the complexity of civil trials. So some districts presumably lack resources, and enforcement there is accordingly inefficient.

Figure 2 displays the variation in length of trials over time for three districts, Madrid, Navarra, and Rioja, selected as instances of poor, average, and good

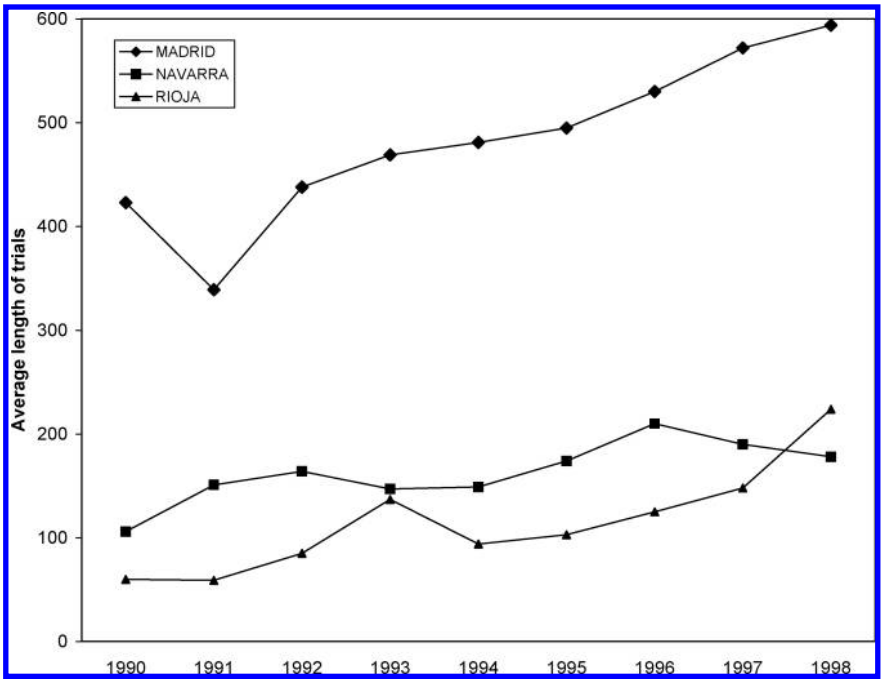

FIGURE 2. Time-series variation in length of trials. The figure shows the variation of the length of trails of three selected judicial districts from 1990 to 1998. The three districts (Madrid, Navarra, and Rioja) correspond to low, average, and high quality of law enforcement.

enforcement, respectively. The figure shows a distinct pattern in each district. The visual intuition is confirmed by the calculation of the serial correlation over time. The correlation is positive for all regions. It ranges widely from 0.03 to 0.89, with an average of 0.54, suggesting considerable heterogeneity. In summary, the evidence shows a substantial variability in law enforcement both cross-sectionally and in the time-series.

In addition to this geographical and time variability, our legal variable has another key advantage. A major weakness of cross-country studies of law enforcement is that indicators of judicial inefficiency have a strong negative correlation with income, and their significance often disappears when income is controlled for. In our study, this is not the case. Figure 3 displays the sample correlation between the length of trials and the level of economic activity (proxied by the per capita GDP index shown in column (5) of Table 1) by district. The correlation is slightly positive and equal to 0.034.[6] Because our legal variables measure the

6. We obtain similar levels of correlation using the probability of a long trial as a proxy for law enforcement, or measuring the correlation between legal enforcement and economic activity by region rather than by judicial district, or taking aggregate rather than per capita GDP.

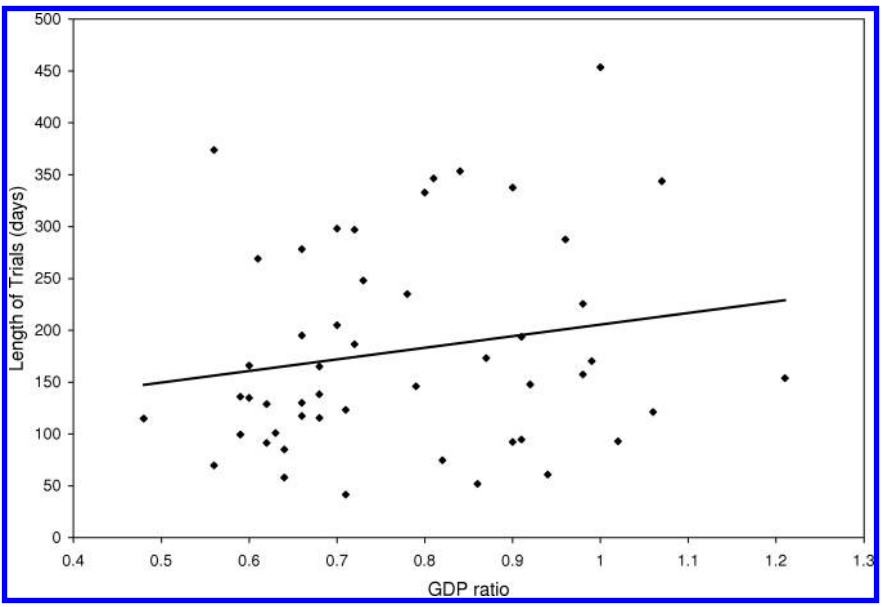

FIGURE 3. Length of trials and per capita gross domestic product by judicial district. The figure shows the correlation between the length of trails and the per capita gross domestic product index, by judicial district. The values are taken from columns (3) and (5) of Table 1.

inefficiency of the judicial system, this means that more developed districts (with higher fiscal income) have slightly weaker creditor protection. As a result, our legal variable does not pick up regional differences in economic conditions. The empirical analysis will confirm this provision.

The lack of cross-sectional correlation between income and enforcement is due to a crucial institutional characteristic of the Spanish judicial system. Spain is a federation of 17 regions endowed with very substantial autonomy in a number of spheres. However, the administration of justice is the responsibility of the central government, which selects and appoints judges, magistrates, and auxiliary staff and determines the allocation of financial and human resources to each judicial district. Judicial expenses are financed by federal tax revenues and resource allocation is not based on regional economic development. This feature is crucial for our analysis, because it removes any possible institutional link between enforcement and regional tax revenue.

2.1.2. Firm characteristics. Firm-level data are drawn from the Survey on Firm Strategies. The survey was conducted yearly by the Fundación Empresa Publica from 1990 to 1999. We explore both cross-sectional and time-series variation. The survey provides information and balance-sheet data for 1,700 large,

medium-sized, and small manufacturing firms (listed and non-listed) all over the country. For each firm the survey provides the location by region.[7]

The survey also provides general information on the production activity (number of industrial plants, ownership structure, age of the firm, number of workers, characteristics of products, total sales, production costs, technology, structure of the product market). Manufacturing firms are classified into 18 sectors according to NACE-CLIO: meat food; food and tobacco products; beverage products; textiles and textile products; leather and leather products; wood and wood products; pulp, paper, paper products, publishing, and printing; chemical products; rubber and plastic products; non-metallic mineral products; iron products; basic metals and fabricated metal products; machinery and equipment; electrical and optical equipment; motor vehicles, trailers, and semi-trailers; other transport equipment; furniture and manufacturing; other manufactured products.

We show summary statistics of firm variables in Table 2, Panel (A), and we report the precise definition of these variables in Table 2, Panel (C). The average age of a firm in our sample is about 25 years, with individual cases ranging between 1 and 269 years. The average number of employees is 269; 68.10% of the firms in our sample have fewer than 200 employees and 88.72% fewer than 500. The share of firms belonging to groups of firms is 29.30%. In 2.74% of our sample the public sector has an equity stake. Only 3.76% are listed. In short, the sample consists mostly of small and medium-sized manufacturing firms.

Balance-sheet data are very detailed. We have information on tangible and intangible assets. Tangible assets include machineries, plants, and buildings and the intangible assets correspond to research and development expenditures. Table 2, Panel (A), shows that the average intangibility ratio is relatively low. This depends on the large number of firms (51% of our sample) that do not have any research and development activity. On the liability side, we can distinguish between debt to financial institutions (among which banks) and other liabilities. The average leverage ratio is 30%. In our sample, 59% of the firms have debt to banks; the majority of them have less than 45 employees, suggesting that firms using bank finance are mostly of small size. Bank financing is the most important source of external finance: The average share of bank debt over total debt is 68%. For each type of debt, the survey reports the average interest rate. This information is crucial to our analysis, because it gives us a very precise measure of the cost of bank financing. Table 2, Panel (A), shows that the average cost of bank finance is 9.7%. For a small number of firms (1% of the sample) external financing is very costly (above 18%).

7. Because the firm's survey provides only information about the location of firms by region, we aggregate the judicial data by region in order to match the legal variables with the firm variables.

TABLE 2. Descriptive statistics on firm and aggregate variables.

Panel A: Firm Variables

Variables	*No. of Obs.*	*Mean*	*Std. Dev.*	*Min*	*Max*
Age	21,287	25	22.51	1	269
No. of Workers	18,836	269.27	852	1	25,363
Size	12,257	13.30	2.55	4.14	20.73
Asset Intangibility	13,529	0.04	0.57	0	0.51
Leverage Ratio	15,823	0.30	0.29	0	0.96
Cost of Bank Debt in %	8,193	9.69	4.10	3	25
Percentage listed firms	3.76%				
Percentage firms < 200 workers	68.10%				
Percentage firms < 500 workers	88.72%				
Percentage firms non-state ownership	97.26%				
Percentage firms part of groups of firms	29.30%				

Panel B: Regional Variables

	No. of Obs.	*Mean*	*Std. Dev.*	*Min*	*Max*
Herfindahl Index	45	3351.61	931.36	1698	5409
GDP	170	1.80	0.49	0.89	3.162
Savings	68	202.53	76.97	61.25	353.65
Legal Costs (Length of trial)	147	234.46	118.68	59.35	593.79

(Continued)

TABLE 2. *(Continued)*

Panel C: Definitions of Variables

Variable	*Definition*	*Source*	*Period*
Age	No of years from firm's foundation	FEB	By firm. 1990–1999
Age Squared	Squared value of the firm age	FEP	By firm. 1990–1999
Listed Firms	Dummy variable taking value equal to one if the firm is listed and zero otherwise	FEP	By firm. 1990–1999
Asset Intangibility	Research and development expenditures over the stock of tangible assets, including plants, machinery, land, etc.	FEB	By firm. 1990–1999
Firm Size	Logarithm of the book value of total capital, in thousands of pesetas.	FEP	By firm. 1990–1999
Cost of Bank Debt	Average interest rate on the stock of bank debt, in %.	FEP	By firm. 1990–1999
Leverage Ratio	Ratio of financial debt (short term plus long term debt toward financial institutions) over the sum of book value of equity and financial debt.	FEP	By firm. 1990–1999
Herfindahl Index	Squared sum of the market shares of banks operating in the reference market. Market shares are calculated by using the credit provided by each bank to firms and households. The index is available for five areas: *South*, *Center and North West*, *East and North East*, *North*, and *Nationwide*. Spanish regions are grouped by considering the geographical position and the distribution of banking activity. *South* includes Andalucia. *Center and North West* includes Extremadura, Castilla La Mancha, Castilla León and Galicia. *East and North East* includes Catalunia, Comunidad Valenciana, Murcia, Aragon, Rioja, Baleares and Canarias Islands. *North* includes Euskadi, Navarra, Asturias y Cantabria. *Nationwide* includes large banks operating at national level (e.g., BBVA, BSCH, La Caixa, Caja Madrid, etc). Madrid is not included in the previous areas, because all the banks located in Madrid have a national market. We assign to Madrid the index corresponding to the area called *Nationwide*.	Santiago Carbó and Francisco Fernandez.	By area. 1990–1998
GDP	Gross domestic product in millions of pesetas divided by the population	INE	By region. 1990–1998
Savings	Households' disposable income less households' final consumption, divided by resident population (in units). Both disposable income and consumption were expressed in thousands of euros. We use the fixed exchange rate euro/pesetas to convert them in thousands of pesetas.	INE	By region. 1995–1998
Legal Costs	Average length of trials in days. We multiply the mean value of each interval (1 month, 4 months, 9 months, respectively) by the number of trials in each category. For the last interval (more than one year) we take two years. We then multiply the mean values by the number of trials in the corresponding interval. We add the four terms and divide by the total number of trials concluded.	INE	By judicial district. 1990–1998

Notes: This table shows summary statistics of the variables used in the regressions. Panel A illustrates firm-level data. Panel B illustrates aggregate data at the regional level. Panel C shows the precise definition and the source for each variable listed in Panels A and B. The abbreviations FEB and INE correspond to Foundation Empresa Publica and National Institute of Statistics, respectively.

