THE QUALITY OF THE LEGAL SYSTEM, FIRM OWNERSHIP, AND FIRM SIZE

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Abstract—We show that firm size is increasing with the quality of the legal system in Mexico. A 1-standard-deviation improvement in the quality of the legal system is associated with a 0.15–0.30 standard deviation increase in firm size. We also show that the legal system affects firm size by reducing the idiosyncratic risk faced by firm owners. The legal system has a smaller impact on partnerships and corporations than on proprietorships, where risk is concentrated in a single owner. All of the findings are robust to instrumenting for legal quality using historical conditions. By focusing on firms in a single country, the data draw attention to the importance of informal institutions.

I. Introduction

THAT institutions affect economic outcomes is now well established. In a seminal paper, Acemoglu, Johnson, and Robinson [henceforth, AJR] (2001) show that property rights institutions affect GDP per capita in a causal fashion. There is also evidence suggesting specific channels through which institutions affect economic outcomes. Acemoglu et al. (2003) show a causal channel between historical determinants of institutional quality and macroeconomic volatility, and Besley (1995) and Johnson, McMillan, and Woodruff (2002a) provide evidence on the relationship between institutions and the willingness of entrepreneurs to invest in their enterprises.

In this paper, we explore in more detail the link between the institutional environment and investment by entrepreneurs. We develop a framework in which the institutional environment affects the level of idiosyncratic risk faced by an entrepreneur investing an increasing share of his assets in a single firm. Entrepreneurs can mitigate the effect of idiosyncratic risk by diversifying ownership, that is, by incorporating and taking on equity partners. In the absence of diversified ownership, we show that lower-quality institutions limit the size of an entrepreneur's firm. The framework predicts that institutional quality will have a more limited impact where ownership is diversified.

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We take this framework to data from a census of firms in Mexico. The census data allow us to distinguish between proprietorships and firms that are incorporated.[1] We find that firms located in Mexican states with weak legal environments are smaller than those located in states with better legal environments. Moreover, consistent with the model, we find that the effect of the legal system is larger for those industries in which proprietorships make up a larger percentage of firms. Our data suggest that reduction of idiosyncratic risk is one important channel through which the quality of the institutional environment affects the investment decisions of entrepreneurs.

Does the quality of the legal system affect the efficiency of the economy through the firm size channel we identify in this paper? According to the theoretical framework developed here, the answer is yes. We present results from a translog production function that provide empirical support for an efficiency effect as well. Where a better legal system reduces idiosyncratic risk, capital is allocated more efficiently among entrepreneurs.

We deal with the endogeneity of institutions in what is now a standard manner, using instruments for institutional quality. In particular, we use differences in historical circumstances, as suggested by AJR (2001) and Engerman and Sokoloff (2002). We show that the efficiency of the legal system varies across states in Mexico in a systematic way with historical circumstances. In particular, the quality of legal institutions is lower where the indigenous population was more prevalent one hundred years ago. Consistent with the work of Engerman and Sokoloff (2002), legal-system quality is also lower in states with higher levels of activity in production of agricultural crops with high economies of scale.

Recent work on "unbundling" institutions suggests several important ways of thinking about the institutional environment that are applicable to our paper (see Acemoglu & Johnson, 2005; and Acemoglu, 2005). First, we use contemporary measures of institutional quality that are related to the narrow institutions of financial contracting. However, the quality of narrow institutions is likely to be highly correlated with broader institutional quality. The instruments we use to overcome endogeneity problems are similar to those used by AJR (2001) and Engerman and Sokoloff (2002) to describe the formation of broad institutions. We do not have instruments that allow us to unbundle broad and narrow institutions. Hence, while we describe

[1] A sole proprietorship is an unincorporated business that is owned by one individual, with no distinction between the liabilities of the firm and the personal liabilities of the owner. It is the simplest form of business organization.

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narrow institutions related to financial contracting, many of our results might also be interpreted as representing the effects of the broader institutional environment on outcomes. We return to this issue in the concluding section of the paper.

We believe our paper contributes to unbundling of institutions in a different dimension. Economic outcomes are affected by both formal and informal institutions. Formal institutions include the laws that govern economic relationships and the formal structure by which those relationships are governed—whether courts operate by civil or common law, for example. Informal institutions are well-established but unwritten norms that govern the functioning of bureaucracies, legislatures, and judiciaries. Informal institutions affect how formal laws are applied and enforced. Though formal institutions are sometimes measured directly (for example, Djankov et al., 2003; and Persson & Tabellini, 2003), informal institutions are inherently more difficult to identify. Measures of informal institutions generally must be based on impressionistic measures of institutions that conflate the formal and informal. In practice, most commonly used measures of institutions reflect a mixture of the formal and the informal.

We suggest that one method of isolating the impact of informal institutions is to examine environments in which formal institutions do not vary but informal institutions do. By using data from a single country where economic relations are governed largely by national laws, we are able to isolate differences in the quality of informal institutions. In this regard, Mexico is a particularly interesting example. Between 1929 and 1989, a single party controlled the presidency, the legislature, and every governorship and state legislature in the country. At least until 1989, then, the formal institutions governing the country and each of its federal entities were essentially the same. Since 1989, formal institutions have begun to change in modest ways,[2] but formal institutions were still very homogeneous in 1998, when the data we use were gathered. In spite of the presence of very similar formal institutions, however, the institutional environment varies markedly across states within Mexico.

Methodologically, our work is related to Kumar, Rajan, and Zingales [henceforth, KRZ] (2002), who examine the determinants of firm size across thirteen European countries. They find that more efficient legal systems are associated with larger firm sizes across countries in Western Europe, an effect especially pronounced in industries characterized by low levels of capital intensity. They posit that the reason for this is that all legal systems in Europe are of high enough quality to protect investment in physical capital. Variation among the European countries, therefore, shows up in the more challenging area of intangible assets such as intellectual property. Our paper complements KRZ (2002) in that the legal environment in Mexico varies from bad to less bad, while the legal environment in Western Europe varies from good to very good.[3] Hence, protection of more basic contracts is less certain in Mexico.

The paper is organized as follows: section II presents a simple model of the link between firm size, ownership, and the quality of the legal system, and derives testable implications of the model. Section III describes the data. Section IV presents the regression results, and section V provides concluding remarks.

II. Investment, Firm Size, and Legal Institutions

We develop a simple analytical framework based on Lucas's (1978) model determining the distribution of firm size. Our intention is not to break new theoretical ground but rather to focus ideas. We make an explicit consideration of the quality of the legal system. An increase in the quality of the legal system reduces the risk faced by entrepreneurs and lowers their required rate of return to capital. We focus on the effect of idiosyncratic risk faced by the entrepreneurs who invest an increasing share of their wealth in an enterprise. The inclusion of idiosyncratic risk generates a set of predictions about the relative impact of improvements in the legal system on proprietorships and corporations. A critical distinction between proprietorships and corporations is that in the latter, owners are able to both limit and diversify their risk through equity sharing arrangements, albeit at the cost of creating agency problems that may subject outside investors to stealing by insiders.[4] Among the firms in our data, corporations and limited partnerships represent the primary vehicle for diversifying risk. Generally, the literature equates equity investments with stock markets. However, our data are dominated by firms that are far too small to issue publicly traded equity securities.[5]

We begin by establishing a benchmark distribution of firm size in an economy with fully diversified ownership. We then consider an economy of owner-managed proprietorships in which a single owner bears all of the risk and creditors of the business can make claims on the owner's nonbusiness assets. We show that an improvement in the quality of the legal system that reduces idiosyncratic risk allows an expansion of investment by higher-ability entrepreneurs. In a perfect legal system, the distribution among proprietorships will approach that of the benchmark case of

[2] To give a couple of examples, 23 of Mexico's 32 federal entities have passed freedom of information acts since 2000, and 15 have independent tribunals to govern the careers of judges, including appointments and promotions.

[3] The rule of law as measured by the Political Risk Services group and averaged over the period 1990–1999 is 9.72 for the sample of eleven European countries in KRZ (2002), but only 4.73 for Mexico (with higher scores denoting better rule of law). Even the lowest score across countries in Europe, 7.82 for Greece, is well above the score for Mexico.

