

## **Related Lending and Economic Performance:**

### **Evidence from Mexico**

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#### **Abstract:**

There is a broad consensus that bankers in LDCs engage in related (insider) lending. There is not, however, a consensus as to whether related lending has a positive or negative effect on economic growth. We argue that related lending has negative consequences for growth compared to the outcome that would obtain in an efficient capital market because bankers choose borrowers based on personal contacts rather than the quality of the underlying projects. The result is the misallocation of capital. We also argue that related lending arises as a rational response to high levels of default risk. Thus, it is an endogenous outcome of weak property rights and/or information asymmetries that are costly to overcome. In sum, related lending is a second-best outcome, but it is superior to the readily available alternative: banking systems that effectively do not lend at all for productive purposes.

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There is a broad consensus that bankers in developing countries engage in related (or insider) lending. They commonly extend credit to their close business associates, members of their own families or clans, and themselves. It is also common for them to have significant non-financial interests, and to use their banks as mechanisms to finance those interests.<sup>1</sup>

There is not, however, a consensus as to whether related lending has a positive or negative effect on economic growth. One view, associated with Naomi Lamoreaux, is that when the costs of information are high, related lending is economically efficient. Related lending, in this view, allows bankers to overcome information asymmetries and thereby solve the problem of adverse selection. This view receives empirical support from the experience of banks in early industrial New England.<sup>2</sup> A second view, associated with La Porta, López-de-Silanes and Zamarripa, is that related lending is bad for growth because it provides a mechanism for bankers to loot their own banks, at the expense of minority shareholders, depositors, and (when there is deposit insurance) taxpayers. This view receives empirical support from Mexico's experience during its 1995-98 banking crisis, when related loans had higher rates of default and lower rates of recovery than unrelated arm's-length loans.<sup>3</sup>

Adjudicating between these views will require more empirical research on the causes and consequences of related lending than has been conducted to date. The extant studies are of cases that are different in many dimensions. Related lending in

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<sup>1</sup> La Porta, Lopez-de-Silanes, and Zamarripa 2003; Laeven 2001.

<sup>2</sup> Lamoreaux 1994.

<sup>3</sup> La Porta, Lopez-de-Silanes, and Zamarripa 2003.

19<sup>th</sup> century New England took place in the context of virtually unrestricted entry into banking (which produced hundreds of small unit banks), a specie standard, and the policing of banks through the Suffolk system. Related lending in 1995-98 Mexico took place in the context of unlimited deposit insurance (and consequent moral hazard), highly leveraged banks, and macroeconomic instability. Under these conditions, bankers had incentives to take excessive risks or, worse yet, loot their own banks.<sup>4</sup>

We argue, on the basis of detailed bank and industry data from an economically stable period in Mexico, that even when the specific conditions of 1995-98 do not hold, related lending still has negative consequences for growth. The mechanism, however, is different than the one outlined by La Porta, López-de-Silanes and Zamarripa. Bankers do not need to loot their own banks for related lending to have negative consequences for growth: related lending only needs to misallocate capital via discrimination in the credit market.

We also argue, consistent with Lamoreaux, that related lending is 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

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<sup>4</sup> La Porta, Lopez-de-Silanes, and Zamarripa 2003.

variety of informal means. Second, bankers can obtain information about related borrowers at relatively low cost.<sup>5</sup>

The logical implication is that in many LDCs the first best outcome—arm's length lending based on objective performance criteria—is not readily available. Two options, however, are available. Bankers can limit their lending to relatively safe assets, such as government bonds, severely limiting the scope of financial intermediation. Alternatively, they can engage in related lending. As we argue below, related lending 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 have slower productivity growth and a less competitive market structure than they would in the 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

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<sup>5</sup> For more discussion of the advantages that accrue to creditors from long-term relationships in the credit market see Greebaum, Kanatas and Venezia 1989, Sharpe 1990, Rajan 1992, and Petersen and Rajan 1994 and 1995.

