Banks, Insider Connections, and Industrialization in New England: Evidence from the Panic of 1873

Eric Hilt*
Wellesley College and NBER

Abstract: Using newly collected data from Massachusetts, this paper documents the extent of bank director representation non-financial firms' boards, and investigates whether bank-affiliated companies fared better during the recession that followed the Panic of 1873. Around 59 percent of all non-financial corporations had at least one bank director on their boards. These firms survived the recession of the 1870s at higher rates, and among the surviving firms, those with bank affiliations saw their growth rates and credit ratings decline less than firms without bank affiliations. Consistent with banker-directors helping to resolve problems related to asymmetric information, these effects were strongest among younger firms, and those with lower shares of fixed assets on their balance sheets. In contrast, the presence of bank cashiers on firms' boards, which created an association with a bank without significantly increasing the likelihood of a credit relationship, had no effect. These results imply that during New England's industrialization, affiliations with commercial banks helped nonfinancial corporations survive economic downturns.

* Email ehilt@wellesley.edu. I would like to thank Katharine Liang, Paige Kirby, Chloe Peters, and June Wang for research assistance.

1. Introduction

The contribution of commercial banks to the development of the American economy remains an unsettled issue. Although some have argued that America's early financial development stimulated its industrialization (Rousseau and Sylla, 2005), part of that financial development may have been undertaken in anticipation of the economic growth that followed. And even if we accept that the growth of the banking sector over the nineteenth century aided industrialization, little is known about the specific mechanisms through which banks may have produced such effects.

In the case of New England, which led American industrialization, Lamoreaux (1986; 1994) has argued that the region's banks functioned like investment clubs, lending to insiders and channeling capital to the manufacturing firms founded by their directors. This suggests that personal connections helped firms overcome problems of asymmetric information and obtain access to finance. Although this view has gained wide adherence, some scholars have expressed skepticism, arguing that the records of individual banks often do not show much lending to insiders.[1] Evaluating these debates is difficult, however, because both the advocates for the insider lending view and their critics have been forced to rely on the records of a small handful of institutions, whose representativeness is difficult to assess. The extent of affiliations between commercial banks and manufacturing firms, and the consequences of any such ties for industrial development in the region, have never been analyzed systematically.

This paper presents new data on the nonfinancial corporations of Massachusetts in the 1870s, and analyzes the role of bank-firm affiliations in promoting industrial growth. Using comprehensive data on the composition of boards of directors and on firms' balance sheets, the paper documents the extent of bank affiliations, as measured by board interlocks, and analyzes their effects. In order to address the problem that bank affiliations were likely to have been established among a positively selected group of firms, the effects of bank-firm affiliations are estimated by analyzing changes in firm outcomes in response to a major economic crisis: the Panic of 1873, and the ensuing economic downturn. This shock

[1] Wright (1999) and Lockard (2000) offer analyses of individual bank lending records that do not show high levels of lending to insiders. However, the data in Wang (2008) do show significant levels of insider lending.

disrupted financial markets and reduced demand, and likely made an affiliation with a commercial bank much more valuable by creating adverse selection problems in credit markets.[2] By analyzing changes in firm outcomes in response to this shock, the influence of any time-invariant firm characteristics such as managerial quality, which were likely correlated with bank affiliations, can be eliminated.

The results indicate that affiliations between banks and nonfinancial corporations were quite extensive in 1870s Massachusetts, and that the firms with bank affiliations did indeed suffer less in the wake of the crisis. Around 59% of all nonfinancial corporations had a bank director on their board, and among the publicly traded corporations, the rate was even higher (85%). All firms suffered in the years following the 1873 panic, but firms affiliated with banks failed at lower rates. And among the surviving firms, those with bank affiliations saw their growth rates fall and credit ratings deteriorate by less than firms without bank affiliations. These effects were substantial: the failure rate over the years 1873-81 for firms with bank affiliations was about 8 percentage points lower (equivalent to more than 20 percent of the mean failure rate in the years up to 1881), and the post-1873 growth rates of those firms was about 6 percentage points higher (equivalent to 85 percent of the overall 1872 growth rate). Consistent with bank affiliations helping to resolve asymmetric information problems, the effects were stronger among younger firms, and those with lower shares of fixed assets on their balance sheets.

The presence of a bank director on a company's board could potentially benefit that company through several different channels. Nineteenth century bank directors held discretion over the allocation of credit from their institution, so a directorship with a nonfinancial corporation may have facilitated greater access to credit by the corporation.[3] But an affiliation with a bank may also have functioned as a signal of the quality of the corporation, and a banker director may also have contributed financial expertise to its management. In order to investigate the importance of credit relationships in the results, I study the effects of the presence of a bank cashier on firms' boards. As bank cashiers normally could not

[2] The adverse selection problems produced by a financial crisis are described in Bernanke (1983).
[3] On the decision making procedures by which nineteenth century American banks approved or declined loan requests, see Lamoreaux (1994), Bodenhorn (2003a), and Meissner (2005). Gibbons (1859) presents a first-hand account.

control the flow of credit the way bank directors could, their presence on a firm's board likely added financial expertise signaled quality without directly facilitating greater access to credit. Their presence on firms' boards produced no discernable effect.

An obvious source of concern regarding the empirical results is that they may reflect the selection of particular types of firms into affiliations with banks. The empirical analysis controls for time-invariant unobserved characteristics such as the quality of a firm's assets or management, but if firms that were more resilient to a shock were more likely to be affiliated with banks, then this would imply that the firms without bank affiliations may not constitute an appropriate control group for the firms with bank affiliations.

I use several approaches to address this issue. First, I control for a range of firm characteristics that were likely related to resiliency, such as leverage and size, as well as the average personal wealth of the directors and the centrality of the firm's board in the network of corporate directors. Second, I estimate specifications in which I include direct measures of resiliency, credit ratings. And third, I use inverse propensity scores to re-weight the treated and control firms so that observable characteristics of both resemble those of the population. In each case the effect of a bank affiliation remains, although with a diminished magnitude.

The findings of this paper contribute to several areas of research. A large literature has investigated the operations of nineteenth-century American banks (for example, Lamoreaux, 1994; Meissner 2005; Bodenhorn 2003a; 2003b; 2007) and their importance for American economic development (Calomiris 1995; Rousseau and Sylla, 2005). Most recently, Jaremski (2014) has documented that counties with greater bank entry under the national banking acts experienced greater industrialization, and Fulford (2015) has shown that rural counties just above the population level needed to sustain the presence of a national bank (given the minimum capital required by the statute) experienced greater agricultural production. This paper adds to the literature by presenting new firm-level evidence on the extent of relationships between banks and nonfinancial companies in the late nineteenth century and, more importantly, on the value of those relationships during a major economic downturn. The

results suggest that a possible mechanism behind the observed correlations between the development of the banking sector and industrialization could be that affiliations with banks helped nonfinancial corporations survive economic downturns.

Secondly, this paper contributes to the literature on the role of banking systems in the Industrial Revolution and subsequent historical waves of industrialization around the world. Some scholars have argued that financial institutions were not important in these episodes, because most of the investments in fixed capital in the new enterprises were financed by direct equity investments from firm founders or from retained earnings, rather than sources outside the firms such as banks.[4] The analysis of this paper suggests that banks may nonetheless have served an important role if they provided industrial enterprises with liquidity during economic downturns. Some of this research has evaluated the effects of bank-firm affiliations in a variety of historical contexts, such as Germany (Edwards and Ogilvie, 1996; Guinnane, 2002), Mexico (Maurer and Haber, 2007), and the United States (Delong, 1991; Ramirez, 1995; Frydman and Hilt, 2017). This paper complements those latter works in its finding that bank affiliations were quite extensive, and valuable, in 1870s Massachusetts. It also presents an interesting contrast with studies of modern American firms, which show that affiliations with commercial banks are relatively rare (Güner, Malmendier, and Tate, 2008; Kroszner and Strahan, 2001).

Finally, historical American banking and financial crises are the subject of a large and growing literature.[5] Recent contributions, which have been facilitated by technological advances that have made the digitization of historical sources more efficient, have focused on the consequences of historical crises at the firm level. Much of that work has been focused on the Great Depression.[6] This paper advances this new development in the literature by studying the firm-level consequences of an earlier financial crisis, that of the 1870s, whose impact was transmitted within a very different institutional context.

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[4] For the case of the Industrial Revolution in Britain, see Mokyr (1999: 95-103), and the references cited therein. For some related arguments applied to the case of Germany, see Edwards and Ogilvie (1996).
[5] Overviews are presented in Calomiris and Gorton (2000), Wicker (2000), Bordo and Haubrich (2010) and Hanes and Rhode (2013). Works on the Panic of 1873 include Kindleberger (1990), Bordo (1990) and Mixon (2008).
[6] On the Great Depression, see Benmelech et al. (2017), Babina et al. (2017), and Graham et al. (2011). On the Panic of 1907, see Frydman, Hilt and Zhou (2015).

2. Historical Background

2.1 Banks and Industrialization in New England

The rise of large-scale manufacturing enterprises in the United States began in New England, in particular with the development of the integrated cotton textile mill in Massachusetts.[7] The very first such enterprise, Francis Lowell and Nathan Appleton's Boston Manufacturing Company, incorporated 1813, was financed by merchants who had accumulated large fortunes in international trade, and who drew on their connections with other prominent merchant families to raise capital for their venture. These men and their associates have been called an "enterprising elite," and went on to found a number of other companies that followed the same model but on a much greater scale, channeling the capital they accumulated in commerce into manufacturing.[8]

Many of these entrepreneurs also held directorships with banks. The founders and principal stockholders of the Boston Manufacturing Company included at least three bank directors, including two from the Boston Bank, from which the company borrowed regularly.[9] This pattern would continue with the companies that were founded in the years that followed to emulate the Boston Company in Lowell, often by many of the same individuals.[10] These firms maintained close ties to major banks, and benefitted from those ties. This pattern was followed among the regions railroads as well, whose founders and early board members included prominent capitalists who held directorships with banks.[11]

Lamoreaux (1994) has argued that over the following decades, the proliferation of manufacturing enterprises in New England was made possible by close ties between those firms and the region's banks.

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[7] An 'integrated' mill both spun thread from raw cotton and wove it into fabric, using machines driven by water power (or later, steam power). For a history of the early years of this industry in America, see Ware (1931). See also McGouldrick (1968) and Handlin and Handlin (1974).

[8] The term "enterprising elite" is due to Dalzell (1987), who tells this history well.

[9] Nathan Appleton and Israel Thorndike, Jr., founders of the Boston Company, were directors of the Boston Bank. Rosenberg (2011) documents the company's early borrowing from the bank. Section 1.6 of the Appendix provides additional sources and evidence.

[10] All of the textile firms of Lowell incorporated prior to 1830 included at least three Boston bank directors on their boards.

[11] For example, the board of the Boston and Worcester railroad in 1842 included David Henshaw, a director of the Merchant's Bank of Boston, and Nathaniel H Emmons, a director of Boston's Union Bank. (*Report of the Directors of the Boston and Worcester Rail-Road Corporation to the Stockholders…* Boston: I.R. Butts, 1842; *Stimpson's Boston Directory*).

The directors of early New England banks often founded them specifically for the benefit of the firms they controlled, and channeled capital from the banks to their other enterprises through insider lending—that is, lending to the directors or to enterprises owned by the directors. Such transactions were not hidden from the banks' shareholders, who knew that investing in bank stock was really investing in a portfolio of loans to the directors and their firms. Close relationships between nonfinancial firms and banks helped resolve many of the information problems inherent in financial markets in a relatively early stage of development.

Although manufacturing firms borrowed primarily from banks to finance their working capital (Davis, 1966), much of their fixed capital was financed through equity. Banks did not purchase equity directly, but they often provided credit to entrepreneurs—so-called accommodation loans—that were partly collateralized by shares of stock (Lamoreaux 1986). These loans were short-term but renewable, and the liquidity they provided to entrepreneurs was likely quite important.