[4] There is a large literature on the agency problems in corporations and partnerships (for example, Alchian & Demsetz, 1972; Holmstrom, 1982; and Fama & Jensen, 1983).

[5] Moreover, because bank loans in Mexico are generally more than fully collateralized with real estate (see Gelos & Werner, 2002; and La Porta, Lopez-de-Silanes, & Zamarripo, 2003), debt does not alleviate idiosyncratic risk.

the incorporated economy. The framework suggests that in an economy with a mixture of corporations and proprietorships, the relationship between firm size and the quality of the legal environment will be strongest in sectors where there is a larger proportion of proprietorships.

Consider an economy composed of corporations only. Each agent can become an entrepreneur and produce output Y using capital K and labor L according to $Y = \Omega\theta K^{\alpha}L^{(\beta-\alpha)}$, where $\alpha < \beta < 1$.[6] The parameter Ω indicates the quality of the legal system, with $\Omega \in [0, 1]$; θ is a measure of the entrepreneurial talent of the agent, with $\theta \in [0, 1]$ and talent increasing in θ. Every entrepreneur faces decreasing returns to scale,[7] but higher-ability entrepreneurs produce higher levels of output both on average and at the margin.

An entrepreneur with a given talent level produces more output where the legal system is more efficient. For example, the legal system may affect the production function of a firm through the demand for products. Better legal systems may increase the demand for a given firm's output by increasing the number of available trading partners (Johnson et al., 2002b).

Each agent weighs the profit from being an entrepreneur against the endogenously determined wage rate. Given that all firms are corporations whose owners are fully diversified, we assume that all face the same interest rate, r, and pay the same wage rate, w. Each potential entrepreneur then chooses K and L according to

$$w = (\beta - \alpha)\theta\Omega K^{\alpha}L^{(\beta-\alpha-1)}, \tag{1}$$

and

$$r = \alpha\theta\Omega K^{\alpha-1}L^{(\beta-\alpha)}. \tag{2}$$

Denote the levels of labor and capital that satisfy equations (1) and (2) as $L^*(\theta)$ and $K^*(\theta)$. Then the profit for an agent from self-employment is $Y(K^*(\theta), L^*(\theta)) - wL^*(\theta) - rK^*(\theta)$. This implies that entrepreneurs with higher θ will run larger firms. Lucas (1978) shows that an equilibrium exists in which agents with the highest levels of entrepreneurial ability become entrepreneurs and the remaining agents become wage workers. In this equilibrium, the distribution of firm size depends on the distribution of entrepreneurial talent and the economy's capital-to-labor ratio.

Proposition 1: Firm size increases with the quality of the legal system, even when ownership is fully diversified.

The proof of proposition 1 is straightforward. An improvement in the legal system causes an increase in the demand for labor and capital from all entrepreneurs. This puts upward pressure on wage and rental rates, inducing entrepreneurs with low ability to leave self-employment for wage work. As a result, average firm size increases.

We now examine the equilibrium distribution of firm size in an economy where all firms are proprietorships, each of which is owned by a single agent. Investment comes from the personal wealth of the owner, invested directly or used as collateral for loans. We assume all loans are fully collateralized, consistent with bank lending markets in Mexico (La Porta et al., 2003). This is an important assumption because full collateralization implies that debt does not reduce the risk to the owner. An individual's risk can be diversified only by making equity investments in other firms, assumed away in the proprietorship economy. The owner faces unlimited liability for losses incurred operating the business. The production function and the distribution of entrepreneurial talent are as before. All agents earn the same rate of return on capital invested without risk outside the business. However, the risk premium required for capital invested in the business, denoted as ρ, is increasing in the level of investment for all levels of capital investment, $\rho \geq 1$ and $\rho_K > 0$. A better legal system provides a more certain operating environment and allows firms to protect profits from bureaucrats with kleptocratic tendencies.[8] Hence, idiosyncratic risk is a decreasing function of the quality of legal enforcement. The legal system now not only enters the production function directly, but also impacts investments by reducing the idiosyncratic risks faced by this entrepreneur. We assume that all agents have similar aversion to idiosyncratic risk, and that the distribution of wealth and entrepreneurial ability are uncorrelated.

Proposition 2: The positive impact of the quality of the legal system on firm size is greater for proprietorships, where idiosyncratic risk plays a larger role, than for corporations.

Again, the proof is straightforward. As before, maximizing agents choose labor according to equation (1), but the cost of capital now includes a return to idiosyncratic risk, so optimal investment is now

$$r = \frac{\alpha\theta\Omega K^{\alpha-1}L^{(\beta-\alpha)}}{\rho(K, \Omega)}. \tag{3}$$

The effect of idiosyncratic risk on the distribution of firm sizes can be seen by comparing the impact of an increase in θ on the level of capital (and labor) demanded by a single firm in equations (2) and (3). For equation (2), $\partial^2 Y/\partial K\partial\theta$ is $\alpha\ \Omega\ K^{\alpha-1}L^{(\beta-\alpha)}$; for equation (3), the same cross partial adjusted for idiosyncratic risk is $\dfrac{\alpha\Omega K^{\alpha-1}L^{(\beta-\alpha)}}{\rho(K, \Omega)}$. Since K is

[6] Kihlstrom and Laffont (1979) develop a similar model in which it is the degree of risk aversion rather than entrepreneurial talent that determines whether individuals become entrepreneurs or workers.

[7] Alternatively, we could write the production function as $Y = \Omega K^{(\alpha\theta)}L^{(1-\alpha)\theta}$, in which the scale factor is a function of entrepreneurial ability. This produces identical predictions with additional complexity.

[8] There is ample evidence that an improvement in the legal protection of property positively affects investment. See, among others, Besley (1995), Johnson et al. (2002a), Claessens and Laeven (2003), and Banerjee and Iyer (2005).

increasing in θ, the latter is smaller, indicating that a change in entrepreneurial ability is associated with a smaller increase in capital employed. Hence, an increase in entrepreneurial ability is associated with a smaller increase in the size of the firm when idiosyncratic risk is incorporated.

The consideration of idiosyncratic risk reduces the average firm size through an indirect route as well. The reduction in investment by the most able entrepreneurs will result in lower market wage rates. This will induce additional entry into self-employment. The new entrants will have lower entrepreneurial ability than the marginal entrant in the economy without idiosyncratic risk, and hence will employ less capital and labor than the previous marginal entrant. An improvement in the legal system also reduces idiosyncratic risk where the latter is not eliminated through dispersed ownership. This results in an additional increase in firm size wherever proprietorships are important.

The quality of the legal system may also affect the distribution of legal forms. However:

Proposition 3: The effect of the quality of the legal system on the ratio of proprietorships to corporations is theoretically ambiguous.

The proof is straightforward. An improvement in the legal system reduces the cost of moving to the corporate form of organization by reducing the cost of finding outside partners. It also directly increases the benefits of incorporation by increasing the demand for the firm's goods. However, since an improvement in the legal system also reduces idiosyncratic risk among proprietors, it reduces the benefits of incorporation and increases the size of existing proprietorships. If the latter effect outweighs the former, an improvement in the quality of the legal system could result in an increase in proprietorships relative to corporations.

We provide empirical evidence in support of propositions 1 to 3 in section IV.

III. Data

Our data on firm investment and employment come from the Mexican economic census of 1998 carried out by Instituto Nacional de Estadística Geografía e Informática (INEGI). The data are given in reference to December 31, 1998. The economic census covers the manufacturing, commerce, services, and construction sectors. Data are gathered for every location of each firm in Mexico, but INEGI does not make the firm-level data available. Instead, the data were provided to us at the two-digit industry level, by state and by employment size. There are as many as twelve size bins in each state/industry.[9]

The data have two important limitations. First, the bins are derived from plant-level data. Both our framework and most of the theories explaining firm size distributions refer to enterprise-level data rather than plant data. We have no way to aggregate the data at the enterprise level. Instead, INEGI provided us data by industry/state bin for the sample of domestically owned firms that operate from a single location within Mexico. For most of the analysis, we limit the sample to these firms for whom the data represent both the plant and enterprise level. Foreign-owned firms are excluded because they are quite likely to have operations outside of Mexico, and they may have access to courts in other countries that operate in a different institutional environment. Even if we could aggregate the data to the firm level, it is not clear what measure of institutional quality would be appropriate for a firm operating in multiple states. Firms with multiple plants located in different states are likely to use courts in different states depending on where disputes arise.[10] We will show, however, that the results we report below are robust to including the foreign-owned and multiplant firms.