large and finance-dependent industry—cotton textile manufacturing.<sup>6</sup> We construct a panel of textile mills that covers a 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. Moreover, the ability to obtain a bank charter (and hence obtain credit via related lending) was exogenously determined: the government allocated charters on the basis of political connections.<sup>7</sup> 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.<sup>8</sup> Indeed, cotton textile manufacturing was Mexico's largest manufacturing industry, and as Table 1 shows, it grew rapidly throughout this period.<sup>9</sup>

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<sup>6</sup> We break off our analysis in June 1913 because a civil war broke out at the end of 1913. See Haber, Razo, and Maurer 2003, chapters 3, 4, 5.

<sup>7</sup> Mexico's banking system makes an interesting natural laboratory because there was no deposit insurance, the banks were very well capitalized, shareholders developed mechanisms to monitor directors, depositors policed banks by withdrawing deposits from risky banks, and charters were allocated on political grounds. See: Haber, Razo, and Maurer 2003, p. 120; Maurer 2002, pp. 101-03 and 108-10; Huybens, Luce, and Pratap 2003.

<sup>8</sup> There were no barriers to entry produced by patents, proprietary technology, control of raw materials, advertising, branding, or control of wholesale or retail distribution. In addition, economies of scale were exhausted at small firm sizes, compared to such industries as steel, cement, or chemicals. Finally, high tariff protection insulated the industry from imports. See Gómez-Galvarriato 1999, pp. 604 and 608; Maurer and Sharma 2001, p. 960.

<sup>9</sup> 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. See Haber 1989.

Our analysis demonstrates that 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: relatively productive 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 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.<sup>10</sup>

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 discusses the impact of related lending 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.<sup>11</sup> Over the next three decades, spurred on by legislation enacted by the

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<sup>10</sup> 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. See Musacchio and Read 2003.

<sup>11</sup> 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

country's dictatorial ruler (Porfirio Díaz, who ruled from 1876 to 1911), Mexico's banking system expanded. By 1896, Mexico had six chartered banks with total assets of 50 million dollars. By 1911, there were 42 banks, controlling assets of 385 million dollars.<sup>12</sup> (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 the federal government could grant a bank charter. It allowed only two banks, the Banco de Londres y México (BLM) and the Banco Nacional de México (Banamex), to branch nationally. All other banks were prohibited from branching outside their concession territories, which were generally contiguous with state lines. With very few exceptions, charters were granted to only one bank in any territory, meaning that there were typically only three banks operating in any state: Banamex, the BLM, and the bank that had a federal charter for that state. Special tax concessions and high minimum capital requirements safeguarded these charters. Finally, non-chartered banks were

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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 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.

<sup>12</sup> The ratio of bank assets to GDP in 1911 was .27, roughly twice as high as in 2003.

prohibited from issuing notes, meaning that they could not effectively compete against chartered banks.<sup>13</sup>

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.<sup>14</sup>

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

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<sup>13</sup> Maurer 2002, chap. 2; Haber, Razo, and Maurer, 2003, chap. 4.

<sup>14</sup> Maurer 2002, pp. 40-44; Haber, Razo, and Maurer 2003, pp. 88-90; Razo 2003, chaps. 8 and 9.

charters (in 1884) experimented with arm's length loans. These loans almost always 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 or one of that bank's directors.<sup>15</sup>

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.<sup>16</sup> Banamex' most significant competitor, the BLM, also made sizable loans to its own board members to finance manufacturing company start-ups.<sup>17</sup>

A cross-section of loans we have drawn for 1908 for four other banks (the Banco de

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<sup>15</sup> 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.

<sup>16</sup> The data for this estimate come from a random sample of 50 entries in the Libro de Responsabilidades of the Banco Mercantil de Veracruz, located in Galería 2 of the Archivo General de la Nación in Mexico City.

<sup>17</sup> Maurer 2002, p. 103.

