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Related Lending and Economic Performance:

Evidence from Mexico

by

Noel Maurer
Stephen Haber*

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Stanford University
John A. and Cynthia Fry Gunn Building
366 Galvez Street | Stanford, CA |
94305-6015

There is broad agreement in the literature that bankers in LDCs treat their banks as mechanisms to finance the business enterprises of their close friends, members of their own families or clans, and themselves. This practice is often called "related lending." The literature also argues that related lending has negative effects on welfare because it creates incentives to bankers to make imprudent loans—or even loot their own banks.[1] Finally, it is often argued that related lending should be prevented through prudential regulation by the government and through changes in the corporate governance of banks.[2] Underlying this argument is the notion that related lending exists because of the lack of appropriate regulation and supervision. The argument therefore contains the following implicit counterfactual claim: with appropriate regulation and supervision, bankers in LDCs would behave like bankers in developed countries: they would make arm's-length loans based on objective performance criteria.

We argue that related lending is not a consequence of inadequate regulation and supervision, but is rather a rational response to high levels of default risk. High levels of default risk can exist for any number of reasons, but prominent among them are weak institutions to enforce contract rights and high costs of obtaining information about potential borrowers. Related lending mitigates these problems. First, bankers do not need recourse to the formal legal system to sanction related borrowers. Rather, they can do so through a wide variety of informal means. Second, bankers can obtain information about related borrowers at relatively low cost.

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[1] La Porta, Lopez-de-Silanes, and Zamarripa 2003.
[2] For example, see Laeven 2001.

It logically follows that attempts to eliminate related lending through supervision and regulation will not produce the first-best outcome of arm's length lending based on objective performance criteria. Rather, in the context of high default risk, the close regulation and supervision of banks so as to preclude related lending will produce very little lending of any type.[3]

Unfortunately, the institutional problems that give rise to high levels of default risk (weak property rights enforcement and high costs of information) cannot be reformed at the stroke of a pen. Enhancing the enforcement of contract rights requires, in the first place, that governments actually have the capacity to adjudicate and enforce those rights. This requires more than the power of coercion. It requires that the government have an efficient administrative apparatus that can adjudicate disputes at low cost to the contracting parties.[4] The *capacity* to enforce contracts is, however, only half the battle. Any government that has the power to effectively adjudicate contract rights also has the power to abrogate or selectively enforce them. Thus, the effective enforcement of contract rights also requires that there be self-enforcing political institutions that limit the authority and discretion of public officials.[5]

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[3] If bankers face high default risk they will not invest their assets in debt contracts but will instead invest in securities—particularly those issued by governments. Mexico since 1997 is an example of this outcome: when foreign firms purchased Mexico's banks, they had few mechanisms with which to discriminate among potential borrowers and they knew that it would be difficult to enforce contracts through the legal system. They have therefore increasingly allocated their assets to the holding of government debt. See Haber and Musacchio, 2004.

[4] If the cost of adjudication to the parties is high, then economic agents will only make contracts whose rate of return exceeds the cost of contract enforcement. This will curtail the number of contracts into which agents enter, and thereby depress economic activity.

[5] Constraints on public officials and government capacity are causally linked. If the power of public officials is not limited, economic agents will be subject to expropriation risk. They will therefore refrain from making investments whose rate of return does not compensate them for the risk that the

Reducing information costs is similarly complicated. A common solution to high information costs is the creation of a system of institutionalized credit reporting. The problem is that it is difficult in the short term to create such systems because lenders and borrowers both have incentives to keep credit information private. A bank may prefer, for example, to closely guard information about particularly good borrowers. If the bank publicizes a borrower's good behavior, then the borrower will have the option of seeking a lower interest rate from another bank.[6]

This means that, paradoxically, the best option available to policy makers is to allow bankers to engage in related lending. As we argue below, this is clearly a second-best outcome because bankers will misallocate capital. They will choose borrowers based on personal contacts rather than the quality of the underlying projects. Discrimination in the credit market will cause relatively unproductive firms to get more capital than they otherwise would. Over the long run, relatively unproductive (but bank-related) firms will gain market share at the expense of relatively productive (but non-related) firms. Downstream industries, therefore, will demonstrate both slower productivity growth and a less competitive market structure than they would in the

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government will expropriate their assets or the stream of income those assets produce. The result will be lower levels of investment, which, in turn, will reduce the pool of wealth and income that the government can tax. With fewer resources, the government will be less able to develop an effective administrative and coercive apparatus that can adjudicate property rights. This fundamental dilemma of governance was noted as long ago as the Middle Ages (Greif et. al. 1994), but in recent years it has spawned a sizable political science literature. For representative works, see: North and Weingast 1989; Shepsle 1991; Hoffman and Norberg 1994; McGuire and Olson 1996; Weingast 1997a, 1997b; North et. al., 2000; Olson 2000; Bates 2001; Haber, Razo, and Maurer 2003.

[6] See, for example, Sharpe 1990, Rajan 1992, Petersen and Rajan 1995, and Greebaum, Kanatas and Venezia 1989, for evidence that creditors who enjoy exclusive relationships with their borrowing are more able to extract rents. Petersen and Rajan 1994 argue that such exclusive relationships may also benefit borrowers, since creditors will be more likely to provide finance early on, knowing that they can extract benefits in the future.

presence of an efficient credit market. Nevertheless, a banking system that allocates capital inefficiently is still a better outcome than a banking system that does not lend at all.

We operationalize our argument about the causes and consequences of related lending by looking at the lending strategy of Mexican banks during the period 1880-1913. We then analyze how that strategy affected the structure and performance of a large and finance-dependent industry—cotton textile manufacturing.[7] We construct a panel of textile mills that covers the 25-year period (1888-1913), and code the panel by mill characteristics, including ties between a mill owner and a bank. We focus on Mexico during this period because related lending to bank directors and their enterprises was widespread.[8] We focus on the cotton textile industry because it is an ideal natural laboratory to test the relationship between the way that banks allocate credit and the structure and performance of the real economy. Cotton textile manufacturing was finance-dependent, but at the same time the industry approximated the requirements of perfect competition to an unusual degree.[9] Indeed, cotton textile

[7] We break off our analysis in June 1913 because the underlying political economy of Mexico's banking system changed dramatically as of 1914, as a consequence of a civil war whose purpose was to depose the government of Victoriano Huerta. The 1914 civil war not only brought about predatory behavior by the government against the banks, it also interfered with the operation of the factor markets necessary to run the textile industry. For a discussion see Haber, Razo, and Maurer 2003, chapters 3, 4, 5.

[8] Mexico's banking system makes an interesting natural laboratory during this period because there was no deposit insurance, the banks were very-well capitalized, bank charters were distributed on political grounds, shareholders developed elaborate monitoring mechanisms,. and bank depositors policed their own banks, withdrawing deposits from risky banks and placing them in safer ones. See Haber, Razo, and Maurer 2003, p. 120 for data on bank capitalization. For a discussion of the institutional mechanisms that outside shareholders in Porfirian banks developed to monitor the activities of bank directors, see Maurer 2002, pp. 101-03 and 108-10. See Huybens, Luce, and Pratap 2003 for a discussion of active monitoring by depositors. We discuss the criteria by which bank charters were distributed later on in the paper.

[9] The industry was characterized by relatively low barriers to entry and near-constant returns to scale technology. The capital equipment was easily divisible. Economies of scale were exhausted at small

manufacturing was Mexico's largest manufacturing industry, and as Table 1 shows, it grew rapidly throughout this period.[10]

Our analysis demonstrates that the textile mills that were related to banks were less profitable and less technically efficient than their competitors. Nevertheless, access to bank credit allowed them to grow faster, become larger, and survive longer than their more productive competitors. The implication for growth is clear: efficient firms lost market share to relatively unproductive (but bank-related) competitors. As a consequence, the overall rate of growth of productivity in the industry was quite modest. Related lending also had an implication for the market structure of the textile

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firm sizes. This does not mean that scale economies were non-existent in textile production. It does mean, however, that scale economies in textiles were exhausted at relatively small firm sizes compared to such industries as steel, cement, or chemicals. In these industries, scale economies were so large relative to the size of the Mexican market that they precluded more than a few firms from operating at the minimum efficient scale of production. The estimated minimum efficient scale in the Mexican textile industry during this period was approximately 0.7 percent of the market: small, but not zero. (See Maurer and Sharma 2001, p. 960.)

There were no barriers to entry produced by patents, proprietary technology, control of raw materials, advertising, branding, or control of wholesale or retail distribution. The technology to produce textiles was freely available in Mexico: U.S. and British machinery companies openly competed to sell textile machinery to Mexican manufacturers. Cotton was also freely available, as Mexico had two major cotton growing regions, one in the North (the La Laguna region of Durango and Coahuila) and another in the South (coastal Veracruz). The importation of raw cotton required no special permit, though a tariff was levied. The purchasers of cloth from the textile mills (wholesalers and large retailers) were expert judges of cloth: branding and advertising were of little importance.