Many of the region's industrial enterprises achieved enormous scale by attracting equity investments from large numbers of investors. Although the shares of some of these firms were traded on the Boston Stock Exchange, trading in industrial enterprises was neither liquid nor anonymous, and indeed personal or business connections often formed the basis of many investors' portfolio decisions (see Martin, 1886, Davis, 1957, and Atack and Rousseau, 1999). Nonetheless, relatively small investors did participate in this market, and some of the largest manufacturing corporations had hundreds of shareholders. As Berle and Means (1932) noted, these enterprises exhibited what they termed the "separation of ownership from control" to a substantial degree—with diffuse ownership by many small investors, control over some of these enterprises resided with their managers, who often held only a relatively small portion of their firms' equity.[12] Some contemporary observers argued that the governance of at least some of these enterprises suffered as a result, and Erastus Bigelow, a prominent textile

[12] Berle and Means (1932) claim that New England's largest manufacturing enterprises of the mid-19th century were an exception to the rule that the separation of ownership from control occurred in the late nineteenth century with liberal corporation laws and the rise of big business. However, Hilt (2008) argues that in fact this problem was quite common in very early American corporations.

manufacturer, complained that the passive investors in large corporations sustained highly inefficient enterprises.[13]

Close ties between financial institutions and nonfinancial corporations create conflicts of interest, but when the nonfinancial corporation is controlled by directors who are unaccountable to the other stockholders, and who also control the financial institution, these conflicts become particularly acute. In a pamphlet filled with polemical attacks against the management of many public corporations in Massachusetts, one early stockholder claimed that the managers of some of these enterprises engaged in rampant self-dealing, and in particular argued that a prominent financial institution connected to several major textile corporations had lent excessively to those firms, contributing to their insolvency.[14] Thus at least some contemporaries felt that these relationships were harmful, rather than helpful, to nonfinancial corporations and their owners.

2.2 The Panic of 1873 and Its Aftermath

In September of 1873, a panic broke out on Wall Street, plunging financial markets into turmoil. The New York Stock Exchange closed for 10 days. The subsequent economic contraction produced substantially elevated unemployment, and a long slump (see Rezneck, 1950). As illustrated in Panel (a) of Figure 1, the growth of industrial production fell substantially during the years 1874-78, with a significant contraction of nearly -6% in 1875. Among the consequences of the disruption of financial markets and fall in spending was a rise in bankruptcies. Panel (b) of Figure 1 shows that the total liabilities of failing businesses nearly doubled in 1873 and remained elevated through 1878.

Following the outbreak of the panic, a number of Massachusetts manufacturing firms moved to dismiss parts of their workforce and reduce output.[15] The business environment over the subsequent

[13] Bigelow is quoted at length in Harris-Gastrell (1873). Hilt (2015) presents a detailed analysis of the governance of these enterprises.
[14] Ayer (1863). In many respects, Ayer's analysis foreshadows that of Louis Brandeis' enormously influential *Other People's Money* (1914).
[15] *Boston Daily Advertiser*, 30 September 1873.

years was regarded as quite difficult, and many firms either shut down or came close to shutting down.[16] One contemporary journalist offered an assessment of the causes of the firms' poor performance:

> "Most of our manufacturing cities and towns feel the effect of the dullness and financial stringency of the times. The Atlantic Mills, Lawrence, have reduced their product, and will run on short time for the present; the Blackstone is rumored to have decided on a temporary suspension…The Fall River owners are taking steps to ensure concert of action in the matter of running cotton mills on shorter time. This is considered necessary because of the *falling off in the amount of sales* and the *high price of money* [italics added]."[17]

The fall in demand, and the contraction in the supply of available credit, were both seen as contributing to the problems firms faced. The disruption of New York's banking markets likely contributed to the credit stringency, but there was another factor as well. Early in the panic, several prominent "jobbers"—mercantile firms involved in the distribution of goods—failed (Sprague, 1910: 77-80). These failures created significant losses for any manufacturers that had extended credit to them, and likely disrupted mercantile credit networks. Panel (d) of Figure 1 plots the rates of profit (measured as return on assets) for large Massachusetts textile manufacturers over the 1870, and shows a precipitous decline between 1873 and 1876.[18]

Similar problems were faced by railroad firms, then the largest business enterprises in the United States. The panic followed a period of rapid growth in railway mileage, both nationally and in Massachusetts, and in fact broke out when Jay Cooke & Co., railroad bankers, closed their doors. The ensuing years witnessed a wave of railroad bankruptcies, and a rapid decline in railroad investments.[19] Although the effects on Massachusetts railroads were not as extreme as those of other regions, the state's railroad commissioner noted that the panic "gave a decided check to the work of railroad construction" in

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[16] For example, in 1875 the *Boston Daily Advertiser* noted that "many large manufacturing companies during the year past have had their profits so largely reduced, or wholly swept away, that they were confronted with the option of suspension of business…" (7 September).

[17] *Salem Register*, 23 October 1873.

[18] The profit rates are calculated from McGouldrick (1868). McGouldrick's sample was obtained from the manuscript holdings of Baker Library at Harvard University, and includes eleven of the largest and most prominent textile manufacturers from Massachusetts and the surrounding states. These firms are therefore not representative, but the fact that their results were so poor over this period suggests that smaller and less prominent firms likely suffered to an even greater extent.

[19] Benmelech and Bergman (2017) document the freeze-up of the bond market that occurred following the panic, which particularly affected railroads, the most important issuers of corporate debt at the time.

the state.[20] As Panel (c) of Figure 1 shows, the profitability of Massachusetts railroads was depressed throughout the mid-1870s.[21]

In such a difficult economic environment, the wave of insolvencies created by the downturn would likely have created adverse selection problems in credit markets. As Bernanke (1983) notes, the problem of identifying good borrowers from bad borrowers becomes much more difficult, as, for example, the value of collateral held by many firms became more uncertain. But if a firm and a bank had a longstanding relationship, in which the bank was able to gain privileged access to information about the firm's assets and operations, and its record of repayment of loans, the bank would likely have been more willing to lend to the firm at a time of greater uncertainty or greater pressure on the firm's resources. Although no systematic data on bank lending survives from this era, the narrative account of bank lending procedures presented in Gibbons (1859) suggests that in times of stringency, the privileged position of bank directors in the allocation of credit were quite valuable. And the loan data from a New York bank presented in Bodenhorn (2003b) suggest that during a credit crunch, banks did indeed provide greater access to credit to their longstanding customers.

It is also important to note that the banks of Massachusetts were not directly affected by the events that led to the onset of the Panic of 1873, and were in a relatively strong position at its outset. Although they initially continued payments after the suspension in New York, the strong demand for reserves from New York led the Boston banks to enact a partial suspension September 27.[22] Over the following years there were no bank failures in Massachusetts, and indeed 21 new banks opened in Massachusetts between 1873 and 1880.[23] In general one would expect that in a financial panic, firms affiliated with financial institutions facing runs would be differentially impacted, and indeed, recent

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[20] *Sixth Annual Report of the Board of Railroad Commissioners*, January 1875. Boston: Wright & Potter. These comments were made in response to the railroads' 1874 fiscal year, Sept.1873-Sept. 1874.

[21] These data are calculated from Massachusetts railroads' annual reports submitted to the state's railroad commissioner, used as part of the main dataset for this paper (see below). Railroads were the only category of sample corporations required to submit information on revenues or profits.

[22] Sprague (1910: 66-67) documents the response of Boston and Worcester banks to the onset of the panic. Sprague notes that at the outset of the panic, Boston banks had $10 million in cash reserves against $61 million in deposits.

[23] The state's banks did however see a significant decline in their returns on equity, and wrote off substantial losses (Comptroller of the Currency, 1872-1880).

research has sought to identify the economic consequences of financial crises using borrowers' exposure to troubled financial institutions.[24] But the commercial banks of Massachusetts were conservatively managed and in sound condition in 1873, and firms affiliated with them were unlikely to have suffered.[25] Whether or not bank affiliations were actually helpful is the focus of the analysis below.

3. Data

All of the data utilized in the analysis that follows were hand-collected for this paper. The Appendix presents comprehensive details on the sources and methods used in the creation of the dataset. Here, I present a brief overview.

Beginning in 1870, the state of Massachusetts required most nonfinancial business corporations other than railroads to submit an annual certificate of condition to the state. Microfilm copies of the original certificates were found within the collection of the Massachusetts Archives, and transcribed. Unique among all American states, the certificates of condition of Massachusetts corporations open a new window into the financing and management of mid-nineteenth century corporations. The forms required disclosure of the names of the officer and directors, all of the stockholders and the number of shares held by each, and a rudimentary balance sheet. However, as the required disclosures were primarily intended to protect the interests of the firms' creditors and facilitate the collection of taxes, the form did not solicit any information about revenues, profits or dividends.

For the purposes of this paper, this information was collected from all of the certificates filed for the year 1872. The accounting data presented on the forms were published annually in the *Abstract of the Certificates of Corporations* by the Secretary of the Commonwealth, and the data for prior and subsequent years was collected from those published volumes.

[24] See, for example, Chodorow-Reich (2014) and Fernando May and Megginson (2012) on firms affiliated with or dependent on Lehman Brothers following its bankruptcy, or Frydman, Hilt and Zhou (2015) on firms affiliated with New York trust companies following the Panic of 1907.

[25] This is not to say that the mid-1870s were a particularly good period for the state's banks—they saw a significant decline in their returns on equity, and wrote off substantial losses (Comptroller of the Currency, 1872-1880).

Railroads and streetcar companies were regulated by different statutes, which required much more detailed disclosures. Data for all independently operating railroads and streetcar companies in Massachusetts were collected from the compiled reports in the *Annual Report of the Board of Railroad Commissioners,* published annually.

For 1872, accounting data and the names of all directors for 603 nonfinancial corporations were collected, and those corporations' accounting data were recorded for all subsequent years in which they existed, up to 1881. In order to identify ties between banks and nonfinancial corporations, the names of all directors of all of the state's banks were recorded from the 1872 *Massachusetts Register and Directory*. These names were then cross-referenced with the names of the directors of the nonfinancial corporations, in order to identify interlocks.

Among the 603 sample firms, 59 percent had a bank director on their board. The boards of some banks were interlocked quite extensively with those of nonfinancial corporations. Consider the example of the National Bank of Northampton, illustrated in Figure 2. The bank had nine directors, of which six held directorships on at least one nonfinancial corporation. In total, the bank's directors held board seats with fourteen other corporations—twelve manufacturing firms, one utility and one railroad—all of which were located in nearby towns. Several of the bank's directors owned substantial equity states in the non-financial corporations where they held board seats, and were probably founders of those enterprises. In other cases, the bank directors held very little of the stock of the other companies, or even none of the stock at all. Perhaps those latter directors were primarily bankers, whereas the former are best thought of as entrepreneurs. This is a distinction we will return to later in the analysis.

The federal census of 1870 included information about real and personal wealth. The manuscripts were searched for all of the names of directors of Massachusetts nonfinancial corporations to obtain this information. There were 2,747 unique individuals who held directorships with nonfinancial corporations, and of those, 1,636 could be uniquely identified in the census, a match rate of around 60%. For the corporations for which the wealth of at least half the directors was found, average director wealth (real plus personal) was calculated.

Finally, credit ratings were collected for the sample corporations. At the time, annual volumes entitled *Bradstreet's Commercial Reports* were published by J.M. Bradstreet & Son and distributed to paying subscribers.[26] The publication's coverage focused on manufacturers, wholesalers and retailers, and did not include any railroads or streetcar companies at all. But for 337 of the sample firms, a letter-graded rating for 1872 was found in the volume. These ratings fell into six categories: AA ('Unquestioned'), A ('Very High'), B ('Excellent'), C ('Good'), D ('Fair'), E ('Very Moderate'). These ratings create an independent measure of the financial condition and resiliency of the sample firms, and were indeed correlated with the probability of failures, as shown below.

Table 1 presents summary statistics for many of the corporations' characteristics for 1872. Column (2) of Panel A shows that the average log value of their total assets was 11.7; their average age, measured as years since incorporation, was 12.9 years; and the average leverage ratio (debts/total assets) for the firms was 0.35. The firms' property accounts—buildings and machines, or in the case of railroads, track and equipment—accounted for about 35 percent of their assets. And although director wealth was only available for about 63 percent of the sample corporations, its mean value was $122,000—equivalent to $2.4 million in today's dollars after adjusting for inflation. Panel B shows how the corporations were categorized into 13 different industries, the most important of which were textiles, and fabricated metals. Panel C presents some firm outcomes. About 38 percent of the firms failed prior to 1882. The average value of the numerical code for the firms' credit ratings (where AA was coded as 1, and E was coded as 6) was about 2.2. And the growth rate of firms' assets in 1872 was about seven percent.