Nuevo León, the Banco de Durango, the Banco Mercantil de Monterrey, and the Banco de 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. 31 percent of the Banco Mercantil de Monterrey's loans also went to a single firm owned by one of its directors. 51 percent of the Banco de Durango's loans went to enterprises owned by family members of one of its directors. An astounding 72 percent of the Banco de Coahuila's loans went to a single firm owned by family members of a director.<sup>18</sup>

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. Bank directors had a long time horizon, and thus had strong incentives to protect their reputations.<sup>19</sup> As a result, Porfirian banks typically had capital-adequacy ratios of 33 percent.<sup>20</sup> Not surprisingly, the banking system was remarkably stable. The banks paid a steady stream of dividends to their shareholders and shares traded for multiples of their par values.<sup>21</sup> Only three bank failures during the entire period 1888-1913 produced losses for depositors or noteholders. All three occurred in the Yucatán sisal region. When the

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<sup>18</sup> We retrieved records of these loans by examining interbank loan sales to the state-owned Caja de Préstamos para Obras de Irrigación. See 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 total size of the loan portfolios of these banks were retrieved from their end-of-year balance sheets published in the Economista Mexicano.

<sup>19</sup> Maurer 2002, pp. 74-80, 94-95, 111-113.

<sup>20</sup> Figures calculated from bank balance sheets published in the Economista Mexicano.

<sup>21</sup> Maurer and Sharma 2002, p. 967.

price of the fiber dropped by half in 1908, so did the local economy and the solvency of the peninsula's banks.<sup>22</sup>

### **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.<sup>23</sup> Our data set includes 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

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<sup>22</sup> Maurer 2002, pp. 112-113.

<sup>23</sup> This data set links 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 by substituting the Gómez-Galvarriato and Musacchio price index for the INEGI cotton textile price index employed by Razo and Haber. 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.

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.<sup>24</sup> 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 some banks were founded by textile entrepreneurs for the purpose of financing their existing manufacturing ventures.<sup>25</sup> 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. We know from the minutes of the bank’s board meetings that it lent heavily to these enterprises.<sup>26</sup> 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.<sup>27</sup>

These data enable us to estimate the prevalence of related lending in the textile industry. The proportion of mills related to banks and the percentage of installed capacity controlled by those mills increased dramatically as the banking system grew.

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<sup>24</sup> 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.

<sup>25</sup> Gamboa Ojeda 1985; Gamboa Ojeda and Estrada 1986; Rodríguez López 1995.

<sup>26</sup> Maurer 2002, p. 98.

<sup>27</sup> The list of banks related to textile entrepreneurs or joint stock textile companies consists of Banamex, BLM, the Banco Oriental, the Banco de Nuevo León, the Banco de Durango, the Banco de Coahuila, the Banco Mercantil de Veracruz, the Banco de Guanajuato, the Banco de Estado de México, and the Banco de Zacatecas.

In 1888, 33 percent of installed capacity was in bank-related mills. By 1913, the proportion had grown to 80 percent.<sup>28</sup> (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 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 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 employ a variety of measures of technical efficiency: operating margins, labor productivity, and total factor productivity.<sup>29</sup> We add controls for mill size and age.

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<sup>28</sup> Following Kane (1988), we measure installed capacity by spindles, which constitute the most important capital input for the production of cotton textile goods.

<sup>29</sup> In order to estimate TFP we used the 1888-1913 firm-level censuses to estimate a Cobb-Douglas production function with constant returns to scale. 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 calculated TFP for firm  $i$  using the following formula:

$$TFP_i = \frac{\text{output}_i}{\text{spindles}_i^a \times \text{labor}_i^b}$$

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

Regardless of the specification, our qualitative results are the same: technical efficiency was uncorrelated with being bank related. (See Table 4). We estimate similar probits—whose results are not reported here—for 1888, 1891, 1895, 1896, 1912, and 1913. The only difference is that these probits do not include a variable for operating margins (because of data constraints). Not a single one of these probits, regardless of the specification employed, found any relationship between higher technical efficiency and bank relation. 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.<sup>30</sup>

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 to determine whether bank-related mills 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.<sup>31</sup> 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 and Jones on international productivity comparisons, we took the number of workers as the measure of the labor

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<sup>30</sup> These probit results are available from the authors.