The second issue is that the data are organized according to the number of workers, while the theoretical framework is based on the level of capital stock. This should not be a major concern because there is a strong correlation between labor and capital in the data.[11] The median level of invested capital increases monotonically with the bin size measured by employment.

In our standard regression specification, we exclude several industries that are dominated by government-owned firms: oil and gas extraction, coal mining, water and electricity, and education and medical services. We also exclude the fishing industry, both because the industry remains dominated by cooperatives established with significant government assistance and because the regional location of fishing is determined by geography. Finally, the census data do not include firms involved in agricultural production, though agricultural processing firms are included. There are 32 states and 24 two-digit sectors, resulting in 768 potential state/sector data points. Since some states have no employment in some sectors, we have about 700 observations for most of the regressions.

We begin by benchmarking the Mexican data to data on firm-size distribution from the 1997 U.S economic census. Average firm size in Mexico is much smaller than in the United States. While more than 96% of firms in Mexico employ 10 employees or fewer, only about 78% in the United States do so. As a percentage of the total firms, the number of large firms with more than 500 employees is about eight times larger in the United States than in Mexico.

[9] These are 0–2 workers, 3–5 workers, 6–10 workers, 11–15 workers, 16–20 workers, 21–30 workers, 31–50 workers, 51–100 workers, 101–250 workers, 251–500 workers, 501–1,000 workers, and 1,001 or more workers. So, for example, an observation is the number of firms employing 6–10 workers in the textile industry located in the state of Jalisco.

[10] The single-plant firms in our data are generally forced to use the courts in the state where the firm is located.

[11] The correlation between number of workers and fixed assets at the bin level is 0.48 and statistically significant at the 1% level. The data show that invested capital is strictly increasing in the number of workers.

TABLE 1.—FIRM SIZE, QUALITY OF LEGAL SYSTEM, INDIGENOUS POPULATION, AND CROPS BY STATE

State	Average Firm Size	Weighted Average Size	Typical Firm Size	Share of Small Firms	Judicial Efficiency	Judicial Factor	Private Credit	Indigenous	Crops
Aguascalientes	4.12	142.04	2.03	0.56	4.59	2.88	0.13	0.00	0
Baja California	5.44	279.33	2.92	0.52	3.14	0.74	0.10	0.02	1
Baja California Sur	4.24	68.87	2.14	0.64	2.53	−0.62	0.05	0.02	1
Campeche	3.56	210.16	2.06	0.65	3.21	0.17	0.03	0.42	0
Chiapas	2.38	97.67	1.29	0.79	2.97	−0.24	0.06	0.36	2
Chihuahua	4.19	189.12	2.05	0.59	2.71	−0.43	0.08	0.07	1
Coahuila	4.64	192.82	2.92	0.51	3.40	1.03	0.09	0.00	1
Colima	3.40	74.34	1.31	0.71	3.14	0.08	0.07	0.00	2
Distrito Federal	5.34	578.83	3.31	0.48	2.53	0.15	0.67	0.02	0
Durango	3.81	171.11	2.04	0.57	3.34	0.85	0.06	0.01	1
Guanajuato	3.67	150.14	2.04	0.61	3.03	0.07	0.10	0.01	1
Guerrero	2.63	112.09	1.28	0.74	1.69	−1.80	0.03	0.25	4
Hidalgo	3.00	120.39	1.28	0.64	2.11	−0.15	0.04	0.29	2
Jalisco	3.98	227.97	2.04	0.61	2.39	0.40	0.15	0.00	3
México	3.19	202.60	2.04	0.60	3.20	1.02	0.07	0.13	1
Michoacán	2.67	84.57	1.28	0.77	1.94	−1.34	0.07	0.05	3
Morelos	2.73	63.96	1.29	0.72	3.27	0.64	0.07	0.17	2
Nayarit	2.81	185.78	1.28	0.73	2.49	−1.14	0.04	0.03	4
Nuevo León	5.55	296.17	3.24	0.48	3.00	0.47	0.26	0.00	2
Oaxaca	2.19	79.16	1.28	0.81	2.64	0.15	0.02	0.52	3
Puebla	2.90	106.70	1.28	0.66	2.54	0.37	0.10	0.32	3
Querétaro	4.40	177.03	2.91	0.51	3.24	0.07	0.08	0.10	0
Quintana Roo	4.45	108.86	2.05	0.59	2.46	−1.02	0.10	0.69	0
San Luis Potosí	3.30	138.52	2.06	0.63	2.84	−0.15	0.08	0.06	2
Sinaloa	3.80	147.40	2.06	0.64	2.67	−0.19	0.19	0.03	2
Sonora	3.93	189.57	2.04	0.62	3.06	0.52	0.18	0.12	2
Tabasco	3.62	248.38	2.05	0.61	3.11	0.89	0.09	0.09	3
Tamaulipas	3.82	210.08	2.04	0.59	3.01	1.38	0.06	0.00	2
Tlaxcala	2.61	57.56	1.27	0.68	2.19	−0.88	0.04	0.16	0
Veracruz	2.83	253.56	1.28	0.71	2.20	−1.49	0.06	0.20	4
Yucatán	3.46	272.85	2.05	0.62	2.03	−1.77	0.12	0.69	0
Zacatecas	2.42	65.03	1.28	0.79	2.26	−1.50	0.04	0.00	1
Total	3.60	172.79	1.93	0.64	2.78	−0.02	0.10	0.15	2

Average size is the unweighted average firm size in terms of workers. Weighted average size is the employee-weighted average of average firm size in each of the bins. Typical firm size is the logarithm of the average firm size in the bin where the median worker is located. Share of small firms is the share of employment in firms with 0–20 employees. Judicial efficiency is based on 1998 survey data from ITAM/GMA and is measured as the average of seven individual indicators. Judicial efficiency factor is the first principal component of the seven judicial efficiency indicators. Private credit is private credit to GDP in 2000. Indigenous is the share of the indigenous population in 1900. Crops is the number of cultivated crops with large economies of scale (sugar, coffee, rice, and cotton) in 1939, from the 1940 census. All firm size figures exclude firms with multiple establishments and firms with foreign ownership. Data on firm size distribution, private credit, indigenous population, and crops are from INEGI. More detailed definitions of the alternative size variables can be found in the main text.

The numbers confirm Tybout's (2000) observation that employment in developing countries (such as Mexico) is disproportionately concentrated in very small firms.

Comparing the distribution of employment by legal form of organization in Mexico and the United States, we find that in Mexico a much larger share of employment is concentrated in single proprietorships (38% versus 6% in the United States). Because the majority of proprietorships are smaller firms, this is consistent with the previous finding.

Table 1 shows Mexican state-level data for several different measures of firm size, all of which are highly correlated. The firm-size measures are based on data for single-location, domestically owned firms only.[12] The first column shows the simple average firm size, calculated as the sum of employees and contract employees[13] divided by the number of units reported in the census. For Mexico as a whole, there is an average of 13.6 employees per unit reporting in the census. The simple average number of employees per firm can be misleading because the average may be brought down by a large number of very small firms.[14] We thus consider several alternative firm-size measures. We will find that our basic results are robust to any of these definitions.

Davis and Henrekson (1997) and KRZ (2002) suggest an alternative calculation of firm size that weights each bin by the number of employees in that bin. This employee-weighted firm size is given by

$$\sum_{bin=1}^{n} \left(\frac{N_{bin}^{emp}}{N_{sec}^{emp}} \right) \times \left(\frac{N_{bin}^{emp}}{N_{bin}^{estab}} \right),$$

[12] The share of multiplant or foreign-owned firms in total employment ranges from as low as 11% in Nuevo Leon to as high as 52% in Chihuahua. On average, about 24% of employees are employed by multiplant firms with foreign ownership. These employees are concentrated in the large firms.

[13] In order to avoid labor laws requiring firms to share profits with employees, firms sometimes establish independent entities that exist only to hire workers for the firm. These workers are reported as contract employees.

