THE MEXICAN ECONOMY, 1870–1930

Essays on the Economic History of Institutions, Revolution, and Growth

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Chapter 2

Institutional Change and Economic Growth: Banks, Financial Markets, and Mexican Industrialization, 1878–1913

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During the Porfiriato, the Mexican government reformed the laws governing banking and the chartering of joint stock corporations. What effects did these institutional reforms have on economic growth? Did these institutional reforms accelerate or impede the growth of the real economy?

To address these questions this chapter focuses on three interrelated questions. First, what impact did Porfirian law have on the structure of the banking industry? Second, what was the relationship between the structure of the banking industry and the extension of credit to the "real" economy? Third, did imperfections in credit extension have a measurable impact on the performance of the real economy?

To answer these questions, we employ firm-level census data and tax records covering Mexico's largest manufacturing industry, cotton textiles, over the period 1878 to 1913. Although 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. These bank-connected firms, however, were not any more productive than their competitors who did not receive bank financing.

We also argue that laws that permitted the formation of limited-liability joint stock companies appear to have been important mostly because they facilitated relationship banking. The evidence indicates 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 general incorporation law allowed firms to find a way around a poorly functioning legal system. Thus, 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 stock market were massively larger than their competitors. However, it appears that going to the stock market 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]

In short, we find that the political economy of Porfirian Mexico gave rise to formal institutions that produced a concentrated banking system. Because of the high cost of obtaining information, these banks provided credit only to those manufacturing firms that were owned by bank directors. This produced allocation inefficiencies: banks connected to manufacturing firms were no more productive than their competitors. Had Mexico had banking laws that made it easier to charter a bank, it would have industrialized faster.

We organize the argument as follows. The first section briefly describes the history of Mexican financial law and the growth of the banking system. 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.

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 thirteen 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 Yves 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 estab-

lished 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 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 percent, compared to 50 percent 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 U.S.$125,000), and 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 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 percent 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.

What this means is that Mexico had very few banks. In 1909, Mexico possessed forty-two formally incorporated financial institutions of various kinds.[2] For comparison, in the same year the United States enjoyed the services of 18,723 banks and trust companies.[3] Figure 2.1 presents 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 figure 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 0.20, where it remained for the rest of the period. Nevertheless, with forty-two banks and banking companies in operation by 1910, the banking system remained about as concentrated as one with only five equally sized institutions.[4]

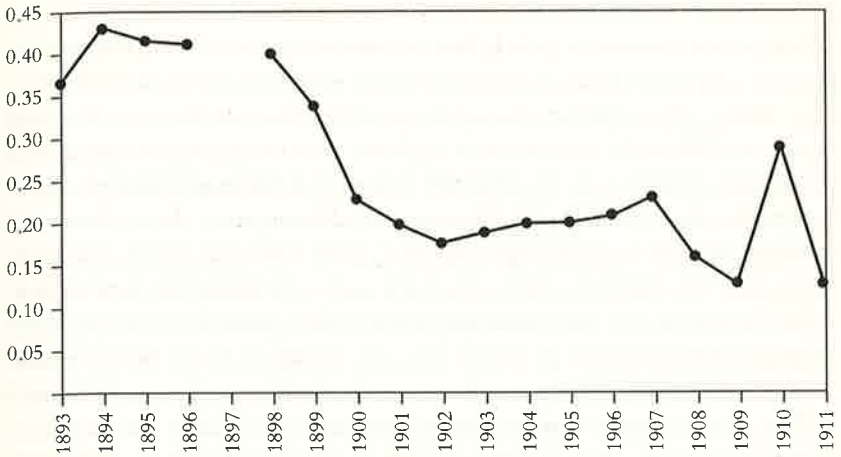

Figure 2.1. Herfindahl Index for Mexican Banking

SOURCE: *Economista Mexicano*, various issues.

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 among 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. Since the number of banks was highly limited, the implication is that far fewer potential entrepreneurs could receive credit than in countries like the United States.