<sup>31</sup> 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.

input.<sup>32</sup> We adjusted, however, for changes in the legal length of the workday.<sup>33</sup> We control for mill age, location, bank-relation, and whether it was publicly traded.<sup>34</sup>

There are several striking features of the regressions results reported in Tables 5 and 6. First, there is evidence that some firms had grown beyond the optimal scale of production. When output is measured by value (specification 1 of Table 5) the coefficient on the labor input is statistically insignificant. When output is measured in meters of cloth (specification 1 of Table 6), the coefficient on the labor input is *negative* and significant at the 90 percent level. When we control for bank relation (specification 2 of Table 6) the coefficient on the labor input is no longer significant. The implication

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<sup>32</sup> 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.

<sup>33</sup> 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:

$$\ln y = \alpha + \beta_1 \cdot \ln k + \beta_2 \cdot \ln L + \beta_3 \cdot \text{Year Dummies}.$$

This specification allowed us to test for economies of scale as well as to measure the growth of TFP across cross-sections. 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:

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

where  $Y_{it}$  is the dependent variable of firm  $i$  at time  $t$ ;  $\mathbf{a}$  is the overall intercept term for all firms;  $\mathbf{b}$  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  $\mathbf{b}$ .

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.

<sup>34</sup> 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.

is that it was bank-related mills that account for the diseconomies of scale detected in specification 1.

Second, productivity growth in this industry, after an initial burst in the early 1890s (a one-time jump likely caused by the industry's switch from water power to electric power) was stagnant. To the degree that the year dummies in specification 1 of Table 5 display any pattern, it is a gradual *fall* in TFP. We obtain similar results when we measure output by volume, rather than by value (specification 1 of Table 6). The coefficients for 1896 and 1912 are nearly identical—indicating no productivity growth over a 16 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 over a 30 year period.<sup>35</sup>

Third, the only statistically-significant coefficients on the interaction between bank-relation and year are negative. For example, specification 2 of Table 5 indicates that, when we measure output by value, bank-related mills 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 6 demonstrates, the average productivity of bank-related mills 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.

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<sup>35</sup> Haber 1998.

One might be tempted to argue that the productivity differentials between related and non-related mills in 1912 and 1913 were somehow driven by the beginning of the Mexican Revolution in 1910. This argument does not fit the evidence.

The textile industry (and manufacturing in general) continued to grow through the end of 1913: both the real value of textile production *and* the number of mills were higher in 1912 and 1913 than they had been before the Revolution started.<sup>36</sup>

One also might be tempted to argue that the productivity differentials between bank-related and unrelated mills were caused by imperfections in securities markets, not imperfections in the credit market. This argument, too, is not supported by evidence. Our regression results are robust to the addition of dummy variables that interact census year with being listed on the Mexico City stock exchange (there were four such firms).<sup>37</sup>

An even more 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. Here again, the argument is not consistent with evidence. 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

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<sup>36</sup> For a detailed analysis of the effect of the Mexican Revolution on Mexico's manufacturing sector, see Haber, Razo, Maurer 2003, chapter 5.

<sup>37</sup> The history of these four firms are discussed in Haber 1989.

years.<sup>38</sup> The results, reported in Table 7, indicate that bank-related mills were, in the aggregate, less productive than non-related mills.

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 the productivity of labor and capital (measured in spindlage). We measure output in two ways: real value and physical volume (meters of cloth). Table 8 presents the results of these exercises. There do not appear to be major differences, in the aggregate, of labor productivity across the two sectors. When measured by value, labor productivity is roughly the same for bank related and non-related mills. When measured by volume, the results vary across census years, but non-related mills appear to be more productive in most census years. There are, however, clear productivity differences across bank-related and non-related mills when we measure the productivity of capital. When output is measured by value, the productivity of capital in the non-related sector is consistently 9 to 22 percent higher than the bank-related sector. When output is measured in meters of cloth, capital productivity 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

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<sup>38</sup> We use 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*.

