

Institutional Change and Economic Growth? Banks, Finance Markets, and Mexican Industrialization

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ABSTRACT

What do banks do? Close relationships between banks and their borrowing firms is thought to bring a number of benefits, particularly in the early years of an industry, when information asymmetries are high and managerial talent scarce. These benefits come because relationship banking helps investors pick winners, allows banks to learn more about the industry and provide funds more efficiently over time, and enables entrepreneurs to make better use of scarce managerial talent. All these imply that firms enjoying close bank relationships should be more efficient than their competitors. Using evidence from the Mexican textile industry during the nation's first wave of industrialization (1878-1913) we find that firms with close bank relationships grew faster and exhibited significantly lower short-term sensitivity of investment to cash flow, but enjoyed neither higher TFP nor employed more capital-intensive technology than other firms. We conclude that relationship banking simply eased capital constraints, but provided few of the other benefits putatively attributed to it. In addition, we find that changes in incorporation laws enabled firms to take better advantage of bank credit, by easing the transactions costs associated with debt defaults, while the few limited liability companies traded on capital markets gained large one-time advantages in size and productivity but no dynamic edge. Therefore, we further conclude that reforms designed to open capital markets (or conversely, regulations designed to limit them) can have significant effects on the growth or other sectors of the economy. This analysis is based on estimates from mill-level data for an unbalanced panel of 191 factories over the period.

Introduction

What difference did the institutional reforms governing banks and securities markets have on Mexican economic growth? This paper uses evidence from the Mexican cotton textile manufacture between 1878 and 1913 in order to examine the impact of institutional change on Mexico's industrialization.

Economic theory grants us three hypotheses. First, manufacturing firms that develop close relationships with banks grow faster than their competitors. That is to say, in the early stages of development banks lend money based on personal connections. In the absence of these connections, firms face liquidity constraints, and can therefore only grow as fast as they reinvest earned profits. Banks enable firms to overcome these constraints and grow faster. This implies that firms enjoying bank-connections will grow faster than all others but not necessarily be more productive. This growth in size is what economists generally refer as "extensive growth."

Second, firms tied to banks may be able to draw on managerial talent or other abilities from the bank. For example, firms connected to banks may be able to access markets and new technologies through their relationships with well-placed bankers. In this case, firms would not only grow faster (e.g. show extensive growth), they would also be more efficient. This is what economists refer to as "intensive growth." Both types of growth, extensive and intensive, can lead to per capita income gains. However, it is the latter phenomenon of intensive growth, e.g. an increase in total factor productivity, that is crucial to sustain economic growth over the long term.

The third hypothesis is that the establishment of formal banks and securities markets has no effect. The pre-existing informal network of merchants may provide capital as

efficiently as the formal organizations that sprang up as a result of Porfirian legal reforms. In the case, we would find no appreciable differences between firms connected to banks and firms not connected to banks.

Which of these is the case can not be answered as a matter of economic theory. It is an empirical question that can only be answered by coupling historical evidence to statistical analysis. We employ firm-level census data and tax records covering Mexico's largest manufacturing industry, cotton textiles, over the period 1878 to 1913. Although as an empirical matter we focus solely on textiles, it is reasonable to expect that the patterns displayed in this industry hold across the manufacturing sector. Using detailed evidence from bank annual reports, the financial press, and the minutes of bank boards of directors, we identify which firms were connected to chartered banks, which firms raised capital from the securities markets, and which firms relied solely on traditional merchant networks to finance investment.

Our argument runs in the following terms. Porfirian law limited the number of banks that could operate in any market. Prior to the development of modern credit reporting banks tended to lend on the basis of personal connections, something true in the antebellum United States as well as Porfirian Mexico, and to an extent characterizing Mexican banking until the present day. The upshot was that only a limited number of textile firms could get access to bank capital. We find that textile firms with inside connections to banks grew faster than firms that relied on traditional merchant networks. We also find that they were no productive; nor do they appear to have been more profitable.

Laws that permitted the formation of limited liability joint stock appears to have been important mostly because they facilitated relationship banking. The evidence indi-

cates that firms took advantage of the limited liability laws to allow them to easily collateralize bank loans. Banks held stock in these joint stock textile companies as a guarantee for the loans, allowing them to seize the firms' assets in the event of default without the need for costly and prolonged litigation. In this sense, reforms in limited liability allowed a way around a poorly functioning legal system. This means that joint stock companies were larger than other firms, and grew faster, but like bank-connected firms were no more productive.

The few joint stock companies that were openly traded on the stockmarket were massively larger than their competitors. However, it appears that going to the stockmarket provided only a one-time gain. The few firms that listed on the Bolsa received a large infusion of capital at the time of their listing that allowed them a one-time gain in size and productivity. That one-time advantage, however, was whittled away over time.¹

We organize the argument as follows. The first section briefly describes the history of Mexican financial law. The second section describes how the resulting financial system was used to finance textile manufacturing. The third section describes our data and the methodology used to analyze it. Section four presents our results in graphical form. Section five formalizes the analysis presented in section four, using multivariate statistical techniques to control for intervening variables and to determine the direction of causality. Section six concludes.

¹ It is not clear why more companies did not list their shares. The formal institutional barriers to doing so were extremely low. One hypothesis is that the firms that listed independently—as opposed to raising capital from the market by means of a chartered bank—were already large enough that the firms could “insure” themselves against idiosyncratic shocks and therefore invite the confidence of investors. In other words, listed firms were not big because they listed, they listed because they were already big, and the size advantaged directly derived from the listing were smaller than they appear. See Maurer and Sharma (1999).