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. 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 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 closer 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 both the incentives and leverage to monitor firms owned by other directors because a default by one of these firms would damage the credibility of the entire group, 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 over borrowing firms in the case of default. Loans would be made not to the firm, but to 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.

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.[6] 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 analy-

sis. 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.[7] 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.[8]

Total labor-hours were not available. We therefore followed Razo and Haber 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.[9]

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:

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

where Y_{it} is the dependent variable of firm i at time t; α is the overall intercept term for all firms;[10] 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.

For our productivity regressions, we followed Razo and Haber and assumed a Cobb-Douglas production function of the form $Y = A \cdot K^{\gamma} \cdot L^{1-\gamma}$ 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 normalized 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:

$$\text{Ln } y = \alpha + \beta_1 \cdot \text{Ln } k + \beta_2 \cdot \text{Ln } L + \beta_3 \cdot \text{Time Trend} + \delta \cdot \text{Dummies} + \gamma \cdot \text{Interaction Terms}$$

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 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, 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 nonconnected 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 textile 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. A strong relationship holds in either case.

Table 2.1a

Average Value of Output per Firm, by Type of Firm

Year	*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

NOTE: These data are presented graphically in Figure 2.3a.

Data Analysis

Tables 2.1a, 2.1b, and 2.2 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 the general incorporation laws of 1889. 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

Table 2.1b

Average Output in Meters of Cloth per Firm, by Type of Firm

Year	*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

NOTE: These data are presented graphically in Figure 2.3b.

Table 2.2

Average Installed Spindlage per Firm, by Type of Firm

Year	*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

NOTE: These data are presented graphically in Figure 2.4.

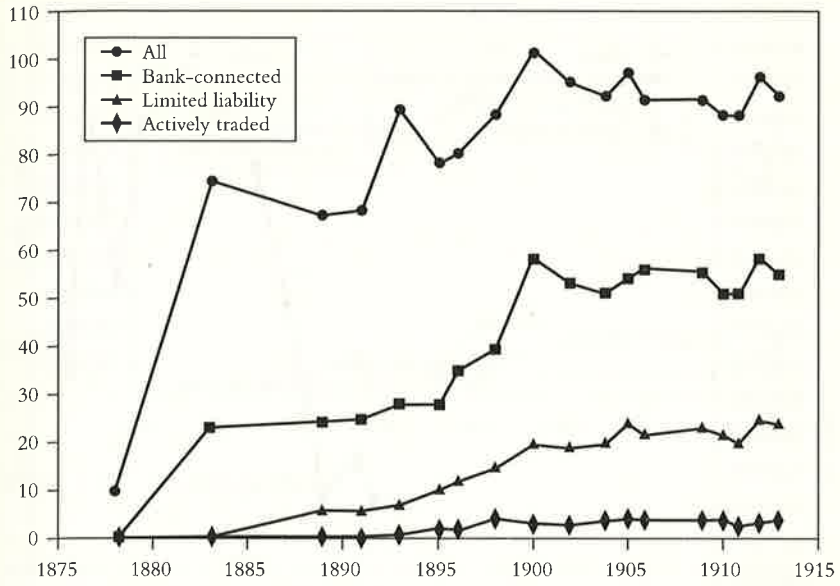

Figure 2.2. Number of Firms, by Type

exchange. Only four companies, which collectively owned sixteen 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.