2.2. Methodology

To isolate the effect of law enforcement on firm financing, we examine three firm variables: the firm's cost of credit, size, and leverage ratio. The cost of credit is defined as the average rate paid on the cumulative stock of debt to banks. Following most of the literature (Petersen and Rajan 1995, 1997; Demirgüç-Kunt and Maksimovic 1998, among others), we measure size by the total stock of capital.[8] Finally, leverage is defined in standard fashion as financial debt (short-term plus long-term debt to financial institutions) over the sum of book value of equity plus financial debt.

As noted, our measure of law enforcement is the average length of trials. Explanatory variables also include several firm characteristics. Following related papers (see, among others, Diamond 1989), we include firm's age as a proxy for the firm's reputation. We test for the presence of non-linear effects by controlling for the square of the age. Following Giannetti (2003), who documents systematic differences in leverage between listed and unlisted firms, we add a listing dummy. We also control for the degree of asset intangibility, as suggested by Fan, Titman, and Twite (2003) and Giannetti (2003), among others. Because intangible assets have low collateral value, we expect asset intangibility to be correlated negatively with external financing and leverage and positively with the cost of credit. Finally, we include the size of the firm as a control variable in the specifications of the cost of credit and leverage, because both are likely to depend on size.

We also control for the degree of concentration of the banking industry through the *Herfindahl Index*. Other things being equal, we expect banking concentration to raise interest rates, reflecting a less competitive credit market and possibly closer bank-firm relations. We also control for differences in the regional economic development, including regional per capita income (*GDP*) as a regressor. As noted, regional budget considerations should not affect our analysis for two reasons. First, the resources allocated to judicial districts come out of the federal budget, not regional taxes, so there are no institutional links between the quality of law enforcement and the level of economic development. Second, there is a slightly positive correlation between legal costs and economic activity. This suggests that more developed regions or judicial districts have somewhat more inefficient courts. Table 2, Panel (B), reports summary statistics of *Herfindahl Index* and *GDP*.

Our data set pools a panel of firms (observations across industries, regions, and years) with a panel of judicial data (observations across regions and years). We estimate each equation using fixed-effects regressions at firm level. We also include a full set of industry and regional dummies to take account for any potential cross-industry and cross-regional heterogeneity (beyond the economic

8. Our findings are not sensitive to different gauges of firm size, such as number of workers. This is no surprise, given the high sample correlation (0.83) between stock of capital and number of workers.

heterogeneity captured by the *GDP*), and a full set of year dummies to control for cyclical effects.

In summary, we estimate the following specifications:

$$Y_{ijt} = \alpha_0 + \alpha_1 Age_{ijt} + \alpha_2 (Age_{ijt})^2 + \alpha_3 Listed_{ijt} + \alpha_4 Intang_{ijt} + \alpha_5 Legalcosts_{jt} + \alpha_6 GDP_{jt} + \alpha_7 Herfindahl_{jt} + \alpha_D D + \varepsilon_{ijt}, \quad (1)$$

where Y_{ijt} is either the cost of credit, the leverage, or the size of the firm; α_D, ψ_D, and δ_D are vectors of parameters; D is the matrix of industry, regional, and year dummies; and the indices i, j, t refer to the firm, the region, and the time period, respectively.

2.3. Results

Table 3 shows the results of estimating equation (1) for the cost of external finance. The sample used in this estimation only includes firms with positive amount of debt (hence positive cost of debt).[9] Column (1) refers to the basic specification, using only firm-level variables. The coefficient of the legal variable is positive and significant at the 1% level; because enforcement is measured by the average length of trials, our evidence suggests that external finance costs more for firms located in the districts where trials are longer. The coefficient of *Age* is negative and statistically significant at the 11% level, that of *Age Squared* is positive but not significant. That is, financing is more costly for younger firms, in line with established evidence and intuition (age as a proxy for reputation). The coefficient of size is negative and statistically significant at the 1% level, suggesting that, unsurprisingly, larger firms pay lower interest rates. Stock exchange listing does not affect the cost of credit, and a high degree of asset intangibility increases it, as banks presumably charge higher interest rates to compensate for the low collateral value of intangible assets.

All our results remain qualitatively unaltered controlling for the banking concentration (column (2)). The positive coefficient of the *Herfindahl Index* indicates that banks charge higher rates when they face less competition. However,

9. Using firms with positive cost of debt could introduce a sample selection problem, if banks located in bad judicial districts set collateral requirements as a condition to provide credit. These requirements could be high enough that some firms are excluded from funding and are thus credit-constrained. We test formally for sample selectivity, using the two-stage Heckman procedure. In the first stage, we estimate a probit model, where the dependent variable is a dummy equal to one if bank debt is positive (the firm is not credit-constrained) and zero otherwise (the firm is credit-constrained). We include law enforcement among the regressors. The definition of credit rationing used in the probit model is subject to two caveats. First, all firms with zero debt are credit-constrained, while some of them may not have debt because they do not need it. Second, firms can be credit-constrained even with positive debt, as long as their demand of bank funds has been satisfied only *partially*. The lack of information prevents us from using more precise measures of bank rationing. The two-stage Heckman procedure produces a coefficient of the Mill's ratio not statistically different from zero at conventional levels. We obtain the same conclusion estimating the model with maximum likelihood.

TABLE 3. Legal costs and the cost of bank debt.

	Dependent variable: cost of bank debt		
	(1)	(2)	(3)
Legal Costs	0.0016**	0.0018**	0.0018**
	(0.007)	(0.007)	(0.007)
Age	−0.0100	−0.0100	0.0099
	(0.0064)	(0.0064)	(0.0064)
Age Squared	3.85e-05	3.68e-05	3.68e-05
	(3.67e-05)	(3.67e-05)	(3.67e-05)
Listed Firm	−0.0828	−0.0873	−0.0873
	(0.4105)	(0.4105)	(0.4106)
Asset Intangibility	−0.4006	−0.3982	−0.38984
	(0.3427)	(0.3427)	(0.3428)
Size	−5.436***	−0.5403***	−0.5402***
	(0.1000)	(0.1000)	(0.1000)
Herfindahl Index		4.87e-04	4.87e-04
		(4.30e-04)	(4.30e-04)
GDP			−0.0018
			(0.0285)
Fixed Effects			
- *Firm*	YES	YES	YES
- *Industry*	YES	YES	YES
- *Region*	YES	YES	YES
- *Year*	YES	YES	YES
Adj. *R-sq*	0.7554	0.7553	0.7553
No. of obs.	5,118	5,118	5,118

Notes: The dependent variable is the average interest rate on the stock of bank debt. We report the coefficients obtained through fixed-effects regressions at the firm level and the corresponding standard errors in brackets. Each regression includes 18 industry dummies, a full set of regional dummies to control for unobserved geographical heterogeneity, and a full set of year dummies to control for aggregate shocks. The dummy results are not reported to save space. The variable *Legal Costs* is the average length of trials concluded in days. *Age* is the number of years since the foundation of a firm. *Age Squared* is the square of the firm's age. *Listed* is a dummy variable equal to one if the firm is listed and zero otherwise. *Asset Intangibility* is the share of research and development expenditures over total capital. *Size* is the logarithm of the stock of capital. Column (1) refers to the baseline specification. Column (2) adds the *Herfindahl Index* (squared sum of the share of credit provided by all the banks operating in the reference market) to the set of explanatory variables. Column (3) includes also the per-capita level of the regional gross domestic product, *GDP*, to control for geographical differences in the degree of economic activity. **Significant at 5%; ***Significant at 1%.

this effect is not statistically significant at the conventional levels. Our finding contrasts with Jappelli, Pagano, and Bianco (2005), who show an ambiguous relationship between cost of credit and judicial efficiency in Italy, when the degree of banking concentration is factored in. Finally, in column (3), we control for the cross-sectional differences in economic development by the regional per capita *GDP*. *GDP* seems to be uncorrelated with the firm-specific cost of bank finance and the result on the legal variable does not change.

In Table 4, the dependent variable is the size of the firm. The legal variable has a negative and statistically significant coefficient, suggesting that firms in more efficient districts are bigger. As expected, older firms are larger, although the positive effect of age on size decreases over time (the coefficient of *Age Squared* is negative). Listed firms are larger, but the coefficient is not statistically significant, probably because there are few listed firms in our sample (only 3.76%). Firms with

TABLE 4. Legal costs and firm size.

	Dependent variable: firm size		
	(1)	(2)	(3)
Legal Costs	−3.24e-04***	−3.6e-04***	−3.59e-04***
	(1.07e-04)	(1.08e-04)	(1.08e-04)
Age	0.0056***	0.0056**	0.0056***
	(0.0009)	(0.0009)	(0.0009)
Age Squared	−3.25e-05***	−3.23e-05***	−3.24e-05***
	(6.36e-06)	(6.36e-06)	(6.36e-06)
Listed Firm	0.0748	0.0749	0.0749
	(0.0566)	(0.0566)	(0.0566)
Asset Intangibility	−0.4635***	−0.4635***	−0.4636***
	(0.0378)	(0.0378)	(0.0378)
Herfindahl Index		−1.24e-04**	−1.25e-04**
		(6.08e-05)	(6.08e-05)
GDP			−0.0019
			(0.0039)
Fixed Effects			
- *Firm*	YES	YES	YES
- *Industry*	YES	YES	YES
- *Region*	YES	YES	YES
- *Year*	YES	YES	YES
Adj. *R-sq*	0.9810	0.9810	0.9810
No. of obs.	10,179	10,179	10,179

Notes: The dependent variable is the size of the firm, measured by the logarithm of the stock of capital. We report the coefficients obtained through fixed-effects regressions at the firm level and the corresponding standard errors in brackets. Each regression includes 18 industry dummies, a full set of regional dummies to control for unobserved geographical heterogeneity, and a full set of year dummies to control for aggregate shocks. The dummy results are not reported to save space. The variable *Legal Costs* is the average length of trials concluded in days. *Age* is the number of years since the foundation of a firm. *Age Squared* is the square of the firm's age. *Listed* is a dummy variable equal to one if the firm is listed and zero otherwise. *Asset Intangibility* is the share of research and development expenditures over total capital. Column (1) refers to the baseline specification. Column (2) adds the *Herfindahl Index* (squared sum of the share of credit provided by all the banks operating in the reference market) to the set of explanatory variables. Column (3) includes also the per-capita level of the regional gross domestic product, *GDP*, to control for geographical differences in the degree of economic activity. **Significant at 5%; ***Significant at 1%.

a smaller share of intangible assets are also larger, likely because R&D expenses are standardized by total assets. As in the previous table, all the results remain qualitatively the same when we control for banking concentration (column (2)) or for regional differences in economic activity (column (3)).