I. Banking law in the Porfiriato

Mexico's first chartered bank, a branch of the British Bank of London, Mexico, and South America, began operations in 1863, but the origins of the Porfirian financial system date back only to 1875. In that year, starting with the establishment of the Banco de Santa Eulalia in the northern border state of Chihuahua, two banking clusters began to emerge, one in Chihuahua and the other in Mexico City. In 1884, in the wake of a serious financial crisis prompted by the federal government's overissuance of railroad subsidy promises, the federal authorities engineered the merger of the two largest Mexico City banks into the Banco Nacional de México, or Banamex. The explicit intention was to model Banamex on the early Bank of England, granting it a monopoly over the issuance of paper money in return for providing credit to the federal government and the rest of the banking system in times of trouble.

For better or for worse, Banamex never played the role intended for it. Political opposition to the proposed monopoly over paper money soon crystallized around the local branch of the Bank of London, Mexico, and South America, which enjoyed extensive connections with many prominent Porfirian financiers and politicians. The resulting legal and political battles lasted 13 years, and the law giving Banamex its privileges never went into effect.

Between 1884 and 1897, Mexico possessed no general banking laws. Since Mexico's Spanish traditions essentially held that all economic activities undertaken without authorization from either a general law or a special concession were illegal, Mexico did not undergo a period of free-banking. Rather, bank charters were granted at the whim of the Secretary of Finance. Under Manuel Dublán, who served between 1884 and 1893,

bank charters were issued fairly liberally. His successor, José Ivés Limantour, changed that policy, revoking many of the bank charters issued by Dublán and refusing to issue any new ones pending the promulgation of a general banking law.

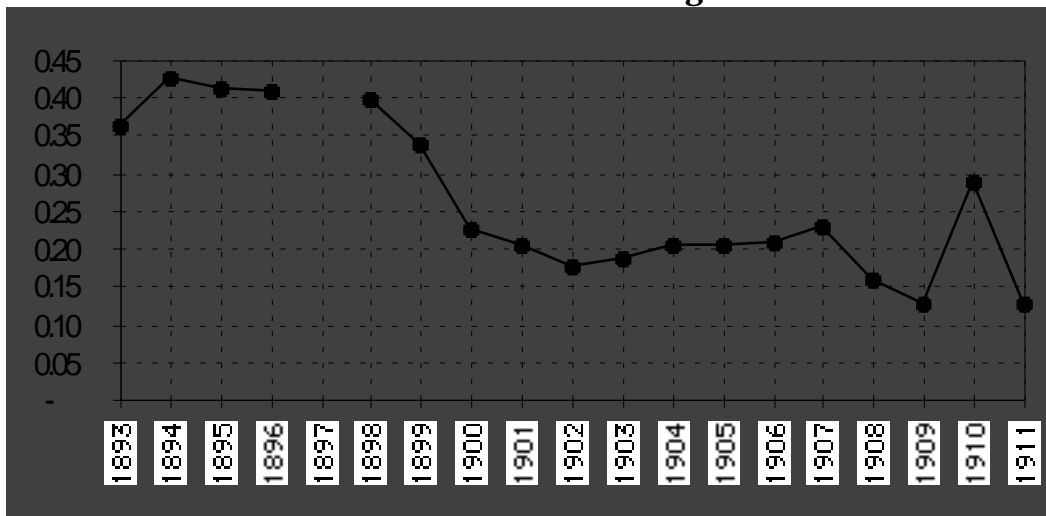
The resulting law, the General Credit Institutions and Banking Act of 1897, was a compromise between three competing interests. First were the Mexico City financiers and political elite arrayed around Banamex and BLM, whose concessions granted them lower reserve requirements and the exclusive right to branch across state lines. Second were the smaller banks established under Dublán, which wanted to preserve their right to issue banknotes and limit further competition as much as possible. Third were the local political and economic elites in the various states, which wanted the right to establish their own banks to finance their entrepreneurial activities.

The Act of 1897 preserved most of Banamex's and BLM's privileges. They continued to enjoy the exclusive right to branch nationally and enjoyed a reserve requirement on their banknote issues of only 33%, compared to 50% for most of their competitors. In addition, Banamex enjoyed the exclusive privileges of providing financial services to the federal government: collecting tax receipts, making payments, holding federal deposits, and underwriting all foreign and domestic federal debt issues.

The existing banks were rewarded with very strict limits on competition. The law set a minimum capital requirement of 250,000 pesos (roughly US\$125,000), and the law was written in such a way as to allow only a single bank to be established in a state, although existing banks were grandfathered in under the law and several banks were granted the right to establish branches in adjoining states. These banks, along with new ones founded under the new law, were not permitted to branch outside their concession territory, issue

new stock on the stock exchange without the special permission of the Secretary of Finance, or establish branches or agencies within the Federal District. In addition, they were required to maintain a reserve requirement of at least 50% on their note issues. The law also allowed for the establishment of mortgage banks and “bancos refaccionarios,” which were denied the right to issue banknotes and were subject to various restrictions on the types of investment they could make. Without the right to issue notes, these banks could not compete, and Porfirian entrepreneurs took out few charters for them.

Chart 1: Herfindahl index for Mexican banking



Source: *Economista Mexicano*, various issues.

The result was a rather concentrated banking structure. Chart 1 reproduces estimates of the Herfindahl concentration index for the banking system, defining market share as the proportion of the total assets of the banking system belonging to an individual bank. As the chart makes clear, the passage of the 1897 Act produced a one-time wave of entry, driving down the Herfindahl from around 0.45 to about 0.2, where it remained for the rest of the period. The number of banks increased from 10 to around 35. Nevertheless, with

42 banks and banking companies in operation by 1910, the banking system remained about as concentrated as one with only five equally-sized institutions.²

What this means is that Mexico had very few banks. In 1909, Mexico possessed 42 formally incorporated financial institutions of various kinds.³ In the same year, the United States enjoyed the services of 18,723 banks and trust companies.⁴

II. Textile Finance in Porfirian Mexico

Banks made financing decisions based on the personal connections of their directors. Essentially, Porfirian banks worked as investment clubs. A group of entrepreneurs, after obtaining a bank charter, would pay in the required minimum capital and then immediately lend the proceeds to themselves. They would then sell shares in the bank on the Mexico City exchange or overseas, and in that way attract outside capital for their own particular entrepreneurial activities. Investors knew quite well when buying bank stock that they were actually investing in the diversified economic activities of the bank's directors, but they preferred bank stock over direct investments in industry for three reasons. Since the number of banks was highly limited, the implication is that far fewer potential entrepreneurs could receive than in countries like the United States.