The top of Panel A presents the frequency with which the firms had a bank director on their boards, and column (3) presents the differences in the values of all the remaining characteristics between firms with and without a director interlock with a commercial bank, as estimated from regressions with robust standard errors. Turning first to Panel B, the industry variables in column (3) indicate that bank

[26] These published volumes have not seen much use among economic or business historians, presumably because they are difficult to find today. Each subscriber's copy was numbered and was officially 'loaned,' rather than sold, to the subscriber, and was to be returned to the publisher "at the end of the subscription." A competing publication of ratings was published at the time by a competitor, the Mercantile Agency. However, no copy of the 1872 volume could be found.

interlocks were more common among textile manufacturers and railroads, and less common among paper producers and makers of food and tobacco products. These differences in the distribution of industries between firms with and without bank directors will be accounted for in the empirical analysis below through the use of industry fixed effects.

But more importantly, the data in Panel A show that corporations with a bank interlock had less leverage, were older, had more assets, and had wealthier directors. And the data in Panel C show that firms with bank interlocks received substantially better credit ratings. This raises a particular challenge for empirical analysis, since the selection of stronger or more 'well-established' firms into bank affiliations could easily be responsible for any observed differences in performance between the two groups of firms during the 1870s. Although the growth rates of firms with and without bank directors did not differ significantly in 1872 (Panel C), one might imagine that any change in performance observed over subsequent years could be due the greater resiliency of the firms with bank directors on their boards. In the empirical analysis that follows, this challenge will be addressed carefully.

4. Analysis of Firm Outcomes

A range of firm outcomes can be calculated from the available data. The most important is survival. As discussed above, 38 percent of Massachusetts corporations that existed in 1872 failed prior to 1882. In at least some cases, this was likely an outcome of firms being unable to roll over or pay maturing debts, or being unable to obtain financing for the acquisition of working capital or other critical transactions. If affiliations with banks enabled firms to overcome asymmetric information problems and gain access to credit during the economic downturn, then they should have increased firms' survival rates.

Other firm outcomes will necessarily be observed only among surviving firms. As the certificates of condition available for most of the sample firms do not provide any information about profits or cash flows, the usual accounting measures of rates of return cannot be computed. However, the annual growth rates of firms can be computed as the change in total assets from year to year. In addition, the credit

ratings for surviving firms during or after the shock can be compared to their ratings prior to the economic shock, to construct a measure of the change in their financial condition. An additional volume of the same publication of J.M. Bradstreet & Son was found for the year 1878, so that the change in ratings between 1872 and 1878 can be computed for surviving firms. Among the 337 firms for which an 1872 rating was found, 227 of them were rated in the 1878 volume. In a reflection of the difficult economic conditions that prevailed, the average value of the change in ratings among these surviving firms was +0.93, indicating a worsening by nearly a full notch (effectively going from a rating of A to B).

Given that the latter two outcomes are observed only conditional on survival, the empirical relationship between them and bank affiliations will be obtained from a selected group of firms, which may understate the effect of bank affiliations. In particular, if bank affiliations enable otherwise weaker firms to survive and remain in business, the observed relationships between bank affiliations and surviving firms' growth rates and credit ratings changes will be biased downward. Put differently, a firm that faces a rapid decline in its growth rate or credit rating may be better able to survive and remain in the dataset if it is affiliated with a bank, thereby lowering the average value of those outcomes for bank-affiliated firms.

Before proceeding with the analysis, some suggestive evidence of the effect of bank affiliations on the outcomes for Massachusetts' corporations is presented in Figure 3. Panel (a) of the figure plots Kaplan-Meier survival curves for corporations with and without bank directors on their boards. The survival functions for the two groups of firms are starkly different; those without bank directors failed at much higher rates throughout the period. Panel (b) presents the annual growth rates of the firms between 1872 and 1881. All of the sample firms' growth rates fell in 1874 and remained depressed through 1879. Clearly, these were difficult years. But the differences between the two groups are quite significant, particularly in the years 1874-77. Corporations with ties to banks enjoyed a substantial advantage during the downturn, and their growth rates did not fall to the same extent as those of other firms. It is worth noting that the firms with bank affiliations did not enjoy any advantage in growth rates in the years following or prior to the recession.

4.1 Regression specifications

Given the varying structure of the data for the three outcomes, slightly different empirical specifications will be used for each one. However, in each case, the characteristics of firms prior to the shock, as observed in 1872, will be used to predict firm outcomes after the shock.

The effect of bank affiliations on firm failure rates will be estimated in a linear probability model as follows:

(1) $$fail_{icj} = \beta_0 + \beta_1 banker\text{-}director_i + \mathbf{z}_i\beta_2 + \alpha_c + \delta_j + \varepsilon_{icj.}$$

where the determinants of failure include a binary indicator for an affiliation with a bank (*banker-director*$_i$); county and industry fixed effects (α_c and δ_j); and other 1872 firm characteristics likely predictive of failure that differ between firms with and without bank affiliations, such as log assets, firm age, and leverage ($\mathbf{z}_i$).

A somewhat different specification will be used for estimating firm growth rates. With the latter, we can observe the rates before and after the shock, and therefore use the panel dimensions of the data to estimate the difference-in-differences in a model with firm fixed effects. These will absorb any unchanging firm characteristics, such as management quality, which may influence the firms' growth over time. The effect of bank affiliations on the growth rates of corporations will be estimated in the following empirical framework:

(2) $$y_{it} = \beta_0 + \beta_1 banker\text{-}director_i \times post\text{-}1873_t + \mathbf{z}_{it}\beta_2 + \gamma_i + \theta_t + \varepsilon_{it}$$

where y_{it} is the growth rate of company i in year t; *banker-director*$_i$ is an indicator for the presence of one or more bank directors on the board of company i; *post-1873*$_t$ is an indicator for the years following 1873; $\mathbf{z}_{it}$ is a vector of different firm characteristics, including industry and county indicators, as well as 1872 characteristics such as firm size, age and leverage, interacted with a post-1873 indicator; and θ_t and γ_i are year and firm fixed effects.

Finally, the change in firms' credit ratings will be estimated in a different framework. In order to account for the fact that the initial credit rating likely predicted the subsequent change in firms' credit

ratings, initial rating fixed effects will be used.[27] Thus the effect of bank affiliations on ratings changes will be estimated only from the variation within a given initial rating level. The 1872 ratings levels represent summary indicators of the financial condition of firms, so that the estimation framework focuses on the effect of bank affiliations on subsequent changes in financial health, among firms of initially similar financial condition. As the initial ratings likely took into account the effect of observable characteristics such as firm size and leverage, including those additional characteristics in the regression with the initial ratings may be redundant. The specification to be estimated will be:

(3) $$\Delta rate_{icj} = \beta_0 + \beta_1 banker\text{-}director_i + \boldsymbol{z}_i\beta_2 + \lambda_r + \alpha_c + \delta_j + \varepsilon_{icj.}$$

which is the same as equation (1) above, with the addition of the λ_r term, which represents the fixed effects for the initial ratings levels.

4.2 Baseline Estimation Results

Table 2 reports results for regressions based on different versions of equation (1)-(3). In column (1), the model is estimated with fixed effects only, and in column (2) additional firm characteristics are included in the regressions. (The full set of parameters of each regression is reported in the Appendix). The results in both columns provide clear evidence that firms with bank directors on their boards survived at higher rates, and conditional on survival, they experienced less of a decline in their growth rates and worsening of their credit ratings in the years following 1873.[28] The results in column (2) indicate that the survival rate of firms with bank affiliations was nearly 10 percentage points higher; that the growth rates of these firms, relative to the years 1873 and before, was 6 percentage points higher, compared to firms without bank affiliations; and that the change of the credit ratings of firms with bank affiliations was higher by nearly a quarter of a notch. The latter two estimates likely understate the true effect of bank

[27] For example, it was likely impossible for a firm with a very poor credit rating to exist for a sustained period with that same credit rating. Given its poor rating, it would likely have difficulty in obtaining credit, and was therefore likely to fail. However, if it managed to turn things around and survive, it would then receive a higher rating reflecting its improved status. But only in the latter case could a change in ratings be calculated.

[28] With credit ratings a lower number is better, and a negative estimate reported in the table reflects a *better* change (less of a deterioration) in credit ratings.

affiliations, since they are observed conditional on survival, and bank affiliations likely enabled otherwise weaker firms to survive.

An obvious concern regarding these results, however, could be that the firms with and without bank directors were quite different, and in particular the firms without bank directors were in fact so different they do not constitute an appropriate control group. The firms with bank directors on their boards were larger, older, and less levered—to the extent that these observable differences contributed to the resiliency of firms or success during the downturn, this could be responsible for the results. In order to address this concern, I use estimated propensity scores to restrict the sample to the common support in the propensity to have an affiliation with a bank, and also weight the observations by their inverse propensity scores.[29] The results of these regressions are presented in column (3) of Table 2. The estimated effect of an affiliation with a bank is reduced in magnitude slightly, but remains generally similar, particularly for firm failure rates and growth rates.

Given that the analysis focuses on responses to the economic shock, the most important difference between firms with and without bank affiliations would be their degree of resilience to a shock. The credit ratings of the firms, used above as an outcome, are an estimate of the probability of a default, and therefore may serve as a measure of resiliency. Table 3 presents regressions of the same form as column (2) of Table 2, but with fixed effects for each rating level included. The predictive power of the ratings for failures is clearly evident in column (2) of Table 3. But even conditional on ratings, bank affiliations reduced the probability of failure, and increased growth rates relative to pre-crisis levels. Interestingly, the ratings have little effect on growth rates, which is consistent with their function as a measure of default probabilities for creditors, rather than growth opportunities.

[29] The procedure is as follows. I first estimate the propensity scores using a firm-level probit regression of an indicator for an affiliation with a bank with 1872 measures of log assets, leverage, and industry indicators. I then restrict the sample to the common support in the propensity to have such an affiliation; that is, I eliminate firms without an affiliation with a propensity score below the minimum for the firms with an affiliation (and above the maximum for those with an affiliation). Finally, I use the estimated propensity scores to construct weights for each firm. These weights are applied to the treated and control firms so that both groups resemble the population, and ensure that the regression will produce consistent estimates of the Average Treatment Effect of bank affiliations. See Imbens (2004).

An additional concern regarding these results may be that they reflect the effects of other director or board characteristics that may be correlated with bank affiliations. That is, the estimated effects of bank interlocks may not result from bank affiliations per se, but from other characteristics or connections of banker-directors. For example, banker-directors were likely to have been wealthier than most directors, and director wealth may have been an important determinant of firms' survival and growth, for example because wealthier men would have been better able to guarantee their firms' debts or tolerate losses for longer periods.

Alternatively, firms with bank directors on their boards were almost certainly better connected in a much broader sense, and likely had director interlocks with firms other than banks. Recent research from Babina et al. (2017) on American firms during the Great Depression has shown that better-connected firms were more likely to survive that period. In order to explore this latter possibility, the full network of all interlocks among all Massachusetts corporations' boards was used to calculate the eigenvector centrality of each corporation's board.[30]

Table 4 presents the results of regressions that are the same as those reported in column (2) of Table 2 (with firm characteristics as controls), but with average director wealth and the eigenvector centrality of the board included as additional controls. With the exception of the change in rating, the estimated effect of bank affiliations is quite robust to the inclusion of these variables. Interestingly, the director wealth variable is positively correlated with firm failure—perhaps wealthier directors took greater risks with their firms. Director wealth was essentially uncorrelated with the change in firms' growth rates following 1873, but it led to a significantly better change (less of a deterioration) in ratings. Somewhat different from the Babina et al. (2017) results, the eigenvector centrality of the board was essentially uncorrelated with firm failures. However, it was positively related to post-1873 growth rates and ratings changes.

[30] Eigenvector centrality captures the importance of a node in a network by measuring the importance of the nodes to which it is connected (and is therefore recursive in nature.) See the Appendix.

4.3 Mechanisms Behind the Effects: Asymmetric Information

Bank affiliations may have helped non-financial corporations overcome problems of adverse selection in credit markets. This would imply that the firms that benefitted most from a resolution of the adverse selection problem would have seen their outcomes improve to the greatest extent. In order to test whether or not this was the case, some variables reflecting the degree of asymmetric information faced by each of the sample firms are needed.

One good candidate as a proxy for the degree of asymmetric information faced by firms might be their ages. Relative to a new firm, creditors would have had more experience dealing with the older, better-established firms. The quality and business prospects of new firms may have been relatively difficult for outsiders to assess, particularly in an economic downturn. This implies that new firms should have benefitted to a much greater extent from an affiliation with a bank, as the affiliation would have enabled the bank to obtain better information regarding the firm's assets and prospects. In addition, higher quality or more reliable firms were almost certainly more likely to survive over time. A creditor who was completely unfamiliar with a firm could therefore infer from its age that it was relatively more likely to be a reliable borrower.