Table 5 shows the results for the leverage ratio. The coefficient of the legal variable is not statistically significant, suggesting that the performance of courts does not explain variations in the leverage ratio.[10] The leverage ratio does not

10. In line with our findings, there is descriptive evidence from Rajan and Zingales (1995) and Booth et al. (2001) that differences in leverage across G-7 countries are not so large. Our finding contrasts both with cross-country analyses (Fan, Titman, and Twite 2003; Giannetti 2003) and with national analyses, (Shuetrim, Lowe, and Morling 1993; Castanias 1983; Gertler and Gilchrist 1993) that find a positive correlation between enforcement and leverage. However, an important distinguishing feature of our work could explain the different result. Whereas we interpret bankruptcy costs as costs related to the behavior of courts and measure them using statistical information on trials concluded, the papers cited above use firm variables, like the size of the firm. If the size of the firm itself depends on the enforcement, then the results could be altered by endogeneity.

TABLE 5. Legal costs and leverage ratio

	Dependent variable: leverage ratio		
	(1)	(2)	(3)
Legal Costs	−2.65e-05	−2.8e-05	−2.81e-05
	(5.00e-05)	(5.06e-05)	(5.06e-05)
Age	−6.86e-06	−6.56e-06	−7.88e-06
	(4.35e-04)	(4.35e-04)	(4.35e-04)
Age Squared	2.04e-07	2.13e-07	2.19e-07
	(2.77e-06)	(2.77e-06)	(2.77e-06)
Listed Firm	0.0037	0.0037	0.0037
	(0.0242)	(0.0242)	(0.0242)
Asset Intangibility	−0.0053	−0.0053	−0.0053
	(0.0119)	(0.0119)	(0.0119)
Size	0.0623***	0.0623***	0.6233***
	(0.0058)	(0.0058)	(0.0058)
Herfindahl Index		−5.48e-06	−5.25e-06
		(2.87e-05)	(2.87e-05)
GDP			9.96e-04
			(0.0017)
Fixed Effects			
- *Firm*	YES	YES	YES
- *Industry*	YES	YES	YES
- *Region*	YES	YES	YES
- *Year*	YES	YES	YES
Adj. *R-sq*	0.7236	0.7235	0.7235
No. of obs.	8,332	8,332	8,332

Notes: The dependent variable is the leverage ratio defined as debt over debt plus equity (short term plus long term debt toward financial institutions over the sum of book value of equity and financial debt). We report the coefficients obtained through fixed-effects regressions at the firm level and the corresponding standard errors in brackets. Each regression includes 18 industry dummies, a full set of regional dummies to control for unobserved geographical heterogeneity, and a full set of year dummies to control for aggregate shocks. The dummy results are not reported to save space. The variable *Legal Costs* is the average length of trials concluded in days. *Age* is the number of years since the foundation of a firm. *Age Squared* is the square of the firm's age. *Listed* is a dummy variable equal to one if the firm is listed and zero otherwise. *Asset Intangibility* is the share of research and development expenditures over total capital. *Size* is the logarithm of the stock of capital. Column (1) refers to the baseline specification. Column (2) adds the *Herfindahl Index* (squared sum of the share of credit provided by all the banks operating in the reference market) to the set of explanatory variables. Column (3) includes also the per-capita level of the regional gross domestic product, *GDP*, to control for geographical differences in the degree of economic activity. ***Significant at 1%.

seem to depend on age, listing, or asset intangibility; conversely, larger firms are more leveraged.

In summary, our findings indicate that the behavior of courts does affect the cost financing to firms and their size. This effect is robust to year and regional fixed-effect controlling for aggregate shocks and unobserved cross-sectional heterogeneity, but also to regional per-capita GDP, controlling for idiosyncratic regional economic shocks. Furthermore, if we use the other proxy for law enforcement (the proportion of trials concluded after one year), we obtain the same results in all our specifications.

As a last finding, we document that the distortions generated by a poorly functioning legal system are not only statistically significant but also economically relevant. We quantify these economic effects by a simple experiment. We compute

the estimated reduction in the cost of bank credit and increase in firm size that would result from upgrading the district with the worse efficiency to top quality of enforcement in our sample. This would increase firm size by 14% and reduce the cost of credit by about 16% (corresponding to a reduction of 0.68 percentage points on an average cost of credit of 4.17%).

2.4. Robustness Checks

2.4.1. Large outliers. We want to make sure that our results are not driven by large outliers, re-estimating the specifications for different sub-samples. If large outliers drive the enforcement effect, it should disappear in at least one sub-sample. Tables 6 and 7 report the results of this robustness check for credit cost and firm size.[11] We define the sub-samples using three thresholds: 50 workers (column (1)), 250 workers (column (2)), and 500 workers (column (3)), corresponding to the 50th, 75th, and 90th percentiles of our sample, or, roughly speaking, small, medium-sized, and large firms.

In Table 6, the legal variable keeps the positive sign in all three specifications. Moreover, the statistical significance increases when the sample includes the 75th and the 90th percentile of firms, possibly because of the increment in the number of observations with respect to the smallest sub-sample. Interestingly, the economic significance of the legal variable decreases monotonically when the sub-sample includes larger firms. This qualitative pattern suggests that legal inefficiency has a stronger economic impact on the cost of credit when firms are smaller.

Table 7 shows the same robustness check for firm size. The legal variable keeps its negative sign in the three specifications. As in the previous table, its statistical significance increases when we enlarge the sample and its economic impact is greater for the smallest half (column (1)), suggesting again that enforcement is likely to have a stronger impact on the size of smaller firms. One possible reason could be that large firms can choose their location strategically and are thus more likely to be located in the more efficient judicial districts, whereas small and medium-sized firms tend to be owner-managed and located near to the owner's residence.

2.4.2. Lagged legal enforcement. One of our main findings is that the effect of court activity is not only statistically but also economically significant. We obtain this result by exploiting both cross-sectional and time-series variation in the legal variable. One could claim that temporal changes in court efficiency take time to affect firms' decisions, so our simultaneous legal variable might fail to capture

11. This robustness check confirms that the legal variable does not have a statistically significant effect on leverage. The results for leverage are not shown but are available on request.

TABLE 6. Sub-samples and the cost of bank debt.

	Dependent variable: cost of bank debt		
	(1) *≤ 50 workers 50th percentile*	(2) *≤ 250 workers 75th percentile*	(3) *≤ 500 workers 90th percentile*
Legal Costs	0.0023**	0.0022**	0.0021***
	(0.0011)	(0.0009)	(0.0008)
Age	−0.0213	−0.112	−0.0160*
	(0.0162)	(0.0107)	(0.0085)
Age Squared	9.53e-05	4.07e-05	7.41e-05
	(1.28e-04)	(8.08e-05)	(5.87e-05)
Listed Firm	0.7053	0.0140	−0.0517
	(1.3119)	(0.7040)	(0.5377)
Asset Intangibility	−0.0788	−0.4245	−0.4374
	(0.5402)	(0.3618)	(0.3489)
Size	−0.6575***	−0.5896***	−0.5564***
	(0.1444)	(0.1139)	(0.1044)
Herfindahl Index	4.62e-04	6.36e-04	6.06e-04
	(6.20e-04)	(5.05e-04)	(6.20e-04)
GDP	−0.0022	−0.0013	0.0011
	(0.0319)	(0.0296)	(0.0286)
Fixed Effects			
- *Firm*	YES	YES	YES
- *Industry*	YES	YES	YES
- *Region*	YES	YES	YES
- *Year*	YES	YES	YES
Adj. *R-sq*	0.7485	0.7531	0.7581
No. of obs.	2,667	3,885	4,626

Notes: The dependent variable is the average interest rate on the stock of bank debt. We report the coefficients obtained through fixed-effects regressions at the firm level and the corresponding standard errors in brackets. Each regression includes 18 industry dummies, a full set of regional dummies to control for unobserved geographical heterogeneity, and a full set of year dummies to control for aggregate shocks. The dummy results are not reported to save space. The variable *Legal Costs* is the average length of trials concluded in days. *Age* is the number of years since the foundation of a firm. *Age Squared* is the square of the firm's age. *Listed* is a dummy variable equal to one if the firm is listed and zero otherwise. *Asset Intangibility* is the share of research and development expenditures over total capital. *Size* is the logarithm of the stock of capital. *Herfindahl Index* is the squared sum of the share of credit provided by all the banks operating in the reference market. *GDP* is the per-capita level of the regional gross domestic product. Columns (1), (2), and (3) refer to sub-samples of firms with a number of workers lower or equal to 50 workers, to 250 workers, and to 500 workers, respectively. **Significant at 5%; ***Significant at 1%.

the full time-series effect. This argument is likely to be more relevant for size than credit cost, because size is presumably a more persistent variable.

We address the issue by using a specification in which the legal variable is lagged. To eliminate noise we use the lagged two-year average of length of trials. Column (1) of Tables 8, 9, and 10 shows the coefficients for cost of credit, firm size, and leverage. The enforcement variable keeps the same sign and similar magnitude as in the basic specifications.

2.4.3. The role of executory titles. The Spanish bankruptcy system provides for executory titles that give the creditor the right to enforce his credits without the

TABLE 7. Sub-samples and firm size.