Finally, while some large retailers owned their own textile companies, and bought from their own mills at a discount, control of retailing did not pose a barrier to entry, as there were literally thousands of dry goods retailers spread throughout the country. Indeed, the census data, and firm histories, make it clear that small and mid-sized mills sold their output through jobbers and commissioned salesmen throughout the country. (See, for example, Compañía Industrial de Parras, S.A. 1949; Carden 1890; Graham-Clark 1909.) High tariff protection insulated the industry from imports. From 1901 to 1912 the effective rate of protection for coarse cotton cloth varied from a low of 31 percent to a high of 83 percent. The effective rate of protection for fine weave cloth over the same period varied from 45 percent to 102 percent. (See Gómez-Galvarriato 1999, pp. 604 and 608.)

[10] The cotton textile industry was only one of many finance-dependent industries in Porfirian Mexico. Measuring the independent impact of capital misallocation in these other industries is complicated by the lack of firm level census data, as well as by the fact that the performance of these industries might have been affected by a number of factors, of which differential access to capital caused by related lending would be only one.

industry. Even though cotton textile manufacturing is a textbook case of an industry with constant returns to scale, Mexico's bank-related textile mills grew so large relative to their (non-related) competitors that the Mexican cotton textile industry had the market structure of an increasing returns to scale industry.[11]

The rest of this paper is organized as follows. Section II provides a discussion of the lending practices and industrial organization of the Mexican banking system. Section III then discusses the impact that related lending had on the structure and performance of the cotton textile industry. It presents econometric results from our panel data analysis, and it draws comparisons to data from other countries. Section IV concludes.

II. Related Lending and the Mexican Banking System

Circa 1880 the Mexican banking system was so small as to be practically non-existent. Only two chartered (note-issuing) banks existed in the entire country. One, the Banco de Londres y México (henceforth BLM), was a branch of a British bank that operated in Mexico City and focused primarily on financing foreign trade. The other was a small operation chartered by the government of the border state of Chihuahua.[12]

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[11] Related lending also generates a hypothesis related more to sociology than economics. If bankers make loans to themselves or entrepreneurs in their social network, then we should expect to see a high degree of interlock on corporate boards. Additionally, the nodes of business networks should be populated by bankers. See Musacchio and Read 2003 for a test of these hypotheses using comparative network analysis of corporate boards in Mexico and Brazil in 1909. They find that they hold.

[12] Until the growth of the chartered banking system in the decades after 1884, most financial intermediation took place in merchant houses, which issued bills of exchange and advanced credits to entrepreneurs in their social networks. These institutions did not, however, have any of the advantages of banks: they did not sell equity to outside investors, they did not have limited liability, they did not take deposits, and their bills of exchange had to be 100 percent backed by specie reserves. In short, they were different from modern banks in a fundamental sense: they made money by speculating with the funds of

Over the next three decades, spurred on by legislation enacted by the country's dictatorial ruler (Porfirio Díaz, who ruled from 1876 to 1911), Mexico's banking system expanded. Most of this growth occurred after 1897, when the Díaz government enacted a general banking and credit law. In 1896, Mexico had only six chartered banks with total assets of 50 million dollars. By 1911, there were 42 banks, controlling assets valued at 385 million dollars. Mexico was still underbanked by the standards of developed countries: its ratio of bank assets to GDP was only 0.27, versus 0.65 in the United States. Nevertheless, compared to the 1880s, Mexico had a sizable banking system by 1911. (See Table 2).

Mexico's banking system had three salient features. First, the federal government tightly regulated the number of banks that competed in any market by controlling the number and types of charters granted. Second, the government chose which groups received charters based on their political connections. Third, the vast majority of lending was related lending.

Mexico's banking regulations created binding constraints on entry and competition. Only two banks, the BLM and the Banco Nacional de Mexico (hereafter Banamex), were permitted to branch nationally. All other banks were prohibited from branching outside their concession territories, which were generally contiguous with state lines. With few exceptions, charters were granted to only one bank in any territory, meaning that there

their proprietor, rather than with funds that belonged to people other than the proprietor. For an examination of how such a merchant house operated, see Walker 1987.

were typically only three banks operating in any state: Banamex, the BLM, and the bank that had a federal charter for that state.[13]

This organization of banking markets was the product of federal legislation explicitly designed to create a series of segmented monopolies and oligopolies. First, the government made sure that chartered banks would not have to compete against unchartered banking companies by prohibiting the latter from issuing banknotes. Chartered banks, on the other hand, could issue banknotes up to two times their specie reserves, which gave them a tremendous advantage over non-chartered banks. Banamex was allowed to issue notes up to three times its level of specie reserves, giving it an even greater advantage.[14] Second, in 1884 the federal government prohibited the states from chartering banks.[15] Third, the federal government limited the number of chartered banks by creating a series of legal barriers to entry. Chartered banks were subject to a two percent tax on bank capital and a five percent tax on banknotes, but Banamex, the BLM, and the first bank chartered in each territorial concession were exempted from both taxes. In addition, the law established a minimum capital requirement equivalent to $250,000—five times the minimum capital required for a national bank charter in the United States. In case these barriers proved insufficient, the

[13] Mexico City had five banks, three of which lacked the legal right to issue banknotes. The border states of Chihuahua and Sonora, because of peculiarities of their banking histories, had as many as six banks at different times.
[14] Banks that received territorial concessions between 1886 and 1897 were able to negotiate their reserve requirements with the Secretary of Finance. They were almost always held to a fifty percent reserve ratio, except for the the Banco de Nuevo León, was allowed to issue notes up to three times its reserves, the same as Banamex.
[15] Maurer 2002, p. 23.

law further specified that all charters, as well as issues of new shares by existing banks, had to be approved by the Secretary of Finance.

The Díaz government did not choose the groups that received a bank charter based on their entrepreneurial talents: it chose them based on their political connections. Not surprisingly, public officials close to Díaz populated bank boards. Consider, for example, the case of Banamex, which was both the largest and (because of a special charter that made it the treasury's financial agent) the most lucrative bank in the system. Its board of directors was a who's who of political insiders, including the brother of the Secretary of the Treasury, the Deputy Secretary of the Treasury, the President of Congress, a federal Senator, and the president's Chief of Staff. The chairman of the board of its major competitor, the BLM, was none other than the Secretary of War. Banks with limited territorial concessions were also chosen based on their political connections. The only difference was that state governors, rather than cabinet ministers, sat on their boards and received directors' fees, stock distributions, dividends, and in some cases loans made with no expectation of repayment. In some cases, the governor himself received the bank concession. In fact, the system was deliberately conceived to distribute benefits to the state governors, and give them a stake in the maintenance of Porfirio Díaz's rule.[16]

Mexico's newly created banking system quickly converged on related lending as the dominant business strategy. Initially, Banamex, which received one of the first federal charters (in 1884) experimented with arm's length loans. These loans almost always

[16] Maurer 2002, pp. 40-44; Haber, Razo, and Maurer 2003, pp. 88-90; Razo 2003, chaps. 8 and 9.

went into default, and the collateral proved to be either fictitious or unrecoverable. Banamex therefore hired agents to screen borrowers, and quickly found that the agents colluded with the borrowers—resulting in yet more defaults and unrecoverable collateral. By 1886, Banamex had shifted strategy: it lent primarily to its own directors, members of their families, or their close business associates. In fact, from 1886 to 1901 *all* of the private (non-government) loans made by Banamex went to its own directors. After 1901 Banamex extended credit to non-related borrowers, but only if they satisfied one of two criteria: the borrower had a loan guarantee from the federal government (as was the case with some railroad companies); or the borrower was either the Banco Oriental (a large bank that had the territorial concession for Puebla and parts of adjoining states) or one of that bank's directors.[17]

Related lending, in fact, appears to have been standard business practice for Porfirian banks. Data we have retrieved on the loan portfolio of the Banco Mercantil de Veracruz indicates that 86 percent of its loans to individuals from 1898 to 1906 went to the bank's own directors.[18] Banamex' most significant competitor, the BLM, also made sizable loans to its own board members to finance manufacturing company start-ups.[19] A cross-section of loans we have drawn for 1908 for four other banks (the Banco de Nuevo Leon, Banco de Durango, Banco Mercantil de Monterrey, and the Banco de

[17] The reason given by Banamex board members for the latter exemption is instructive: most of the loans made by the Banco Oriental went to its own directors, all well-known textile magnates. Loans to them, and to their bank, were a means of investing in their manufacturing enterprises. Thus Banco Oriental loans were deemed low risk precisely because the bank practiced related lending. Maurer 2002, pp. 95-103, 108-110; Maurer and Sharma 2001, pp. 953-956. The case of the Banco Oriental, and its relationship to the Puebla textile industry, is detailed in Gamboa Ojeda 1985 and Gamboa Ojeda and Estrada 1986.
[18] The data for this estimate come from a random sample of 50 entries in the Libro de Responsibilidades of the Banco Mercantil de Veracruz, located in Galería 2 of the Archivo General de la Nación.
[19] Maurer 2002, p. 103.