Figure 2.2 indicates the relative number of various types of firm: bank-connected firms, limited-liability firms, publicly traded joint stock companies, and other firms. 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 start-ups 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

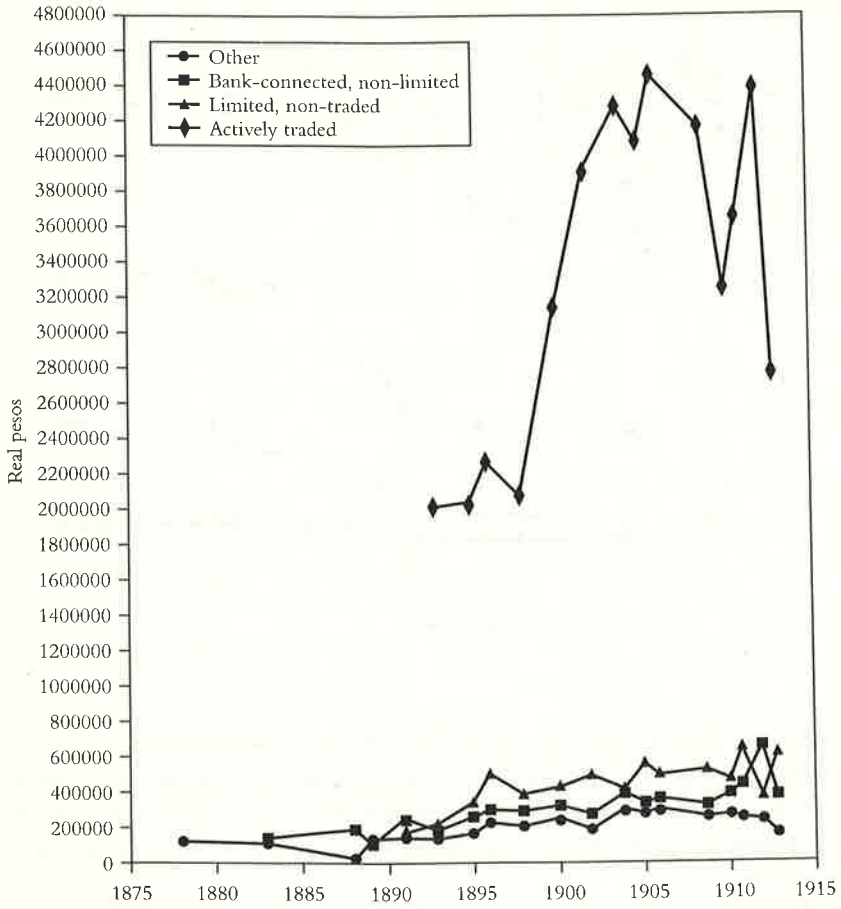

Figure 2.3a. Value of Output, by Firm Category

partly owned by a bank or have an interlocking directorate with one) and partnerships or proprietorships 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 (see Figure 2.3a).[14] Measuring output in meters shows similar results, although the output of the limited-liability companies appears to stagnate after 1896 (see Figure 2.3b).

Our capacity measure, installed spindlage, behaves similarly (see Figure 2.4). The four traded companies start out big and stay big. The size of