	Dependent variable: firm size		
	(1) *≤ 50 workers 50th percentile*	(2) *≤ 250 workers 75th percentile*	(3) *≤ 500 workers 90th percentile*
Legal Costs	−3.66e-04*	−3.04e-04**	−3.56e-04***
	(1.97e-04)	(1.38e-04)	(1.19e-04)
Age	9.488e-05	0.0087**e-03	0.0080***
	(0.0023)	(0.0015)	(0.0012)
Age Squared	−7.97e-07	−6.09e-05***	−5.51e-05***
	(1.95e-05)	(1.14e-05)	(9.23e-06)
Listed Firm	1.1316	0.1286	0.0771
	(0.2572)	(0.1295)	(0.0904)
Asset Intangibility	−0.6287***	−0.6166***	−0.4544***
	(0.0705)	(0.0529)	(0.0393)
Herfindahl Index	−1.49e-04	−1.84e-04**	−1.90e-04***
	(1.01e-04)	(7.66e-05)	(6.75e-05)
GDP	8.13e-04	0.0013	−0.0014
	(0.0049)	(0.0043)	(0.0041)
Fixed Effects			
- *Firm*	YES	YES	YES
- *Industry*	YES	YES	YES
- *Region*	YES	YES	YES
- *Year*	YES	YES	YES
Adj. *R-sq*	0.9144	0.9638	0.9743
No. of obs.	4,823	7,605	9,047

Notes: The dependent variable is the size of the firm, measured by the logarithm of the stock of capital. We report the coefficients obtained through fixed-effects regressions at the firm level and the corresponding standard errors in brackets. Each regression includes 18 industry dummies, a full set of regional dummies to control for unobserved geographical heterogeneity, and a full set of year dummies to control for aggregate shocks. The dummy results are not reported to save space. The variable *Legal Costs* is the average length of trials concluded in days. *Age* is the number of years since the foundation of a firm. *Age Squared* is the square of the firm's age. *Listed* is a dummy variable equal to one if the firm is listed and zero otherwise. *Asset Intangibility* is the share of research and development expenditures over total capital. *Herfindahl Index* is the squared sum of the share of credit provided by all the banks operating in the reference market. *GDP* is the per-capita level of the regional gross domestic product. Columns (1), (2), and (3) refer to sub-samples of firms with a number of workers lower or equal to 50 workers, to 250 workers, and to 500 workers, respectively. *Significant at 10%; **Significant at 5%; ***Significant at 1%.

need for a trial. It is likely that the frequency of these contracts, hence the number of cases that reach courts, depends on the quality of courts. In particular, we expect agents to be more interested in such titles where courts are inefficient. In this case, the relation between credit conditions and judicial enforcement may be non-linear. For short or moderate length of trials, the firm's financing decisions are likely to depend on our legal variable, but beyond some critical length the relation could be weaker, because firms resort more often to executory titles. The use of executory titles would thus tend to decrease the average length of trials in less efficient districts, and with it the cross-sectional variability of the legal indicator. If anything, then, this bias would work against the significance of the legal variable.

TABLE 8. Lagged and non-linear legal costs and the cost of bank debt.

	Dependent variable: Cost of bank debt		
	Lagged Legal Costs Bi-Annual Lagged Average	*Non-Linear Legal Costs Box–Cox Transformation* $\widehat{\lambda}$*:* -0.0038 *(s.e.: 0.67)*	
		$\log(x)$	$(x^{\lambda}-1)/\lambda$
	(1)	(2)	(3)
Legal Costs	0.0016*	0.3625*	0.3559*
	(0.009)	(0.1974)	(0.1934)
Age	−0.0105	−0.0102	−0.0102
	(0.0071)	(0.0064)	(0.0064)
Age Squared	3.96e-05	3.80e-05	3.79e-05
	(3.87e-05)	(3.67e-05)	(3.67e-05)
Listed Firm	−0.2962	−0.0816	−0.0816
	(0.4871)	(0.4107)	(0.4107)
Asset Intangibility	−0.3882	−0.4146	−0.4145
	(0.3880)	(0.3426)	(0.0378)
Size	−0.5244***	−0.5440***	−0.5440***
	(0.1219)	(0.1000)	(0.1000)
Herfindahl Index	5.432	4.41e-04	4.41e-04
	(4.731e-04)	(4.29e-04)	(4.29e-04)
GDP	−0.0038	−0.0023	−0.0023
	(0.0292)	(0.0285)	(0.0285)
Fixed Effects			
- *Firm*	YES	YES	YES
- *Industry*	YES	YES	YES
- *Region*	YES	YES	YES
- *Year*	YES	YES	YES
Adj. *R-sq*	0.7470	0.8354	0.7552
No. of obs.	3,895	5,118	5,118

Notes: The dependent variable is the average interest rate on the stock of bank debt. We report the coefficients obtained through fixed-effects regressions at the firm level and the corresponding standard errors in brackets. Each regression includes 18 industry dummies, a full set of regional dummies to control for unobserved geographical heterogeneity, and a full set of year dummies to control for aggregate shocks. The dummy results are not reported to save space. The variable *Legal Costs* is the two-year lagged average of the length of trials concluded in days (Column (1)). In Column (2) and (3), we use two non-linear transformations of the average length, namely $log(x)$ and $(x^{\lambda}-1)/\lambda$, respectively. *Age* is the number of years since the foundation of a firm. *Age Squared* is the square of the firm's age. *Listed* is a dummy variable equal to one if the firm is listed and zero otherwise. *Asset Intangibility* is the share of research and development expenditures over total capital. *Size* is the logarithm of the stock of capital. *Herfindahl Index* is the squared sum of the share of credit provided by all the banks operating in the reference market. *GDP* is the per-capita regional gross domestic product. *Significant at 10%; ***Significant at 1%.

This argument is confirmed by the data. We implement a Box–Cox transformation of the legal variable, to control for non-linear effects.[12] When applied to the average length of trials, the maximum likelihood estimate of λ determines the functional form of the legal variable, where $\lambda = 1$ implies linearity. The results of the Box–Cox transformation with respect to cost of finance, firm size, and leverage are reported in Tables 8, 9 and 10. In Table 8, columns (2) and (3), the

12. A Box–Cox transformation of a variable x, denoted by x^{λ}, is defined as $x^{\lambda} = (x^{\lambda}-1)/\lambda$ if $\lambda \neq 0$ and $x^{\lambda} = \ln(x)$ if $\lambda = 0$.

TABLE 9. Lagged and non-linear legal costs and firm size.

	Dependent variable: Firm Size	
	Lagged Legal Costs *Bi-Annual Lagged Average*	*Non-Linear Legal Costs* *Box–Cox Transformation* $\widehat{\lambda}$: 13.16* *(s.e.: 7.18)* $(x^{\lambda}-1)/\lambda$
	(1)	(2)
Legal Costs	−2.499e-04**	−4.37e-37**
	(1.104e-04)	(1.39e-37)
Age	−0.0069***	0.0056***
	(0.0010)	(0.0009)
Age Squared	3.75e-05***	3.3e-05***
	(3.67e-05)	(6.36e-06)
Listed Firm	0.0576	−0.0803
	(0.0643)	(0.0566)
Asset Intangibility	−0.7402***	−0.4605***
	(0.0549)	(0.0378)
Herfindahl Index	−1.104e-04	2.04e-04
	(0.732e-04)	(6.08e-05)
GDP	−0.0023	−0.0016
	(0.0040)	(0.0038)
Fixed Effects		
- *Firm*	YES	YES
- *Industry*	YES	YES
- *Region*	YES	YES
- *Year*	YES	YES
Adj. *R-sq*	0.9813	0.9810
No. of obs.	6,775	10,179

Notes: The dependent variable is the logarithm of the stock of capital. We report the coefficients obtained through fixed-effects regressions at the firm level and the corresponding standard errors in brackets. Each regression includes 18 industry dummies, a full set of regional dummies to control for unobserved geographical heterogeneity, and a full set of year dummies to control for aggregate shocks. The dummy results are not reported to save space. The variable *Legal Costs* is the two-year lagged average of the length of trials concluded in days (Column (1)). In Column (2), we use a non-linear transformation of the average length, namely $(x^{\lambda}-1)/\lambda$. *Age* is the number of years since the foundation of a firm. *Age Squared* is the square of the firm's age. *Listed* is a dummy variable equal to one if the firm is listed and zero otherwise. *Asset Intangibility* is the share of research and development expenditures over total capital. *Size* is the logarithm of the stock of capital. *Herfindahl Index* is the squared sum of the share of credit provided by all the banks operating in the reference market. *GDP* is the per-capita regional gross domestic product. *Significant at 10%; **Significant at 5%; ***Significant at 1%.

estimated value of λ is -0.0038 with a standard error of 0.6693. We cannot reject the hypothesis that $\lambda = 0$ or $\lambda = 1$, in which cases the transformation of the legal variable is $log(x)$ and $(x^{\lambda}-1)/\lambda$), respectively. In both cases, the coefficient of the legal variable is still positive and statistically significant. In the specification for firm size (Table 9, column (2)) the estimated λ is 13.1605, which is statistically significant at the 10% level. The coefficient of the transformed legal variable is negative, as expected, and statistically significant at the 5% level. Finally, for leverage (Table 10, columns (2) and (3)), the transformed legal variable is not statistically significant, regardless of the Box–Cox transformation. In summary, all these results suggest that potential non-linearities of the legal variable do not change our findings.

TABLE 10. Lagged and non-linear legal costs and leverage ratio.

	Dependent variable: Leverage Ratio		
	Lagged Legal Costs Bi-Annual Lagged Average	*Non-Linear Legal Costs Box–Cox Transformation* $\widehat{\lambda}$*: −0.23 (s.e.: 0.89)*	
		$log(x)$	$(x^{\lambda}-1)/\lambda$
	(1)	(2)	(3)
Legal Costs	−1.54e-05	−0.0106	−0.0357
	(5.35e-05)	(0.0132)	(0.0432)
Age	1.74e-04	−6.66e-06	−5.27e-06
	(4.687e-04)	(4.35e-04)	(4.35e-04)
Age Squared	1.10e-06	2.16e-07	2.10e-07
	(3.00e-06)	(2.77e-06)	(2.77e-06)
Listed Firm	0.0100	0.0035	−0.0035
	(0.0285)	(0.0242)	(0.0242)
Asset Intangibility	−0.0374	−0.0054	−0.0054
	(0.0251)	(0.0119)	(0.0119)
Size	0.0750***	0.0623***	0.0623***
	(0.0065)	(0.0058)	(0.0058)
Herfindahl Index	−5.00e-07	5.67e-06	−5.64e-06
	(3.29e-05)	(2.86e-05)	(2.86e-05)
GDP	9.649e-04	0.0010	0.0010
	(1.765e-03)	(0.0017)	(0.0017)
Fixed Effects			
- *Firm*	YES	YES	YES
- *Industry*	YES	YES	YES
- *Region*	YES	YES	YES
- *Year*	YES	YES	YES
Adj. *R-sq*	0.7073	0.7990	0.7235
No. of obs.	6,529	8,332	8,332

Notes: The dependent variable is the leverage ratio defined as debt over debt plus equity (short term plus long term debt toward financial institutions over the sum of book value of equity and financial debt). We report the coefficients obtained through fixed-effects regressions at the firm level and the corresponding standard errors in brackets. Each regression includes 18 industry dummies, a full set of regional dummies to control for unobserved geographical heterogeneity, and a full set of year dummies to control for aggregate shocks. The dummy results are not reported to save space. The variable *Legal Costs* is the two-year lagged average of the length of trials concluded in days (Column (1)). In Column (2) and (3), we use two non-linear transformations of the average length, namely $log(x)$ and $(x^{\lambda}-1)/\lambda$, respectively. *Age* is the number of years since the foundation of a firm. *Age Squared* is the square of the firm's age. *Listed* is a dummy variable equal to one if the firm is listed and zero otherwise. *Asset Intangibility* is the share of research and development expenditures over total capital. *Size* is the logarithm of the stock of capital. *Herfindahl Index* is the squared sum of the share of credit provided by all the banks operating in the reference market. *GDP* is the per-capita regional gross domestic product. ***Significant at 1%.