Investors preferred to purchase stock in banks rather than in the textile companies directly for three reasons. First, the federal government tightly regulated the banks, requiring them to issue monthly balances and placing highly-paid inspectors in their offices. Reporting requirements for non-bank companies were far looser and regularly flouted: few of the already few companies that listed directly on the stock exchange

² Explain Herfindahl

³ Estimate from data in Peñafiel

complied with the requirement that they publish annual balance sheets and profit-and-lost statements in the financial press. Bank balance sheets, however, had to be published regularly and bore more relationship to the actual state of the enterprise than balances released by other companies.

Second, bank directors usually possessed specialized knowledge about the activities and regions in which they invested; more so than investors in Mexico City or overseas. In fact, these banks actually functioned as the heart of a “grupo” of enterprises owned or controlled by their directors: it would have been difficult for outsiders to replicate their knowledge of the market or industry. However, it was relatively easy to establish mechanisms designed to monitor the activities of the directors. In addition, since the directors and outside investors were playing a repeated game with each other, inasmuch as the directors would return to the stock and bond market for new capital, reputations were very important and very carefully guarded. In essence, these banks passed the problem of asymmetric information from one between bank directors and borrowers to one between shareholders and bank directors.⁵

The third reason is that by getting the banks to diversify for them, investors lowered the risks they faced. Bank directors had enough incentives and leverage to monitor firms owned by other directors because a default by one of these firms would damage the credibility of the bank, hurting the ability of the other directors to raise capital for their own enterprises. Thus investing in banks served as a mechanism by which investors could monitor managers in firms over which they had no direct knowledge or control. Firms organized as joint stock companies in order to give bank directors more leverage

⁴ Binder and Brown 1991: 52.

⁵ See Maurer (1999).

over borrowing firms in the case of default. Loans would be made not to the firm, but its owners personally, who pledged shares in the firm as collateral. The other directors in the bank could then simply seize the stock in the event of default. It should therefore not be surprising that very few joint stock textile firms were actually publicly traded.

III. Data and Methods:

We draw on the textile data set and methods developed by Razo and Haber in their study of long-term productivity growth in the Mexican textile industry. This study employs part of their larger data set, covering the following firm-level censuses: 1878, 1883, 1888, 1889, 1891, 1893, 1895, 1896, 1912, and 1913. We also include data from a sample of excise tax records for the years 1898, 1900, 1902, 1904, 1907, and 1909.

We transformed the raw data to create a uniform data set. First, we changed every relevant variable from its initial frequency to an equivalent annual value. Second, because some multi-mill companies reported some variables at the mill level and others at the company level, we consolidated mills into companies, and used the latter as our observational unit of analysis. Third, we employed the estimated price index developed by Razo and Haber for cotton textile goods for the period 1850-1933, which uses available Mexican cotton price data and in its absence, an algorithm derived from U.S. cotton sheeting and textile prices, the peso-dollar exchange rate, and the tariff on imports.

We proxied capital by the number of spindles because it was the only uniform and consistent definition of capital across censuses. We know, however, from detailed machinery reports in some of the censuses, that spindles constituted the most important

capital input for the production of cotton textile goods.⁶ This corresponds to the findings of work on the United States textile industry. In fact, the literature on the U.S. textile industry tends to use spindlage as the measure of capital or capacity as well.⁷ We therefore believe it adequate to employ spindlage as our proxy for capital.

Total labor-hours were not available. We therefore followed Razo and Haber's earlier work on textile productivity, as well as the work of Atack and Sokoloff on productivity in the United States and of Bernard and Jones on international productivity comparisons, employing total workers as the measure of the labor input.⁸

We used multivariate regression techniques for a two-dimensional analysis of textile companies (our observational units) by both particular points in time as well as for extended periods of time. For any time t , we are able to estimate ordinary least squares regressions of potential explanatory factors for each cross-section of observational units. At the same time, we have constructed time series for individual observational units. These series enable us to follow the changes of certain variables over time. Putting the two together enabled us to construct a panel data set where we can check for both concurrent and long-term effects of the explanatory variables we propose in our models.

We used an unbalanced panel procedure to estimate basic pooled and fixed-effects specifications of regressions for the years 1878-1913 of the following type:

⁶ For instance, the ratio of spindles to looms, the other major capital input, was 30:1 in 1857, 28:1 in 1893, and 28:1 in 1913.

⁷ See, for instance, N.F. Kane, Textiles in Transition: Technology, Wages, and Industry Relocation in the U.S. Textile Industry, 1880-1930 (Westport, Conn. and London, 1988).

⁸ See J. Atack, Estimation of Economies of Scale in Nineteenth Century United States Manufacturing (New York and London, 1985); K.L. Sokoloff, 'Was the Transition from the Artisanal Shop to the Non-mechanized Factory Associated with Gains in Efficiency? Evidence from the U.S. Manufacturing Censuses of 1820 and 1850', Explorations in Economic History, vol. 21, no. 4 (1984), pp. 351-82; and A.B. Bernard and C.I. Jones, 'Productivity across Industries and Countries: Time Series Theory and Evidence', The Review of Economics and Statistics, vol. 78, no. 1 (1996), pp. 135-146.

$$Y_{it} = \alpha + \beta X_{it} + u_{it}$$

where Y_{it} is the dependent variable of firm i at time t ; α is the overall intercept term for all firms;⁹ β is a vector of coefficients corresponding to the X_{it} vector of independent variables and u_{it} is a stochastic term. We assumed usual normality and independence conditions to obtain least-squares estimates of β .¹⁰