Another possible proxy for the degree of asymmetric information the percentage of firms' assets represented by their buildings, equipment and land—their property account, or fixed assets. Although imperfect, this is an indication of the share of firms' assets that may represent good collateral for a loan, or that might actually have some salvageable value in case the firm were liquidated. The firms were in fact required to report this value exactly for the benefit of their creditors. Firms with a lower share of these fixed assets, which likely had a higher fraction of intangible assets such as patents or financial claims on their balance sheets, would have been much more subject to asymmetric information problems. These are exactly the firms that should have benefitted most from affiliation with a bank, which, again, could have obtained better access to information about the true quality of the firms' assets through participation in the firms' management.

In order to test for this mechanism, the same specifications as column (2) of Table 2 are used, and a series of interaction terms added. For example, for the outcome of firm failures, and the case with firm age, equation (1) becomes:

$$\text{(1a)} \qquad fail_{icj} = \beta_0 + \beta_1 banker\text{-}director_i + \beta_2 banker\text{-}director_i \times age_i + \beta_3 age_i + \boldsymbol{z}_i\beta_4 + \alpha_c + \delta_j + \varepsilon_{icj.}$$

The parameter of interest becomes β_2, the interaction between a bank affiliation and firm age, and the hypothesized sign is positive: the preventative effect of bank affiliations on firm failures (reflected in a negative value of β_1) should be diminished for older firms. The validity of the test itself is reflected in β_3—firm age should help avert failures if it is a good proxy for firms with lower degrees of asymmetric information. Similar modifications will be made to equations (2) and (3).

Tables 5 and 6 present results of these regressions. In all but one of the six regressions in the two tables, the estimated coefficients have signs consistent bank affiliations helping to address problems of asymmetric information. For example, in column (2) of Table 5, the main effect of a bank affiliation on post-1873 firm growth is positive; the interaction term between bank and firm age is negative, meaning that the overall effect is smaller for older firms; and the effect of age itself is positive, implying that older firms did indeed grow differentially faster in the years following 1873, consistent with the hypothesized role of age as a negative proxy for asymmetric information problems.

In Tables 5 and 6, the rows labeled implied effects report the effects of the main bank affiliation variable plus the effects of the interaction term multiplied by different values of the firm characteristic. In the case of equation (1a) from Table 5, for example, these rows report the value of $\hat{\beta}_1 + \hat{\beta}_2 \times age_p$, where the value of age_p corresponds to the *p*th-percentile of the firm age distribution. Reading down the rows, the changing values reported reflect the variation in the effect of bank affiliations for corporations with greater values of firm age (or the greater vales of the share of fixed assets on their balance sheet, in the case of Table 6). Consistent with the effect being smaller for firms less subject to problems arising

from asymmetric information, the absolute value of the coefficients falls, in some cases quite steeply, for firms at higher percentiles of the age or fixed assets share distribution.

The one exception is column (3) of Table 5, the effect of age interactions on the changes in firms' credit ratings. Here the interaction term is negative rather than positive, and the rows reporting the implied effects show magnitudes that increase, rather than decrease, with firm age. Evidently with ratings changes, older firms enjoyed a greater benefit from affiliations with banks than younger firms. But it should be noted that age itself does not have the hypothesized (negative) effect of improving firms credit rating changes, which implies that, at least in this context, age may not be a valid marker for asymmetric information problems. The initial ratings of firms, or perhaps selection into having a rating, may have fully reflected the effect of age on investors knowledge of the firm.[31]

These results may also help address concerns regarding selection on unobservable characteristics leading to improved post-1873 outcomes. For that to be responsible for the results, the selection would have to have been differentially better for firms with fewer fixed assets on their balance sheet, and for younger firms. This is certainly not implausible, but one might generally expect the selection on unobservables to follow similar patters as the selection on observables.

4.4 Mechanisms Behind the Effects: Credit, or Signaling?

The benefits of affiliations with commercial banks documented in the preceding analysis could be the product of several possible mechanisms. First, bank directors may have provided financial or managerial expertise to a firm. Second, the affiliations with banks created by bank directors may have signaled to creditors and suppliers that the firm was reliable or unlikely to experience financial distress.

[31] Two other proxies for asymmetric information were explored: firm size, and whether or not a firm had a credit rating. Firm size is commonly used in the literature as a proxy for asymmetric information (eg, Chodorow-Reich, 2014), and whether or not a firm was rated is certainly a reasonable measure of the prominence of a firm, and the extent of information about it. Both variables perform as expected in firm failure regressions; larger firms and rated firms survived at higher rates, and the protective effect of bank affiliations diminished with firm size and for rated firms. Yet neither has the hypothesized effects on post-1873 growth: larger firms, and rated firms, grew differentially slower, relative to the pre-1873 period. It is possible that the effects of post-1873 growth are biased downward, since they are observed only conditional on survival.

Or third, the affiliation may have actually facilitated lending from the director's bank to the business, consistent with Lamoreaux's (1994) insider lending hypothesis. Call these the management channel, the signaling channel, and the insider lending channel. Each of them could potentially facilitate improved access to credit and enhance the resiliency of firms in response to an economic shock, and each of them might be expected to have greater effects among firms suffering differentially from problems arising from asymmetric information.

Although distinct, these three channels are not mutually exclusive. It is possible—perhaps even likely—that the estimated effects reported above are the product of some combination of the three. Yet it is important to distinguish among them, as each implies that bank affiliations solved a different problem. Understanding the role that banks played in America's economic development, and discerning any lessons from this experience for other contexts, requires identifying the specific problem they solved.

In order to identify the relative importance of the different possible channels, one would ideally want an experiment in which particular channels were shut down among subsets of bank-firm affiliations, and the outcomes compared. One possibility that comes close to this is the presence of bank cashiers, rather than directors, on nonfinancial company boards. Bank cashiers were the day-to-day managers of banks, who maintained the accounts and oversaw all of the banks' operations. The ranks of bank cashiers often included many talented and ambitious men, who would go on to illustrious careers in finance and industry. They were certainly financial experts. But they generally could not allocate credit from the bank. They were typically present at the meetings of banks' discount committees, and interacted with banks' borrowers, but as they were expected to serve as an independent check on the directors and guard against any misuse of the banks' funds, they were generally not permitted to be borrowers from banks, or to serve as guarantors of their banks' loans.[32] The presence of a bank cashier on a firm's board could

[32] Gibbons (1859) describes the role of cashiers in great detail, from first-hand experience. See also Bodenhorn (2003a). Lamoreaux (1994) does mention a case of a failed bank where a cashier was a borrower (p. 43), indicating that the practice of prohibiting cashiers from being depositors or borrowers was not universal. But given the significance of the cashier's role, it would have been prudent and sensible to rule out any loans to the cashier. It should also be noted that cashiers were normally required to post bonds to ensure that they would perform their role in good faith. A large enough loan balance with the bank could completely undermine the incentive mechanism

potentially benefit the firm through the management channel or the signaling channel, but generally not through the insider lending channel.

Twenty of the sample corporations had bank cashiers on their boards. Table 7 reports estimates from regressions similar to those of column (1) in Table 2—that is, without firm characteristics included as controls—but with the bank director on board indicator replaced with one for a bank cashier on the board. If a bank cashier brought financial expertise (the management channel) or a prestigious affiliation (the signaling channel), comparisons between the estimated magnitudes from these regressions with those estimated above for bank directors will reveal the relative importance of the insider lending channel.

The estimates reported in Table 7 reveal that the management and signaling channels were unlikely to have been important. For firm failures and growth, the point estimate for the presence of a bank cashier is quite small, and the effect on firm ratings changes was large but positive, indicating a harmful effect. The validity of this test requires that bank cashiers actually did bring financial expertise and a prestigious signal to the companies where they held directorships that was similar to those created by the presence of a bank director. If that was indeed the case, then the results of this test suggest that the insider lending channel was likely quite important.

4.5 Discussion: Reconciling the Results with Those of Modern Studies

Among modern American firms, board interlocks with commercial banks are relatively uncommon (see Kroszner and Strahan, 2001). Most of the bankers on American firms' boards today are regarded as independent or "outside" directors and only rarely represent banks with lending relationships with the firms where hold board seats. The extant evidence we have on the effects of bank-firm affiliations associated with lending relationships among modern firms suggests that they are not actually helpful, and tend to enable managers to make inefficient investments (see Güner, Malmendier, and Tate, 2008).

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created by the bond; the gain to a malfeasant cashier from defaulting on the loans from the bank could compensate for the loss of the bond.

The differences between that study's results and those obtained here may be due in part to the different macroeconomic environments under study; the modern effects of affiliations with a healthy financial institution during a financial crisis or recession may be different. But there is another, more important factor that may explain the difference. The bankers on modern boards are, above all, bankers. In contrast, the bankers on the boards of nonfinancial corporations in the 1870s were not primarily bankers, but instead were entrepreneurs.

It is possible to quantify the extent to which these banker-directors were entrepreneurs, rather than bankers. For a subset of Massachusetts banks, those located in Boston, ownership lists are available, so the ownership stakes banker-directors held in their banks can be systematically compared to the stakes they held in the nonfinancial companies where they held directorships.[33] These comparisons are presented in Table 8. For the 87 different individuals who held directorships both with Boston banks and non-financial corporations for which an ownership list was available, the average fraction of the total stock of the banks they held was less than 1%, whereas their average stake in the nonfinancial companies where they held directorships was more than 8%. Since they often held board seats with multiple nonfinancial companies, the (par) value of their holdings in those firms was far greater than their holdings in banks—nearly $37,000 more.

The financial fortunes of these men were clearly much more closely tied to their nonfinancial firms than to their banks. This gave them a very strong financial incentive to use their connections to banks to help their non-financial corporations grow, rather than the other way around. These were not bankers on non-financial company boards; they were entrepreneurs on bank boards, and this distinction likely explains the contrast with modern firms' experiences. It may also help explain the prevalence of historical banker-directors; the large equity stakes they held likely minimized the conflicts between the

[33] These data are from the volume, *A List of Stockholders in the National Banks of Boston, May 1 1866.* They were therefore six years old in 1872, when the ownership of the other corporations is measured. There is likely some measurement error in the ownership stakes in the banks presented in the table, but there is no reason to believe that it systematically understates the bank ownership shares. In addition, many of these men held directorships with railroads, for which no ownership stakes are available. The omission of railroad ownership stakes likely causes the comparisons in Table 7 to understate the differences between the financial stakes held by these men in non-financial corporations relative to Boston banks.

interests of creditors and equity holders that may make it undesirable to have a banker on a corporate board.

5. Conclusion

In the 1870s, bank-firm affiliations, cemented with board seats, were quite common among nonfinancial corporations in New England. This paper has used newly collected data to document the extent of these affiliations, and their value. Among all nonfinancial corporations in Massachusetts, 59 percent had a bank director on their board. Entrepreneurs who founded and invested in manufacturing enterprises and other firms commonly held board seats with commercial banks, and these relationships likely helped address problems related to asymmetric information, and improved the firms' access to credit.

The empirical analysis used the shock of the Panic of 1873 and the ensuing recession to assess the value of these relationships, and the mechanisms creating that value. In the wake of the financial contraction, there was a significant decline in industrial production, and a wave of bankruptcies. In such an environment, adverse selection problems in credit markets become particularly acute. And if bank-firm ties helped address those problems, they would likely have become quite valuable. The analysis indicated that whereas all firms suffered following the panic, those that had ties to banks failed at lower rates, saw their growth rates fall by considerably less, and saw their credit ratings decline by less. Consistent with these effects arising from bank-firms helping to address asymmetric information problems, these effects were greater for younger firms and those with lower shares of fixed assets on their balance sheets.

The results of this paper suggest a role for banks in the industrialization process that previous studies have not emphasized. Economy-wide or sectoral shocks periodically buffet all economies, and when significant, they wipe out large numbers of firms. The cumulative effect of these shocks likely impedes development and industrialization. In nineteenth century New England, affiliations with banks helped sustain nonfinancial corporations faced with macroeconomic shocks, by mitigating the asymmetric

information problems that become so acute. Whether or not banks provided a substantial fraction of firms' outside finance overall, relationships with banks were likely critical during periods of economic volatility.