2.4.4. Alternative interpretation: bankruptcy story. So far we have interpreted the average length of trials as an institutional parameter that describes the functioning of local jurisdictions. However, in a more general setting, this variable could be the result of an imbalance between the demand for law enforcement and its supply. The supply is given by the resources allocated to the judicial district. The demand depends on actual or potential litigation and may be affected by local economic conditions. A negative economic shock in a given region on a given year could increase the number of bankruptcies, hence the demand for justice, and possibly as a result the length of trials. Simultaneously, bad economic conditions

could drive up the cost of credit. Thus, one could argue that our results are compatible with the enforcement variable being a proxy for number of bankruptcies, hence regional economic shocks.

However, our results do not support this alternative interpretation, for several reasons. First, in all the regressions we control not only for regional and time differences, but also for the regional per capita income (*GDP*), which should take account of idiosyncratic regional economic shocks. Moreover, as discussed in Section 2.1, there is a weakly positive—rather than negative—cross-sectional correlation between *GDP* (both aggregate and per capita) and the average length of trials. This implies a weak but positive correlation between good economic performance and bad law enforcement, the opposite of what a bankruptcy story would imply.

As an additional robustness check, we compute the time-series correlation between the legal variable and the per-capita income, for each region. If our sample contains negative shocks that increase the length of trials (e.g., bankruptcies), we should find a negative correlation between the two variables in most regions. First, we calculate the correlation between the average length of trials and the first differences of *GDP*, since changes in *GDP* should capture economic shocks better. In this case, all regions have a correlation not significantly different from zero at the 5% level. The average correlation is -0.05. We obtain very similar results using the growth rate rather than first differences of *GDP*. In addition, we also consider the first differences in levels of both variables (*GDP* and length of trials). Only one region shows a correlation significantly different from zero, but it is positive. Finally, we calculate the correlation between the average length and the growth rate of *GDP* lagged one period, namely $(GDP_{t-1}-GDP_{t-2})/GDP_{t-2}$, to take into account that the effect of economic shocks on bankruptcy and therefore on courts might need time to unfold. Only one region shows a negative and statistically significant correlation; the average correlation is relatively low, -0.15.

Finally, as a last test, we add the proxies for regional economic shocks above as explanatory variables in all the regressions. Tables 11, 12, and 13 contain these robustness checks for cost of credit, firm size, and leverage. In column (1) of the three tables we control for *GDP* lagged one period. In column (2), we include the first differences in *GDP* and in column (3) we use differences in *GDP* lagged one period. Finally, in the last two columns, we control for the growth rate and the growth rate lagged one period. Overall, the previous findings are confirmed. The legal variable keeps the expected sign and its statistical significance in all the specifications for cost of credit and firm size, and it has no significant effect on leverage. None of the controls of *GDP* are statistically significant at the conventional levels.

In summary, the absence of any significant correlation over time between enforcement and economic conditions and the additional robustness checks reported in Tables 11, 12, and 13 suggest that a bankruptcy story is unlikely

TABLE 11. Lagged *GDP* and the cost of bank debt.

	Dependent variable: Cost of Bank Debt				
	(1)	(2)	(3)	(4)	(5)
Legal Costs	0.0017**	0.0017**	0.0014*	0.0017**	0.0014*
	(0.0079)	(0.007)	(0.008)	(0.007)	(0.008)
Age	−0.0114*	−0.0114*	−0.0143*	−0.0114*	−0.0143*
	(0.0066)	(0.0066)	(0.0082)	(0.0066)	(0.0082)
Age Squared	4.25e-05	3.68e-05	4.39e-05	4.26e-05	4.36e-05
	(3.75e-05)	(3.75e-05)	(4.17e-05)	(3.75e-05)	(4.17e-05)
Listed Firm	−0.0664	−0.0666	0.1446	−0.0663	0.1439
	(0.4219)	(0.4219)	(0.7134)	(0.4219)	(0.7134)
Asset Intangibility	−0.4218	−0.4220	−0.6906	−0.4218	−0.6898
	(0.3575)	(0.3575)	(0.8040)	(0.3576)	(0.8038)
Size	−0.5412***	−0.5406***	−0.5584***	−0.5403***	−0.5589***
	(0.1059)	(0.1059)	(0.1281)	(0.1059)	(0.1280)
Herfindahl Index	4.02e-04	4.08e-04	4.89e-04	4.12e-04	4.79e-04
	(4.45e-04)	(4.45e-04)	(5.20e-04)	(4.44e-04)	(5.20e-04)
GDP_{t-1}	0.0213				
	(0.0292)				
$(GDP_t - GDP_{t-1})$		−0.0079			
		(0.0212)			
$(GDP_{t-1} - GDP_{t-2})$			0.0046		
			(0.1000)		
$(GDP_t - GDP_{t-1})/GDP_{t-1}$				−0.0205	
				(0.0570)	
$(GDP_{t-1} - GDP_{t-2})/GDP_{t-2}$					0.0316
					(0.0579)
Fixed Effects					
- *Firm*	YES	YES	YES	YES	YES
- *Industry*	YES	YES	YES	YES	YES
- *Region*	YES	YES	YES	YES	YES
- *Year*	YES	YES	YES	YES	YES
Adj. *R-sq*	0.7520	0.7519	0.7357	0.7519	0.7357
No. of observations	4,831	4,831	3,799	4,831	3,799

Notes: The dependent variable is the average interest rate paid on the stock of bank debt. We report the coefficients obtained through fixed-effects regressions at the firm level and the corresponding standard errors in brackets. Each regression includes 18 industry dummies, a full set of regional dummies to control for unobserved geographical heterogeneity, and a full set of year dummies to control for aggregate shocks. The dummy results are not reported to save space. The variable *Legal Costs* is the length of trials concluded in days. *Age* is the number of years since the foundation of a firm. *Age Squared* is the square of the firm's age. *Listed* is a dummy variable equal to one if the firm is listed and zero otherwise. *Asset Intangibility* is the share of research and development expenditures over total capital. *Size* is the logarithm of the stock of capital. *Herfindahl Index* is the squared sum of the share of credit provided by all the banks operating in the reference market. GDP_{t-1} is the regional per-capita GDP lagged one period. $(GDP_t - GDP_{t-1})$ is the difference between the current regional per-capita GDP and the value lagged one period. $(GDP_{t-1} - GDP_{t-2})$ is the difference between the regional per-capita GDP lagged one period and two periods. $(GDP_t - GDP_{t-1})/GDP_{t-1}$ is the growth rate of regional per capita GDP, while $(GDP_{t-1} - GDP_{t-2})/GDP_{t-2}$ is the growth rate lagged one period. *Significant at 10%; **Significant at 5%; ***Significant at 1%.

TABLE 12. Lagged *GDP* and firm size.

	Dependent variable: Firm Size				
	(1)	(2)	(3)	(4)	(5)
Legal Costs	−3.13e-04***	−3.11e-04***	−3.39e-04***	−3.09e-04***	−3.41e-04***
	(1.11e-04)	(1.11e-04)	(1.19e-04)	(1.10e-04)	(1.19e-04)
Age	0.0058***	0.0058***	0.0074***	0.0057***	0.0074***
	(0.0009)	(0.0009)	(0.0011)	(0.0009)	(0.0011)
Age Squared	3.29e-05***	3.29e-05***	3.62e-05***	3.29e-05***	3.62e-05***
	(6.37e-06)	(6.37e-06)	(6.98e-06)	(6.37e-06)	(6.98e-06)
Listed Firm	0.0792	0.0792	0.1050	−0.079	0.1050
	(0.0575)	(0.0575)	(0.0782)	(0.0575)	(0.0782)
Asset Intangibility	−0.6636***	−0.6636***	−0.7779***	−0.6633***	−0.7782***
	(0.0498)	(0.0498)	(0.0626)	(0.0498)	(0.0626)
Herfindahl Index	1.28e-04**	1.28e-04**	2.04e-04***	1.28e-04**	2.06e-04***
	(6.19e-05)	(6.19e-05)	(7.53e-05)	(6.18e-05)	(7.54e-05)
GDP_{t-1}	0.0018				
	(0.0039)				
$GDP_t - GDP_{t-1}$		−0.0012			
		(0.0022)			
$GDP_{t-1} - GDP_{t-2}$			0.0025		
			(0.0026)		
$(GDP_t - GDP_{t-1})/GDP_{t-1}$				−0.0019	
				(0.0076)	
$(GDP_{t-1} - GDP_{t-2})/GDP_{t-2}$					0.0086
					(0.0073)
Fixed Effects					
-Firm	YES	YES	YES	YES	YES
-Industry	YES	YES	YES	YES	YES
-Region	YES	YES	YES	YES	YES
-Year	YES	YES	YES	YES	YES
Adj. *R-sq*	0.9811	0.9811	0.9849	0.9811	0.9849
No. of obs.	9,586	9,586	7,470	9,586	7,470

Notes: The dependent variable is the logarithm of the stock of capital. We report the coefficients obtained through fixed-effects regressions at the firm level and the corresponding standard errors in brackets. Each regression includes 18 sector dummies, a full set of regional dummies to control for unobserved geographical heterogeneity and a full set of year dummies to control for aggregate shocks. The dummy results are not reported to save space. The variable *Legal Costs* is the length of trials concluded in days. *Age* is the number of years since the foundation of a firm. *Age Squared* is the square of the firm's age. *Listed* is a dummy variable equal to one if the firm is listed and zero otherwise. *Asset Intangibility* is the share of research and development expenditures over total capital. *Herfindahl Index* is the squared sum of the share of credit provided by all the banks operating in the reference market. GDP_{t-1} is the regional per-capita GDP lagged one period. $(GDP_t - GDP_{t-1})$ is the difference between the current regional per-capita GDP and the value lagged one period. $(GDP_{t-1} - GDP_{t-2})$ is the difference between the regional per-capita GDP lagged one period and two periods. $(GDP_t - GDP_{t-1})/GDP_{t-1}$ is the growth rate of regional per capita GDP, while $(GDP_{t-1} - GDP_{t-2})/GDP_{t-2}$ is the growth rate lagged one period. **Significant at 5%; ***Significant at 1%.

TABLE 13. Lagged *GDP* and leverage ratio.