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 productivity differences between non-related and bank-related mills are significantly larger when we measure capital productivity than labor productivity. In other words, if one took a bank-related mill and a 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 capital. Capital-labor ratios in bank-related mills should, therefore, be significantly higher than in non-related mills. As demonstrated in Table 9, this is true in every census year from 1893 to 1913.<sup>39</sup>

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 productive 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

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<sup>39</sup> Our findings are therefore consistent with the argument made by Stulz (2000) that capital market imperfections can give rise to over-investment.

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: If mills need outside sources of capital to survive negative shocks, then we would expect bank-related mills to have higher survivorship rates.<sup>40</sup>

We employ a Cox maximum-likelihood proportional hazards model to estimate the effect of mill age, size, labor productivity, 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 that had access to bank credit and their competitors, 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. (See Table 10).

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<sup>40</sup> Zingales 1996.

## 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. The results are presented in Table 11.

Specification 1 of Table 11 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 that interact 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 mills 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 firms 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. 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. If this hypothesis were true, we would expect to see bankers acquiring stakes in large pre-existing mills. 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. Rather they used their banks to finance mills that they already owned (or they founded entirely new mills). Of the 34 mills that switched from being non-related to being bank-related, 33 were owned by textile entrepreneurs who later became bankers. Only one pre-existing mill was acquired by a bank director after the bank was incorporated.

#### Related Lending and Market Structure:

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 12 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. 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: the United States, Brazil, and India.<sup>41</sup> The third, following Sutton, compares the Mexican textile industry's actual market structure to a hypothetical, fully competitive industry, in which the market structure was a function solely of industry size and a stochastic growth process.<sup>42</sup>

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,

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<sup>41</sup> Haber 1997; Haber 2003.

<sup>42</sup> The method assumes that all firms in a market have an identical chance of gaining or losing market share over time. Even under perfect competition, therefore, firms will have unequal market shares in equilibrium, 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.

unlike Mexico, concentration fell or remained stable as the textile industry grew.) Second, the Mexican cotton textile industry was much more concentrated than the 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.<sup>43</sup> (See Table 13.)

#### **IV. Conclusions and Implications:**

In an efficient capital market, more productive firms drive less productive firms out of business. In Mexico, however, relatively unproductive firms expanded their market share at the expense of relatively productive 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 limit their lending to safe assets, such as government bonds, severely limiting the scope of financial intermediation. The current Mexican banking industry is an example of this outcome.<sup>44</sup> The second was to engage in related lending, with the consequent misallocation of

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<sup>43</sup> Our results, using historical evidence, are broadly consistent with the results obtained from present-day cross country comparisons. See Cetorelli 2001; Cetorelli 2003; Cetorelli and Gambera 2001; and Beck, Demirgüç-Kunt, and Maksimovic 2003.

<sup>44</sup> See Haber and Musacchio, 2004.

capital. An outcome in which the banking system does not lend to private industry is worse than an outcome in which lending takes place, but capital is misallocated.

We would suggest that our results extend beyond the literature on related lending. It also has an application to the literature on property rights and economic growth. One of the most robust findings of the cross-country growth regression literature is that there is positive correlation between secure property rights, financial development, and rates of economic growth.<sup>45</sup> The mechanisms that underlie this statistical relationship have not, however, been fully explored. Our results indicate that one channel through which weak property rights slow growth is by creating distortions in credit markets.

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<sup>45</sup> See Rajan and Zingales 1998; King and Levine, 1993a, 1993b; Levine and Zervos 1998; Beck, Levine, and Loayza 2000; Levine 1997, 1998, 1999; Neusser and Kugler 1998; Rousseau and Wachtel 1998; Beck, Demirgüç-Kunt, Levine, and Maksimovic, 2001; Beck, Demirgüç-Kunt, and Levine, 2002; La Porta, Lopez-de-Silanes, Shleifer, and Vishny. 1998; La Porta, Lopez-de-Silanes, Shleifer, and Vishny. 2000.