For our productivity regressions, we followed Razo and Haber and assumed a Cobb-Douglas production function of the form $Y = A K^\alpha L^{1-\alpha}$ with constant returns to scale where K and L represent the capital and labor inputs and A is a function that captures improvements in technology over time.¹¹ In order to use linear estimation procedures, we took natural logarithms of a normalised production function of the form $y = k^\alpha$ where $y = Y/L$ and $k = K/L$ and added explanatory variables to arrive at the following model:

$$\ln y = \alpha + \beta_1 \ln k + \beta_2 \ln L + \beta_3 \text{Time Trend} + \text{dummies} + \text{Interaction Terms}$$

Relationships between banks and textile firms were identified in three ways, the first two of which always coincided with the third. The first, applicable for limited liability companies, was significant holdings of textile stock directly by a bank, such as Banamex's mammoth holdings in the Compañía Industrial Manufacturera (CIMSA). Another was the pledging of significant amounts of corporate stock as a guarantee for a personal

⁹ For OLS estimates, this coefficient would be the same for all firms; for fixed effects, it was not estimated as it was allowed to vary freely among cross-sections. Both models, the basic pooled and fixed effects produced the same qualitative results with minor differences in the magnitude of the estimated coefficients. In some cases, as with the time trend, the estimates were nearly identical. Thus, to avoid repetition, we report only results from the basic pooled model.

¹⁰ In the construction of time series for each observation units, it is evident that plain OLS techniques would result in biased estimates because some of the variables in latter periods could be predicted from earlier years (e.g., spindles at time t could very well be equal to spindles at time $t+1$). The panel procedure individually identifies each company over time to correct for potential autocorrelation in its variables.

¹¹ We tested for both this production function as well as for Translog production functions but found the Cobb-Douglas production function to be a better model for our panel data set.

start-up loan by the founders of a textile firm. As mentioned earlier, firms were usually financed by personal loans to the directors, who then pledged stock in the firm as collateral. This has been commonly considered the strongest indicator of a tight bank-firm relationship,¹² and appears from the available data to have been coterminous with our third measure, interlocking directorates between banks and textile firms. Since direct evidence from internal bank accounts is available only for five banks—Banamex, the Banco Oriental, the Banco de Zacatecas, the Banco de Jalisco, and the Banco Mercantil de Veracruz—our investigation focused on interlocking directorates as an indicator of a bank-firm relationship. This marker provides the additional advantage of identifying relationships between banks and firms not organized as limited-liability companies.

By comparing the listed owners of textile firms with those of the banks reported in their annual reports published in the *Economista Mexicano*, we determined which textile firms enjoyed an inside relationship with a bank. Attachment was constant, and no firms connected with a bank changed hands to a non-connected owner during the period. In the cases of limited liability firms, we identified bank relationships for the four publicly-traded firms whose boards of directors were known. For the others, relationships were identified from available bank records at the Archivo General de la Nación (AGN) or Archivo Histórico del Banco Nacional de México (AHBNM).

It should be noted here that firm directors were more likely to participate with other entrepreneurs in founding banks than banks were to lend money to unrelated firms and demand in return equity or a seat on the board. In fact, Banamex was the only bank we identified that followed the second strategy. Nevertheless, a strong relationship holds in either case.

¹² See Gerschenkron (1962) and Schumpeter (1939).

IV. Data Analysis

Tables 1 and 2 provide descriptive statistics for three classes of mill, by year: those owned by a firm or individual connected directly to a bank, those owned by a limited-liability company, and those owned by one of the four limited-liability companies that actively traded their own stock on the Mexico City exchange.

Several patterns in the data become immediately apparent. First, most firms were organized as individual proprietorships or limited partnerships, even after an incorporation law came into effect in the 1880s. Joint-stock companies never amounted to more than about a quarter of all cotton textile companies. Second, few of these joint-stock companies actually traded on the stock exchange. Only four companies, which collectively owned 16 mills, actively traded in Mexico City. Third, the vast majority of joint stock companies also enjoyed bank relationships; in fact, as we noted previously, part of the reason for establishing a joint stock company was to facilitate access to bank capital.

INSERT CHART 2 AROUND HERE

The number of mills belonging to companies or individual owners with a bank relationship underwent two significant growth spurts: one in the early 1880s, after the emergence of organized banking under the early Commerce Code, and the other between 1896 and 1900, during the wave of bank startups engendered by the enactment of the General Banking Act of 1897.¹³ The growth in limited liability companies is smoother, but plateaus in 1900 along with the number of firms enjoying close bank relationships.

The data on average real output by value also show clear patterns. Traded firms start out hugely larger than their competitors, by an order of magnitude, and stay big. Limited

liability firms (all of which save one are either partly owned by a bank or have an interlocking directorate with one) and non-limited firms enjoying a bank relationship grow faster than other companies, from a similar starting point, and the limited liability companies seem to have a slight advantage over firms organized in other ways.¹⁴ Measuring output in meters show similar results, although the output of the limited liability companies appears to stagnate after 1896.

Our capacity measure, installed spindlage, behaves similarly. The four traded companies start out big and stay big. The size of firms without bank relationships barely budges over the entire period. Bank-connected companies are significantly bigger than other firms, but grow rather slowly if at all. Limited liability companies, discounting the traded behemoths, start out larger still than partnerships or proprietorships, and grow significantly over the period. Unfortunately, the lack of observations between 1896 and 1912 prohibits more detailed periodization of spindlage growth.

INSERT TABLES 1a, 1b, and 2 AROUND HERE

INSERT CHARTS 3a, 3b, AND 4 AROUND HERE

These patterns support our hypothesis, but are by no means conclusive. Firms with direct relationships to a bank grew faster, and limited liability provided an additional kick. Unfortunately, “eyeballing” the data can only tell us so much. We do not know if bank-connected firms gained a one-time size advantage or grew faster than their competitors. Nor do we know if they were more productive than their competitors, which

¹³ See Maurer (1997) for details on the timing of bank startups.