	Dependent variable: Leverage Ratio				
	(1)	(2)	(3)	(4)	(5)
Legal Costs	−4.56e-05	−4.92e-05	−5.45e-05	−5.15e-05	−5.46e-05
	(5.15e-05)	(5.13e-05)	(5.24e-05)	(5.12e-05)	(5.24e-05)
Age	5.55e-05	5.14e-05	5.64e-05	4.80e-05	5.72e-05
	(4.36e-04)	(4.36e-04)	(4.36e-04)	(4.36e-04)	(4.36e-04)
Age Squared	4.38e-07	4.16e-07	4.63e-07	3.98e-07	4.68e-07
	(2.75e-06)	(2.75e-06)	(2.75e-06)	(2.75e-06)	(2.75e-06)
Listed Firm	0.0017	0.0017	−0.0055	0.0016	−0.0055
	(0.0243)	(0.0243)	(0.0244)	(0.0243)	(0.0244)
Asset Intangibility	−0.0024	−0.0024	−0.0033	−0.0024	−0.0033
	(0.0122)	(0.0122)	(0.0124)	(0.0122)	(0.0124)
Size	0.0609***	0.0609***	0.0648***	0.0608***	0.0648***
	(0.0059)	(0.0059)	(0.0062)	(0.0059)	(0.0035)
Herfindahl Index	−8.41e-06	−8.82e-06	1.24e-05	1.19e-05	1.19e-05
	(2.88e-05)	(2.88e-05)	(2.91e-05)	(2.91e-05)	(2.91e-05)
GDP_{t-1}	−0.0026				
	(0.0017)				
$(GDP_t - GDP_{t-1})$		0.0011			
		(0.0010)			
$(GDP_{t-1} - GDP_{t-2})$			−0.0018		
			(0.0013)		
$(GDP_t - GDP_{t-1})/GDP_{t-1}$				−0.0020	
				(0.0033)	
$(GDP_{t-1} - GDP_{t-2})/GDP_{t-2}$					0.0051
					(0.0035)
Fixed Effects					
-Firm	YES	YES	YES	YES	YES
-Industry	YES	YES	YES	YES	YES
-Region	YES	YES	YES	YES	YES
-Year	YES	YES	YES	YES	YES
Adj. *R-sq*	0.7241	0.7241	0.7192	0.7240	0.7192
No. of obs.	7,870	7,870	7,401	7,870	7,401

Notes: The dependent variable is the leverage ratio defined as debt over debt plus equity (short term plus long term debt toward financial institutions over the sum of book value of equity and debt). We report the coefficients obtained through fixed-effects regressions at the firm level and the corresponding standard errors in brackets. Each regression includes 18 industry dummies, a full set of regional dummies to control for unobserved geographical heterogeneity and year dummies to control for aggregate shocks. The dummy results are not reported to save space. The variable *Legal Costs* is the length of trials concluded in days. *Age* is the number of years since the foundation of a firm. *Age Squared* is the square of the firm's age. *Listed* is a dummy variable equal to one if the firm is listed and zero otherwise. *Asset Intangibility* is the share of research and development expenditures over total capital. *Size* is the logarithm of the stock of capital. *Herfindahl Index* is the squared sum of the share of credit provided by all the banks operating in the reference market. GDP_{t-1} is the regional per-capita *GDP* lagged one period. $(GDP_t - GDP_{t-1})$ is the first difference of regional per-capita *GDP*. $(GDP_{t-1} - GDP_{t-2})$ is the first difference lagged one period. $(GDP_t - GDP_{t-1})/GDP_{t-1}$ is the growth rate of regional per capita GDP, while $(GDP_{t-1} - GDP_{t-2})/GDP_{t-2}$ is the growth rate lagged one period. ***Significant at 1%.

to be driving our findings. Clearly, even controlling for differences in per capita *GDP* or for other types of heterogeneity at the regional and industry levels might not be enough to rule out the potential endogeneity of the quality of the judicial system. Ideally, we would need to appeal to legal reforms that affect judicial districts in different ways, but these events are very rare and are absent from our sample.

3. The Theoretical Framework

In this section, we suggest an economic mechanism whereby law enforcement of credit contracts interacts with firms' policies. This mechanism is modeled using a dynamic general equilibrium framework.

We consider an economy with overlapping generations.[13] In each period, a new generation of mass equal to 1 is born and lives for two periods. Individuals are risk-neutral and their utility depends on the expected level of consumption in the two periods (c_t^t, c_{t+1}^t) and on the working time in the first period (l_t^t). The superscript refers to the period in which the generation is born, the subscript to that of consumption or labor decisions. For simplicity, the utility function takes the following form:

$$EU = E[c_t^t + c_{t+1}^t - (l_t^t)^2],$$

where agents do not discount future consumption.[14]

In the first period, individuals have no initial wealth. They can work and save.[15] At the beginning of the second period, they decide how to invest their savings, with two alternatives: a bank account with gross fixed risk-free interest at rate r_{t+1} (in this case, they do not work) and an entrepreneurial activity. The project is risky and consists in producing the only consumption good available in the economy. Entrepreneurs may ask for a bank loan.

Banks collect funds (deposits) from workers to finance entrepreneurs. Banks are risk-neutral. There is free entry into the banking industry. Finally, there is a legal system whose activity affects the degree of enforcement of creditors' right to repossess collateral.

To make our model a good representation of the Spanish case, we divide the economy into two regions, A and B. We assume perfect integration of capital markets, but complete segmentation in the labor markets. These two assumptions capture the Spanish economic situation realistically enough. Financial integration

13. We use a general equilibrium framework because we want to endogenize the wealth endowment of the entrepreneur.

14. This last assumption is not necessary to get our results, but it greatly simplifies the calculations.

15. We assume that at the initial period only the old generation has a positive amount of wealth.

between districts or regions is very high. Banking law is national, and there are no restrictions on domestic capital movements. But the labor market, according to the Economically Active Population Survey (EAPS), is highly segmented.[16] For instance, the proportion of unemployed who would be willing to take a job with a change of residence (not necessarily even a change of region) is under 30% for all our sample period (28.5% in 1996 and 23.5% in 1999). Unemployment rates vary substantially among districts and regions. In 1996, Andalucia and Extremadura had unemployment rates of about 32%, twice as high as in Baleares (15.8%) and Rioja (14.9%). We observe similar differences for other regions and for the following three years.

3.1. Credit Contract and Law Enforcement

In this section, we describe the credit contract between entrepreneurs and banks. To simplify, we consider the agent born in period t, removing the superscript from all the variables.

If the agent decides to become an entrepreneur, in period $t+1$ he has to choose the optimal amount of capital (k_{t+1}) and labor (l_{t+1}). For a given amount of capital invested, he borrows ($k_{t+1} - S_t$) from the bank, where S_t is saving from period t. We only consider debt contracts.[17] The realization of the project is stochastic. If the good state occurs, then production is equal to $y_{t+1} = \min\{\alpha k_{t+1}, l_{t+1}\}$, otherwise zero.[18] Notice that, whereas the capital is provided by individuals belonging to the older generation (born in period t), labor is supplied by the younger generation of period $t + 1$.

Following Holmstrom and Tirole (1997), we introduce asymmetric information (moral hazard) in the credit relation, by assuming that the probability of the good state depends on the entrepreneur's effort.[19] The entrepreneur chooses between two levels of effort: high (exertion) or low (shirking). Exertion yields the probability p_h of success and no private benefits to the entrepreneur. Shirking yields the probability $p_l < p_h$ of success and private benefits $Bk_{t+1} > 0$.[20] Effort is not observable by the bank. Success and failure are observed at no cost. After

16. EAPS is a quarterly survey conducted by the National Institute of Statistics since 1996 on a sample of 200,000 individuals. The survey reports information on employment status and changes (employment and unemployment rates) and of non-participants (participation rate) by region, district, sector, gender, and level of education.

17. Excluding outside equity from the model is consistent with the characteristics of our sample, where only 3.76% of firms are listed.

18. Allowing for substitution between the two inputs does not lead to closed-form solutions. However, the results of the model do not build on this assumption, as explained later in Section 4.

19. Projects are independently distributed across individuals.

20. We can interpret private benefits as a saving on the disutility from effort. We assume that private benefits are linear in the amount of capital goods, as in Holmstrom and Tirole (1997).

the realization of the project, the entrepreneur repays the loan and pays wages to the workers. We assume no depreciation of capital assets. Limited liability is also assumed.

Following the literature on credit rationing (see Bester, 1995; Chan and Kanatas 1985, among others), we consider a *collateralized debt contract*. The entrepreneur can pledge all the investment goods, k_{t+1}, as collateral to the lender. If he defaults, the bank has the right to repossess, but enforcement of this right requires the intervention of the judicial system. Courts are not efficient, which introduces a cost for the creditor in the form of a reduction in the effective liquidation value of the collateral asset. We assume that the worse the performance of courts (the longer trials are), the less the liquidation value of the asset, denoted by gk_{t+1}, where $0 < g < 1$. Better enforcement corresponds to a larger g. This is a fair description of the actual bankruptcy procedure in Spain, which is unable to guarantee a reasonable recovery rate for creditors. This is mostly because of the long time that courts take to complete trials (European Commission 2003).

The financial sector collects funds $(k_{t+1} - S_{t+1})$ to finance the productive sector and repay a gross fixed interest rate, r_{t+1}, on deposits. If the project is successful, the entrepreneur and the bank share the cash-flow left after the payment of wages: $(y_{t+1} - w_{t+1}l_{t+1})$. The bank receives R^b_{t+1} and the entrepreneur R^e_{t+1}. In case of default, the bank gets the liquidation value of the collateral net of the legal costs, gk_{t+1}.

We make the following two assumptions:

ASSUMPTION 1. $p_l(1+\alpha) + (1-p_l)g < 1,$

ASSUMPTION 2. $[p_h\alpha - \dfrac{Bp_h}{(p_h - p_l)}] > \dfrac{3}{2}.$

Assumption 1 implies that the project has a negative present value when the borrower shirks, putting out the low level of effort. Assumption 2 guarantees that the bank's cash flow in the good state is higher than the collateral value of the assets in the bad state.

3.2. Optimal Credit Contract

Consider an entrepreneur with saving S_t. In period $t+1$ he chooses the amount of capital (k_{t+1}), the labor input (l^d_{t+1}), and the effort level. He takes as given the wage, w_{t+1} and the deposit rate r_{t+1}. The maximization problem is

$$\max_{k_{t+1}, l_{t+1}, R^b_{t+1}, R^e_{t+1}} \quad E(c_{t+1}) = p_h\left[R^e_{t+1} + k_{t+1}\right],$$

subject to

$$\left[R^e_{t+1} + k_{t+1}\right]p_h \geq p_l\left[R^e_{t+1} + k_{t+1}\right] + Bk_{t+1},$$
$$p_h R^b_{t+1} + (1 - p_h)gk_{t+1} = (k_{t+1} - S_t)r_{t+1},$$
$$[\min\{\alpha k_{t+1}, l_{t+1}\} - w_{t+1}l_{t+1}] = R^e_{t+1} + R^b_{t+1}.$$

The objective function is the entrepreneur's expected level of consumption at the end of the second period.

The first condition represents the incentive compatibility constraint of the entrepreneur. It requires that the total expected utility from exertion (left-hand side) is equal or greater than from shirking (right-hand side). To avoid trivial cases in which this constraint is not binding, we introduce the following assumption:

ASSUMPTION 3. $$\frac{B}{(p_h - p_l)} > 1.$$

The second constraint is the participation constraint for the bank. The assumption of free entry implies that the total expected income from financing the risky project (left-hand side) is equal to the repayments of the deposit contracts (right-hand side).

The last equation is a feasibility condition: The maximum cash-flow that entrepreneur and bank share cannot be larger than the share of the total production left after paying the wages.