Coahuila) indicate similar lending strategies. 29 percent of the Banco de Nuevo León's loans went to a single firm, owned by one of its directors.[20] 31 percent of the Banco Mercantil de Monterrey's loans also went to a single firm owned by one of its directors.[21] 51 percent of the Banco de Durango's loans went to enterprises owned by family members of one of its directors.[22] As astounding 72 percent of the Banco de Coahuila's loans also went to a firm owned by family members of the director.[23]

Outside shareholders and depositors knew that Mexico's banks practiced related lending. They appear, however, to have viewed the purchase of bank stock as a way to invest in the broad range of enterprises owned by bank directors. Thus, for an outside investor, buying bank shares was much like buying a share of a mutual fund today: risk was spread across a broad range of businesses which were managed by agents (the bank directors) who had reasons to protect their reputations.[24] As a result, Porfirian banks were well-capitalized. In 1894, they had a capital adequacy ratio (paid-in capital

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[20] On December 21st, 1908, the loan was sold to the Caja de Préstamos para Obras de Irrigación, a state-owned banking institution. The record of the transfer can be found in the Sesiones Administrativas de la Caja de Préstamos, Box 1, located in Galería 2 of the Archivo General de la Nación in Mexico City. Data for the Banco de Nuevo León's loan portfolio is from the end-of-year balance sheet published in the Economista Mexicano.

[21] For more on the Madero family's holdings, see Cerruti 1992: 229-31.

[22] On December 14th, 1908, the loans to López Negrete were sold to the Caja de Préstamos para Obras de Irrigación, a state-owned banking institution. The record of the transfer, and the value of the loan, can be found in the Sesiones Administrativas de la Caja de Préstamos, Box 1, located in Galería 2 of the Archivo General de la Nación in Mexico City. Data for the Banco de Durango's loan portfolio is from its end-of-year balance sheet published in the Economista Mexicano. Mortgage loans have been included in calculating the value of the loan portfolio. López Negrete's position on the Banco de Durango board is from the Boletín Financiero y Minero.

[23] On December 21st, 1908, the loans were sold to the Caja de Préstamos para Obras de Irrigación, a state-owned banking institution. The record of the transfer can be found in the Sesiones Administrativas de la Caja de Préstamos, Box 1, located in Galería 2 of the Archivo General de la Nación in Mexico City. Data for the loan portfolios of the Banco Mercantil de Monterrey and the Banco de Coahuila come from their end-of-year balance sheets published in the Economista Mexicano.

[24] Maurer 2002, pp. 74-80, 94-95, 111-113.

plus retained earnings and reserves, divided by assets) of 34 percent. In 1910, the capital adequacy ratio was 32 percent.[25]

The Porfirian banking system proved very stable. The banks paid a steady stream of dividends to their shareholders and shares traded for multiples of their par values.[26] Only three bank failures during the entire period 1888-1913 produced losses for depositors or noteholders. All three of the failed banks were located on the Yucatán peninsula, whose economy was almost entirely dependent on sisal cultivation. When the price of the fiber dropped by half in 1908, so did the local economy and the solvency of the peninsula's banks. (None of the three banks were involved in textile manufacture.) No other banks suspended the convertibility of their deposits or banknotes during the period.[27]

III. Data Analysis

What effects did related lending have on Mexico's cotton textile industry? Did related lending produce an efficient allocation of credit?

We therefore turn to the econometric analysis of a panel data set, constructed by Razo and Haber, of Mexican cotton textile mills and firms.[28] Our data set includes

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[25] Figures calculated from bank balance sheets published in the Economista Mexicano.
[26] Maurer and Sharma 2002, p. 967.
[27] Maurer 2002, pp. 112-113.
[28] This data setlinks mills and firms across manufacturing censuses and excise tax records over the period 1850-1932. For a discussion of the sources and methods used to build the panel, see Razo and Haber, (1998). The census records employed in this study can be found in García Cubas, 1893; Mexico, Dirección General de Estadística 1894; Mexico, Secretaría de Fomento, 1890; Mexico, Secretaría de Hacienda. 1896a; Mexico, Secretaría de Hacienda. 1896b; Archivo General de la Nación, Ramo de Trabajo, Box 5, file 4; Archivo General de la Nación, Ramo de Trabajo, Box 31, file 2. We have recoded their data set to more effectively follow firms during the 1888-1913 period. We have also recalculated the real value of output

cotton textile manufacturing censuses for 1888, 1891, 1893, 1895, 1896, 1912, and 1913. These censuses are enumerated at the mill level and contain information on inputs and outputs, as well as information about location and ownership. In addition, our data set also includes three federal excise tax registers (1900, 1904, and 1909). These are enumerated at the mill level, and include data on output by value only.

We capture relationships between bankers and textile mill owners with dummy variables. Specifically, we code for bank board members who were also the sole proprietors of a textile mill, a partner in a firm that owned a textile mill, or who served on the board of directors of a joint stock corporation that owned a textile mill. We denote such mills as being "bank-related." We treat this dummy variable as a proxy for the ability of the mill's owners to obtain bank credit.[29] We note that the assumption that overlap between mill ownership and a bank directorship is a good proxy for bank credit is consistent with three fundamental facts about Mexican banking. First, we know from case studies by historians that the Banco Oriental and the Banco de Durango had been founded by textile entrepreneurs for the purpose of financing their *existing*

by substituting the Gómez-Galvarriato and Musacchio price index for the INEGI cotton textile price index employed by Razo and Haber. Razo and Haber used the textile price index of the Instituto Nacional de Estadística, Geografía e Informática (INEGI). It is unknown, however, how INEGI estimated this price index. We therefore employ the textile price index estimated by Gómez-Galvarriato and Musacchio (1998), whose methods and sources are known. In addition, we have culled stamping and knitting mills from the data set, and checked the data set against original manuscripts to verify observations with inordinately high or low values.

[29] We note that our definition of bank-connection is restrictive. Entrepreneurs who were connected to a bank in some way other than overlap between their membership on a bank board and ownership of a textile firm (for example, overlapping board memberships in a third, unobserved firm in a different industry, or marriage to a relative of a member of a bank board) are coded as "non-related" firms.

manufacturing ventures.[30] Second, in the case of Banamex, some of its board members were textile industrialists and the bank itself was a major stockholder in one of the country's largest textile companies (the Compañía Industrial Manufacturera). We know from the minutes of the bank's board meetings that it lent heavily to these enterprises.[31] Third, evidence from other large banks (reviewed above) makes it clear that they lent primarily to their own board members, members of their families, and their business associates. We also know that the directors of many of these banks also owned textile mills.[32]

These data enable us to estimate the prevalence of related lending in the textile industry. From zero in 1878 (because there were very few banks), the proportion of bank-related firms rose to 21 percent in 1888 to 57 percent by 1900. The percentage of installed capacity (measured in spindles) in bank-related mills increased even faster: from zero in 1878 to 33 percent in 1888 to 62 percent by 1896, and 80 percent by 1913.[33] (See Table 3.)

The Misallocation of Capital

In an efficient capital market, banks would have allocated credit to textile mills based on their performance characteristics. The most efficient mills would have

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[30] For more the Banco Oriental, see Gamboa Ojeda 1985 and Gamboa Ojeda and Estrada 1986. For more on the Banco de Durango, see Rodríguez López 1995.

[31] Maurer 2002, p. 98.

[32] The list of banks related to textile entrepreneurs or joint stock companies consists of Banamex, BLM, Banco Oriental, Banco de Nuevo León, Banco de Durango, Banco de Coahuila, Banco Mercantil de Veracruz, Banco de Guanajuato, Banco de Estado de México, and the Banco de Zacatecas.

[33] Spindles constitute the most important capital input for the production of cotton textile goods, and thus the literature tends to use spindlage as the measure of capital or capacity. See for example Kane 1988.

received loans, the least efficient mills would have been denied credit. How far from this ideal standard was Mexico?

As a first step in answering this question we estimate a series of probit regressions, where the dependent variable is whether or not a mill was bank-related, and the independent variables are the characteristics of mills. If credit was misallocated, then we should not be able to predict whether a mill was bank-related based on that its performance characteristics.