¹⁴ Output per firm for bank-connected firms of all types stagnates between 1905 and 1910. This is probably not coincidental. In 1905 the Finance Ministry actively moved to limit the further expansion of the non-national banks of issue, prohibiting further stock issues by all bank save Banamex and the Banco de Londres y México. These restrictions were eased after 1910, and several new banks (without the ability to issue banknotes, but with the right to create demand deposits) listed on the exchange in that year. Since

could have driven faster growth. Therefore, we used panel data techniques to test whether bank-connected firms enjoyed higher productivity or grew faster, and we used simple OLS on a cross-section of firms from the 1893 textile census to test whether bank-related firms showed less liquidity-sensitivity to investment than their competitors.

V. Multivariate Regression Results

What difference did bank connections make? We test four hypothesis. First, that bank connected firms were bigger. Second, that they grew faster. Third, that they were more productive. Fourth, that they employed different technology, to the degree that technology can be proxied by their capital-labor ratio. Fifth, that causality ran from firm characteristics to bank connections; in other words, that faster-growing firms chose to associate with banks, rather than bank connections caused firms to grow faster. We find that only the first two of these hypotheses hold.

Were bank firms larger and did they grow faster? Table 3 presents the regression results. The natural log of output, by value at 1900 prices using our textile price index, is the dependent variable. Our explanatory variables are time, geographic location, and type of firm. Due to autocorrelation and heteroskedasity problems in the data, we used FGLS to estimate the regressions. The results support our “eyeball” conclusions from the data. Bank-connected firms grew faster (roughly 50% faster, at an annual rate of approximately 3%, versus 2% for independent firms), but were no larger to start. The few publicly traded companies were more than three-times larger than their competitors at

these banks raised a great deal of their resources through equity issues, these prohibitions could not help but affect the growth of their associated firms.

their founding, but grew no faster. The coefficient on the variable for limited-liability companies was positive, but not statistically significant.

These results hold when we measured growth in meters rather than by value. Bank-connected firms grew by around 2% per year, while independent firms remained stagnant. The huge traded companies, as before, enjoyed a huge one-time advantage, but then *shrank* in size.

INSERT TABLES 3-a AND 3-b HERE

Organization as a limited-liability company provided an additional growth advantage over simple bank-association, but we could not determine from the results of the sensitivity analysis whether this was a one-time or dynamic advantage. However, the results of our spindlage growth regressions lead us to believe that this was a dynamic advantage. Firms not connected to banks did not grow, in line with our other results. Bank-connected firms enjoyed a big one-time advantage (around 70%), and the four publicly-traded conglomerates enjoyed an even larger one (over 200%), but the marginal effect on future growth from being publicly-traded was zero. They were simply simply born bigger. It was organization as a joint stock company, not being actively traded on the stock exchange, that provided the dynamic effect: these companies (when also associated with a bank) grew by more than 4% per year in terms of installed spindlage.

INSERT TABLE 4 HERE

These results are entirely consistent with our anecdotal evidence on bank behavior and our predictions about the advantages of limited liability and the function of banks. The directors of partnerships and proprietorships received personal loans from their bank to start their companies, giving them access to a source of capital denied their independ-

ent competitors. These loans, however, were secured only by the firm directors' personal reputation. If the directors wanted to return to their "house bank" for more long-term capital—as opposed to short-term financing of stocks and inventories—they needed to offer collateral, and the best way to do that, given the constraints of an inefficient legal system and poor property registers, was to organize as a joint stock company and pledge shares as collateral when new loans were needed. This explains why the dynamic effect for these companies shows up most strongly in installed spindlage.

Did these size and growth differences translate into differences in total factor productivity? We used generalized least squares to estimate the coefficients. Table 5 shows various specifications of the relationship, using the natural log of the value of output per worker as the dependent variable. The results are clear: regardless of the specification we used, we could find no significant difference in TFP between bank-connected and independent firms. When meters of cloth is used instead of value as the output measure, limited-liability companies show 20% *lower* TFP than their competitors (Specification 4 of Table 6). The four publicly traded firms enjoyed a one-time productivity advantage at the time of their incorporation—a surprising result, since the coefficients indicate little or no economies of scale in the industry—but they whittled away their advantage over time. The only significant effect is a regional one: firms located in and around Mexico City were roughly 25% more productive.

INSERT TABLE 5-a and 5-b HERE

Were there any technical differences between the different types of firms? One would imagine that bank-connected firms would face a lower cost of capital than their competitors, and therefore should have had a higher capital-labor ratio. Table 7 shows

that there were no significant differences in capital-intensity between the various firm types. Firms located in central Mexico or along the United States border generally employed more spindles per worker, but this was unrelated to their type of organization or access to bank credit. In other words, there is no evidence for significant technological differences for bank-related firms during the period. Only the big traded conglomerates showed any kind of significant productivity advantage, but only at the time of their incorporation.

INSERT TABLE 6 HERE

Which way did causality run? Did firms grow large because they were connected to banks, or did firms simply choose larger, faster-growing firms to associate with? That is to say, did banks simply pick winners? The historical evidence suggests not. Therefore, we ran a series of logit regressions to test whether bank associated can be predicted by differences in technology, age, profitability, or size. The results, based on detailed data from the 1893 census, are unambiguous. Bank-connected firms in 1893 neither earned higher profits, nor used more capital-intensive technology, nor enjoyed higher labor productivity than their competitors.

INSERT TABLE 7 AROUND HERE

Our results indicate that firms connected to banks were larger and grew faster, but were not different in terms of productivity, choice of technique, or profitability. Nor did the banks simply to choose faster-growing firms. What then was the casual mechanism that allowed bank-connected firms to grow faster? We hypothesize that firms not connected to banks could only grow as fast as they could plough back profits from previous production cycles. Bank-connected firms did not face this constraint. We used the same

detailed 1893 census data to test this hypothesis. The census provided information on the prices that firms faced for labor, fuel, and raw materials, which allowed us to calculate operating margins. This allowed us to test whether liquidity constraints—proxied as lower operating margins—affected firm growth directly for a cross-section of 60 different enterprises.