[14] For example, the average size of firms in an industry in which a single firm hires 10,000 employees and nine firms hire one employee each is roughly 1,000. If the same industry instead had 99 firms hiring one employee each, the average firm size would be roughly 100. But in the sense of most theories of firm size, these two industries are not as different as is indicated by the difference in simple average firm size.

where N_{bin}^{emp} is the total number of employees reported in the given bin, N_{sec}^{emp} is the total number of employees in the sector, and N_{bin}^{estab} is the number of establishments in the bin. This alternative measure of average firm size places more weight on larger firms, and hence dampens the impact of a large number of very small firms. The second column of table 1 shows the employee-weighted average firm size. Indeed, this produces a significantly larger average firm size. For Mexico as a whole, the average firm size is now just over 1,100 employees.[15] Finally, the third column of table 1 shows the percentage of employment found in firms with fewer than 20 workers. Across states within Mexico, there is considerable variation in firm size by any of these three measures. For example, the employee weighted average firm size ranges from 275 in the state of Zacatecas to more than 5,000 in the Federal District.

The second major component of our data is the quality of legal institutions. These come from a survey conducted in 1998 under the direction of the Center for the Study of Law at the Instituto Tecnológico Autónomo de México (ITAM/GMA 1999).[16] The ITAM project focused on collection of bank debt through local courts in each of Mexico's 32 federal entities. Bank debt was chosen as the focus of the ITAM/GMA study because banks are centralized but must collect debts in the location of the debtor; that is, they must operate in the courts of each state. From our perspective, the focus of the study on the legal enforcement of financial contracts is fortunate because it fits closely with our model. The data gathered come from interviews with a total of 519 lawyers working for banks directly and as outside counsel (ITAM/GMA, 1999, p. 32).

The relevant commercial laws are national in scope, with only minor variation across states. McNeece and Poelstra (2003), for example, note that "Mexican civil codes [vary] from state to state, though most are based on the Federal Civil Code" (p. 5). The more important variation across states comes from the effect that state laws and state legal enforcement have on the application of law by courts and the ability of claimants to enforce verdicts. State laws vary, for example, on the ease with which collateral can be claimed by a victor in a court decision. We construct a measure of the efficiency of legal enforcement in each state by taking an average of the responses to seven different questions. Each of these questions reflects the judgment of lawyers in the survey, and each is scaled from 1 (worst) to 5 (best). The questions relate to the following: (i) the quality of judges (mean value 3.76); (ii) the impartiality of judges (1.94),[17] (iii) the adequacy of judicial resources (1.88); (iv) the efficiency of enforcement of rulings (2.71); (v) the efficiency of the judicial administration more generally (2.69); (vi) the cost, ease of use, and completeness of property registries (3.33); and (viii) the adequacy of local legislation related to contract enforcement (3.14). The index is shown in the fifth column of table 1, and a graphical presentation of the index across Mexican states is shown in figure 1.

The data point to rather substantial differences in state-level judicial efficiency (varying from a score of 1.69 to 4.59 on a scale from 1 to 5), suggesting that despite the same legal origin and formal laws in each state, stark differences exist in the practice and enforcement of the law across states.[18] While there is some pattern of legal institutions improving as we move north in Mexico, figure 1 makes clear that geography alone does not explain the variation in judicial effectiveness. We return to this issue later when we address concerns with endogeneity between judicial effectiveness and firm size.[19] The fifth column of table 1 shows the first principal component from a factor analysis of the seven measures of judicial efficiency.

The other columns of table 1 show our indicator of financial development by state and our two historical instruments. Financial market development is a more concrete output measure that is determined in part by the ability to write and enforce financial contracts. We use it as a robustness check for the legal quality results. Financial market development is proxied by the ratio of private credit to GDP. These data are the best available measure of access to finance.[20] However, these data have two limitations. First, a

[15] Both the simple average firm size and the weighted average firm size in Mexico are close to the average in the median European country reported by KRZ (2002).

[16] The survey was conducted again in 2001 (Sarre and López Ugalde, 2002). Using the average of the two surveys rather than just the 1998 survey produces somewhat stronger results in most of the regressions that we report in the next section.

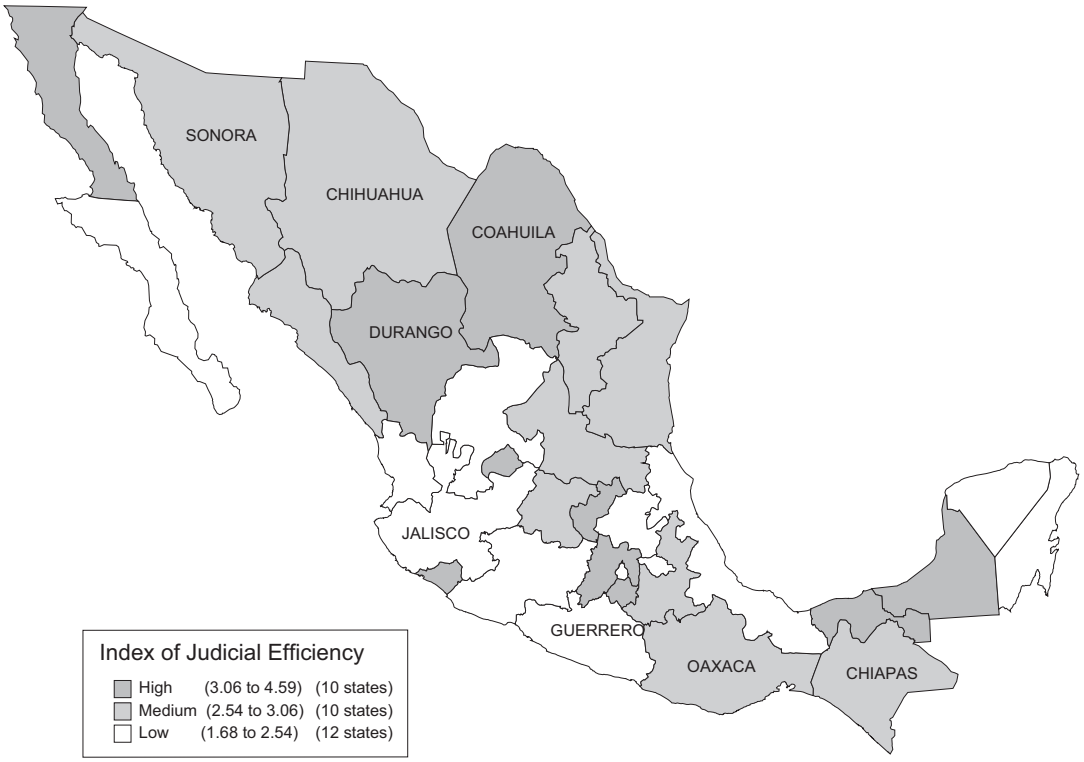
[17] Since the survey was administered to lawyers who generally work for banks, it could be that a high rating on "impartiality" actually reflects a bias in favor of the banks. Given Levine's (1998) finding that rules favoring creditors are associated with higher levels of financial development, we do not see this as a great concern.

[18] Figure 1 shows that judicial efficiency tends to be higher in the northern and central states of Mexico, as well as in some of the southern states. The states in the western and eastern parts of Mexico tend to score low on the judicial effectiveness scale. Aguascalientes has the highest score (4.59) and Guerrero, the lowest (1.69).

[19] Other researchers have noted variation in both the organization and effectiveness of courts across states in Mexico. Cantú and Caballero (2002) show that courts in Mexico differ organizationally in several regards. Negrón Ruiz (2003) discusses the establishment of state judicial councils, which reinforce the independence of the judiciary, in 15 of Mexico's 32 federal entities (see Fix-Fierro, 2003, for a discussion of the importance of the judicial councils). At the state level, many of these characteristics are correlated with the measure of effectiveness we use here. For example, courts in states that provide more information about court cases are more efficient, as are courts in states in which selection and promotion of judges is carried out in a more autonomous fashion.