We begin our analysis with the 1893 manufacturing census, because it provides extremely detailed data on the costs and volumes of all inputs and outputs. We use this data to estimate operating margins for individual mills in 1893. We then estimate a probit regression to determine whether operating margins are correlated with being bank connected. The results, reported in specification 1 of Table 4, indicate that Mexico's banks misallocated credit: operating margins were uncorrelated with being bank-related. These results are robust to the addition of conditioning variables for mill age and size (specifications 2 and 3).[34]

Perhaps operating margins are too crude a measure of mill efficiency. We therefore substitute labor productivity for operating margins in specification 4 of Table 4. We find that it, too, is uncorrelated with being bank-related. We obtain similar (non) results

[34] Mill age was uncorrelated with bank-relation. Mill size was correlated with bank relation, but it is doubtful that mill size determined bank relation. Rather, as we will discuss below, causality appears to have run the other way: bank-related mills grew faster than their competitors and thus became larger than non-connected firms over time.

when we control for the capital-labor ratio by estimating total factor productivity—TFP—at the mill level in specifications 7, 8, and 9.[35]

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[35] We used the 1888-1913 firm-level censuses to estimate a Cobb-Douglas production function of the form $Y = A \cdot K^{\alpha} \cdot L^{\beta}$ 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. In order to use linear estimation procedures, we took natural logarithms and added explanatory variables to arrive at the following model.:

$$Ln\ Y = a + \beta_1 \cdot Ln\ K + \beta_2 \cdot Ln\ L + \text{Cross-sectional Time Dummies}$$

We then normalized the coefficients so that that $\alpha + \beta = 1$. We then calculated TFP for firm *i* using the following formula:

$$TFP_i = \frac{output_i}{spindles_i^{a} \times labor_i^{b}}.$$

These procedures were repeated twice, calculating different coefficients for output measured in meters and output measured in real 1900 pesos.

The other censuses do not permit us to estimate operating margins, because they do not include data on the value and volume of all inputs to production. They do, however, report data on the value and volume of production outputs and therefore allow us to estimate output per worker and TFP. We estimate probit regressions for the 1888, 1895, 1896, 1912, and 1913 manufacturing censuses in order to determine whether it is possible to predict which mills were bank-related based on their technical efficiency. The results, reported in Tables 5, 6, 7, 8, 9 and 10 are unambiguous: not a single one of these regressions, regardless of the specification employed, found any relationship between higher technical efficiency—however measured—and bank connection. The only statistically significant predictor of bank-relation was mill size, but as we shall discuss in detail below, bank relatedness appears to have determined size, rather than vice versa.

Perhaps lending practices in Mexico did not conform to textbook ideals of efficiency, but Mexican banks allocated credit to firms that raised average productivity nonetheless. In order to assess this hypothesis we estimate a time series, cross sectional regression on our panel of textile mills in order to see whether bank-related firms had higher than average TFP. We measure output in two ways: the real value of production and the volume of production in meters of cloth.[36] Following Kane's work on the United States, we used the number of spindles as a proxy for the capital input of each mill. Following Atack and Sokoloff on productivity in the United States, and Bernard

[36] Both measures of output have advantages and disadvantages. Real output is sensitive to the price index. The volume of production gets around the price index problem, but it cannot capture changes in the quality of cloth over time. We note that our results are not materially changed by the choice of output measure.

and Jones on international productivity comparisons, we took the number of workers as the measure of the labor input.[37] We adjusted, however, for changes in the legal length of the workday.

In order to use linear estimation procedures, we took natural logarithms of a Cobb-Douglas 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 specification:

$$Ln\ y = \alpha + \beta_1 \cdot Ln\ k + \beta_2 \cdot Ln\ L + \beta_3 \cdot Year\ Dummies.$$

This specification allowed us to test for economies of scale as well as to measure the growth of TFP across cross-sections.[38] We used variations of this equation to estimate the impact of other features of the mill or its owner: age, location, bank-relation, and whether it was publicly traded.

There are several striking features of the regressions results reported in Tables 11 and 12. First, as one would expect of cotton textile manufacturing, the industry was

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[37] This method of estimating inputs does not capture quality improvements in either labor or machinery over time. It will therefore tend to overestimate the unexplained residual output that cannot be attributed to capital or labor. See: Attack, 1985; Bernard and Jones, 1996; Kane, 1988; Sokoloff, 1984.

[38] 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 later 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 mill over time to correct for potential autocorrelation in its variables. We used an unbalanced panel procedure to estimate fixed effects regressions of the following form:

$$Y_{it} = a + b X_{it} + u_{it}$$

where Y_{it} is the dependent variable of firm *i* at time *t*; *a* is the overall intercept term for all firms; *b* is a vector of coefficients corresponding to the X_{it} vector of non-related variables and u_{it} is a stochastic term. We assume usual normality and independence conditions to obtain least-squares estimates of *b*.

We estimated both fixed and random effects regressions. A Hausmann test indicated that there was little difference between the fixed and random results. The random effects regression, however, indicated that bank-related mills were even less productive (compared to non-related mills) than they were in the fixed effects regression. We therefore report only the fixed effects results in order to bias the evidence against our hypothesis.

characterized by constant returns to scale. When output is measured by value (Table 11) the coefficients on the labor input are small and statistically insignificant. When output is measured in meters of cloth (Table 12), the coefficients on the labor input are *negative*, small and insignificant.

Second, the only statistically-significant coefficients on the interaction between bank-relation and year are *negative*. For example, specification 2 of Table 11 indicates that, when we measure output by value, bank-related firms in 1912 were 11 percent *less* productive than their non-related competitors. The results are even stronger when we measure output by volume. As specification 2 of Table 12 demonstrates, the average productivity of bank-related firms was 27 percent lower than their non-related competitors in 1912 and 39 percent lower in 1913. To the degree that the regressions are picking up change in textile productivity, the bank-related mills were *falling behind* their non-related competitors.

One might be tempted to argue that the productivity differentials between related and non-related mills data from 1912 and 1913 were somehow driven by the beginning of the Mexican Revolution in 1910. This argument does not fit the evidence. First, the real value of textile production *and* the number of mills in the industry were higher in 1912 and 1913 than they had been before the Revolution started.[39]

Third, separating out publicly-traded companies does not affect the results. Perhaps it was the case that a few, very large firms that were not only bank-related but

[39] For a detailed analysis of the effect of the Mexican Revolution on Mexico's manufacturing sector, see Haber, Razo, Maurer 2003, chapter 5.

were publicly traded as well, had grown beyond the optimal scale of production. In other words, perhaps the problem was not that banks were misallocating capital, but that the stock exchange was misallocating capital. There are two problems with this argument. The first is that investors appear to have chosen firms in which to buy shares based on whether there were well-known bankers on their boards—all four of the country's publicly-traded cotton textile companies had at least one (and more often several) board members who were prominent bankers.[40] The second is that our regression results are robust to the addition of dummy variables that interact census year with being listed on the Mexico City stock exchange (specification 3 of both Table 11 and Table 12). In fact, the coefficients on bank-connection barely move from their values in specification 2 of Table 11 and Table 12. Truncating the data set to exclude publicly traded companies had a similar lack of effect. Other controls, such as mill age or location (by region) also failed to change the results.[41]

Fourth, productivity growth in this industry, after an initial burst in the early 1890s, was stagnant. To the degree that the year dummies in specification 1 of Table 11 display any pattern, it is a gradual *fall* in TFP. We obtain similar results when we measure output by volume, rather than by value, in specification 1 of Table 12. The coefficients for 1896 and 1912 are nearly identical—indicating no productivity growth over a 16

[40] See Musacchio and Read 2003 and Razo 2003 for analyses of the boards of directors of publicly-traded manufacturing companies in Porfirian Mexico. Their results indicate that virtually all publicly traded manufacturing firms had bankers as board members. Notably, industries that were primarily financed by foreign direct investment, such as mining and petroleum companies, had virtually no Mexican bankers on their boards. The implication is that having a banker on the board of a manufacturing company was a signal to investors that the firm could obtain working capital from the banking system.

[41] We do not report the results on mill age and location because none of the coefficients were large or significant, and because the addition of these variables had virtually no impact on our year dummies, the interaction of year with bank-connection, or the interaction of year with being traded.

year period. We note that stagnant productivity is a very odd pattern to find in a new industry undergoing rapid extensive growth. Brazil, for example, also possessed a new textile industry undergoing rapid extensive growth, and TFP in Brazil's industry grew in excess of six percent per year.[42]

A skeptical reader might argue that our productivity regressions treat each observation (a mill-year) equally. The regressions do not weight the results by firm sizes. Thus, it might be the case that small and inefficient bank-related mills are driving the regression results. In order to test this hypothesis we break the sample of mills into two sectors, non-related and bank-related, and calculate the productivity of each sector in the aggregate for individual census years using the following formula:

$$TFP_t = \frac{\sum_i \text{Output}_{t,i}}{\left(\sum_i \text{Spindles}_{t,i}\right)^a \cdot \left(\sum_i \text{Workers}_{t,i}\right)^b}$$

where a and b are the (normalized) shares of capital and labor as estimated in the panel regression procedure described earlier and the subscript i identifies the inputs and output of reporting unit i.

The results, reported in Table 13, indicate that bank-related mills were, in the aggregate, less productive than non-related mills. When we measure output by value, the TFP of the non-related mills as a group is consistently higher than the TFP of the bank-related mills as a group. The gap between the two rises from 4 percent in 1893 to 11 percent in 1895, 7 percent in 1912, and 12 percent in 1913. When we measure output

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[42] Haber 1998.

by volume (in meters of cloth), the bank-related sector is more productive than the non-related sector in 1893, but soon loses its advantage. In 1893, the non-related sector was 7 percent less productive than the bank-related sector. In 1895 that gap fell to 4 percent, and in 1896 it fell to 2 percent. By 1913, the non-related sector was 25 percent *more* productive than the bank-related sector.