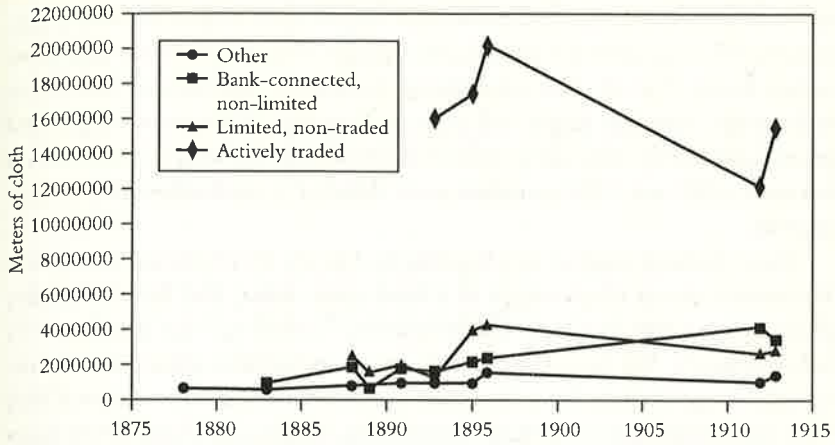

Figure 2.3b. Output in Meters

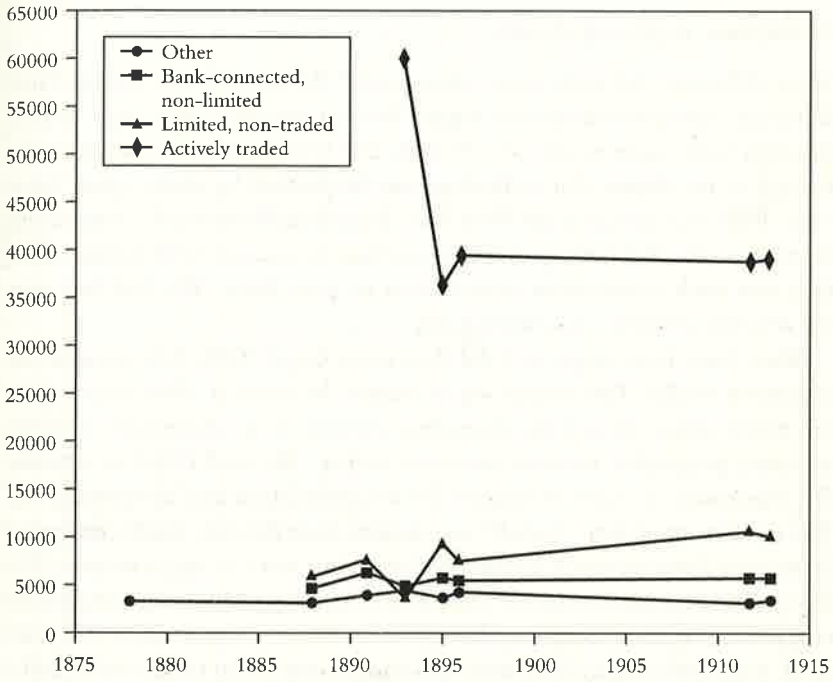

Figure 2.4. Average Spindlage per Firm, by Firm Category

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.

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 could have driven faster growth. Therefore, we used panel data techniques to test whether bank-connected firms enjoyed higher productivity or grew faster.

Multivariate Regression Results

What difference did bank connections make? We test five hypotheses. 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 that 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 2.3a 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. We used FGLS to estimate the regressions in order to control for autocorrelation and heteroskedasity. The results support our "eyeball" conclusions from the data. Bank-connected firms grew faster (roughly 50 percent faster), but were no larger to start. The few publicly traded companies were more than three times larger than their competitors at their founding, but grew no faster. Organization as a joint stock company (when combined with bank connection) produced an additional marginal effect on output, but our regression results did not allow us to determine whether this was a one-time-only or dynamic advantage.

These results hold when we measure growth in meters rather than by

Table 2.3a

Output Growth Regression Results

Dependent variable = value of output in 1900 pesos								
Obs	1488							
N	178							
Adj. R-square	0.10	0.14	0.32	0.32	0.32	0.32	0.32	0.32
	Spec 1	*Spec 2*	*Spec 3*	*Spec 4*	*Spec 5*	*Spec 6*	*Spec 7*	*Spec 8*
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 2.3b

Output Growth Regression Results

Dependent variable = meters of cloth									
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
	Spec 1	*Spec 2*	*Spec 3*	*Spec 4*	*Spec 5*	*Spec 6*	*Spec 7*	*Spec 8*	*Spec 9*
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 2.4
Spindlage Growth Regressions

Dependent variable = installed spindlage							
Obs	640						
N	156						
Adj. R-square	0.08	0.15	0.28	0.28	0.29	0.28	0.28
	Spec 1	*Spec 2*	*Spec 3*	*Spec 4*	*Spec 5*	*Spec 6*	*Spec 7*
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)	