Solving for the optimal credit contract yields the following demands for capital and labor:

$$k_{t+1} = \frac{r_{t+1}S_t}{r_{t+1} - \gamma + p_h\alpha w_{t+1}}, \tag{2}$$
$$l^d_{t+1} = \frac{\alpha r_{t+1}S_t}{r_{t+1} - \gamma + p_h\alpha w_{t+1}}, \tag{3}$$

where $\gamma = p_h(1+\alpha) - [Bp_h/(p_h - p_l)] + (1 - p_h)g$. The denominator in equations (2) and (3) must be positive and lower than r_{t+1}, otherwise entrepreneurs would not borrow. These two conditions are satisfied under Assumption 2.[21]

21. The denominator in equations (2) and (3) is positive and lower than r_{t+1}, if the following two requirements are satisfied:

$$[p_h(1 + \alpha) + (1 - p_h)g - (p_h B)/(p_h - p_l) - r_{t+1}] < \alpha p_h w_{t+1}$$
$$< [p_h(1 + \alpha) + (1 - p_h)g - (p_h B)/(p_h - p_l)].$$

In principle, these two conditions must hold at any time. Because we concentrate our attention on the steady state, we only require that they hold in the steady state. This allows us to rewrite them as follows: $1 < [p_h(1 + \alpha) - (p_h B)/(p_h - p_l)]$. It is easy to show that this condition is always satisfied under Assumption 2.

Both demand functions are decreasing in w_{t+1} and r_{t+1}. Moreover, they are increasing in the entrepreneur's savings, because greater initial wealth increases the availability of external funds and allows the entrepreneur to enlarge the scale of production.

Finally, we can derive the expected return of the entrepreneurial activity, defined as the expected consumption level per unit of saving invested:

$$\mu_{t+1} = \frac{p_h\left[R^e_{t+1} + k_{t+1}\right]}{S_t} = \frac{r_{t+1} B p_h}{(r_{t+1} + p_h \alpha w_{t+1} - \gamma)(p_h - p_l)}. \qquad (4)$$

As expected, μ_{t+1} is decreasing in the cost of inputs, wages, and deposit rate. Moreover, for given w_{t+1} and r_{t+1}, it is increasing in B and $(p_h - p_l)$. Higher private benefits (higher B) tighten the borrower's incentive compatibility condition. Therefore, a larger cash-flow is needed to induce the entrepreneur to exert high effort. Conversely, higher $(p_h - p_l)$ increases the cost of shirking and reduces μ_{t+1}. In addition, for given w_{t+1} and r_{t+1}, higher g increases μ_{t+1}. The intuition is that better legal institutions relax the participation constraint of the bank. As a consequence, for a given amount of saving, the entrepreneur gets more external financing. Production and profits increase.

3.3. Workers' and Investors' Decisions

Consider now the maximization problem faced by the consumer in the first period. He chooses the level of consumption in each period and the supply of labor in the first period. Because he is risk-neutral and does not discount future consumption, it is optimal to save all of his income in order to consume only in the second period, $(c_t = 0, c_{t+1} = S_t \max\{r_{t+1}, \mu_{t+1}\})$. Total saving depends on the labor supplied, the wage, and the probability of being paid, $S_t = p_h w_t l_t$. Given the two investment alternatives, the consumer will chose the one with higher expected return. The maximization problem can be redefined in term of labor supply choice, as follows:

$$\max_{l_t} EU = p_h w_t l_t \max\{r_{t+1}, \mu_{t+1}\} - l_t^2.$$

We can easily derive the optimal level of labor supply (l_t^s) and the optimal saving function (S_t) as follows:

$$l_t^s = \frac{1}{2} w_t p_h \max\{r_{t+1}, \mu_{t+1}\}, \qquad (5)$$

$$S_t = \frac{1}{2} w_t^2 p_h \max\{r_{t+1}, \mu_{t+1}\}. \qquad (6)$$

Both labor supply and savings depend positively on the wage rate and the return on investment in the second period.[22] We are now able to solve for the steady state equilibrium.

3.4. Steady State Equilibrium

We assume that the two regions, A and B, are the same in all ways except enforcement: $g_A > g_B$. Capital markets are perfectly integrated, but there is no labor mobility.[23] The proportion of individuals who decide to become entrepreneurs in region i is π_i.

DEFINITION 1. We define the steady state equilibrium as the pair of wages (w_A^* and w_B^*), the risk-free interest rate (r^*), the expected return to entrepreneurial activity (μ^*), and the number of entrepreneurs in each region (π_A^* and π_B^*) such as to solve the following set of equations:

$$S_A(r^*, w_A^*) + S_B(r^*, w_B^*) = \pi_A^* k_A(r^*, w_A^*) + \pi_B k_B(r^*, w_B^*), \tag{7}$$

$$l_i^s(r^*, w_i^*) = \pi_i l_i^d(r^*, w_i^*), \qquad i = A, B, \tag{8}$$

$$r^* = \mu_i, \qquad i = A, B. \tag{9}$$

Equation (7) represents the equilibrium condition for the credit market, Equation (8) for the labor market. Note that there is a unique equilibrium condition for the capital market given perfect integration, while the assumption of zero labor mobility implies two equilibrium conditions for the labor market, one for each region. Finally, Equation (9) guarantees that agents are indifferent between being depositors and entrepreneurs.

This system has the following solution:

$$\mu^* = r^* = p_h(1+\alpha) + \frac{1}{2}(1-p_h)(g_A+g_B) - \frac{1}{2}\left(1+\sqrt{1-z^2}\right), \tag{10}$$

$$w_A^* = (2\alpha p_h)^{-1}[(1+z) + \sqrt{1-z^2}], \tag{11}$$

$$w_B^* = (2\alpha p_h)^{-1}[(1-z) + \sqrt{1-z^2}], \tag{12}$$

$$\pi_A^* = \frac{2Bp_h}{[p_h(1+\alpha) + z - \frac{1}{2}(1-z+\sqrt{1-z^2})]\mu, (p_h - p_l)}, \tag{13}$$

22. Notice that the first-order conditions are sufficient to characterize the optimal solution, because the problem is concave.

23. As explained previously, these two assumptions capture the actual degree of economic integration among Spanish regions.

$$\pi_B^* = \frac{2Bp_h}{[p_h(1+\alpha)+z-\frac{1}{2}(1+z+\sqrt{1-z^2})]\mu(p_h-p_l)} \tag{14}$$

where $z = (1 - p_h)(g_A - g_B)$. The proportion of entrepreneurs is strictly positive and lower than 1. Therefore, the two extreme situations—all individuals are entrepreneurs or all are depositors—cannot be an equilibrium. From equations (11) and (12), it follows that better creditor protection implies higher wages ($w_A > w_B$). Given the fully integrated capital markets and assuming no arbitrage among investment opportunities, the price of capital and the return to entrepreneurial activity must be equal in the two regions, so differences in law enforcement ($g_A > g_B$) translate fully into differences in wages ($w_A > w_B$).

4. Comparative Statics

Let us investigate the role of the legal system. We assume that courts are more efficient in enforcing the creditor's rights in region A, that is, $g_A > g_B$. We divide the analysis into two parts. First, we discuss the implications for firm activity, focusing on external financing, leverage, size, and the cost of credit. Then we analyze the effects on the region's capital stock and output.

4.1. Law Enforcement and the Activity of Firms

Let us denote the amount of external financing by $d_i = (k_i - S_i)$ and the leverage ratio by d_i/k_i, where $i = A, B$.[24]

Proposition 1. *Firms located in region A (where creditors' rights are more strictly enforced) get more external finance, are larger but with the same leverage ratio as in region B; that is, if $g_A > g_B$, then $d_A > d_B$, $k_A > k_B$, and $(d_A/k_A) = (d_B/k_B)$.*

Proof. First, we prove that firm size is higher in region A. We then use this result to prove the other part of the proposition. Reworking equation (2), we obtain the capital assets invested by each entrepreneur in each region as a function of interest rate and wage: $k_A = [r^2(p_h - p_l)w_A^2/(2B)]$, $k_B = [r^2(p_h - p_l)w_B^2/2B]$. From equations (11) and (12), it follows that $w_A > w_B$. This implies $k_A > k_B$. Then, taking into account that

$$d_i = k_i - S_i = S_i \frac{\gamma_i - p_h \alpha w_i}{r - \gamma_i - p_h \alpha w_i},$$

24. There are many different definitions of "leverage" in the corporate finance literature. We use the broadest, the ratio of total liabilities to total assets.

and $S_i = (w_i^2 p_h r)/2$, we can rewrite the two leverage ratios as follows:

$$\frac{d_A}{k_A} = \frac{d_B}{k_B} = 1 - \frac{Bp_h}{r(p_h - p_l)}.$$

From the two previous results, it follows that, if $g_A > g_B$, then $d_A > d_B$. □

It is worth remarking that whereas the amount of external finance is linear in the entrepreneur's initial wealth, the leverage ratio does not depend on this factor. Moreover, external finance and leverage both depend on the legal variable, but via different channels. Stronger enforcement in region A increases the liquidation value of the collateral, so the bank's participation constraint is less stringent. For a given amount of the initial wealth, banks extend more credit (positive partial equilibrium effect). The greater availability of external financing increases the expected rate of return to the entrepreneurial activity and with it the equilibrium interest rate on deposits. This produces a wedge between the two rates in region B. The safe banking investment, which benefits from better enforcement by drawing interregional funds, provides a higher return than the risky project. Because bank deposits are now more profitable, fewer agents decide to become entrepreneurs, reducing not only the demand for capital but also the demand for labor in region B. Adjustments in the national capital market and in the two labor markets reduce wages in region B and increase them in region A. At the end, the benefit of better enforcement in region A (positive partial equilibrium effect) is fully offset by the higher labor cost (general equilibrium effect).

These two opposite effects keep the leverage ratio constant across regions and explain why we do not find any regional effect of differences in law enforcement. This result, which may seem counterintuitive only in a partial equilibrium approach, does not imply that legal institutions have no effect on capital structure. In fact, if we consider the longitudinal rather than the cross-sectional effects, we find that an increment in enforcement in region A increases leverage in both regions by increasing the return to entrepreneurial activity. The interesting point is that there is a full spill-over effect on region B, working through the national capital market. The rise in the national deposit rate raises the return to enterprise in region B and increases leverage by the same amount as in region A.[25]

The result that the benefit of a better enforcement is fully offset by higher labor costs explains also why the coefficient of savings in the definition of external finance holds constant after changes in the legal variable. This implies that the effect of cross-sectional differences in enforcement on external finance and capital stock works only through differences in per capita savings ($S_A > S_B$) driven by differences in wages (general equilibrium effect). An increment in legal protection

25. One can show that $\partial(d_A/k_A)/\partial g_A = (1 - p_h)[1 + z/\sqrt{1 - z^2}][Bp_h/(p_h - p_l)r]/2 > 0$. The same holds for region B, given that the leverage ratio is the same.

allows entrepreneurs to pay higher wages, inducing young people to work and save more. As a consequence, each entrepreneur has a larger wealth endowment, hence more financing from banks. More external funds and greater initial wealth allow him to enlarge the scale of production, investing more capital and hiring more workers.

Before proceeding with the next proposition, let us denote the cost of external finance by $v_i = R_i^b/d_i$ where $i = A, B$.

PROPOSITION 2. *Firms located in the region where legal institutions are weaker face a higher price for external finance, that is, if* $g_A > g_B$ *then* $v_A < v_B$.