Perhaps it is the case that these results are driven by our specification of a Cobb-Douglas production function. In order to test this possibility, we calculated weighted averages of output per worker and output per spindle, using both value and meters of cloth. Table 14 presents our results. When labor productivity is measured in value, it is roughly similar across to the two sectors, but capital productivity is 9 percent higher in the non-related sector in 1893, and 22 percent higher in 1913. When output per worker is measured in meters, the non-related sector begins 21 percent more productive in 1888 and falls behind the bank-related sector by 1893 (when they are only 86 percent as productive). The non-related sector then pulls even by 1896, and regains its 20 percent advantage by 1912.

The productivity differences are even more stark when measured in terms of output per unit of capital (measured in spindles). When output is measured in value, the output-per-spindle of the non-related sector is consistently 9 to 22 percent higher than the bank-related sector between 1893 and 1912. When output is measured in meters of cloth, the output-per-spindle of the non-related sector is roughly equal to the bank-related sector in 1893-96, but is 35 percent higher in the non-related sector by 1912. In short, the conclusion that productivity was higher in the non-related sector does not seem to be an artifact of how we specified the industry's technology.

One implication of our productivity results is that bank-related mills over-invested in capital. The differences in capital-productivity between non-related and bank-related mills are significantly larger than the differences in labor-productivity. In other words, if one took a bank-related mill and an non-related mill with the same level of gross output, both firms would use approximately the same number of workers to produce it, but the bank-related mill would employ significantly more spindles. Capital-labor ratios in bank-related mills should, therefore, be significantly higher than in non-related mills. Table 15 presents the average capital-labor ratios of the two sectors. Non-related mills are significantly more capital-intensive in 1888 and 1891, but by 1893 they are only 83 percent as capital-intensive as bank-related mills, and they remain approximately 15 percent less capital-intensive through 1913.

A skeptical reader might argue that our results have a survivor bias. Inefficient mills go out of business. Efficient mills thrive and grow. This will be particularly true for non-related mills, which, unlike bank-related mills, could not borrow their way through downturns in the business cycle or random shocks. It should therefore not be surprising that non-related mills were more efficient than bank-related mills: the non-related mills in our data set were the best of the best.

This would be an unusual argument to make in light of the empirical facts: If efficient mills were forcing out inefficient mills, then we should expect to see an increase in average productivity over time. This was, however, an industry with stagnant productivity growth.

This would also be an unusual argument to make in light of its underlying theory. Its core assumption is exactly the argument that we advance in this paper: Mexico did not have an efficient capital market. In an efficient capital market, the best of the best would be precisely those mills that were bank-related or received funding from the financial markets. What we observe, however, is that the best of the best were neither related to banks, nor received funds from the sale of equity to the public.

Survivorship:

The survivor bias argument does, however, raise an interesting question: In an efficient capital market, good firms drive bad firms out of business. If, however, the capital market is inefficient then bad firms can drive good ones out of business. If mills do not need bank-financing to survive downturns in the business, then we would expect to see no difference between the survivorship rates of bank-related mills and unrelated mills. If, however, mills need outside sources of capital to survive negative shocks, then we would expect bank-related mills to have higher survivorship rates, controlling for other characteristics.

We therefore employed a Cox maximum-likelihood proportional hazards model to estimate the effect of mill age, size (measured by installed spindlage), output per worker (measured in both real value and meters of cloth), and a dummy for bank-relation on the probability of mill failure. Mills were defined as "failed" when they disappeared from the subsequent census, never to reappear. All coefficients (and standard errors) are transformed into hazard rates.

We find large and statistically-significant differences in the survivorship rates between the mills which had access to bank credit and their competitors, even when controlling for other factors, such as mill size and productivity. The implication is that mills needed bank credit in order to survive. The results are presented in Table 16.

In specifications 1 and 3 we estimate the model with size, labor productivity, and age as independent variables (the difference between the two specifications is whether we measure labor productivity as the value of output per worker, or the volume of output per worker). Regardless of how we measure labor productivity, we find that it was not a statistically significant predictor of mill survival. We also find that mill age did not predict mill survival, but that there was a positive relationship between size and survival. In specifications 2 and 4 we add dummy variables for bank-relation. The results are clear-cut: controlling for size, labor productivity, and age, bank-related mills were only 32 to 41 percent as likely to fail as their non-related competitors. Labor productivity and age (controlling for bank-relation) still had no impact on determining whether mills survived or failed. Size continued to have some effect on survival, although the relationship was much weaker once we control for bank-relationship. The magnitude of the hazard rates increases and the statistical significance of the coefficients decreases. In fact, when we control for bank relatedness, the size variable is only significant in one of the two specifications. The coefficients on bank relationship, however, were always large and statistically significant—even controlling for the other features of mills. The implication is clear: bank-relation determined survival.

Bank-Relation and the Rate of Growth of Mills

The Cox hazard model suggests that being bank-related had an independent effect on survival, when controlling for firm size. The drop in the significance of the coefficients on mill size once we add a dummy variable for bank relation suggests, however, that there may have been some endogeneity at work: bank-related firms may have begun life bigger than their competitors, or they began life at the same size, but grew faster because they faced lower capital constraints.

In order to test this hypothesis, we employ multivariate regression analysis on our panel of mills. We regress the natural log of installed spindlage against the age of the mill (based on the supposition that older mills might be larger than younger ones), dummy variables for each census year, dummy variables that interact bank-relation with census year, and dummy variables that interact being a publicly-traded company with census year. We employ this last variable to determine whether our results are driven by outliers that had the special characteristic of being traded on Mexico City's fledgling stock market.[43] The results are presented in Table 17.

Specification 1 of Table 17 indicates that mills were growing over time: the coefficients on the year dummies increase as we move from 1888 to 1913. It also indicates that mill age was not a determinant of mill size. Specification 2 adds dummies

[43] There were four such firms. Their histories are discussed in Haber 1989.

that interact the census year with bank-relation. The coefficients on the interaction between bank-relation and year also increase with time, but only become significant at the 10 percent confidence level in 1896, and the 1 percent level in 1912 and 1913. The implication is that bank-related firms did not start out significantly larger than their competitors, but they grew considerably faster. In specification 3 we add dummies that interact being publicly traded and census year, in order to determine whether our results in specification 2 are driven by the four mills that, in addition to being bank-related, were also traded on the Mexico City stock exchange. As one would expect, the mills owned by the four publicly-traded firms grew even faster than the mills owned by bank-related firms. Nevertheless, the coefficients on bank-relation were robust to the addition of the traded-year dummies. Indeed, the magnitude and statistical significance of the bank-relation dummies scarcely changed at all from specifications 2 to 3.[44] In sum, all things being equal, mills owned by bank-related firms grew faster and were larger than their non-related competitors—even though they were technically less efficient.

One might be tempted to argue that banks were "picking winners." In this view, bankers used size as a proxy for success, choosing to acquire stakes in large mills. If this hypothesis were true, we would expect to see bankers acquiring stakes in large pre-existing mills after their banks were founded. When we analyze the history of Mexico's bank-related mills, however, we find the opposite pattern. Bank directors *did not* acquire stakes in pre-existing mills after their banks were founded. In some cases they

[44] We obtained similar results by truncating the data set to exclude traded firms.

founded brand new mills using bank capital. In other cases, they used the bank to finance mills they had owned before the bank was incorporated.

Of the universe of Mexican textile mills, 34 pre-existing mills switched from being non-related to being bank-related. Twelve of these mills were related to Banamex. All twelve were related to Banamex before 1888, and all were either owned by founding board members or had been taken over by the bank in the wake of its disastrous experience with outside loans in 1884-86. Of the remaining 21 switching mills, nine were related to the Banco Oriental. All nine were owned by founding board members of the bank before the bank was incorporated. A similar story can be told for the mills related to the Banco de Durango (three mills), the Banco de Zacatecas (two mills), and the Banco de Coahuila (four mills), and three of the four mills related to the Banco de Nuevo León. All were owned by entrepreneurs who later received bank charters. In short, of the 33 pre-existing mills which switched from being non-related to being bank-related, only one is consistent with the story of a bank "picking winners."

<u>Related Lending and Market Structure:</u>

If bank-related firms grew at a much faster rate than their non-related competitors, then it logically follows that there should have been big size differences between bank related and non-related mills. Table 18 is unambiguous on this point: in 1888, bank related mills were, on average, almost twice the size of unrelated mills; by 1913, they were nearly four times as large. It logically follows that the market structure of the textile industry was more concentrated than that which would have prevailed in an efficient capital market.