[20] We cannot use a more direct measure of firm debt finance because the 1998 census shows only data on the total interest expense of firms; there are no data on total debt. Interest payments are an imperfect measure of access to finance, and may be jointly determined with the measures of firm size which are our primary focus. Furthermore, interest rates paid by firms are likely to vary across states, industries, and firms of different sizes.

FIGURE 1.—JUDICIAL EFFICIENT BY MEXICAN STATE



substantial part of bank lending taking place outside Mexico City is attributed to the Federal District, due to internal reporting procedures at Mexican banks. As a result, credit figures from banks overstate bank activity in the Federal District and understate bank activity in other states. We therefore check that the regression results where we include private credit to GDP are robust to excluding the observations from the Federal District. Second, as mentioned before, previous research has shown that financial market development itself is a function of the efficiency of the legal system (Levine, 1998).

Neither judicial efficiency nor financial market development can be considered exogenous to economic outcomes such as investment and firm size. We address the endogeneity issue by using instruments. The cross-country literature suggests two instruments that are relevant in the Mexican context. Following AJR (2002) and Acemoglu and Johnson (2005), we use historical data on the share of indigenous-speaking people in a given state in 1900. Where the share of indigenous population was higher, European settlers were more likely to develop institutions designed to exploit local labor. In the context of Mexico, the *encomienda* system imported by the Spanish treated indigenous labor as a resource to be used by the immigrant Europeans (Gibson, 1966). Hence, the presence of a larger share of indigenous people might be expected to be associated with a worse institutional environment. The 1900 data are the earliest measure of indigenous population available to us at the state level.[21]

Engerman and Sokoloff (2002) suggest a related instrument. They note that some agricultural crops have higher production economies of scale than others. In particular, they identify sugar, coffee, rice, and cotton as crops with large economies of scale. Where production of these crops is prevalent, the distribution of land and income is likely to be more unequal. Engerman and Sokoloff show that this inequality is reflected in political institutions (for example, the universality of the right to vote in elections). Using data from the 1940 census of agriculture (the first with detailed state-level production data), we identify the number of these four crops produced in each of Mexico's 32 federal entities. This second instrument picks up geographic and climatological differences that may be reflected in regional differences in the quality of institutions. The correlation between the two instruments is quite low (0.05), and when used together the two instruments pass standard overidentification tests. As we discuss below, both explain a significant share of the state-level variation in institutional quality.

[21] The states of Quintana Roo and Baja California Sur were created after 1900, carved out of Yucatán and Baja California, respectively. For these states, we use data from the 1930 census, the first census after they became states.

TABLE 2.—LEGAL FORMS OF ORGANIZATION BY SECTOR IN MEXICO

Sector	Sector Code	Incorporation Intensity
Mining of metals	23	0.60
Mining of nonmetals	29	0.19
Food, beverages, and tobacco	31	0.04
Textiles and leather	32	0.11
Lumber products	33	0.05
Paper products and printing	34	0.20
Chemicals, pharmaceuticals, and plastics	35	0.49
Ceramics, glass, and clay	36	0.04
Basic metals	37	0.78
Metal products and equipment	38	0.13
Other manufacturing	39	0.08
Construction	50	0.76
Wholesale	61	0.27
Retail	62	0.03
Transport	71	0.12
Communications	72	0.19
Real estate	82	0.29
Leasing	83	0.09
Restaurants and hotels	93	0.04
Recreation	94	0.08
Professional services	95	0.09
Repair and maintenance	96	0.03
Other services	97	0.40
Total		0.20

This table shows the importance of legal persons with limited liability versus physical persons with unlimited liability by industrial sector for Mexico. Incorporation intensity is the share of legal persons with limited liability in the total number of firms. The category of legal persons with limited liability includes *sociedades anonimas* (SAs) and *sociedades de responsabilidad limitada* (SRLs). The total number of firms includes individual proprietorships. We exclude other types of legal forms from these total figures.

To explore the differential effect of the quality of the legal system on firms with differences in the degree of idiosyncratic risk, we construct a variable measuring the number of firms with limited liability and multiple owners as a percentage of all firms in a particular industry. We will refer to this variable as the incorporation-intensity measure. The category of firms with limited liability includes *sociedades anonimas* (SAs) and *sociedades de responsabilidad limitada* (SRLs). For simplicity, we refer to these as the corporate legal form, though they include limited partnerships as well. The total number of firms includes these as well as individual proprietorships. We exclude other types of legal forms from these total figures. We also report the share of employment in firms with limited liability and multiple owners.

Table 2 shows the incorporation intensity by industry. A lower number indicates that proprietorships are a more typical legal form of organization in the given industry. The corporate form tends to be more common in the mining and manufacturing industries, while businesses with unlimited liability are common in the services and retail sectors.

Our regressions also control for the effect of market size, measured as the log of population in the state. In robustness checks, we include measures of GDP per capita and education levels in the states. These are not included in the base regressions, because they are themselves endogenous to institutional quality. The data on these variables are from INEGI.

The three firm-size measures are highly correlated and most of the correlations between firm size and judicial efficiency or financial market development are significant as well. The exception is that weighted average firm size is not correlated with judicial efficiency. Judicial efficiency is also not significantly correlated with financial market development. The direction of causation of correlations between judicial effectiveness and economic performance is, of course, not clear. This is an issue we will address in the empirical work below.

IV. Empirical Results

Across industries, the variation in the size of firms is consistent with well-established patterns (see the discussion in KRZ, 2002). Average firm size is positively associated with capital intensity (measured as fixed assets per worker) and with wage levels. We are more interested in regional variation in the size of firms, and we will use information on how institutional variables differ among states to investigate this.

The model predicts that state-level variation in legal efficiency has a positive impact on average firm size (proposition 1). We test this prediction by aggregating all firm-size classes at the sectoral level in each state, and by running regressions using the log of the employee-weighted firm size at the state/industry level as the dependent variable. The regression model is as follows:

$$Size_{ij} = \alpha_i + \beta B_j + \gamma \Gamma_{ij} + \varepsilon_{ij},$$

where $Size_{ij}$ is a measure of average firm size of industry i in state j, α_i is an industry fixed effect, B_j is a vector of state-level variables, Γ_{ij} is a vector of variables that vary by industry and state, and ε_{ij} is the error term. As state-level variables we include a measure of market size and a measure of legal institutions. All regressions include sector-level fixed effects. The regressions, reported in table 3, have 699 observations across 32 states and 24 industries. Not all industries are represented in each state. Although the regressions are based on state-/industry-level data, the institutional variables vary only at the state level.

The first column of table 3 reports an OLS regression for the above model, using the log of weighted average firm size as the dependent variable, and with errors corrected for clustering at the state level.[22] Market size as measured by the log of population has a very strong and positive effect on firm size. A 1-standard-deviation increase in log population (0.8) is associated with a 0.27-standard-deviation increase in the weighted average size of firms. A 1-standard-deviation increase in judicial effectiveness (0.56) increases the weighted firm size by one-sixth of a standard deviation.

[22] Random-effects regressions with random effects at the state level produce very similar results.

TABLE 3.—CROSS-STATE DETERMINANTS OF FIRM SIZE DISTRIBUTION

	(1)	(2)	(3)	(4)
	OLS	IV	IV	IV
Market size	0.501*** (0.091)	0.591*** (0.140)	0.591*** (0.140)	0.595*** (0.134)
Judicial efficiency	0.420*** (0.097)	0.981* (0.506)	1.137*** (0.419)	0.757** (0.301)
R-squared	0.51	0.47	0.45	0.51
States	32	32	32	32
Observations	699	699	699	699
First Stage: Judicial Efficiency				
Market size		−0.115 (0.127)	−0.042 (0.113)	0.013 (0.186)
Indigenous population		−0.150** (0.070)	−0.145** (0.069)	−0.169** (0.079)
Crops			−0.149* (0.077)	−0.185* (0.100)
Geographical controls	No	No	No	Yes
Hansen overidentification test (*p*-value)			0.63	0.63
F-test of identifying instruments		0.03	0.03	0.03
Partial *R*-squared		0.15	0.25	−0.22
R-squared		0.17	0.27	0.29
Observations		32	32	32