We then ran the following three specifications on cross-sectional data from the 1893 census and 1895 tax records:

$$\begin{aligned}\text{VALGROW} &= \text{CONSTANT} + B_1\text{MARGIN} + B_2\text{BANK}*\text{MARGIN} \\ \text{METGROW} &= \text{CONSTANT} + B_1\text{MARGIN} + B_2\text{BANK}*\text{MARGIN} \\ \text{SPINGROW} &= \text{CONSTANT} + B_1\text{MARGIN} + B_2\text{BANK}*\text{MARGIN}\end{aligned}$$

where VALGROW is the percentage growth between 1894 and 1895 of output in 1900 prices, METGROW the percentage growth of meters of output, and SPINGROW is the percentage increase in installed spindlage. MARGIN is the firm's operating margin (calculated as revenues – wages – fuel costs – raw cotton costs), BANK is a dummy variable for bank association, and BANK* MARGIN is a multiplicative interaction term between bank association and operating margins that we used to test if bank associated firms were less sensitive to their operating margins than other firms. (1894 output and margins were calculated using data from the second half of 1893 and the first half of 1894.)

INSERT TABLE 8 AROUND HERE

The results in table 9 indicate that bank relationships played a significant role in alleviating liquidity constraints. When output is measured in constant value, firms which broke even in 1893-94 grew by roughly 1% the subsequent year, as indicated by the constant term. The estimated coefficient of 1.03 on the MARGIN variable suggests that firms without bank relationships reinvested their entire profit margin in expansion,

growing by almost exactly the amount of their margins. Bank related firms, however, exhibited a much weaker connection between their operating margins and growth. The negative coefficient of -0.45 on the BANK* MARGIN variable indicates that bank firms reinvested only 55% of their operating profits in short-term expansion. The interpretation is that firms lacking bank associations were constrained in how fast they could grow. Had they not been, they would not have reinvested all their profits. Bank-related firms, however, were far less constrained, and paid out more than half their profits in dividends or loan repayments. The results for growth of output in meters parallel the results for growth in the value of output, although the statistical significance of the coefficients is substantially less. This, of course, should not be surprising, given the limitations of using meters of cloth as a proxy for real output. Profits, after all, are measured in pesos, not meters of cloth.

The credit market, however, was not perfect. Had it been, one would have expected there to have been no relationship between margins and growth for bank-connected firms. In other words, the additional growth of the bank-related companies did not fully compensate for slower growth by the independent firms, leading to more concentrated industrial structure.

VI. Analysis and conclusion

The data indicate that the advantage from bank relationships for a firm came entirely from the easing of capital constraints. It did not come from “entrepreneurial talent” being granted to the firms from the bank, better marketing, or different technology. Thus, the

data also show that firms with bank-connected did not have higher total factor productivity.

Limited-liability appears to have functioned as a way around ill-defined property rights and an inefficient legal system. Save a single outlier, all joint-stock companies also possessed close bank relationships. These firms grew faster than other bank-connected firms, due to their ability to pledge their shares as collateral, but they were no larger at the time of incorporation, which is what would have been expected had limited-liability induced entrepreneurs to sink more capital into their ventures. In addition, despite a lack of legal or administrative constraints, only the four largest joint-stock companies chose to list their shares on the Mexico City stock exchange, further weakening the argument that limited liability provided benefits other than the ability to borrow more from banks.¹⁵

Total factor productivity did not vary significantly among firms. Banks did not pick winners, nor were winners more likely to found banks. Relationship banking allowed those entrepreneurs lucky enough to obtain a bank concession to more easily finance their enterprises. Their firms grew more rapidly than their competitors. Because only some entrepreneurs could found banks, and in turn use them to finance their textile mills, Mexico had a more concentrated industrial structure than would have otherwise. In fact, as Chart 3 shows, Mexico's industrial structure became more concentrated just as the formal banking system began to develop.

INSERT CHART 3 HERE

¹⁵ For a more detailed explanation of investors' reluctance to purchase equity in any but the largest textile firms, see Sharma and Maurer (1999).

One implication of our results is that Mexico would have industrialized faster with more liberal bank incorporation laws. There would have more textile firms, since a larger number of entrepreneur could have used the banking system to finance their expansion. In addition, our results suggest that individual firms would have grown faster than they did otherwise. With a different set of financial regulations, Mexico would have had more and bigger textile firms by 1913.

TABLE 1-a: Average value of output per firm, by type of firm

	Other	Bank-connected, not joint stock co.	Joint stock co., not actively traded	Actively traded
1878	\$ 113,495			
1883	\$ 108,399	\$ 130,865		
1888	\$ 15,884	\$ 184,455		
1889	\$ 131,785	\$ 110,564		
1891	\$ 139,703	\$ 236,278	\$ 155,731	
1893	\$ 145,222	\$ 191,938	\$ 205,018	\$ 2,023,004
1895	\$ 170,626	\$ 257,054	\$ 334,906	\$ 2,025,356
1896	\$ 225,567	\$ 295,695	\$ 501,619	\$ 2,273,531
1898	\$ 206,946	\$ 296,865	\$ 377,186	\$ 2,083,160
1900	\$ 238,660	\$ 316,536	\$ 426,522	\$ 3,138,567
1902	\$ 189,476	\$ 267,478	\$ 480,406	\$ 3,912,760
1904	\$ 295,389	\$ 386,839	\$ 397,625	\$ 4,295,000
1905	\$ 275,836	\$ 330,400	\$ 557,500	\$ 4,090,000
1906	\$ 290,957	\$ 357,882	\$ 496,200	\$ 4,480,000
1909	\$ 255,406	\$ 316,625	\$ 512,889	\$ 4,180,000
1910	\$ 267,444	\$ 391,333	\$ 454,947	\$ 3,260,000
1911	\$ 249,422	\$ 439,125	\$ 641,111	\$ 3,660,000
1912	\$ 240,875	\$ 657,861	\$ 362,765	\$ 4,392,111
1913	\$ 153,899	\$ 366,385	\$ 606,536	\$ 2,775,649