Proof. Rewrite the bank's participation constraint at the steady state equilibrium in the two regions as:

$$p_h d_A v_A + (1 - p_h) g_A k_A = d_A r,$$

and

$$p_h d_B v_B + (1 - p_h) g_B k_B = d_B r.$$

Then, using the result that there is only one deposit rate (given integrated capital markets), we have

$$(1 - p_h)[g_A(k_A/d_A) - g_B(k_B/d_B)] = p_h(v_B - v_A).$$

Then $k_A/d_A = k_B/d_B$, because they are the inverse of the leverage ratio. It follows that where legal protection is higher, the average price of credit is lower. □

The reason is that banks in the poorer legal environment must charge more for loans in order to compensate for the lower liquidation value of the collateral. Notice that even though bank finance is cheaper in region A, there will be no migration of entrepreneurs. Even if we allow entrepreneurs to choose their location, they do not have any incentive to move, given that the return to entrepreneurial activity is the same in the two regions, namely, (μ_A=μ_B).

Our theoretical analysis provides an explanation for the empirical findings of Section 2, including the result that leverage is neutral to judicial efficiency.

4.2. Law Enforcement and Aggregate Activity

We have seen that regional differences in law enforcement across regions generate differences in capital stock. Here, we investigate whether this effect is also found at the aggregate level. This question is not trivial, because the numbers of entrepreneurs change and capital is free to move across regions. We denote the aggregate level of capital and output in each region by K_i and Y_i, where $i = A, B$.

PROPOSITION 3. *The region with better law enforcement has larger aggregate capital stock and output, that is, if* $g_A > g_B$, *then* $K_A > K_B$ *and consequently* $Y_A > Y_B$.

Proof. By multiplying the capital stock per firm by the number of entrepreneurs, we can rewrite the aggregate capital ratio between the two regions as follows:

$$K_A/K_B = (w_A/w_B)^2 \frac{[p_h(1+\alpha) + z - \frac{1}{2}(1 - z + \sqrt{1-z^2})]}{[p_h(1+\alpha) + z - \frac{1}{2}(1 + z + \sqrt{1-z^2})]}.$$

Because $w_A > w_B$, a sufficient condition for $K_A/K_B > 1$ is

$$[p_h(1+\alpha) + z](1 + \sqrt{1-z^2}) > z^2/2.$$

Then $(1 + \sqrt{1-z^2}) > 1$ for any value of z. Moreover, $z^2 < z$ because $z < 1$ for any given value of g_A and g_B. It follows that the previous condition is always satisfied. Because the output is proportional to capital stock, it also follows that $Y_A > Y_B$. □

As mentioned earlier, more effective protection in region A increases the national interest rate, given that $(\partial r/\partial g_A) = (1 - p_h)[1 + z/\sqrt{1-z^2}]/2 > 0$. The intuition is that the equilibrium interest rate must be equal to the expected rate of return to enterprise to prevent some agents from gaining by changing the allocation of their savings. The expected rate of return to entrepreneurial activity depends on the productivity of capital in the two states of nature. According to the credit contract, in case of default the assets are transferred to the bank. The faster the courts are in completing proceedings, the greater the liquidation value. It follows that better creditor protection increases the productivity of capital in the bad state of nature and hence the expected return to the entrepreneurial activity.

Let us note that, further, more effective protection in region A might generate a positive externality in region B, by inducing a flow of savings to region B, which could increase welfare there. In fact, $(S_A/K_A) = (1 + z + \sqrt{1-z^2})/2 > 1$ and $(S_B/K_B) = (1 - z + \sqrt{1-z^2})/2 < 1$. Under the condition $(1 - z^2) > [p_h(1+\alpha) + (1 - p_h)g_A - 1]$, welfare in region B increases.

In particular, we find that differences in firm size between countries (due to different law enforcement) are magnified with segmentation of capital markets, because partial and general equilibrium effect have the same sign and they reinforce each other. Leverage represents an extreme case of this effect, because when capital markets are segmented differences in law enforcement generate differences in leverage, but they vanish completely with capital market integration.

5. Evidence on Savings and Law Enforcement

Our model provides a formal explanation for our empirical findings, including the result that leverage is neutral to law enforcement. The channel through which better enforcement benefits both the economy as a whole (greater regional capital and output) and the private corporate sector (cheaper credit and larger size) is a general equilibrium effect. Differences in law enforcement induce adjustments in the two labor markets, boosting wages and then savings in the region with better enforcement. Individuals in good judicial districts save more than those in poor ones and are thus able to increase their down-payment on future business activity, and as a consequence get higher profits. In this section, we use data on savings to inquire whether the mechanism suggested by the model is plausible for the Spanish case.

Information on savings in Spain is provided by the National Institute of Statistics (INE) in the Household Income Account (HIA), including data on disposable income and consumption by year and by region. The sample period with information on savings matching information on civil trials goes from 1995 to 1998. This series only provides household information aggregated at the regional level. More specifically, the reported values are the sum of disposable income (or consumption) of all households living in a given region in a given year. We measure savings as the difference between disposable income and consumption; dividing by resident population, we get per capita savings. Table 2 Panel (B) reports summary statistics of savings. On average, per-capita savings are about 202,530 pesetas (about €1,200), with Asturia having the lowest and La Rioja the largest per-capita savings in Spain.

Figure 4 shows the univariate regression of per capita savings on the length of trials. Each observation represents the time-series average of savings and legal enforcement over 1995–1998 for each region. The figure displays a negative correlation between the two variables. In line with our theoretical prediction, this descriptive evidence suggests that in regions where trials are shorter agents save more. We now turn to more formal analysis to understand whether the graphical intuition is confirmed. More specifically, we exploit the panel dimension of the data and add control variables.

Table 14 shows the results of regressing per-capita savings on the degree of law enforcement using various specifications. In column (1), we include the regional per-capita income (*GDP*) to control for geographical differences in economic activity. The legal variable has a negative and statistically significant coefficient (at the 1% level), suggesting that individuals save more in regions where trials are shorter. As expected, the positive sign on *GDP* indicates that savings are greater in richer regions.

Because enforcement could affect saving decisions with a lag, in column (2) we use the length of trials lagged one period. The coefficient is still negative and significant (at the 1% level). To account for the possibility that residuals

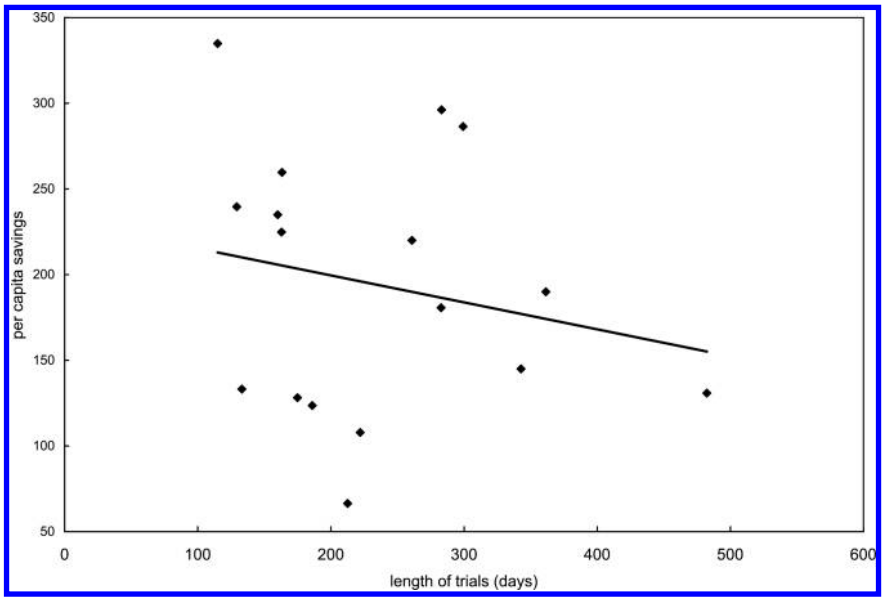

FIGURE 4. Per-capita savings and the length of trials. The figure shows the cross-sectional correlation between per-capita savings and the length of trials.

for a given region are correlated across years, in column (3) we compute robust standard errors clustered by region. The legal variable keeps the negative sign and it is statistically significant at the 5% level. The coefficient of *GDP* remains positive and statistically significant at the 1% level. Finally, in column (4), we use robust standard errors and we add year fixed-effects to control for the dependence of residuals across regions for a given year. Again, the coefficient of the legal

TABLE 14. Legal costs and savings.

	Dependent variable: Per-capita Savings			
	(1)	(2)	(3)	(4)
Legal Costs	−0.2587***		−0.2587**	−0.2675**
	(0.0604)		(0.1113)	(0.1151)
GDP	132.1716***	114.0379***	132.1716***	145.6333***
	(18.9263)	(17.5559)	(25.3478)	(26.7949)
$Legal\ Costs_{\log}$		−0.2386***		
		(0.0603)		
Adj. *R-sq*	0.4236	0.3354	0.4416	0.4977
No. of obs.	65	48	65	65

Notes: The dependent variable is regional per-capita savings. We report the coefficients obtained through ordinary least squares (OLS) and the corresponding standard errors in brackets. The variable *Legal Costs* is equal to the average length of trials concluded in days. *GDP* is the regional per-capita gross domestic product. Column (1) refers to the baseline specification. In Column (2), we use $Legal\ Costs_{lag}$, which is the average length of trials concluded in days, lagged one period. In Column (3), we compute robust standard errors clustered by region. In Column (4), we use robust standard errors and we add year fixed-effects. **Significant at 5%; ***Significant at 1%.

variable is negative and statistically significant at the 5% level and the one of *GDP* is positive and significant as in the previous specifications.

The empirical analysis of this section is very simplified, mainly because data limitations prevent a more compelling exercise. Information on savings and length of trials is available at the regional level only for a limited number of years. Moreover, we document a positive relationship between creditor protection and savings that could also be consistent with other theoretical mechanisms, as long as they feature a positive effect of legal enforcement on output. In summary, we can interpret these findings as suggestive that the mechanism implied by the model is plausible for the Spanish case.

6. Conclusion

The most original aspect of our empirical analysis is the ability to separate the effects of differences in enforcement from those of the content of laws. We exploit the variability in the length of trials across Spanish judicial districts to study the role of law enforcement on firms in a uniform legal framework. We find that in districts where civil trials are longer bank financing is more costly and firms are smaller, but there is no significant effect on leverage ratios.

We propose a theoretical explanation for our findings. We use a two-region dynamic general equilibrium model with overlapping generations, asymmetric information in credit relations and collateralized credit contracts. Assuming that the two regions differ only in the behavior of courts, we account for our empirical evidence. The dynamic general equilibrium framework is crucial. We show that improvements in law enforcement have important general equilibrium effects influencing individuals' capital accumulation. These effects are the key mechanism behind our theoretical predictions. Finally, we document a positive empirical relation between law enforcement and individual savings.

Our analysis could be extended in several directions. For example, it would be interesting to introduce external equity into the model, to study how the three sources of finance (entrepreneur's initial wealth, external equity and bank debt) vary with the degree of legal protection of creditors. Such an extension would require the introduction of shareholder protection. We plan to explore these issues in future research.

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