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Table 1  
The Mexican Textile Industry, 1888-1913

	<u>Mills</u>	<u>Real Value of Production (Millions of 1900 Pesos)1</u>	<u>Volume of Production (Millions of Meters Meters of Cloth)</u>	<u>Installed Capacity (In Thousands of Spindles)</u>	<u>Worker Equivalents2</u>
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 <u>Banks</u> <sup>1</sup>	Bank Assets (M U.S. \$)	Banamex Market <u>Share</u>	BLM Market <u>Share</u>	Herfindahl <u>Index</u> <sup>2</sup>
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

	<u>Spec. 1</u>	<u>Spec. 2</u>	<u>Spec. 3</u>	<u>Spec. 4</u>	<u>Spec. 5</u>	<u>Spec. 6</u>	<u>Spec 7</u>	<u>Spec 8</u>	<u>Spec 9</u>
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*** (3.89)	-0.65** (2.05)	-4.93*** (3.09)	-2.18 (1.37)	-2.11 (1.33)	-3.71** (2.10)	-1.00 (-1.00)	-0.95 (-0.95)	-4.04*** (-2.83)
Operating Margins	0.64 (0.98)	0.630 (0.97)	-0.054 (0.08)						
Ln (Output/Worker)--Meters of Cloth <sup>1</sup>				0.19 (1.02)	0.19 (0.99)	-0.09 (0.43)			
Ln (TFP)--Value <sup>2</sup>							0.08 (0.44)	0.09 (0.47)	-0.16 (0.74)
Age of Mill		-0.002 (0.21)	-0.007 (0.72)		-0.001 (0.11)	-0.007 (0.84)		-0.002 (-0.30)	-0.01 (-1.09)
Ln (Installed Spindlage)--Proxy for Size			0.58*** (2.78)			0.53*** (3.16)			0.59*** (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  
 Productivity Regressions<sup>1</sup>  
 Dependent variable = (LN) Output Per Worker  
 T Statistics in Parentheses

	Output Measured in Real Value		
	<u>Spec 1</u>	<u>Spec 2</u>	<u>Spec 3</u>
Observations	469	469	469
Mills	158	158	158
R <sup>2</sup>	.2790	.2798	.2762
Constant	4.69*** (7.11)	4.71*** (6.93)	4.63*** (6.71)
LN(Capital/Labor) <sup>2</sup>	0.46*** (4.53)	0.46*** (4.49)	0.47*** (4.52)
Ln(Labor) <sup>3</sup>	0.11 (1.15)	0.11 (1.10)	0.12 (1.21)
1895	0.47*** (6.35)	0.42*** (4.52)	0.42*** (4.49)
1896	0.44*** (5.89)	0.45*** (4.67)	0.44*** (4.64)
1912	0.32*** (3.75)	0.30** (2.40)	0.30*** (2.37)
1913	0.33*** (3.87)	0.29*** (2.42)	0.29*** (2.38)
Bank-Related 1893		-0.06 (-0.46)	-0.08 (-0.58)
Bank-Related 1895		0.06 (0.46)	0.05 (0.35)
Bank-Related 1896		-0.07 (-0.53)	-0.07 (-0.51)
Bank-Related 1912		-0.11* (-0.80)	-0.01 (-0.06)
Bank-Related 1913		0.02 (0.16)	0.03 (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 5, 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 6  
 Productivity Regressions<sup>1</sup>  
 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 <sup>2</sup>	0.2329	0.2315	0.2377
Constant	8.26*** (17.84)	8.10*** (17.25)	8.06*** (16.85)
LN(Capital/Labor) <sup>2</sup>	0.32*** (4.95)	0.33*** (5.14)	0.33*** (5.12)
Ln(Labor) <sup>3</sup>	-0.12* (-1.82)	-0.09 (-1.41)	-0.09 (-1.27)
1891	0.09 (1.18)	0.10 (1.26)	0.10 (1.28)
1893	0.03 (0.40)	0.04 (0.54)	0.04 (0.57)
1895	0.22*** (2.97)	0.23*** (2.67)	0.24*** (2.69)
1896	0.40*** (5.39)	0.43*** (4.72)	0.43*** (4.75)
1912	0.40*** (4.99)	0.56*** (4.55)	0.56*** (4.54)
1913	0.48*** (5.88)	0.65*** (5.55)	0.65*** (5.54)
Bank-Related 1888		-0.14 (-0.78)	-0.14 (-0.75)
Bank-Related 1891		-0.20 (-1.15)	-0.20 (-1.16)
Bank-Related 1893		-0.12 (-0.96)	-0.12 (-1.02)
Bank-Related 1895		-0.11 (-0.88)	-0.15 (-1.18)
Bank-Related 1896		-0.13 (-1.04)	-0.18 (-1.36)
Bank-Related 1912		-0.27** (-1.92)	-0.25* (-1.77)
Bank-Related 1913		-0.31** (-2.29)	-0.30** (-2.21)