TABLE 1-b: Average output in meters of cloth per firm, by type of firm

	Other	Bank-connected, not joint stock co.	Joint stock co., not actively traded	Actively traded
1878	1,008,180			
1883	934,805	1,205,277		
1888	1,188,599	2,212,823	2,899,805	
1889	1,030,290	1,016,134	1,712,869	
1891	1,313,622	2,091,119	2,013,714	
1893	1,278,668	1,669,799	1,543,093	16,094,439
1895	1,332,623	2,476,966	4,283,923	17,527,616
1896	2,012,961	2,695,441	4,564,217	20,265,158
1912	1,480,837	4,441,733	2,883,424	12,366,361
1913	1,768,365	3,759,048	3,066,297	15,706,479

TABLE 2: Average installed spindlage per firm, by type of firm

	Other	Bank-connected, non-limited	Limited, non- traded	Actively traded
1878	3,369			
1888	3,198	4,782	6,085	
1891	4,010	6,230	7,535	
1893	4,406	4,839	3,843	59,928
1895	3,595	5,616	9,199	36,524
1896	4,284	5,408	7,762	39,546
1912	3,147	5,932	10,814	38,721
1913	3,599	5,945	10,370	38,841

TABLE 3-a: Output growth regression results

Dependent variable = value of output in 1900 pesos

	Obs	N	Adj. R-square	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7	Spec 8
	1488	178	0.10								
				0.14							
				0.32							
				0.32							
				0.32							
				0.32							
				0.32							
				0.32							
Constant				10.71	10.41	10.48	10.56	10.50	10.48	10.56	10.58
t-stat				(111.1)	(80.96)	(91.89)	(86.53)	(90.84)	(91.64)	(92.16)	(92.46)
Time				0.05	0.05	0.04	0.03	0.04	0.04	0.03	0.03
t-stat				(20.36)	(20.19)	(15.94)	(10.49)	(14.48)	(15.75)	(12.34)	(11.96)
Border					0.05	0.00	0.00	-0.01	0.00	0.00	0.00
t-stat					(0.22)	(-0.02)	(-0.01)	(-0.04)	(-0.03)	(-0.01)	(0.01)
Central					0.55	0.53	0.53	0.53	0.53	0.53	0.53
t-stat					(3.80)	(4.19)	(4.20)	(4.17)	(4.19)	(4.20)	(4.17)
Bank						0.18	0.00	0.19	0.18		
t-stat						(3.23)	(-0.03)	(3.32)	(3.23)		
Bank*time							0.01			0.01	0.01
t-stat							(1.80)			(3.72)	(3.68)
Limited						0.27	0.25	0.05	0.27	0.25	
t-stat						(3.26)	(2.90)	(0.26)	(3.27)	(2.90)	
Limited*time								0.01			0.01
t-stat								(1.21)			(2.85)
Traded						1.77	1.76	1.76	1.56	1.76	1.77
t-stat						(9.86)	(9.83)	(9.83)	(3.22)	(9.83)	(9.98)
Traded*time									0.01		
t-stat									(0.47)		

TABLE 3-b: Output growth regression results

Dependent variable = meters of cloth

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7	Spec 8	Spec 9
Obs	750								
N	158								
Adj. R-square	0.06	0.17	0.24	0.25	0.24	0.25	0.26	0.26	0.26
Constant	13.20	12.71	12.78	12.89	12.77	12.76	12.83	12.84	12.84
t-stat	(129.4)	(89.14)	(96.36)	(95.27)	(96.03)	(96.00)	(97.09)	(97.22)	(97.37)
Time	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.01	0.01
t-stat	(9.20)	(8.98)	(5.60)	(2.33)	(5.42)	(5.89)	(3.03)	(2.98)	(3.06)
Border		0.14	0.07	0.05	0.07	0.07	0.05	0.05	0.07
t-stat		(0.54)	(0.28)	(0.19)	(0.29)	(0.28)	(0.20)	(0.21)	(0.28)
Central		0.95	0.92	0.91	0.92	0.92	0.91	0.91	0.90
t-stat		(5.54)	(5.80)	(5.79)	(5.81)	(5.80)	(5.79)	(5.77)	(5.75)
Bank			0.14	-0.19	0.14	0.14			
t-stat			(1.76)	(-1.54)	(1.73)	(1.75)			
Bank*time				0.02			0.01	0.01	0.01
t-stat				(3.46)			(3.83)	(3.83)	(4.28)
Limited			0.19	0.11	0.27	0.19	0.10		
t-stat			(1.46)	(0.86)	(1.05)	(1.50)	(0.78)		
Limited*time					0.00			0.00	
t-stat					(-0.38)			(0.59)	
Traded			0.91	0.81	0.93	2.64	2.78	2.86	2.85
t-stat			(3.94)	(3.50)	(3.92)	(3.92)	(4.16)	(4.30)	(4.30)
Traded*time						-0.06	-0.07	-0.07	-0.07
t-stat						(-2.74)	(-3.07)	(-3.14)	(-3.08)