value, presented in Table 2.3b. Bank-connected firms grew by approximately 2 percent per year, while independent firms remained stagnant. The large traded companies, as before, enjoyed a huge one-time advantage, but then *shrank* in size. We then reran the above regression using installed spindlage as the dependent variable, as a measure of capacity (see Table 2.4). Overall, the results paralleled our results in Tables 2.3a and 2.3b, save for one difference: when spindlage is used as the dependent variable, it becomes clear that organization as a joint stock company provided a marginal increase in the firm's growth rate, and not simply a one-time spurt. This advantage only applied to firms also connected to banks, and was not related to whether the

firm was publicly traded. In fact, the marginal effect on future growth from being publicly traded was zero—the big conglomerates were simply born bigger. It was organization as a joint stock company and connection to a bank that provided a dynamic effect: these companies grew by more than 3 percent per year in terms of installed spindlage, three times as fast as their competitors.

These results are entirely consistent with 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 independent 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 (TFP)? We used generalized least squares to estimate the coefficients. Table 2.5 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 percent *lower* TFP than their competitors (Specification 4 of Table 2.6). 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 that advantage was dissipated over time. The only significant effect is a regional one: firms located in and around Mexico City were roughly 25 percent more productive.

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 2.7 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

Table 2.5
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)

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.

Which way did causality run? Did firms grow large because they were connected to banks, or did banks simply choose larger, faster growing firms to associate with? That is to say, did banks pick insiders or did banks pick winners? The historical evidence suggests the former. Most of the banks involved in the industry were created by textile entrepreneurs, Banamex being the only significant exception. The 1893 textile census provides the information to test this hypothesis more rigorously. The census contained data

Table 2.6
Productivity Growth Regressions

Dependent variable = meters of cloth produced					
Obs	579				
N	145				
Adj. R-square	0.19	0.25	0.25	0.25	0.25
	Spec 1	*Spec 2*	*Spec 3*	*Spec 4*	*Spec 5*
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)

on the prices that firms faced for labor, fuel, and raw materials, as well as information on their output and inputs of labor and capital. Therefore, we ran a series of logit regressions to test whether bank association can be predicted by differences in technology, age, profitability (defined by the operating margin), or size.

The results are unambiguous (see Table 2.8). Bank-connected firms in 1893 did not earn higher profits, use more capital-intensive technology, or enjoy higher labor productivity than their competitors. Banks did not pick more profitable, faster growing firms to associate with. Rather, banks allocated credit to insiders, whose firms could then grow faster.

What was the causal 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 plow back profits from previous production cycles.

Table 2.7
Capital Intensity Differences Between Firm Types

Dependent variable = spindles/worker					
Obs	632				
N	155				
Adj. R-square	0.04	0.09	0.09	0.09	0.09
	Spec 1	*Spec 2*	*Spec 3*	*Spec 4*	*Spec 5*
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)

Bank-connected firms did not face this constraint. We used the same detailed 1893 census data to test this hypothesis, by testing whether liquidity constraints—proxied as lower operating margins—directly affected firm growth for a cross section of sixty different enterprises.

We ran the following three specifications on cross-sectional data from the 1893 and 1895 censuses:

$$\text{VALGROW} = \text{CONSTANT} + B_1\text{MARGIN} + B_2\text{BANK} \cdot \text{MARGIN}$$
$$\text{METGROW} = \text{CONSTANT} + B_1\text{MARGIN} + B_2\text{BANK} \cdot \text{MARGIN}$$
$$\text{SPINGROW} = \text{CONSTANT} + B_1\text{MARGIN} + B_2\text{BANK} \cdot \text{MARGIN}$$

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

Table 2.8

Cross-Sectional Logit Specs, 1893

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)

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 contained in the "1893" census).

The results in Table 2.9 indicate that bank relationships played a significant role in alleviating liquidity constraints. When output is measured in constant value, firms that broke even in 1893–94 grew by roughly 1 percent 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 percent 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

Table 2.9
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)

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. In fact, one outcome of this financial system was a high and increasing level of concentration in the textile industry. As Table 2.10 shows, both the Herfindahl index and four-firm ratio for the industry increased as a result of the growth of the financial system.