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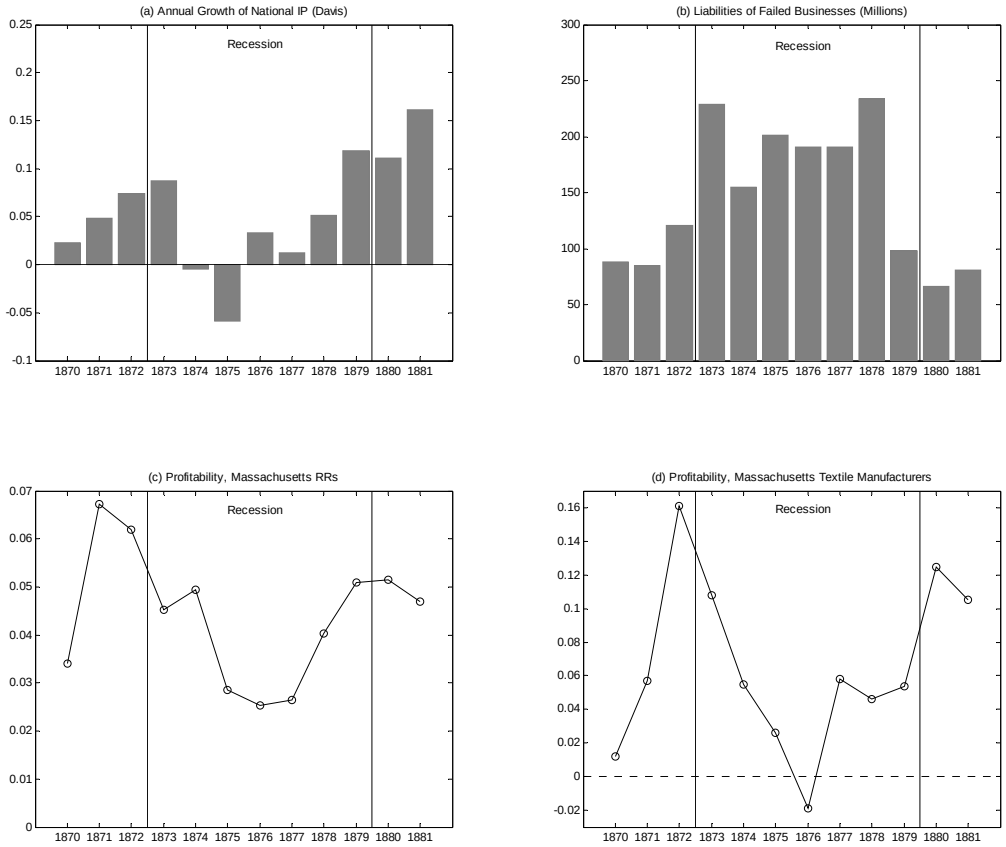

Figure 1: Effects of the Panic of 1873

Panel (a) presents annual rates of growth of industrial production, as calculated from Davis (2004). Panel (b) presents the annual value of liabilities of failed businesses, from the "Dun & Bradstreet Reference Book and Failure Statistics," as reported in *Historical Statistics of the United States.* Panel (c) presents the profitability of Massachusetts railroads, measured as return on assets (net income divided by total assets), as calculated from the reports submitted to the state's railroad commissioner. And Panel (d) presents the profitability of large textile manufacturers, mostly from Massachusetts, measured as return on assets, from McGouldrick (1968, Appendix D). Each panel presents data for 1870-1881, with the beginning and end of the period corresponding to the recession as dated by the NBER (October 1873-March 1879) marked with vertical lines.

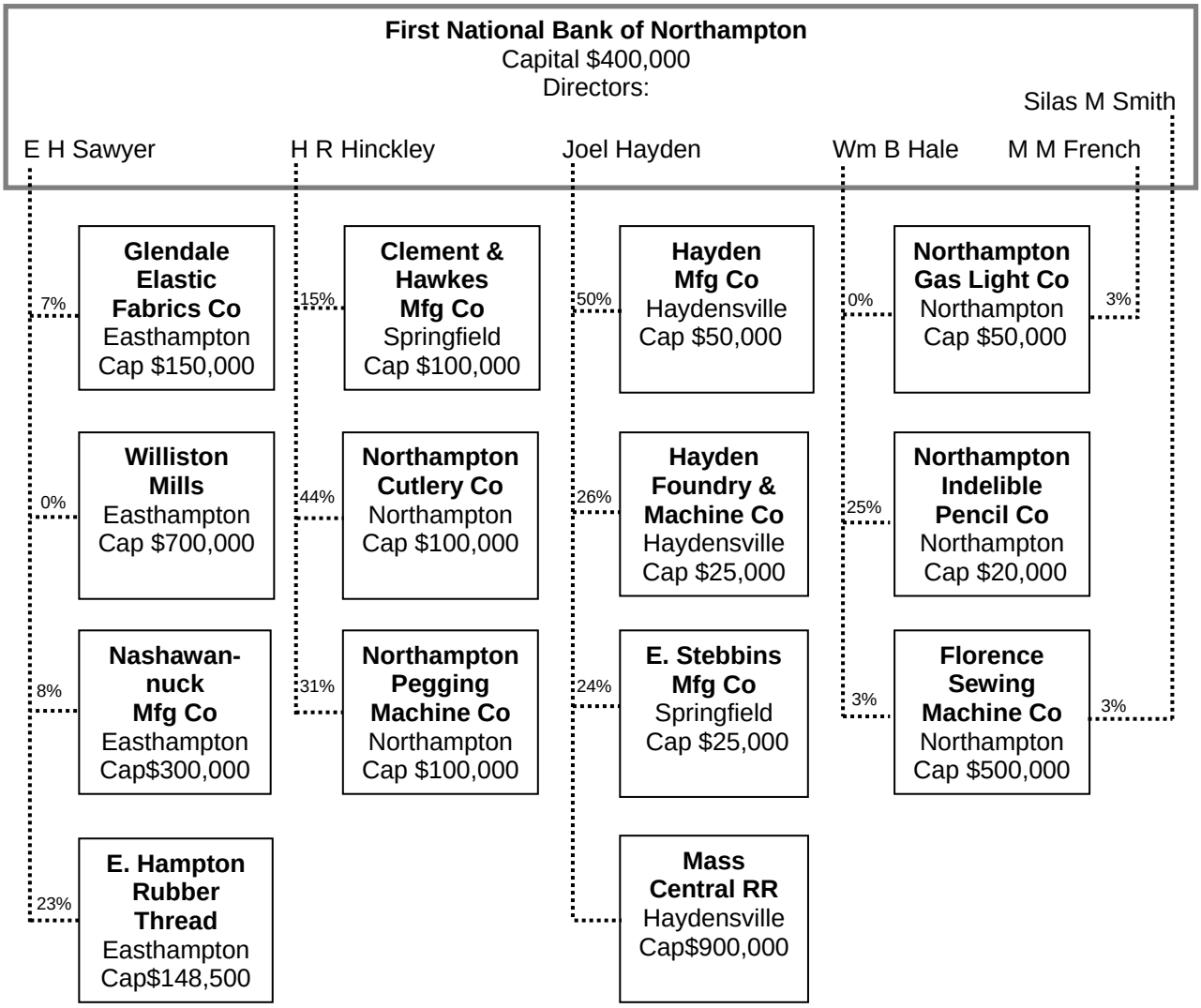

Figure 2: Board Interlocks with of the First National Bank of Northampton, 1872

This figure presents the additional directorships held by each of the board members of the First National Bank of Northampton MA in 1872. The bank had three additional directors who held no additional directorships. Dotted lines indicate directorships. The numbers indicate the percent of the equity of the nonfinancial companies owned by the individual directors. As no shareholder lists were submitted by railroads, the ownership stake held by Joel Hayden in the Massachusetts Central RR is not known.

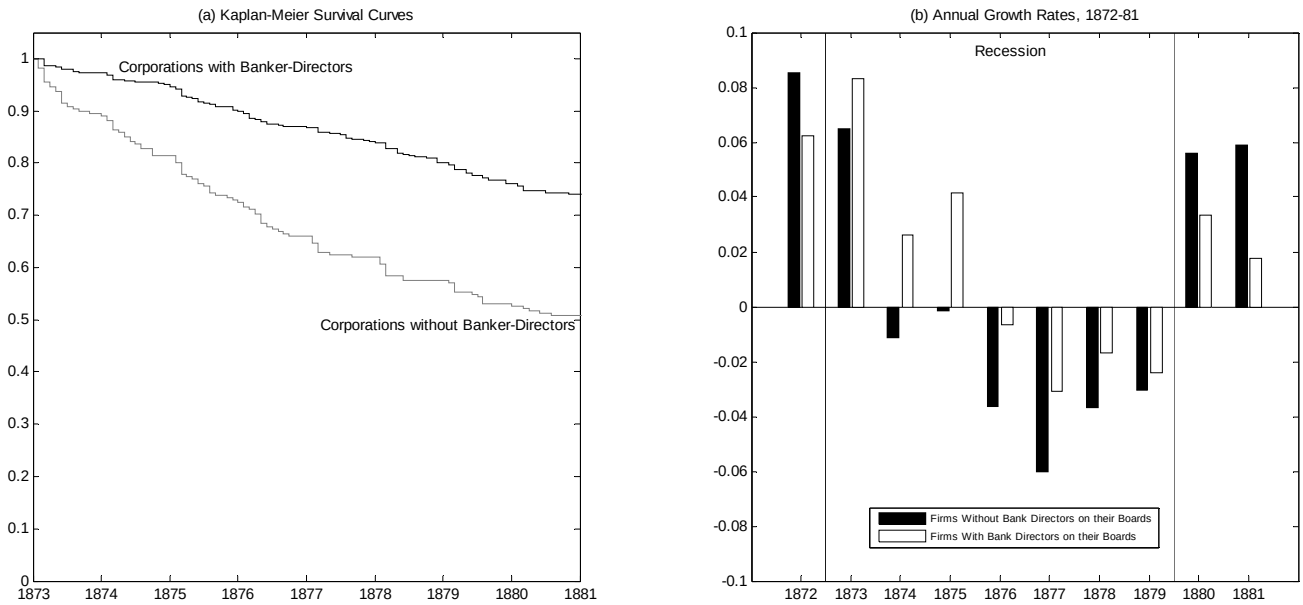

Figure 3: Survival and Growth Rates of Firms with and without Bank Interlocks

Panel (a) of the figure presents Kaplan-Meier survival curves for firms with and without bank directors, for firms existing in 1872. Failure dates are approximated as occurring one year following the final certificate of condition. Panel (b) presents the annual growth rates of total assets of firms with bank directors on their boards (white bars) and those without (dark bars).

Table 1: Summary Statistics

	N (1)	All Firms: Mean [StDev] (2)	Difference: Firms with And Without Bank Director (SE) (3)
A. Firm Characteristics:			
Bank Director on Board, 1872	603	0.589	--
		[0.492]	
Leverage	583	0.347	-0.059**
		[0.303]	(0.019)
Property account / Total assets	556	0.352	0.041
		[0.304]	(0.033)
Firm age, years	602	12.939	2.845+
		[12.547]	(1.367)
Log(Total assets)	584	11.716	0.935**
		[1.687]	(0.163)
Mean director wealth, millions	381	0.122	0.087**
		[0.153]	(0.013)
Eigenvector centrality, firm board	603	0.032	0.041**
		[0.093]	(0.009)
B. Industry:			
Brick and stone products	601	0.033	-0.018
			(0.016)
Chemicals	601	0.017	-0.003
			(0.011)
Metal products	601	0.248	-0.073+
			(0.038)
Food and tobacco	601	0.037	-0.030+
			(0.017)
Glass products	601	0.013	0.008
			(0.009)
Maritime (steamboat, wharf)	601	0.028	0.011
			(0.013)
Mining and petroleum	601	0.038	-0.005
			(0.011)
Paper and wood products	601	0.080	-0.051*
			(0.024)
Railroads	601	0.038	0.060**
			(0.018)
Streetcar	601	0.022	0.014
			(0.012)
Textiles	601	0.271	0.095**
			(0.036)
Utilities	601	0.101	0.028
			(0.025)
Other	601	0.075	-0.037
			(0.025)
C. Outcomes:			
Firm failed prior to 1882	603	0.381	-0.212**
		[0.486]	(0.038)
Firm credit rating, 1872 (1=best, 6=worst)	337	2.291	-0.462*
		[1.112]	(0.185)
Growth rate of total assets, 1872	482	0.070	-0.026
		[0.281]	(0.024)

Table 2:
Effect of Bank Affiliations: Baseline Estimation Results

	(1)	(2)	(3)
A. Linear Probability: Firm Failure Prior to 1882			
Bank Director on Board, 1872	-0.212**	-0.099*	-0.077+
	(0.044)	(0.044)	(0.043)
Observations	601	554	554
R-squared	0.125	0.241	0.244
Industry, County FE	YES	YES	YES
1872 Characteristics	NO	YES	YES
Inverse Propensity Score Weighted; Common Support	NO	NO	YES
B. Panel: Annual Firm Growth, 1871-1881			
Bank Director 1872 x Post-1873	0.050+	0.060*	0.056*
	(0.026)	(0.025)	(0.026)
Observations	4,404	4,338	4,338
R-squared	0.256	0.256	0.266
Firm FE	YES	YES	YES
Industry, County FE x Post-1873	YES	YES	YES
1872 Chars x Post-1873	NO	YES	YES
Inverse Propensity Score Weighted; Common Support	NO	NO	YES
C. Change in Credit Rating, 1872-1878			
Bank Director on Board, 1872	-0.249+	-0.232+	-0.179
	(0.128)	(0.128)	(0.127)
Observations	227	227	227
R-squared	0.247	0.257	0.268
1872 Rating FE	YES	YES	YES
Industry, County FE	YES	YES	YES
1872 Characteristics	NO	YES	YES
Inverse Propensity Score Weighted; Common Support	NO	NO	YES

This table reports estimates of equations (1), (2) and (3). Panel A reports the results for linear probability models of firm failure; Panel B reports difference in difference estimates from panel regressions of annual firm growth rates; and Panel C reports estimates of the determinants of the change in firms' credit ratings (for which a decline represents an improvement to a lower-numbered rating). Column (1) reports a baseline specification. Column (2) reports a specification in which a series of firm-level controls (leverage and firm age in all cases; additional characteristics such as log assets in Panels A and B as well) are included. Column (3) reports results for models in which the firms are weighted by their inverse propensity scores, and the sample is restricted to the common support in the propensity to have a bank affiliation. In Panels A and C, robust standard errors are reported. In Panel B, standard errors clustered by firm are reported. **, *, and + denote significance at 1%, 5% and 10%, respectively.