TABLE 4: Spindlage growth regressions

Dependent variable = installed spindlage

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6	Spec 7
Obs	640						
N	156						
Adj. R-square	0.08	0.15	0.28	0.28	0.29	0.28	0.28
Constant	7.45	7.18	7.18	7.22	7.23	7.18	7.25
t-stat	(87.31)	(58.12)	(64.14)	(63.61)	(64.84)	(63.99)	(64.95)
Time	0.02	0.02	0.01	0.01	0.01	0.01	0.073
t-stat	(10.79)	(10.39)	(5.18)	(3.32)	(3.63)	(5.13)	(2.99)
Border		0.10	0.01	0.01	0.01	0.01	0.01
t-stat		(0.43)	(0.06)	(0.07)	(0.03)	(0.06)	(0.03)
Central		0.52	0.62	0.62	0.61	0.62	0.61
t-stat		(3.49)	(4.51)	(4.54)	(4.53)	(4.50)	(4.52)
Bank			0.17	0.03	0.20	0.17	
t-stat			(2.82)	(0.31)	(3.34)	(2.82)	
Bank*time				0.01			0.01
t-stat				(1.68)			(2.79)
Limited			0.35	0.33	-0.20	0.35	
t-stat			(3.95)	(3.76)	(-1.13)	(3.95)	
Limited*time					0.02		0.01
t-stat					(3.54)		(4.62)
Traded			0.52	0.49	0.42	0.44	0.41
t-stat			(3.33)	(3.10)	(2.70)	(1.01)	(2.62)
Traded*time						0.00	
t-stat						(0.19)	

TABLE 5-a: Productivity growth regressions

Dependent variable = value of output in 1900 pesos

Obs	492					
N	139					
Adj. R-square	0.35	0.37	0.37	0.37	0.36	0.36

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6
Constant	3.82	3.93	4.06	3.91	4.12	4.14
t-stat	(11.38)	(11.99)	(11.89)	(11.30)	(11.91)	11.40
Ln(K/L ratio)	0.65	0.61	0.60	0.61	0.59	0.59
t-stat	(10.08)	(9.38)	(9.13)	(9.29)	(8.98)	8.84
Ln(Workers)	0.07	0.05	0.03	0.05	0.02	.02
t-stat	(1.59)	(1.18)	(0.64)	(1.17)	(0.52)	0.34
Time	0.03	0.03	0.03	0.03	0.03	0.03
t-stat	(9.71)	(9.63)	(8.83)	(9.41)	(9.52)	(8.91)
Border		-0.04	-0.06	-0.04	-0.04	-0.02
t-stat		(-0.29)	(-0.41)	(-0.25)	(-0.26)	(-0.13)
Central		0.24	0.25	0.24	0.24	0.23
t-stat		(2.46)	(2.55)	(2.41)	(2.44)	(2.28)
Bank			0.10			0.12
t-stat			(1.33)			(1.55)
Limited				-0.02		-0.14
t-stat				(-0.19)		(-1.25)
Traded					0.39	1.06
t-stat					(1.76)	(1.70)
Traded * time						-0.02
t-stat						(-1.80)

TABLE 5-b: Productivity growth regressions

Dependent variable = meters of cloth produced

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5
Obs	579				
N	145				
Adj. R-square	0.19	0.25	0.25	0.25	0.25
Constant	7.19	7.29	7.25	7.10	7.33
t-stat	(23.79)	(24.38)	(0.31)	(22.79)	(23.68)
Ln(K/L ratio)	0.46	0.42	0.43	0.44	0.42
t-stat	(8.77)	(8.10)	(8.12)	(8.36)	(7.95)
Ln(Workers)	0.02	-0.01	-0.01	0.01	-0.02
t-stat	(0.44)	(-0.32)	(-0.13)	(0.31)	(-0.42)
Time	0.01	0.01	0.01	0.01	0.01
t-stat	(3.01)	(3.01)	(3.01)	(3.46)	(2.93)
Border		-0.07	-0.06	-0.02	-0.07
t-stat		(-0.45)	(-0.41)	(-0.11)	(-0.45)
Central		0.35	0.35	0.32	0.35
t-stat		(3.29)	(3.23)	(2.92)	(3.28)
Bank			-0.05		
t-stat			(-0.70)		
Limited				-0.21	
t-stat				(-2.13)	
Traded					0.08
t-stat					(0.45)

TABLE 6: Capital intensity differences between firm types

Dependent variable = spindles/worker

	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5
Obs	632				
N	155				
Adj. R-square	0.04	0.09	0.09	0.09	0.09
Constant	2.84	2.64	2.64	2.64	2.65
t-stat	(48.65)	(32.82)	(32.80)	(32.89)	(32.73)
Time	0.004	0.003	0.004	0.00	0.00
t-stat	(2.25)	(1.86)	(2.03)	(1.49)	(1.58)
Border		0.26	0.27	0.25	0.26
t-stat		(1.86)	(1.91)	(1.74)	(1.86)
Central		0.35	0.35	0.35	0.34
t-stat		(3.62)	(3.59)	(3.67)	(3.57)
Bank			-0.05		
t-stat			(-0.85)		
Limited				0.06	
t-stat				(0.71)	
Traded					0.16
t-stat					(1.08)

TABLE 7: 1893 cross-sectional logit specs

Dependent variable = 1 if bank-connected, 0 if otherwise

Obs.	69				
N	69				
R-square	0.051	0.075	0.079	0.059	0.087
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5
Constant	-0.929	-30.07	-29.90	-1.244	-34.01
t-stat	(0.3)	(-1.0)	(-1.0)	(0.1)	(-1.1)
Profit margin	0.854	0.835	0.847	-1.245	0.300
t-stat	(1.5)	(1.4)	(1.4)	(-1.4)	(0.4)
Date founded		0.016	0.016		0.018
t-stat		(1.0)	(1.0)		(1.1)
Ln(Spindles/worker)			-0.013	-0.023	-0.023
t-stat			(-0.4)	(-0.7)	(-0.7)
Ln(Output/worker)				0.001	0.001
t-stat				(1.0)	(1.1)

TABLE 8: Liquidity sensitivity test results

Growth, 1894-95, in:

Dependent var:	Value	Meters	Spindlage
Obs.	60	60	60
Adj. R-square	0.53	0.17	0.02
Constant	1.01	1.37	1.29
t-stat	(21.12)	(9.80)	(12.96)
Margin	1.03	1.45	-0.11
t-stat	(7.11)	(3.40)	(-0.38)
Bank*Margin	-0.45	-0.76	0.42
t-stat	(-2.30)	(-1.31)	(1.03)