Analysis and Conclusions

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 that were 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,

Table 2.10
Textile Industry Market Concentration Measures

Year	*Four-Firm Ratio*	*Herfindahl Index*
1843	0.376	0.053
1850	0.449	0.069
1853	0.430	0.068
1862	0.319	0.049
1865	0.342	0.050
1878	0.160	0.021
1883	0.189	0.023
1888	0.217	0.025
1891	0.228	0.027
1893	0.284	0.036
1895	0.363	0.048
1896	0.371	0.051
1902	0.381	0.064
1906	0.338	0.049
1912	0.271	0.034

NOTE: These data are presented graphically in Figure 2.5.

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]

Banks did not pick winners, nor were winners more likely to found banks. Relationship banking simply 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 it would have had otherwise. In fact, as the data presented in Figure 2.5 show, Mexico's industrial structure became more concentrated just as the formal banking system began to develop.

One implication of our results is that Mexico would have industrialized faster with more liberal bank incorporation laws. There would have been more textile firms, since a larger number of entrepreneurs could have used

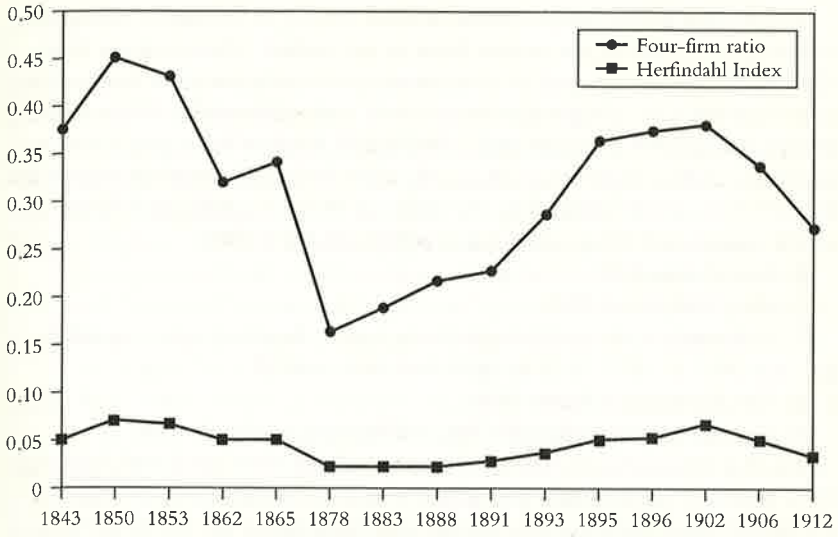

Figure 2.5. Market Concentration Measures

the banking system to finance their expansion. In addition, bank credit would have been allocated more efficiently. Entrepreneurs with a comparative advantage in managing manufacturing concerns would have been able to obtain bank financing, rather than bank credit being constrained to those entrepreneurs who were politically well positioned so that they could obtain a bank charter. Mexico would have had a larger and less concentrated textile industry. It might also have had a more efficient textile industry.

Notes

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 advantages directly derived from the listing were smaller than they appear. See Maurer and Sharma 1999.
2. Maurer 1997: 1.
3. Binder and Brown 1991: 52.

4. The Herfindahl concentration index is defined as the sum of the squares of the market shares of the various firms in the market. The advantage of the Herfindahl index as opposed to other measures of concentration is that it allows concentration to be compared across markets with substantially different structures. Conceptually, a market with a Herfindahl index of 0.5 is just as concentrated as a market containing two equally sized firms, and a market with an index of 0.33 is as concentrated as one made up of three equally sized firms, and so on, regardless of the actual number of firms in the market.

5. See Maurer 1999.

6. Razo and Haber 1998.

7. 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.

8. See, for instance, Kane 1988.

9. See Atack 1985; Sokoloff 1984; and Bernard and Jones 1996.

10. 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.

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

12. See Gerschenkron 1962; and Schumpeter 1939.

13. See Maurer 1997 for details on the timing of bank start-ups.

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 banks 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 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.

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

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