In order to measure concentration we aggregate mills into firms, and estimate four-firm concentration ratios and the Herfindahl index for the Mexican cotton textile industry during the period 1888-1913. In order to determine how low concentration would have been in the absence of related lending, we specify three counterfactuals. The first compares Mexico to itself over time. Cotton textile manufacturing was an industry characterized by constant returns to scale technologies and the absence of entry barriers. We should expect that as the industry grew, concentration should have fallen. The second compares Mexico to other countries that had large textile industries, but which did not have Mexico's banking system. We focus on three countries with large cotton textile industries: the United States, Brazil, and India.[45] The third, following Sutton, compares Mexico's actual performance to a hypothetical Mexico with a fully competitive textile industry.[46]

The results of all three experiments indicate that the Mexican cotton textile industry was "too" concentrated. First, concentration in Mexico actually increased over time, even though the industry was growing quickly. (In the United States, Brazil, and India, unlike Mexico, concentration fell or remained stable as the textile industry grew.) Second, the Mexican cotton textile industry was much more concentrated than the

45 Haber 1997; Haber 2003.

46 It is possible to calculate the four-firm ratio that would be "expected" in a competitive industry. The method assumes that all firms in a market have an identical chance of gaining or losing market share over time. Some firms will gain (and some will lose) market share. Even under perfect competition, therefore, firms will have unequal market shares, but the market share of the largest firms will solely be a function of the number of firms in the industry and a stochastic growth process. See Sutton 1998.

American, Brazilian, or Indian cotton textile industry. Third, the Mexican cotton textile industry showed much higher four-firm ratios compared to the ratio that would be expected in a perfectly competitive market (following Sutton), given the number of firms in the industry.[47] (See Table 19.)

IV. Conclusions and Implications:

In an efficient capital market, the most productive firms drive less productive firms out of business. In Mexico, however, inefficient firms expanded their market share at the expense of efficient firms. Any way that we measure it, bank-related mills were technically less efficient than non-related mills, yet bank-related mills were more likely to survive and expand their operations than non-related mills. The results can be seen in Table 3. Relatively unproductive bank-related mills controlled 33 percent of installed capacity in 1888. By 1913, they controlled 80 percent.

Related lending was a second-best solution, but it was the first-best available solution for Mexico's bankers. Given the insecurity of property rights and the high cost of information, bankers had two options. The first was to make no loans at all.[48] The second was to engage related lending, with the consequent misallocation of capital. An outcome in which the formal banking system makes no loans to private industry is worse than an outcome in which lending takes place, but capital is misallocated.

[47] See footnote 46 for an explanation.

[48] More realistically, bankers might have limited their lending to the government, or invested their resources overseas

This does not mean, however, that policy makers must simply accept the misallocation of capital as a given. It does mean, however, that the most effective means to encourage an efficient allocation of capital is not to try to legislate related lending or weak property rights out of existence. Rather, it may be to encourage entry into banking. If bank charters are limited, then the pool of entrepreneurs who can use the banks to mobilize capital will be limited. If, however, bank charters are granted more liberally, it will increase the probability that talented entrepreneurs will be able to obtain a bank charter, and thereby allocate credit to their firms.[49]

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[49] We note that Naomi Lamoreaux's positive assessment of related lending in 19th-century New England is tied to the fact that there were very low barriers to entry in banking. See Lamoreaux 1994, pp. 52-62.

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Table 1
The Mexican Textile Industry, 1888-1913

	Mills	Real Value of Production (Millions of 1900 Pesos)1	Volume of Production (Millions of Meters) Meters of Cloth)	Installed Capacity (In Thousands of Spindles)	Worker Equivalents2
1888	84		57.9	251.2	15,049
1891	85		94.7	277.7	14,143
1893	113	19.8	120.2	368.3	21,335
1895	98	26.0	170.1	420.6	18,655
1896	100	26.0	194.7	447.4	20,175
1900	122	34.5			
1904	115	34.6			
1909	108	36.1			
1912	126	36.4	267.7	733.3	26,087
1913	128	36.6	294.7	730.7	26,645

1. Value data in 1900 pesos, calculated using the Gómez-Musacchio textile price index.
2. The number of workers in 1912 and 1913 has been adjusted for a reduction in the legal workday from 12 hours to 10.

Source: Mexican textile censuses: years 1888, 1893, 1895, 1896, 1912, and 1913; Mexican cotton textile excise tax schedules for 1900 and 1904.
Original sources for data set as follows:
1888 data from México, Secretaría de Fomento, 1890;
1891 data from México, Departamento de Fomento, 1893;
1893 data from México, Dirección General de Estadística, 1894;
1895 data from México, Secretaría de Hacienda, 1896a;
1896 data from México, Secretaría de Hacienda,1896b;
1900, 1904, and 1909 data from La Semana Mercantil (financial weekly).
1912 data from Archivo General de la Nación, Ramo de Trabajo, Box 5, file 4;
1913 data from Archivo General de la Nación, Ramo de Trabajo, Box 31, file 2.
A discussion of how these censuses were merged into a panel with a uniform format can be found in Razo and Haber 1998.

Table 2
The Mexican Banking Industry, 1896-1912

	Number of Reporting Banks[1]	Bank Assets (M U.S. $)	Banamex Market Share	BLM Market Share	Herfindahl Index[2]
1896	6	50	58%	28%	0.42
1897	10	54			
1898					
1899	13	78	51%	26%	0.34
1900	17	113	39%	25%	0.22
1901	20	107	38%	22%	0.20
1902	23	107	35%	19%	0.17
1903	25	130	37%	17%	0.18
1904	26	184	41%	15%	0.20
1905	26	205	39%	18%	0.20
1906	28	264	40%	16%	0.21
1907	28	301	44%	14%	0.23
1908	34	339	40%	12%	0.19
1909	35	283	37%	12%	0.17
1910	35	302	39%	12%	0.18
1911	35	385	39%	12%	0.18
1912	34	342	36%	11%	0.16

1. In 1911 there were 42 banks in operation,
but only 35 reported data to the Secretary of the Treasury.
The banks which did not report were small operations.

2. Computed nationally, thus assumes that banks with territorial concessions could operate in one another's concession territories. Thus, this is a lower bound
estimate.

Source: Calculated from balance sheets published in El Economista Mexicano.

Table 3
Mexico's Textile Industry, By Bank Relation, 1888-1913

	Percent of Mills Related to Banks	Percent of Total Value Produced by Bank-Related Mills	Percent of Total Meters Produced by Bank-Related Mills	Percent of Total Installed Spindles in Bank-Related Mills
1888	21%		32%	33%
1891	20%		32%	30%
1893	30%	48%	51%	51%
1895	39%	58%	59%	59%
1896	40%	58%	60%	62%
1900	57%	75%		
1904	55%	75%		
1909	61%	81%		
1912	55%	79%	80%	82%
1913	54%	77%	78%	80%

Source: See Table 1.

Table 4
Probit Results for 1893 Census Cross-Section
Dependent Variable = 0 if Independent, 1 if Bank-Related
T Statistics in Parentheses

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6	Spec 7	Spec 8	Spec 9
Number of Observations	81	81	81	105	104	104	101	100	100
LR chi2	1	1.04	9.7	1.07	1	12.2	0.2	0.3	13.34
Prob > chi2	0.32	0.59	0.02	0.30	0.61	0.01	0.66	0.86	0.00
Pseudo R2	0.01	0.01	0.10	0.01	0.01	0.10	0.00	0.00	0.11
Constant	-0.70***	-0.65**	-4.93***	-2.18	-2.11	-3.71**	-1.00	-0.95	-4.04***
	(3.89)	(2.05)	(3.09)	(1.37)	(1.33)	(2.10)	(-1.00)	(-0.95)	(-2.83)
Operating Margins	0.64	0.630	-0.054						
	(0.98)	(0.97)	(0.08)						
Ln (Output/Worker)--Meters of Cloth[1]				0.19	0.19	-0.09			
				(1.02)	(0.99)	(0.43)			
Ln (TFP)--Value[2]							0.08	0.09	-0.16
							(0.44)	(0.47)	(0.74)
Age of Mill		-0.002	-0.007		-0.001	-0.007		-0.002	-0.01
		(0.21)	(0.72)		(0.11)	(0.84)		(-0.30)	(-1.09)
Ln (Installed Spindlage)--Proxy for Size			0.58***			0.53***			0.59***
			(2.78)			(3.16)			(3.36)

* Significant at the 90 percent level; ** Significant at the 95 percent level; *** Significant at the 99 percent level.
1. Measuring output in value rather than meters of cloth did not materially affect the results.
2. Output by value divided by weighted capital and labor. Capital and labor weights estimated from coefficients from productivity regressions--Table 14.
Source: 1893 data from México, Dirección General de Estadística, 1894.

Table 5
Probit Results for 1888 Census Cross-Section
Dependent Variable = 0 if Independent, 1 if Bank-Related
T Statistics in Parentheses

	Spec. 1	Spec. 2	Spec. 3
Number of Observations	52	51	50
LR chi2	0.12	0.1	5
Prob > chi2	0.7274	0.9489	0.1716
Pseudo R2	0.0025	0.0022	0.1061
Constant	-1.83	-1.75	-5.50
	(0.71)	(0.67)	(1.66)
Ln (Output/Worker)--Meters Coth	0.10	0.09	0.02
	(0.35)	(0.31)	(0.05)
Age of Mill		0.00	-0.01
		(0.09)	(0.38)
Ln (Installed Spindlage)--Proxy for Size			0.57***
			(2.05)

* Significant at the 90 percent level
** Significant at the 95 percent level
*** Significant at the 99 percent level

Source: 1888 data from México, Secretaría de Fomento, 1890.