The dependent variable is the logarithm of the weighted average firm size. All regressions are at the state/industry level. Columns 2 to 4 report instrumental variable (IV) regressions. As instruments we use the log of the share of the indigenous population in 1900 and the number of cultivated crops with large economies of scale (sugar, coffee, rice, and cotton) in 1939. In column 4 we add variables measuring state-level average rainfall and temperature, both measured over the 1925–34 period, and the percentage of land that is tropical (as opposed to temperate or arid). We report the first stage for the IV regressions in the lower part of the table. We exclude the electricity, water, oil and gas extraction, coal mining, fishing, and medical and educational services industries and observations based on fewer than three firms. Regressions include the logarithm of total population in a state as a measure of the size of the market. Judicial efficiency is based on survey data from ITAM/GMA at year-end 1998 and is measured as the average of seven individual indicators (on a scale from 0 5): perceived quality of judges; perceived impartiality of judges; adequacy of resources for materials; efficiency in the enforcement of resolutions; efficiency of public ministry of justice; efficiency of public registry of real estate property; and adequacy of local legislation for the enforcement of contracts. A higher score indicates more efficiency. Industry fixed effects are included, but not reported. Standard errors are reported in parentheses and are corrected for potential dependence of observations within states (clusters). We also report the *p*-value of an *F*-test of the identifying instruments, the partial *R*-squared of the identifying instruments, and the *p*-value of the Hansen overidentification test of all instruments. *, **, *** denotes significance at 10%, 5%, and 1%, respectively.

We get similar results when not controlling for market size, although the statistical significance of judicial efficiency is somewhat reduced.

Column 2 of table 3 repeats the regression, instrumenting for judicial efficiency with the share of indigenous population in 1900. The first-stage regression is reported at the bottom of the table. The instrument is significant and explains 15% of the variation in the judicial efficiency measure. Instrumented judicial efficiency remains highly statistically significant. The measured coefficient is about two times larger than the OLS estimate.

Column 3 of table 3 repeats the regression using two instruments for judicial efficiency: the share of indigenous population in 1900 and the production of crops that have large economies of scale in 1939. The instruments are both significant and explain 25% of the variation in the judicial efficiency measure. The instruments pass a standard test of overidentification, indicated by the Hansen statistic. Instrumented judicial efficiency remains highly statistically significant.

The overidentification test provides some confirmation of the validity of the instruments. Nevertheless, some concern with exclusion restrictions remains. In particular, the prevalence of crops with large economies of scale may be the result of geographical and climatological factors that affect both crop choice and economies of scale in production more generally. We do find that geographical variables are associated with the prevalence of large-scale-economy crops. Average rainfall and temperature, both measured from 1925 to 1934, and the proportion of land area classified as tropical are all significantly associated with the prevalence of large-scale-economy crops.[23] Together, they explain about a quarter of the cross-state variance in both crops with large economies of scale and historical indigenous population. In column 4 of table 3 we report the first-and second-stage regressions with these variables added as additional regressors in the IV regression. None of the geographical controls are significant in either the first or the second stage. The instruments remain significant in the first-stage regression, and instrumented judicial efficiency remains significant almost at the 1% level in the second stage, with a coefficient smaller than the IV regression without geographical controls.

One might also be concerned that historical and current indigenous population shares are correlated, and that current indigenous share is related to firm size directly. The former is the case. The correlation between indigenous share in 1900 and indigenous share in 2000 is 0.90. However, when we include indigenous share in 2000 as an additional regressor, judicial efficiency remains significant at the 10% level. Moreover, if we use only crops with large economies of scale as an instrument, and include either historical or current indigenous share as a regressor, neither measure of indigenous share is associated with firm size, and judicial efficiency (instrumented only with large-scale-economy crops) is significant at the 5% level. Given the compelling arguments for a connection between indigenous population and institutional development made by AJR (2001) and Acemoglu and Johnson (2005), and the lack of evidence that

[23] The source of the geographical data is INEGI.

TABLE 4.—ALTERNATIVE SIZE MEASURES, ALTERNATIVE INSTITUTIONAL MEASURES, AND ALTERNATIVE SAMPLES

	(1) Average Firm Size	(2) Typical Firm Size	(3) Share of Small Firms	(4) Invested Capital	(5) Judicial Factor	(6) Private Credit	(7) GDP and Education	(8) All Firms	(9) All Sectors	(10) All Bins
Market size	0.216**	0.388**	−0.066**	0.992***	0.396***	0.126	0.519***	0.621***	0.545***	0.585***
	(0.100)	(0.172)	(0.028)	(0.206)	(0.125)	(0.114)	(0.064)	(0.147)	(0.138)	(0.142)
Judicial efficiency	0.746**	1.345**	−0.227***	1.604**			0.514**	1.060**	1.039***	1.158***
	(0.302)	(0.535)	(0.082)	(0.658)			(0.209)	(0.419)	(0.390)	(0.416)
Judicial factor					0.619***					
					(0.235)					
Private credit						5.967**				
						(2.923)				
Per capita income							0.236			
							(0.265)			
Schooling							2.043*			
							(1.094)			
Hansen test (*p*-value)	0.67	0.56	0.59	0.23	0.36	0.71	0.42	0.30	0.20	0.27
R-squared	0.64	0.45	0.52	0.33	0.46	0.45	0.55	0.44	0.49	0.44
States	32	32	32	32	32	32	32	32	32	32
Observations	699	699	699	699	699	699	699	699	799	706

This table reports instrumental variables (IV) regressions. The dependent variable is the logarithm of the weighted average firm size, unless otherwise noted. As instruments for judicial efficiency we use the log of the share of the indigenous population in 1900 and the number of cultivated crops with large economies of scale (sugar, coffee, rice, and cotton) in 1939. We exclude the electricity, water, oil and gas extraction, coal mining, fishing, and medical and educational services industries. We exclude observations based on fewer than three firms. Industry fixed effects are included in the regressions, but not reported. The dependent variable in regression (1) is the logarithm of unweighted average firm size in terms of workers. The dependent variable in regression (2) is the logarithm of the average firm size in the bin where the median worker is located, referred to as the "typical" firm size. The dependent variable in regression (3) is the share of workers in firms with fewer than 20 employees. The dependent variable in regression (4) is average firm size weighted by the level of invested capital stock. In regression (5) we use the first principal component of the seven judicial efficiency indicators rather than the composite measure of judicial efficiency. In regression (6) we use state-level private credit to GDP rather than judicial efficiency. Data on private credit are from INEGI. In regression (7) we control for state-level log per capita income and education. Schooling is the share of population in each state aged fifteen years and over with at least nine years of schooling education in 1990. The dependent variable in regression (8) is calculated for all firms (including foreign-owned and multiplant firms). In regression (9) we include all industries (including government sectors). In regression (10) we include observations based on fewer than three firms. Market size is the logarithm of state population. Standard errors are corrected for potential dependence of observations within states (clusters). We also report the *p*-value of an *F*-test of the identifying instruments and the *p*-value of the Hansen overidentification test of all instruments. *, **, *** denotes significance at 10%, 5%, and 1%, respectively.

indigenous share and firm size are directly related, we use both instruments in the remaining regressions. The robustness of the results to various instrumenting strategies and controls is, however, reassuring.

Table 4 presents results from alternative measures of firm size, alternative measures of institutions, and several alternative samples. All regressions are estimated using an IV approach with the share of indigenous population in 1900 and the production of crops with large economies of scale in 1939 as instruments for judicial efficiency.[24] Looking at the alternative definitions of firm size first, the results are very similar if we use the simple unweighted average firm size (column 1). We also obtain similar (somewhat stronger) results when we define the state/industry firm size as being the size bin that includes the median worker. We refer to this as the "typical" firm size (column 2). We find similarly significant results if we regress the share of workers in the state/sector working in firms with fewer than 20 workers (column 3). Note that the coefficient on judicial efficiency is negative in this case, indicating that better legal systems are associated with a smaller percentage of the workers being employed in small firms. Indeed, the results are robust to using a cutoff of 10, 50, 100, or 250 workers instead of 20 workers to define small firms. In column 4, we use the log of weighted average firm size in terms of invested capital levels rather than employees as the dependent variable, and again find similar results.