Table 3:
Effect of Bank Affiliations Controlling for Credit Ratings

	Firm Failure			Annual Firm Growth	
	(1)	(2)		(3)	(4)
Bank Director, 1872	-0.165**	-0.106+	Bank Dir. 1872 x Post-1873	0.101**	0.099**
	(0.059)	(0.058)		(0.033)	(0.032)
Rated AA		-0.815**	Rated AA x Post-1873		0.036
		(0.106)			(0.200)
Rated A		-0.628**	Rated A x Post-1873		0.039
		(0.106)			(0.200)
Rated B		-0.509**	Rated B x Post-1873		0.032
		(0.111)			(0.200)
Rated C		-0.453**	Rated C x Post-1873		0.031
		(0.128)			(0.207)
Rated D		-0.461	Rated D x Post-1873		-0.035
		(0.290)			(0.206)
Constant	0.766**	1.211**	Constant	0.034	0.032
	(0.241)	(0.224)		(0.045)	(0.049)
Observations	335	335	Observations	2,681	2,681
R-squared	0.095	0.182	R-squared	0.220	0.220
Industry FE, County FE	YES	YES	Industry, County FE x Post-73	YES	YES

This table reports estimates of the same specifications as column (2) of Table 2 for each of the three outcome variables. That is, each column presents the same regression as column (2) of Table 2, with the addition of the controls for director wealth and eigenvector centrality of the board. In columns (1) and (3), robust standard errors are reported. In column (2), standard errors clustered by firm are reported. **, *, and + denote significance at 1%, 5% and 10%, respectively.

Table 4:
Effect of Bank Affiliations Controlling for Wealth and Connections of Directors

	Dependent Variables:		
	Firm Failure (1)	Annual Firm Growth (2)	Change in Rating (3)
Bank Director on Board, 1872	-0.156**		-0.133
	(0.055)		(0.166)
Eigenvector centrality of Board, 1872	-0.013		-0.910+
	(0.196)		(0.535)
Mean director wealth	0.460**		-0.703+
	(0.170)		(0.415)
Bank Director 1872 x Post-1873		0.080**	
		(0.031)	
Eigenvector centrality x Post-1873		0.252*	
		(0.100)	
Mean director wealth x Post-1873		0.003	
		(0.090)	
Observations	356	2,822	163
R-squared	0.314	0.276	0.256
Industry, County FE (x Post-1873)	YES	YES	YES
Firm FE	--	YES	--
1872 Characteristics (x Post-1873)	YES	NO	YES
1872 Rating FE	--	--	YES

This table reports estimates of the same specifications as column (2) of Table 2 for each of the three outcome variables. That is, each column presents the same regression as column (2) of Table 2, with the addition of the controls for director wealth and eigenvector centrality of the board. In columns (1) and (3), robust standard errors are reported. In column (2), standard errors clustered by firm are reported. **, *, and + denote significance at 1%, 5% and 10%, respectively.

Table 5:
Effect of Bank Affiliations Estimated with Interactions with Firm Age

	Dependent Variables:		
	Firm Failure (1)	Annual Firm Growth (2)	Change in Rating (3)
Bank Director on Board, 1872	-0.143*		-0.186
	(0.059)		(0.187)
Bank Director 1872 x firm age 1872	0.003		-0.004
	(0.003)		(0.009)
Firm age 1872	-0.006*		0.002
	(0.003)		(0.007)
Bank Director 1872 x Post-1873		0.105**	
		(0.037)	
Bank Director 1872 x Post-1873 x firm age 1872		-0.004*	
		(0.002)	
Firm age 1872 x Post-1873		0.005**	
		(0.002)	
Implied effects:			
25th pctile of firm age	-0.132**	-0.090**	-0.200
50th pctile of firm age	-0.122**	-0.076**	-0.215
75th pctile of firm age	-0.093+	-0.037	-0.255*
Observations	580	4,338	227
R-squared	0.249	0.257	0.257
Industry, County FE (x Post-1873)	YES	YES	YES
Firm FE	--	YES	--
1872 Characteristics (x Post-1873)	YES	NO	YES
1872 Rating FE	--	--	YES

This table reports estimates of the same specifications as column (2) of Table 2 for each of the three outcome variables. That is, each column presents the same regression as column (2) of Table 2, with the addition of the firm age interactions. The rows labeled "implied effects" report the values of the bank director on board coefficient plus the bank director times firm age coefficient multiplied by the value firm age corresponding to the reported percentile of its distribution. In columns (1) and (3), robust standard errors are reported. In column (2), standard errors clustered by firm are reported. **, *, and + denote significance at 1%, 5% and 10%, respectively.

Table 6:
Effect of Bank Affiliations Estimated with Interactions with Fixed Asset Share

	Dependent Variables:		
	Firm Failure (1)	Annual Firm Growth (2)	Change in Rating (3)
Bank Director on Board 1872	-0.119+		-0.711**
	(0.064)		(0.218)
Bank Director 1872 x (Property Acct / Assets) 1872	0.058		1.525*
	(0.134)		(0.641)
(Property Acct / Assets) 1872	-0.065		-0.876
	(0.114)		(0.581)
Bank Director 1872 x Post-1873		0.100*	
		(0.040)	
Bank Director 1872 x Post-1873 x (Property Acct / Assets) 1872		-0.125+	
		(0.066)	
(Property Acct / Assets) 1872 x Post-1873		-0.002	
		(0.055)	
Implied effects:			
25th pctile of (Property Acct / Assets)	-0.113*	0.088+	-0.560**
50th pctile of (Property Acct / Assets)	-0.102*	0.064+	-0.271*
75th pctile of (Property Acct / Assets)	-0.088+	0.033+	0.103
Observations	554	4,238	220
R-squared	0.241	0.251	0.306
Industry, County FE (x Post-1873)	YES	YES	YES
Firm FE	--	YES	--
1872 Characteristics (x Post-1873)	YES	NO	YES
1872 Rating FE	--	--	YES

This table reports estimates of the same specifications as column (2) of Table 2 for each of the three outcome variables. That is, each column presents the same regression as column (2) of Table 2, with the addition of the interaction terms for the value of the property account as a share of total assets. The rows labeled "implied effects" report the values of the bank director on board coefficient plus the bank director times property account / assets coefficient multiplied by the value of property account/assets corresponding to the reported percentile of its distribution. In columns (1) and (3), robust standard errors are reported. In column (2), standard errors clustered by firm are reported. **, *, and + denote significance at 1%, 5% and 10%, respectively.

Table 7:
Effect of Bank Cashiers on Firm Boards

	Dependent Variables:		
	Firm Failure	Annual Firm Growth	Change in Rating
	(1)	(2)	(3)
Bank Cashier on Board, 1872	-0.033		0.544**
	(0.102)		(0.181)
Bank Cashier 1872 x Post-1873		-0.021	
		(0.053)	
Observations	601	4,407	227
R-squared	0.086	0.253	0.193
Industry, County FE (x Post-1873)	YES	YES	YES
Firm FE	--	YES	--
1872 Rating FE	--	--	YES

This table reports estimates of the same specifications as column (1) of Table 2 for each of the three outcome variables, only with the bank director on board indicator replaced by an indicator for a bank cashier on board. In columns (1) and (3), robust standard errors are reported. In column (2), standard errors clustered by firm are reported. **, *, and + denote significance at 1%, 5% and 10%, respectively.

Table 8:
Ownership Stakes, Directors of Boston National Banks
Who Also Held Directorships with Nonfinancial Corporations

	Bank	Nonfinancial Corporation	Difference
	(1)	(2)	(3)
Mean fraction of shares held	0.0069	0.0805	-0.0736***
	[0.0098]	[0.1020]	(0.011)
Mean par value of shares held (Dollars)	6,175	22,116	-15,941***
	[8,264]	[28,420]	(3,118)
Total par value of shares held (Dollars)	6,344	43,111	-36,767***
	[8,364]	[57,938]	(6,125)

Note: A total of 87 individuals held directorships with a Boston National Bank and at least one nonfinancial corporation. These individuals held directorships with an average of 1.83 nonfinancial companies other than railroads, for which no ownership lists are available. The omission of railroad ownership stakes implies that the differences reported in the table understate the true differences. The first row compares the fraction of the shares they held in their bank, to the average fraction they held in their nonfinancial corporation(s). The second row compares the par value of the shares, and the third row compares the total par value of their stakes in their banks and in their nonfinancial corporations. Standard deviations are presented in brackets, standard errors in parentheses. Ownership stakes in banks obtained from *A List of Stockholders in the National Banks of Boston, May 1 1866.*

Appendix: Sources, Data and Methods
(For Online Publication Only)

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1. Sources

1.1 Manufacturing companies, utilities and other non-financial businesses

The names of officers and directors, their shareholdings, and the total number of shareholders was collected from the certificates of condition filed by all Massachusetts business corporations other than banks, insurance companies, railroads and streetcar companies, which were subject to separate regulations and disclosure requirements. These certificates survive as microfilm in the Records of the Secretary of the Commonwealth in the Massachusetts State Archives. The content of these handwritten certificates was transcribed by hand.

An example is presented as Figure A1 on the following page. At the top of the form are spaces to fill in the names of the president, treasurer and directors. Below that are questions about the size of the capital stock, the amount the corporation has invested in real estate, the amount invested in personal estate, the total assets of the company, and the total debts of the company. At the bottom of the form is the complete list of stockholders and the amount held by each, which for many companies extended onto dozens of additional pages.

These forms were created to protect creditors, and to facilitate the collection of taxes. They therefore do not include any information about revenues, profits or dividends – these would be relevant mostly to stockholders, who presumably had access to that information anyway at their company's annual meetings.

The accounting data presented on the forms were published annually in the *Abstract of the Certificates of Corporations* by the Secretary of the Commonwealth. The date of incorporation of each firm was obtained from the annual *Report of the Tax Commissioner of the Commonwealth of Massachusetts*.

1.2 Railroads and streetcar companies

The names of all directors, annual accounting information, location of operations, status of operations, and number of shareholders was collected from the *Annual Report of the Board of Railroad Commissioners* of Massachusetts. These reports present much more detailed accounting information than those submitted by manufacturers and utilities. Profitability and revenues, for example, can be calculated quite precisely from the information disclosed. This information is used in Figure 1 of the paper, but the small number of railroads and streetcar companies (and the limited variation within those industries in the presence of board interlocks with commercial banks) limits the value of these data for the analysis of this paper.

The railroad and streetcar reports do not provide information on the stock holdings of directors.