Table 6
Probit Results for 1891 Census Cross-Section
Dependent Variable = 0 if Independent, 1 if Bank-Related
T Statistics in Parentheses

	Spec. 1	Spec. 2	Spec. 3
Number of Observations	78	72	67
LR chi2	1.0	3.1	5.4
Prob > chi2	0.3193	0.2143	0.1445
Pseudo R2	0.0125	0.0434	0.0858
Constant	1.13	2.44	-1.77
	(0.57)	(1.13)	(-0.61)
Ln (Output/Worker)--Meters Coth	-0.23	-0.34	-0.27
	(-0.99)	(-1.40)	(-1.11)
Age of Mill		-0.01	-0.01
		(-1.21)	(-1.07)
Ln (Installed Spindlage)--Proxy for Size			0.45*
			(1.88)

* Significant at the 90 percent level
** Significant at the 95 percent level
*** Significant at the 99 percent level

Source: 1891 data from México, Departamento de Fomento.

Table 7
Probit Results for 1895 Census Cross-Section
Dependent Variable = 0 if Independent, 1 if Bank-Related
T Statistics in Parentheses

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6
Number of Observations	83	82	79	82	81	81
LR chi2	0	0.33	6.72	0.02	0.68	6.74
Prob > chi2	0.9959	0.8472	0.0813	0.9007	0.7118	0.0807
Pseudo R2	0	0.003	0.0626	0.0001	0.0062	0.0615
Constant	-0.22	-0.068	-2.88	-0.48	-0.48	-3.75
	(0.14)	(0.04)	(1.17)	(-0.26)	(0.26)	(-1.6)
Ln (Output/Worker)--Meters Cloth[1]	-0.001	-0.003	-0.08			
	(0.01)	(0.01)	(0.26)			
Ln (TFP)--Value2				0.04	0.07	0.03
				(0.12)	(0.23)	(0.11)
Age of Mill		-0.004	-0.008		-0.006	-0.008
		(0.58)	(1.01)		(-0.81)	(-1.01)
Ln (Installed Spindlage)--Proxy for Size			0.44**			0.44**
			(2.3)			(2.37)

* Significant at the 90 percent level
** Significant at the 95 percent level
*** Significant at the 99 percent level

1. Measuring output in value rather than meters of cloth did not materially affect the results.
2. Output by value divided by weighted capital and labor. Capital and labor weights estimated from coefficients from productivity regressions--Table 14.

Source: 1895 data from México, Secretaría de Hacienda, 1896a.

Table 8
Probit Results for 1896 Census Cross-Section
Dependent Variable = 0 if Independent, 1 if Bank-Related
T Statistics in Parentheses

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6
Number of Observations	82	81	79	84	83	83
LR chi2	1.26	1.35	5.75	0.14	0.48	3.66
Prob > chi2	0.2614	0.5089	0.1244	0.7097	0.7885	0.3006
Pseudo R2	0.0113	0.0122	0.053	0.0012	0.0042	0.0324
Constant	1.84	1.98	-0.52	0.38	0.45	-1.93
	(0.99)	(1.05)	(0.22)	(0.24)	(0.28)	(0.9)
Ln (Output/Worker)--Meters Cloth[1]	-0.23	-0.23	-0.33			
	(1.1)	(1.12)	(1.22)			
Ln (TFP)--Value[2]				-0.10	-0.09	-0.10
				(0.37)	(0.32)	(0.34)
Age of Mill		-0.003	-0.006		-0.005	-0.006
		(0.35)	(0.73)		(0.61)	(0.77)
Ln (Installed Spindlage)--Proxy for Size			0.43**			0.31*
			(2.24)			(1.75)

* Significant at the 90 percent level
** Significant at the 95 percent level
*** Significant at the 99 percent level

1. Measuring output in value rather than meters of cloth did not materially affect the results.
2. Output by value divided by weighted capital and labor. Capital and labor weights estimated from coefficients from productivity regressions--Table 11.

Source: 1896 data from México, Secretaría de Hacienda,1896b.

Table 9
Probit Results for 1912 Census Cross-Section
Dependent Variable = 0 if Independent, 1 if Bank-Related
T Statistics in Parentheses

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6
Number of Observations	97	95	90	104	102	101
LR chi2	1.41	2.08	12.31	0.88	1.27	22.51
Prob > chi2	0.2357	0.3534	0.0064	0.3492	0.5293	0.0001
Pseudo R2	0.0111	0.017	0.1088	0.0063	0.0094	0.1683
Constant	-1.46	-1.83	-6.13**	1.38	1.12	-5.99**
	(-0.94)	(-1.17)	(-2.11)	(1.14)	(0.91)	(-2.37)
Ln (Output/Worker)--Meters Cloth[1]	0.20	0.24	0.09			
	(1.18)	(1.39)	(0.39)			
Ln (TFP)--Value[2]				-0.19	-0.16	-0.13
				(-0.92)	(-0.079)	(-0.49)
Age of Mill		0.0008	-0.0003		0.0042	0.0054
		(0.13)	(-0.04)		(0.75)	(0.76)
Ln (Installed Spindlage)--Proxy for Size			0.69***			0.84***
			(3.09)			(3.89)

* Significant at the 90 percent level
** Significant at the 95 percent level
*** Significant at the 99 percent level

1. Measuring output in value rather than meters of cloth did not materially affect the results.
2. Output by value divided by weighted capital and labor. Capital and labor weights estimated from coefficients from productivity regressions--Table 14.

Source: 1912 data from Archivo General de la Nación, Ramo de Trabajo, Box 5, file 4.

Table 10
Probit Results for 1913 Census Cross-Section
Dependent Variable = 0 if Independent, 1 if Bank-Related
T Statistics in Parentheses

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5	Spec. 6
Number of Observations	95	93	90	102	100	99
LR chi2	0.01	0.06	18.56	1.54	3.46	26.63
Prob > chi2	0.94	0.97	0.00	0.22	0.18	0.00
Pseudo R2	0.00	0.00	0.16	0.01	0.03	0.20
Constant	0.40	-0.05	-4.73*	-1.54	-2.35	-9.46***
	(0.25)	(-0.03)	(-1.80)	(-1.07)	(-1.55)	(-3.36)
Ln (Output/Worker)--Meters Coth[1]	-0.01	0.04	-0.19			
	(-0.08)	(0.20)	(-0.84)			
Ln (TFP)--Value[2]				0.31	0.42	0.35
				(1.23)	(1.64)	(1.15)
Age of Mill		0.0009	0.002		0.0063	0.0073
		(0.16)	(0.34)		(1.10)	(1.19)
Ln (Installed Spindlage)--Proxy for Size			0.81***			0.91***
			3.66			(4.11)

* Significant at the 90 percent level
** Significant at the 95 percent level
*** Significant at the 99 percent level

1. Measuring output in value rather than meters of cloth did not materially affect the results.
2. Output by value divided by weighted capital and labor. Capital and labor weights estimated from coefficients from productivity regressions--Table 14.

Source: 1913 data from Archivo General de la Nación, Ramo de Trabajo, Box 31, file 2.

Table 11
Productivity Regressions[1]
Dependent variable = (LN) Output Per Worker
T Statistics in Parentheses

	Output Measured in Real Value		
	Spec 1	Spec 2	Spec 3
Observations	469	469	469
Mills	158	158	158
R^2	.2790	.2798	.2762
Constant	4.69***	4.71***	4.63***
	(7.11)	(6.93)	(6.71)
LN(Capital/Labor)[2]	0.46***	0.46***	0.47***
	(4.53)	(4.49)	(4.52)
Ln(Labor)[3]	0.11	0.11	0.12
	(1.15)	(1.10)	(1.21)
1895	0.47***	0.42***	0.42***
	(6.35)	(4.52)	(4.49)
1896	0.44***	0.45***	0.44***
	(5.89)	(4.67)	(4.64)
1912	0.32***	0.30**	0.30***
	(3.75)	(2.40)	(2.37)
1913	0.33***	0.29***	0.29***
	(3.87)	(2.42)	(2.38)
Bank-Related 1893		-0.06	-0.08
		(-0.46)	(-0.58)
Bank-Related 1895		0.06	0.05
		(0.46)	(0.35)
Bank-Related 1896		-0.07	-0.07
		(-0.53)	(-0.51)
Bank-Related 1912		-0.11*	-0.01
		(-0.80)	(-0.06)
Bank-Related 1913		0.02	0.03
		(0.16)	(0.21)
Traded 1895			-0.09
			(-0.21)
Traded 1896			-0.19
			(-0.53)
Traded 1912			-0.29
			(-0.70)
Traded 1913			-0.32
			(-0.78)

Table 11, continued

1. Functional form is OLS with fixed effects. Production function is Cobb Douglas.
2. Spindles per worker, adjusted for legal length of workday.
3. Number of workers, adjusted for legal length of workday.