Columns 5 and 6 repeat the regression in column 3 of table 3, using alternative measures of institutional quality. In column 5, we use the first principal component of the seven judicial efficiency questions as an alternative measure of institutions. The standard deviation of the factor is about 80% larger than the standard deviation of the straight average, so the results are quite similar, both in magnitude and significance. In column 6, we replace judicial efficiency with a standard measure of financial market development, the ratio of private credit to GDP. The financial development measure is based on more concrete data than our survey-based measure of judicial efficiency, and thus may be a more palatable indication of financial contracting for those concerned with subjective measures. We want to stress, however, that the financial development measure is based on debt, while the financial contracts most relevant in our model are ownership contracts. The results are similar, consistent with the notion that financial market development itself is a function of the efficiency of the legal system. The ratio of private credit to GDP has a standard deviation of about 10%, suggesting that a 1-standard-deviation increase in credit is associated with an increase of about 0.36 of a standard deviation in firm size. This is comparable to the level effect of judicial efficiency in the IV regressions.[25,26]

Column 7 adds the level of per capita income in the state and the percentage of the population aged fifteen and older with at least nine years of schooling. These are excluded from the base regressions because they are likely to be

[24] We obtain similar results in all regressions when using OLS with clustering at the state level instead.

[25] We obtain very similar results when using the number of bank branches per capita in the state as measure of financial development. We obtain data on bank branches per capita in 2000 from INEGI.

[26] The IV regressions in columns 5 and 6 pass the standard identification tests, such as the *F*-test of identifying instruments and the Hansen overidentifying test.

TABLE 5.—FIRM SIZE DISTRIBUTION, QUALITY OF THE LEGAL SYSTEM, AND NATURAL PROPENSITY TO INCORPORATE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS with Clustering	OLS with State Fixed Effects	IV with State Fixed Effects	OLS with Clustering	OLS with State Fixed Effects	IV with State Fixed Effects	IV: Organizational Form
				Controlling for Other Channels			
Market size	0.501***			0.502***			0.024
	(0.091)			(0.091)			(0.023)
Judicial efficiency	0.572***			1.346*			0.126**
	(0.127)			(0.707)			(0.060)
Judicial efficiency × Incorporation intensity	−0.798**	−0.863***	−1.713***	−0.759**	−0.810***	−1.631**	
	(0.299)	(0.312)	(0.632)	(0.284)	(0.291)	(0.656)	
Judicial efficiency × Vertical integration				−0.172	−0.145	−0.812	
				(0.456)	(0.471)	(0.806)	
Judicial efficiency × Capital intensity				−0.059	−0.068	−0.174	
				(0.059)	(0.062)	(0.174)	
F-test of overidentifying restrictions			0.00			0.00	0.03
Hansen overidentification test (*p*-value)			0.44			0.80	0.72
R-squared	0.52	0.60	0.59	0.52	0.60	0.59	0.66
States	32	32	32	32	32	32	32
Observations	699	699	699	699	699	699	667

The dependent variable in regressions (1) to (6) is the weighted average firm size. The dependent variable in regression (7) is the ratio of corporations to proprietorships at the industry/state level. Incorporation intensity is the ratio of corporations to proprietorships at the industry level. Vertical integration is the ratio of value added to sales at the industry level. Capital intensity is the ratio of fixed assets plus inventories to employment at the industry level. Incorporation intensity, vertical integration, and capital intensity are calculated based on data from the 1998 Mexican economic census. Columns 1 and 4 report OLS regressions with clustering at the state level. Columns 2 and 5 report OLS regressions with state fixed effects. Columns 3 and 6 report instrumental variables (IV) regressions with state fixed effects, and column 7 reports an IV regression without state fixed effects. As instruments for judicial efficiency (or finance), we use the log of the share of the indigenous population in 1900 and the number of cultivated crops with large economies of scale (sugar, coffee, rice, and cotton) in 1939. We drop the construction sector in the regression reported in column 7 because of missing data on organizational form at the industry/state level. All regressions exclude the electricity, water, oil and gas extraction, coal mining, fishing, and medical and educational services industries. We further exclude observations based on fewer than three firms. Industry fixed effects are included in all regressions and state fixed effects in regression (2), (3), (5), and (6), but these are not reported. Judicial efficiency is based on survey data from ITAM/GMA and is measured as the average of seven individual indicators. Standard errors are reported in parentheses and corrected for potential dependence of observations within states (clusters). We also report the *p*-value of an *F*-test of the identifying instruments and the *p*-value of the Hansen overidentification test of all instruments. *, **, *** denotes significance at 10%, 5%, and 1%, respectively.

endogenous to the quality of the legal system (and institutions more broadly). We do not have separate instruments for them. Their coefficients should be interpreted with some caution as a result. For our purposes, a key point worth noting is that when they are included, the measure of judicial efficiency remains significant. The coefficient on judicial efficiency is reduced in magnitude by nearly 50%, however.

The results are also robust to including foreign and multiplant firms in the sample (column 8), to including the sectors dominated by the government, such as electricity and mining (column 9),[27] and to including sectors with bins containing fewer than three firms (column 10).[28] Thus, the results are robust to various measures of firm size and institutions, and to various ways of defining the sample. Both the results in this table and those in table 3 are robust to the exclusion of one industry or state at a time. Hence, no industry or state appears to be driving the results.

A. *Legal Quality and Corporate Form*

A key prediction of the model is that the legal system will have a larger impact on the size of proprietorships than on the size of corporations (proposition 2). To test this differential effect, we add to the regressions a variable measuring the percentage of firms in the industry that are corporations and the interaction of this term with the measure of the quality of the legal system. The structure of the regression model is now

$$Size_{ij} = \alpha_i + \beta B_j + \gamma \Gamma_{ij} + \xi L_i \Omega_j + \varepsilon_{ij},$$

where L_i is the incorporation intensity in industry i and Ω_j is the quality of the legal system in state j. The other variables are as before. Again, all regressions include sector-level fixed effects.

Table 5 reports OLS and IV regressions of the extended model. We include industry fixed effects in all regressions and state fixed effects in the regressions reported in columns 2 and 3. The OLS regression reported in column 1 does not include state fixed effects but instead controls for market size and judicial efficiency directly. We find that the interaction term is negative and significant. This indicates that the efficiency of the legal system has less effect in sectors with greater incorporation intensity. In other words, changes in the quality of the legal system impact sectors where proprietorships predominate (such as services) more than sectors where corporations predominate (such as manufacturing of basic metals). Indeed, the negative coefficient on the interaction term is larger in magnitude than the original positive coefficient on judicial efficiency. However, the

[27] If we run the regression in column 10 only for the government sectors, then the coefficient on judicial efficiency is smaller in magnitude, as expected, and no longer statistically significant; the number of observations in this case is reduced to only 100.

[28] In many of these sectors, we had to estimate the number of firms from the total number of employees, and hence we chose not to include them in our base regressions. Also, these regressions are less subject to outliers in state/sector firm-size estimates.

standard deviation on incorporation intensity is only 0.20, so the combined level and interaction effect is positive.[29]

How much does the impact of incorporation intensity vary with the quality of the legal system? A specific example may help clarify what the coefficient on the interaction term means. Take an industry such as "repair and maintenance" that is at the 25th percentile of our measure of incorporation intensity (in other words, relatively many proprietorships) and an industry such as "wholesale trade" that is at the 75th percentile of incorporation intensity. The coefficient estimate in column 3 of table 5 suggests that the difference in average firm size between "repair and maintenance" and "wholesale trade" in Jalisco (that is at the 25th percentile of judicial efficiency) is 0.14 higher than the difference in average firm size between the same industries in Baja California (that is at the 75th percentile of judicial efficiency). In other words, moving from Jalisco to Baja California benefits the sector where proprietorships predominate relatively more. As a comparison, the mean difference in average firm size between the "wholesale" and "repair and maintenance" sectors across states is 0.83. This suggests that the effect of judicial efficiency accounts for about 17% of the mean difference. This is an economically significant effect.