1.3 Commercial bank directors

The names of all directors of the commercial banks located within Massachusetts in 1872, nearly all of which were national banks, were obtained from *The Massachusetts Register, 1872, Containing A Record of State and County Officers, and a Directory of Merchants, Manufacturers, etc.* (Boston: Sampson & Davenport). This source also lists the names of the banks' cashiers. It unfortunately does not list the directors of savings banks; interlocks with the boards of those institutions may also have been of value.

We, Geo. C. Fisk President, R. S. Ryde Treasurer,
and Saml. W. Ladd.

being a majority of the Directors of The Wason Manufacturing Company of Springfield Mass in compliance with the provisions of the thirty-third section of the two hundred and twenty-fourth chapter of the Acts of the year eighteen hundred and seventy, do hereby certify, that the last annual meeting of said Corporation was held on the Fifth day of February in the year 1872

That the amount of capital stock of said Corporation then paid in was
One hundred thousand — dollars;

That the amount invested in real estate was
One hundred and ninety thousand three hundred & four dollars (190,304.00)

That the amount invested in personal estate was
Four hundred and eighty six thousand six hundred & two. dollars (486,602.00)

That the real & personal estate cost.
Six hundred & seventy six thousand nine hundred & six dollars (676,906.00)

And the then estimated value of both real & personal estate was
Seven hundred thousand dollars;

That the amount of property then owned by, and of debts then due to, said Corporation, was invoiced at
Six hundred & seventy six thousand, nine hundred & six dollars;

That the amount of demands then existing against said Corporation, as nearly as can be ascertained, is
Two hundred and seventeen thousand three hundred & eighty two. dollars: 217,382.00

and that the following list contains the name of each shareholder in said Corporation, with the number of shares then standing in his name.

NAME OF SHAREHOLDER.	No. of shares.	NAME OF SHAREHOLDER.	No. of shares.
Geo. C. Fisk	375		
R. S. Ryde	150		
Saml W. Ladd	60		
C. Vanhorn	60		
W. R. Paige	20		
R. E. Emery	25		
Agawam National Bank	60		
G. J. M. Davis, R. S. Ryde Trustees	760		
	1,500		

In Witness whereof, we have hereto signed our names, this Seventh day of February in the year eighteen hundred and seventy-two.

Geo. C. Fisk Pres.
S. W. Ladd
R. S. Ryde Treas.

[OVER.]

Figure A1 – Example the "Certificate of Condition"
(Form submitted by manufacturers and utilities)

1.4 Director wealth

The federal census of 1870 included information about the assessed real and personal wealth of individuals. Using a web-based online search index, the manuscripts were searched for all of the names of directors of Massachusetts corporations, so that this information could be obtained. There were 2,747 unique individuals who held directorships with the sample corporations. Searches were conducted for each individual using their name and the county of the corporation where they held a directorship, although matches were not constrained to be to individuals residing within the same county as the corporation. In cases where multiple potential matches were found with the same name, ages and occupations were used to identify the most likely matches. In many cases, there were too many individuals in the census with the same name, and no match was chosen. The procedure followed produced matches for 1,647 individuals, a match rate of about 60%. For these individuals, the sum of their reported real and personal wealth was recorded. However, for 204 of the 1,647 individuals found, no wealth information was provided to the census enumerator.[1] These individuals were excluded from the analysis.

1.5 Credit ratings

Credit ratings for 1872 were obtained from Volume 32 of *Bradstreet's Commercial Reports, Embracing the Bankers Merchants Manufacturers and Others in the United States and the Dominion of Canada* (New York: J.M. Bradstreet & Son) published January 6 1873. Ratings for 1878 were obtained from volume 43 of the same publication, published October 1878. These volumes present lists of firms organized by town, along with their ratings. Most of the businesses listed in these volumes are not corporations, but merchant partnerships and sole proprietorships. However, large numbers of non-financial corporations are present in the volumes. No railroads, streetcar companies, or commercial banks or insurance companies were rated in these volumes.

1.6 Early Massachusetts manufacturing company directors

The names of the founders and principal subscribers of the Boston Manufacturing Company (1813), along with the Merrrimack (1822), Hamilton (1825), Appleton (1828) and Lowell (1828) companies, are listed in Ware (1931: 320-21). Comparing these lists to the names of the directors of the banks of Boston, as reported in the *Boston Directory* (Boston: Frost and Stimpson, 1820), indicates that the founders of the Boston Manufacturing company included two directors from the Boston Bank (Nathan Appleton and Israel Thorndike Jr.), and one from the Suffolk Bank (Patrick T. Jackson). The surviving records of the Boston Manufacturing Company indicate that Patrick T. Jackson was authorized by the directors to borrow as much as $25,000 at a time from the Suffolk Bank (Resolution of 28 November 1818, Box 3, Folder 14, Boston Manufacturing Company collection, Baker Library, Harvard Business School.)

Similarly, the Merrimack Company's principal subscribers include four bank directors, the Hamilton's include seven bank directors, the Appleton's include six bank directors, and the Lowell's include four bank directors.

[1] The individuals with no wealth reported included noted figures such as Congressman Oakes Ames and his son Oliver Ames, who were major investors in the Union Pacific Railroad, and owners of several manufacturing enterprises. This suggests that some wealthy individuals, perhaps those with ties to politics, may have refused to answer enumerators questions about their wealth, and that the data on director wealth obtained from the census will be measured with error.

2. Variables: Definitions and construction

2.1 Accounting and related variables

Many of the accounting variables are extremely noisy. In order to eliminate the effect of outliers on the analysis, all of the accounting variables defined below are winsorized at the top and bottom 2% of their distributions.

Total Assets: For the corporations submitting certificates of condition (manufacturers and utilities mainly), total assets is recorded as the amount reported for "The amount of property owned by, and debts due to, the corporation" on the form. For the railroads and streetcar companies, which submitted different annual reports, this is calculated from the liabilities disclosed: paid-in capital + debts + surplus.

Growth of assets: Calculated as the change in total assets from the previous year to the current year, divided by the level of total assets in the previous year.

Leverage: For all sample companies, this is calculated as total debts/total assets.

Property account/Total assets: For the manufacturers and utilities, this is calculated as real estate/total assets. The "amount invested in real estate" reported on the certificate of condition should include all fixed property such as machines; the other category of assets disclosed on the forms is personal estate which should be working capital and intangible assets. For the railroads, this is calculated as the sum of the amount invested in the roadbed and equipment / total assets.

Director wealth: This is calculated as the mean value of real plus personal wealth, as reported in the 1870 federal census. However, only companies for which the wealth of at least half of the directors was found are included in the analysis.

Failure: The circumstances and exact dates of the closure of firms are not observed. A firm was denoted as having failed if it ceases to submit certificates of condition to the state. (These forms were required for tax purposes and the Secretary of the Commonwealth would seek to strip corporations of their charters if they failed to submit the required certificates.) The date of failure is assumed to be one year after the firms' last annual meeting.

Firm age: Calculated as current year – year of incorporation.

County: This is the county of the corporation's operations, as reported to the state.

Industry: The certificates of condition do not provide information on the products or industries of the firms. To obtain information on industries, directories of Massachusetts such as *The Massachusetts Register, 1872, Containing A Record of State and County Officers, and a Directory of Merchants, Manufacturers, etc.* (Boston: Sampson & Davenport) were consulted. These directories generally listed specific products or narrow industries, which were then grouped into 13 broad industry categories. Table A1 below lists many of the original narrow industries listed in the directory, and, to the left, the broad industry categories into which they were grouped.

Table A1: Industry Categories

Broad Industry	Industry
Brick and Stone	Brick Granite Tile
Chemicals	Paint Pharmaceuticals Chemicals
Food and Tobacco	Beer Cheese Fruit preserves Ice Sugar
Glass	Glass
Maritime	Dry dock Steamboat Wharf
Metal products	Fabricated metals Machinery and engines Primary metals
Mining and petroleum	Coal Gold or silver mining Oil
Paper and wood products	Furniture Paper Lumber
Railroads	Railroads
Streetcars	Streetcars
Textiles	Apparel Cordage Cotton or woolen fabric Dying and bleaching Jute Bagging
Utilities	Gas Telegraph Water
Other	Hotel Instruments Leather Public hall Publishing Rubber

Ratings: The 1878 *Bradstreet's* volume rates the credit of companies on a letter-graded scale: AA ("Unquestioned"), A ("Very High"), B ("Excellent"), C ("Good"), D ("Fair"), E ("Very Moderate"), and F ("…"). These were converted to a numeric scale, with AA equal to 1, and F equal to 7. However, no ratings of F were observed, so effectively the ratings are a numerical scale from 1 to 6, with one being the best and 6 being the worst.

The 1872 volume utilizes a slightly more fine-grained scale; instead of simply AA, for example, the highest ratings can be "AA AA AA," or "AA AA," or "AA." These values are aggregated together to form a 6-point scale compatible with the 1878 ratings.

Change in ratings, 1872-78: This is calculated as the 1878 rating – 1872 rating. As shown in the paper, the average value of this is positive, indicating that among the surviving firms that were rated in 1878, their rating was on average worse (higher) than it had been in 1872.

2.2 Board variables

Bank director on board: This is an indicator variable equal to one if the corporation has a director in common with a Massachusetts commercial bank in 1872. This variable is constructed by cross-referencing a list of all directors of non-financial corporations with a list of all directors of commercial banks. As names are sometimes abbreviated (eg, "Jno" for "John") and sometimes only initials are reported, all names are first converted to a string consisting only of first initial + middle initial + surname + suffix. The full names are then hand-checked for all matches to verify that two individuals with the same initials but different names are not incorrectly designated as the same person.

Eigenvector centrality, firm board: This is a measure of the centrality of a company's board within the network of all company boards. Based on the notion that a node in a network is central if it is connected to other central nodes, eigenvector centrality is a recursive concept based on the centrality of the boards to which a board is connected. This was calculated for the entire network of Massachusetts corporate boards, including those of some corporations not included in the analysis, such as insurance companies. The graph of this network is presented below as Figure A2. In the figure, commercial banks are colored red, and all other companies are colored blue.

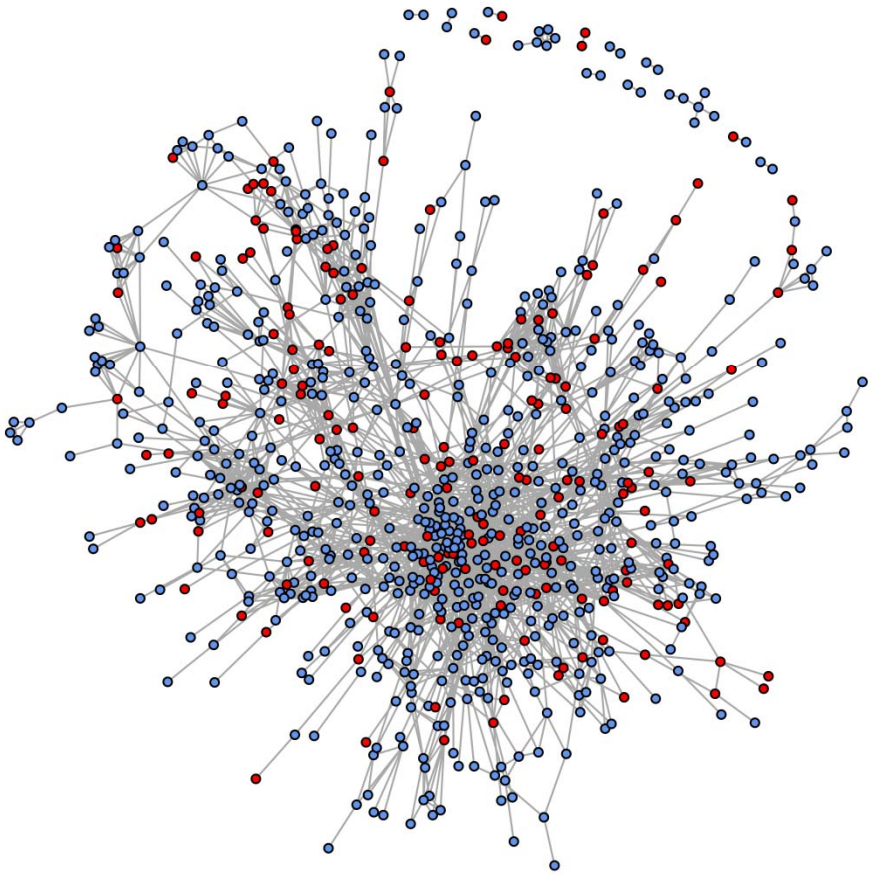

Figure A2: Graph of the Network of All Massachusetts Corporations' Boards, 1872

This figure presents the graph of the network of connections among all Massachusetts corporations in 1872. Commercial banks are depicted in red, all other corporations are depicted in blue. The connections among them are those created by board interlocks.