Table 12
Productivity Regressions[1]
Dependent variable = (LN) Output Per Worker
T Statistics in Parentheses

	Output Measured in Meters of Cloth		
	Spec 1	Spec 2	Spec 3
Observations	642	642	642
Mills	170	170	170
R^2	0.2329	0.2315	0.2377
Constant	8.26***	8.10***	8.06***
	(17.84)	(17.25)	(16.85)
LN(Capital/Labor)[2]	0.32***	0.33***	0.33***
	(4.95)	(5.14)	(5.12)
Ln(Labor)[3]	-0.12*	-0.09	-0.09
	(-1.82)	(-1.41)	(-1.27)
1891	0.09	0.10	0.10
	(1.18)	(1.26)	(1.28)
1893	0.03	0.04	0.04
	(0.40)	(0.54)	(0.57)
1895	0.22***	0.23***	0.24***
	(2.97)	(2.67)	(2.69)
1896	0.40***	0.43***	0.43***
	(5.39)	(4.72)	(4.75)
1912	0.40***	0.56***	0.56***
	(4.99)	(4.55)	(4.54)
1913	0.48***	0.65***	0.65***
	(5.88)	(5.55)	(5.54)
Bank-Related 1888		-0.14	-0.14
		(-0.78)	(-0.75)
Bank-Related 1891		-0.20	-0.20
		(-1.15)	(-1.16)
Bank-Related 1893		-0.12	-0.12
		(-0.96)	(-1.02)
Bank-Related 1895		-0.11	-0.15
		(-0.88)	(-1.18)
Bank-Related 1896		-0.13	-0.18
		(-1.04)	(-1.36)
Bank-Related 1912		-0.27**	-0.25*
		(-1.92)	(-1.77)
Bank-Related 1913		-0.31**	-0.30**
		(-2.29)	(-2.21)

Table 12 Continued

Traded 1895	0.48
	(1.19)
Traded 1896	0.38
	(1.16)
Traded 1912	-0.35
	(-0.94)
Traded 1913	-0.17
	(-0.45)

1. Functional form is OLS with fixed effects. Production function is Cobb Douglas.
2. Spindles per worker, adjusted for legal length of workday.
3. Number of workers, adjusted for legal length of workday.

* Significant at the 90 percent level
** Significant at the 95 percent level
*** Significant at the 99 percent level

Note: controlling for mill age and mill location by region did not materially affect the results.

Source: See Table 1.

Table 13
Mexican Textile Mill Productivity, By Independent and Bank Connected Mills

	Weighted TFP, Value			Weighted TFP, Meters		
	Bank-Related	Independent	Gap	Bank-Related	Independent	Gap
1878					1,181	
1888				1,142	1,226	107%
1891				1,249	1,246	100%
1893	264	275	104%	1,284	1,206	94%
1895	296	314	106%	1,525	1,461	96%
1896	277	307	111%	1,673	1,725	103%
1912	296	318	107%	1,659	2,115	127%
1913	292	328	112%	1,797	2,321	129%

Source: See Table 1.

Table 14
Output per worker and output per spindle

	Weighted Output per Worker, Value			Weighted Output per Worker, Meters		
	Independent	Bank-Related	Gap	Independent	Bank-Related	Gap
1878				5,948		
1888				6,188	5,100	121%
1891				6,466	5,804	111%
1893	991	1,049	94%	5,275	6,154	86%
1895	1,243	1,266	98%	7,361	8,099	91%
1896	1,204	1,201	100%	9,029	8,689	104%
1912	1,371	1,403	98%	12,103	10,104	120%
1913	1,384	1,373	101%	13,074	10,814	121%

	Weighted Output per Spindle, Value			Weighted Output per Spindle, Meters		
	Independent	Bank-Related	Gap	Independent	Bank-Related	Gap
1878				288		
1888				299	310	96%
1891				296	327	91%
1893	60	53	112%	333	327	102%
1895	60	56	109%	357	356	100%
1896	60	51	119%	407	398	102%
1912	55	48	113%	462	343	135%
1913	59	48	122%	514	376	137%

Source: See Table 1.

Table 15
Capital-labor ratios

	Bank-related	Independent	Gap
1878		21	
1888	15	17	112%
1891	18	22	123%
1893	19	16	83%
1895	23	21	90%
1896	24	20	83%
1912	29	25	87%
1913	29	24	84%

Source: Table 1

Table 16
Cox Hazard Model
Dependent Variable=1 if Survive, 0 if Fail[1]
(T Statistics in Parenthesis)

	Spec. 1	Spec. 2	Spec 3	Spec 4
Number of Observations	332	332	443	443
Prob > chi2	0.0026	0.0014	0.0001	0.0001
Age of Mill	0.99	0.99	0.98**	0.98**
	(-1.25)	(-1.33)	(-2.02)	(-2.07)
LN (Output Per Worker)--Value[2]	0.95	0.95		
	(-0.22)	(-0.22)		
LN (Output Per Worker)--Meters[2]			1.08	1.06
			(0.39)	(0.28)
LN (Installed Spindlage)--Proxy for Size	0.55***	0.61**	0.57***	0.61**
	(-2.63)	(-2.11)	(-3.44)	(-2.89)
Bank-Related Dummy		0.48*		0.57**
		(-1.75)		(-2.08)

1. When coefficients are transformed into hazard rates they represent the effect that the independent variable has on the mill failing. The smaller the coefficient, the greater the independent variable's impact on the mill's chance of failure. For example, a coefficient of 0.32 on the bank connection dummy means that a bank connected mill has a one-third chance of failing in any given period compared to a mill with an independent mill.

2. Output per worker data adjusted for changes in length of legal workday.

* Significant at the 90 percent level
** Significant at the 95 percent level
*** Significant at the 99 percent level

Source: See Table 1.

Table 17
Size Regressions
Dependent Variable: Ln (spindlage)
T Statistics in Parentheses

	Spec. 1	Spec.2	Spec. 3
Observations	700	700	700
Groups	179	179	179
R^2	0.0906	0.1232	0.2159
Constant	7.66***	7.67***	7.66***
	(106.72)	(107.19)	(108.43)
Age	0.01*	0.01	0.01
	(1.70)	(1.58)	(1.49)
1891	-0.06	-0.04	-0.04
	(-0.98)	(-0.63)	(-0.68)
1893	-0.03	-0.03	-0.03
	(-0.53)	(-0.44)	(-0.42)
1895	0.10	0.08	0.08
	(1.42)	(0.91)	(0.94)
1896	0.14*	0.09	0.09
	(1.80)	(1.00)	(1.03)
1912	0.25*	0.04	0.05
	(1.82)	(0.25)	(0.34)
1913	0.25*	0.08	0.10
	(1.77)	(0.52)	(0.61)
Bank 1888		-0.05	-0.03
		(-0.42)	(0.26)
Bank 1891		-0.12	-0.07
		(-0.95)	(-0.54)
Bank 1893		-0.00	0.04
		(-0.01)	(0.43)
Bank 1895		0.07	0.08
		(0.72)	(0.85)
Bank 1896		0.12	0.11
		(1.25)	(1.11)
Bank 1912		0.30***	0.28***
		(2.92)	(2.65)
Bank 1913		0.26***	0.22***
		(2.52)	(2.22)

Table 17, continued

Traded1895	0.47
	(1.54)
Traded1896	0.57**
	(2.26)
Traded1912	0.97***
	(3.49)
Traded1913	0.97***
	(3.49)

* Significant at the 10percent level
** Significant at the 5 percent level
*** Significant at the one percent level

Source: See Table 1.

Table 18
Average Textile Mill Size

	Installed Capacity (Spindles Per Mill)		
	Unrelated Mills	Bank-Related Mills	% Difference
1888	2,549	4,611	181%
1891	2,860	4,895	171%
1893	2,320	5,467	236%
1895	2,759	6,711	243%
1896	2,862	6,417	224%
1900			
1904			
1909			
1912	2,303	8,725	379%
1913	2,234	8,680	389%

1. For 1912 and 1913, the size indicators for multi-mill firms were divided by the number of mills in the firm, because the census aggregated the outputs of multi-mill firms.

Source: See Table 1.
Table 19

Industrial Concentration in Cotton Textiles,
Mexico, Brazil, India, and the United States

	Four Firm Ratio					Herfindahl Index		
		Mexico						
Circa	Mexico	Expected	Brazil	India	U.S.A.	Mexico	Brazil	India
1888	18%	19%	37%		8%	0.022	0.058	
1891	20%	19%				0.020		
1893	29%	15%				0.038		
1895	33%	17%	35%			0.042	0.059	
1896	30%	16%				0.041		
1900	30%	14%		19%	7%	0.038	0.028	0.018
1904	33%	15%	21%			0.042		
1909	38%	15%				0.045		
1912	30%	14%		19%	8%	0.039		0.018
1913	31%	14%	14%			0.041	0.014	

Source: For Mexico see Table 1; for Brazil, Haber 1997; for India and the U.S.A., Haber 2003.