Table 6 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 7  
 Mexican Textile Mill Productivity, By Independent and Bank Connected Mills

	Weighted TFP, Value			Weighted TFP, Meters		
	<u>Bank-Related</u>	<u>Independent</u>	<u>Gap</u>	<u>Bank-Related</u>	<u>Independent</u>	<u>Gap</u>
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 8  
Output per worker and output per spindle

	<u>Weighted Output per Worker, Value</u>			<u>Weighted Output per Worker, Meters</u>		
	<u>Independent</u>	<u>Bank-Related</u>	<u>Gap</u>	<u>Independent</u>	<u>Bank-Related</u>	<u>Gap</u>
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%

  

	<u>Weighted Output per Spindle, Value</u>			<u>Weighted Output per Spindle, Meters</u>		
	<u>Independent</u>	<u>Bank-Related</u>	<u>Gap</u>	<u>Independent</u>	<u>Bank-Related</u>	<u>Gap</u>
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 9  
Capital-labor ratios

	<u>Bank-related</u>	<u>Independent</u>	<u>Gap</u>
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 10  
 Cox Hazard Model  
 Dependent Variable=1 if Survive, 0 if Fail<sup>1</sup>  
 (T Statistics in Parenthesis)

	<u>Spec. 1</u>	<u>Spec. 2</u>	<u>Spec 3</u>	<u>Spec 4</u>
Number of Observations	332	332	443	443
Prob > chi2	0.0026	0.0014	0.0001	0.0001
Age of Mill	0.99 (-1.25)	0.99 (-1.33)	0.98** (-2.02)	0.98** (-2.07)
LN (Output Per Worker)--Value <sup>2</sup>	0.95 (-0.22)	0.95 (-0.22)		
LN (Output Per Worker)--Meters <sup>2</sup>			1.08 (0.39)	1.06 (0.28)
LN (Installed Spindlage)--Proxy for Size	0.55*** (-2.63)	0.61** (-2.11)	0.57*** (-3.44)	0.61** (-2.89)
Bank-Related Dummy		0.48* (-1.75)		0.57** (-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 11  
 Size Regressions  
 Dependent Variable: Ln (spindlage)  
 T Statistics in Parentheses

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

Table 11, 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 12  
Average Textile Mill Size

	Installed Capacity (Spindles Per Mill)		% Difference
	Unrelated Mills	Bank-Related Mills	
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%
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 13  
 Industrial Concentration in Cotton Textiles,  
 Mexico, Brazil, India, and the United States

Circa	Four Firm Ratio					Herfindahl Index		
	<u>Mexico</u>	<u>Expected</u>	<u>Brazil</u>	<u>India</u>	<u>U.S.A.</u>	<u>Mexico</u>	<u>Brazil</u>	<u>India</u>
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.