3. Additional details: Sample companies and data

3.1 Inclusion in the sample

In order to be included in the sample, a company must have existed in 1872, and submitted a certificate of condition with valid accounting data in that year. There were 24 manufacturers and utilities that submitted certificates in 1872 that indicated that they were shutting down or were already shut down, and those firms were excluded from the analysis.

Among the railroads, there were four that submitted annual reports that were actually chartered by another state. These railroads' operations extended into Massachusetts, but they mainly operated in other states and were headquartered in those other states. These railroads were excluded from the analysis, because their directors did not live in Massachusetts, and any interlocks between their boards and financial institutions would therefore be unlikely to be observed. (If they had bank interlocks, they would likely have been with out-of-state banks.)

In addition, there were 28 railroads and 13 streetcar companies that were leased to other railroads or streetcar companies. Some of these firms reported very little accounting data, but even those that did present full accounting statements were excluded from the dataset. They were not independent businesses, but divisions of another business.

Finally, the certificates of condition of 24 cooperatives were excluded from the sample, as these business may not have been operated in the same way that the other business corporations were. Most of these were mercantile cooperatives, but there were a handful of manufacturers among them as well.

3.2 Summary data by industry

One way to understand the characteristics of the sample firms more clearly is to observe them by industry. These tabulations are presented as Tables A2-A4 below. Table A2 presents board data.

Table A2: Board Data by Industry

Industry	*N*	Bank Director On Board	Board Size	Stock Ownership By Directors	Eigenvector Centrality
Brick and stone products	20	0.400	5.550	0.458	0.032
Chemicals	10	0.500	4.300	0.403	0.045
Food and tobacco	22	0.364	4.909	0.353	0.016
Glass products	8	0.750	5.500	0.322	0.049
Maritime	17	0.588	4.706	0.360	0.024
Metal products	148	0.510	4.591	0.495	0.015
Mining and petroleum	23	0.435	4.957	0.378	0.017
Paper and wood products	48	0.521	4.313	0.597	0.005
Railroads	23	0.913	7.217	--	0.095
Streetcar	13	0.846	6.308	--	0.012
Textiles	163	0.687	4.644	0.451	0.060
Utilities	61	0.689	4.918	0.264	0.028
Other	45	0.444	5.133	0.455	0.013

As Table A2 shows, the sample is dominated by textile manufacturers and manufacturers of metal products. The rate at which the sample companies had a board interlock with a bank varied substantially across industries, with 91 percent of railroads 85 percent of streetcar companies having such an interlock, and only 37 of food and tobacco makers having one. The next column shows that railroads and streetcar companies also had unusually large boards, although interestingly, the final column shows that railroads' boards were much more central in the network of directors (as measured by eigenvector centrality) than those of streetcar companies. Finally, although stock ownership data is not available for railroads and streetcar companies, since they did not disclose their lists of stockholders, among the other firms managerial ownership is consistently quite high, ranging from 26 percent to 50 percent.

Table A3: Accounting Data by Industry

	N	Total Assets	Leverage	Property Account/ Assets	Firm Age
Brick and stone products	20	142,642	0.335	0.417	5.550
Chemicals	10	113,972	0.387	0.403	15.700
Food and tobacco	22	296,010	0.346	0.422	9.909
Glass products	8	279,614	0.239	0.323	17.750
Maritime	17	67,140	0.215	0.235	18.824
Metal products	148	242,797	0.415	0.203	10.480
Mining and petroleum	23	99,857	0.307	0.246	7.652
Paper and wood products	48	182,196	0.375	0.327	6.146
Railroads	23	4,274,176	0.232	0.883	24.522
Streetcar	13	451,936	0.166	0.897	8.154
Textiles	163	606,869	0.371	0.349	16.828
Utilities	61	141,323	0.202	0.475	16.492
Other	45	196,770	0.376	0.362	10.044

Table A3 presents accounting data by industry. Again, the railroads are the extreme outliers, with total assets of $4.3 million on average. The industry with the second largest firms, textile producers, had on average about $600,000 in total assets. Unsurprisingly, railroads and streetcars' assets were dominated to an unusual extent by their property accounts. But surprisingly, the railroads and streetcars were among the least leveraged industries. Unlike their successors later in the 19th century that were much more leveraged, early railroads were financed to a much greater extent with equity.

Finally, Table A4 presents outcome data by industry. The firms with the best (lowest) credit ratings in 1872 were the textile manufacturers. The growth of the sample firms' assets in 1872 varied substantially by industry, but was extremely high among the railroads, which were in the midst of a historic building boom in the early 1870s. The failure rates across industries varied substantially, with 50 percent or more of the firms in several industries failing prior to 1880. Finally, for all the industries in which credit ratings can be observed (railroads and streetcars were not rated), the average change in their ratings from 1872 to 1878 was positive, indicating that their ratings worsened, often substantially.

Table A4: Outcome Data by Industry

	N	Rating, 1872	Growth of Assets, 1872	Failed Prior to 1882	Change in Ratings, 1872-78
Brick and stone products	20	3.091	0.163	0.600	1.167
Chemicals	10	3.200	0.040	0.400	0.250
Food and tobacco	22	2.111	0.004	0.500	1.250
Glass products	8	2.333	-0.114	0.500	1.000
Maritime	17	3.200	0.024	0.471	--
Metal products	148	2.484	0.078	0.443	0.914
Mining and petroleum	23	2.667	0.026	0.522	1.250
Paper and wood products	48	2.600	0.076	0.375	1.000
Railroads	23	--	0.172	0.304	--
Streetcar	13	--	0.072	0.000	--
Textiles	163	1.838	0.066	0.356	0.967
Utilities	61	2.640	0.076	0.164	0.762
Other	45	2.385	0.050	0.422	0.800

4. Additional details: Estimation

4.1 Inverse propensity score weights

Table 2 of the paper reports estimates obtained from inverse propensity score weighted regressions to address concerns that our main estimated effects may reflect differences in observable characteristics between firms with and without interlocks with banks. In this section, I provide the details of this estimation.

I use what is commonly termed "inverse probability of treatment weighting" to create a sample in which the distribution of baseline characteristics is independent of the treatment. In the standard notation for the literature, define Z to be an indicator variable for having an interlock with a bank in 1872. The propensity score is the probability of being in that group conditional on baseline covariates: $e_i = \Pr(Z_i = 1|X_i)$. With inverse probability of treatment weighting, railroads with the same propensity score will have the same distribution of baseline characteristics.

The procedure is as follows. First, I estimate the propensity score itself. This is obtained from a probit regression of Z on 1872 firm characteristics, including leverage, size, and indicators for industry. The results of the probit regression for the specification used in Table 2 are reported in Table A5 below.

In the next step, I restrict the analysis to the observations in the region of common support in the propensity score distribution. That is, I eliminate corporations in the treated group (those with bank directors on their boards) with propensity score values outside the range of those of the control group, and eliminate those in the control group with scores outside the range of the treated group.

Table A5: Probit Regression for Propensity Scores

	Indicator: Bank Director On Board
Log (Assets), 1872	0.257**
	(0.040)
Leverage, 1872	-0.260
	(0.189)
Observations	582
Pseudo R-squared	0.119
Industry FE	YES

Finally, I use the estimated propensity scores to construct weights for each corporation in the regressions. These weights are applied to the treated and control corporations so that both groups resemble the population. The weights are defined as follows: $w_i = \frac{Z_i}{e_i} + \frac{1-Z_i}{1-e_i}$. With these weights, a least-squares regression will produce consistent estimates of the Average Treatment Effect (see the discussion in Imbens, 2004)

4.2 All estimates from Table 2

In order to conserve space, Table 2 in the paper presents only a subset of the parameters estimated in the regressions it reports. The full regressions are presented here.

Table A6: Regressions, Firm Failure (Panel A, Table 2)

	(1)	(2)	(3)
Bank Director on Board, 1872	-0.212**	-0.099*	-0.077+
	(0.044)	(0.044)	(0.043)
Log(Assets), 1872		-0.081**	-0.087**
		(0.014)	(0.015)
Leverage, 1872		0.327**	0.336**
		(0.066)	(0.071)
Age, 1872		-0.004*	-0.005**
		(0.002)	(0.002)
(Property Acct / Assets), 1872		-0.035	-0.065
		(0.079)	(0.085)
Constant	0.417*	1.054**	0.993**
	(0.206)	(0.293)	(0.275)
Observations	601	554	554
R-squared	0.125	0.241	0.244
Industry, County FE	YES	YES	YES
1872 Characteristics	NO	YES	YES
Inverse Propensity Score Weighted; Common Support	NO	YES	YES

Table A6: Regressions, Annual Firm Growth (Panel B, Table 2)

	(1)	(2)	(3)
Bank Director 1872 x Post-1873	0.050+	0.060*	0.056*
	(0.026)	(0.025)	(0.026)
Log(Assets) 1872 x Post-1873		-0.023*	-0.032**
		(0.009)	(0.010)
Leverage, 1872 x Post-1873		-0.054	-0.074
		(0.046)	(0.051)
Age, 1872 x Post-1873		0.002**	0.003**
		(0.001)	(0.001)
Constant	0.061	0.092+	0.055
	(0.054)	(0.055)	(0.057)
Observations	4,404	4,338	4,338
R-squared	0.256	0.256	0.266
Firm FE	YES	YES	YES
Industry, County FE x Post-1873	YES	YES	YES
1872 Characteristics x Post-1873	NO	YES	YES
Inverse Propensity Score Weighted; Common Support	NO	NO	YES

Table A7: Regressions, Change in Ratings (Panel C, Table 2)

	(1)	(2)	(3)
Bank Director on Board, 1872	-0.249+	-0.232+	-0.179
	(0.128)	(0.128)	(0.127)
Leverage, 1872		0.373	0.258
		(0.278)	(0.318)
Age, 1872		-0.000	-0.001
		(0.004)	(0.004)
Constant	2.202**	2.110**	2.016**
	(0.493)	(0.524)	(0.470)
Observations	227	227	227
R-squared	0.247	0.257	0.268
Industry, County FE	YES	YES	YES
1872 Characteristics	NO	YES	YES
Inverse Propensity Score Weighted; Common Support	NO	NO	YES

5. Archival evidence of borrowing from affiliated banks

In order to investigate whether director interlocks with banks were actually associated with lending relationships, a careful search of the business manuscript holdings of Baker Library of Harvard Business School was conducted for the accounting records of sample companies. At least some records of a relatively large number of sample companies are held in that library's collection, but comprehensive borrowing information for any period of time is available for only three of them: the Lawrence Manufacturing Company, the Dwight Manufacturing Company, and the Fall River Iron Works.

Perhaps unsurprisingly, given that their records survive, these were all very large and successful companies. Their total assets in 1872 were all greater than $1.5 million (relative to the mean for the entire sample of about $450,000); they were all well-established and at least 30 years old in 1872; and their credit ratings were extremely good (the two companies for which a rating was found for 1872 received the highest rating). It is not obvious whether this would make the companies more or less likely to rely on borrowing from affiliated banks, but it seems likely that these firms would have benefitted less from affiliations with banks relative to younger or smaller companies.

For each of these companies, a full year of borrowing as recorded in their notes payable account was collected.[2] The year chosen was the closest to 1872 where comprehensive records were available. Each of the three companies had a director interlock with at least one bank. Data on their borrowing is presented in Table A8 below.

Table A8: Borrowing of Sample Companies

Company	Year	Number Of Loans Recorded	Total Borrowing	Total Borrowing from Affiliated Bank(s)	Fraction of Borrowing from Affiliated Bank(s)
Lawrence Manufacturing Company	1872	24	$740,000	$265,000	0.358
Dwight Manufacturing Company	1873	95	$1,657,200	$240,000	0.145
Fall River Iron Works	1876	59	$667,500	$304,000	0.455

Each of the companies did at least some borrowing from an affiliated bank, but the fraction of the total value of their borrowing accounted for by affiliated banks varied widely, from 14.5 percent to 45.5 percent. Interlocked banks were very likely to be a source of credit for these firms, but they were certainly not the only source of credit.

The other sources of credit included: other commercial banks, savings banks, private banks, individuals and estates, and insurance companies.

[2] Lawrence data collected from Series E, vol. EG-3. Dwight data collected from Vol. DM-6. Fall River Iron Works Data collected from vol. DB6. Lawrence Manufacturing Company, Dwight Manufacturing Company, Fall River Iron Works Company collections, Baker Library, Harvard Business School.