Next, we consider several alternative channels through which judicial efficiency may affect firm size. First, the effect could depend on the degree of vertical integration of the firm. We would expect the effect of judicial efficiency on firm size to be more pronounced for nonvertically integrated firms because a nonvertically integrated firm relies more on the judicial system to enforce contracts with suppliers and customers (Johnson et al., 2002b). A highly vertically integrated firm does not rely on the judicial system as much since all activities are internalized. As a measure of vertical integration at the sector level we use the ratio of total value added to total sales in the sector, where a value of 1 means that firms in the sector are highly vertically integrated and a value of 0 means that firms are not vertically integrated.[30]

Judicial efficiency could also affect firm size differently depending on the capital intensity of the sector, as in KRZ (2002). They find that the effect of judicial efficiency on firm size is more pronounced for firms in sectors with low levels of capital intensity. As a measure of capital intensity at the sector level, we use the ratio of total fixed assets plus inventories to total employment in the sector. An additional reason for controlling for capital intensity is that corporations tend to be more capital intensive and so our measure of incorporation intensity might be picking up the effects of capital intensity rather than the effect of diversified ownership.

The regressions reported in columns 4 to 6 of table 5 repeat those reported in columns 1 to 3 but also consider the differential effect of vertical integration and capital intensity on firm size by including interaction terms between judicial efficiency and vertical integration and between judicial efficiency and capital intensity.[31] Consistent with our prior regressions, we find a negative coefficient on the interaction term between judicial efficiency and vertical integration, although the effect is not statistically significant. We also find a negative coefficient on the interaction term between judicial efficiency and capital intensity, consistent with the findings of KRZ (2002), although again the effect is statistically insignificant. Importantly, our main result is unaffected. Incorporation intensity remains an important channel through with judicial efficiency affects firm size, even after controlling for the degree of vertical integration and capital intensity.

Finally, we consider the effect of judicial efficiency on the relative share of corporations among all firms. As we discussed above, the theoretical prediction on the sign of judicial efficiency is ambiguous (proposition 3). The results shown in column 7 of table 5 indicate that firms in states with higher-quality judicial systems are more likely to be incorporated. Since the regression includes sector fixed effects, this should be interpreted as a within-sector effect. This is consistent with better financial contracting environments making the identification of equity partners easier, and with the judicial system making it easier to expand customer bases.

B. Efficiency Effects

The theoretical framework implies that increased firm size is associated with increased efficiency in the economy. Where idiosyncratic risk is reduced, capital is allocated more efficiently among entrepreneurs. Thus, theoretically at least, improvements in the quality of the legal system improve the efficiency of the economy. The implication of the theory is that these consequences should show up as increasing returns to scale. The existing literature examining returns to scale among firms in developing countries suggests that returns to scale are modest if present at all (Tybout, 2000). However, most of this literature is limited to an examination of the manufacturing sector. One exception is the paper by Pagano and Schivardi (2003), which finds that productivity growth is increasing in firm size across industries in Europe. Like us, they use data from both

[29] We find qualitatively similar results when we define incorporation intensity in terms of employment rather than number of firms. This is hardly surprising given that the correlation between these two measures at the sectoral level is 0.94. We also find similar results when using the alternative measures of average firm size considered in table 4.

[30] When we use the distinction between manufacturing, which is interfirm-contracting intensive, and retail/service sectors as an alternative measure of interfirm contracting instead of vertical integration we obtain similar results.

[31] The correlation between incorporation intensity and vertical integration is −0.26 (significant at 1%), and the correlation between incorporation intensity and capital intensity is +0.33 (significant at 1%), hence, incorporation intensity captures sector-specific differences that are to a large extent distinct from those captured by vertical integration or capital intensity.

TABLE 6.—QUALITY OF THE LEGAL SYSTEM AND FIRM PRODUCTIVITY

	(1) OLS	(2) IV
Judicial efficiency	0.118**	0.352**
	(0.047)	(0.155)
ln(Capital)	0.464*	0.405*
	(0.232)	(0.218)
ln(Labor)	0.404*	0.473**
	(0.218)	(0.201)
ln(Materials)	−0.040*	−0.044**
	(0.023)	(0.022)
ln(Capital) × ln(Labor)	0.064	0.049
	(0.046)	(0.042)
ln(Capital) × ln(Materials)	0.014***	0.015***
	(0.004)	(0.004)
ln(Labor) × ln(Materials)	−0.028***	−0.030***
	(0.004)	(0.004)
ln(Capital)^2	−0.024	−0.018
	(0.022)	(0.020)
ln(Labor)^2	−0.030	−0.020
	(0.027)	(0.024)
ln(Materials)^2	0.009***	0.009***
	(0.001)	(0.001)
F-test of overidentifying restrictions		0.03
Hansen overidentification test (*p*-value)		0.25
R-squared	0.95	0.94
States	32	32
Observations	699	699

Dependent variable is the logarithm of sales (output) at the industry/state level. We estimate the following translog production function: $\ln(Y) = \ln(K) + \ln(L) + \ln(M) + \ln(K) \times \ln(L) + \ln(K) \times \ln(M) + \ln(L) \times \ln(M) + \ln(K)^2 + \ln(L)^2 + \ln(M)^2 + \varepsilon$, where Y is output as measured by gross production, K is capital as measured by fixed assets, L is labor as measured by number of employees, and M is materials as measured by raw materials and intermediate goods. Column 1 reports an OLS regression and column 2 reports an instrumental variables (IV) regression. As instruments for judicial efficiency (or finance), we use the log of the share of the indigenous population in 1900 and the number of cultivated crops with large economies of scale (sugar, coffee, rice, and cotton) in 1939. We further exclude the electricity, water, oil and gas extraction, coal mining, fishing, and medical and educational services industries. We exclude observations based on fewer than three firms. Standard errors are reported in parentheses and corrected for potential dependence of observations within states (clusters). We also report the *p*-value of an *F*-test of the identifying instruments and the *p*-Value of the Hansen overidentification test of all instruments. *, **, *** denotes significance at 10%, 5%, and 1%, respectively.

manufacturing and service sectors, where the presence of proprietorships is greater.

We provide some additional evidence of efficiency effects by running regressions for a basic translog production function and including judicial efficiency on the right-hand side. Table 6 reports the results of this exercise. After controlling for capital, labor, and material inputs, we find that the output of firms (as measured by the log of sales) increases with the quality of the legal system. We estimate the production function using both OLS and IV. The coefficient on our standard measure of judicial efficiency when estimating using OLS is 0.12 (column 1), indicating that a 1-standard-deviation increase in the quality of the legal system is associated with an increase in sales of about 0.03 standard deviations. The increase is substantially larger in the IV estimation (column 2)—almost 0.10 standard deviations. Overall, these results suggest that improvements in the quality of the legal system are associated with improvements in the efficiency of the economy.

V. Conclusions

We draw three broad conclusions from the model and the data. First, the data show the importance of informal institutions in determining outcomes. The formal laws governing both economic transactions and broader relationships between individuals and the state (or elites) are very similar across states in Mexico. The perceived efficiency of the legal system varies. The variation is consistent with historical factors previously identified in cross-country research as affecting the quality of institutions. The variation in the quality of the legal system is reflected in a variation in the size of firms.

Second, the results provide support for the idea that one of the ways an improved legal system affects economic outcomes is by diminishing idiosyncratic risk. Empirically, this support comes primarily from the interaction between legal quality and incorporation intensity. The coefficient on this interaction indicates that legal systems have a larger effect on firm size in industries dominated by proprietorships than in industries where corporations are more prevalent. Idiosyncratic risk is reduced away when liability is limited and ownership is dispersed—that is, when firms are organized as corporations.

We interpret our collective results as indicating that contracting institutions are important in the efficiency of the economy. This conclusion differs to some extent from that of Acemoglu and Johnson (2005) who find that broader property rights measures affect economic outcomes but narrower contracting institutions have no effect. However, the difference between our results and theirs may not be so great. That is, it may still be the case that contracting institutions are of second-order importance to broader property rights institutions. None of our regressions controls for broader property rights institutions, which are likely to be highly correlated with our measures of narrow contracting institutions. But even if we interpret judicial efficiency as proxying for broader measures of institutions in the initial regressions (reported in tables 3 and 4), then the results in table 5 suggest that individuals are able to contract around these difficulties. That is, where they are able to incorporate and diversify ownership, the effect of weaker institutions is markedly diminished. Thus, we believe that, taken as a whole, our results show that narrow contracting institutions matter.

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