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**Corporate Governance  
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in the Corporate  
Networks of Brazil,  
Mexico, and the United  
States circa 1910**

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Corporate Governance and Networks: Bankers in the Corporate Networks of Brazil, Mexico, and  
the United States circa 1910

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**Abstract**

How does the development of financial markets change the interaction between banks and corporations? This paper compares the importance of interlocking boards of directors between corporations and banks in Brazil, Mexico and the United States circa 1909. The hypothesis tested is that the development of financial markets and the institutions that accompany it (e.g. financial disclosure rules, investor protections, etc) allows corporations to rely less on connections to banks. There are two specific hypotheses tested in this work. First, given the development of disclosure and corporate governance standards in Brazil, I expect bankers to have been less central than in Mexico and, perhaps, the United States. Second, I test if the availability of financing alternatives, like a well developed bond market in Brazil, reduced the average importance of corporate connections to commercial banks compared to Mexico. I test these hypotheses using network analysis and a simple multivariate regression that explains bank connections. I use comparable business directories to create databases with names of directors and financial information for all major corporations in Mexico and Brazil in 1909. The findings show that using different centrality measures, connections between banks and corporations were less important in Brazil than in Mexico and the United States. Also, in Brazil, the availability of bonds as a way to obtain financing allowed corporations to have a lower average number of connections to banks when compared to their Mexican counterparts. In Mexico, foreign companies, which had access to financial markets abroad, had also lower average connections with banks. I conclude by arguing that even though the Brazil, Mexico and the U.S. had very different network structures, rapid industrial growth was achieved by these three countries. In Mexico, a strong and dense network replaced for some of the institutions that promoted financial development and growth in Brazil.

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## **I. Introduction**

What is the role of networks of interlocking boards of directors under different institutional settings? How does the development of financial markets change the interaction between banks and corporations? To answer these questions, this paper explores the relationships of bankers and corporations in Brazil, Mexico, and to a lesser extent, the United States at the turn of the twentieth century.

There is no consensus on the role of ties between banks and corporations for the process of economic development. According to some studies, close relations between banks and corporations aid economic growth by improving access to capital for companies and reducing monitoring costs for banks. The idea is that having a close relation with financial intermediaries can reduce information asymmetries, improve monitoring of managerial decisions, and ultimately provide banks with more capacity to enforce loan contracts (Aoki, 1990; Diamond, 1984; Lamoreaux, 1994). Moreover, having close ties to a bank may guarantee access to funding during a crisis for related corporations (Hoshi, Kashyap, and Scharfstein, 1990).

But in some cases, close relations between corporations and banks are only favorable to the latter. When bankers develop close ties to firms, they might be the only ones with information about the past behavior of their clients. Therefore, these banks might have a better idea of the cash flows of their customers and their past behavior as borrowers. With this private information, banks can “extract the rents attributable to knowing that the borrower is less risky” (Petersen and Rajan, 1994, p. 6). In other words, a related banker might be better able to evaluate risky projects than a distant lender (Byrd and Mizruchi, 2003; Rajan and Zingales, 2001). Therefore, banks have the incentives to capture “most of the rents that client firms may enjoy due to their access to capital and thereby push down firm profits” (Weinstein and Yafeh, 1998, p. 639).

While there is no consensus on the benefits of bankers and corporations having close relations, there is evidence that these relations weaken when firms have more options to finance. Since the late 1980s, there are at least two documented cases where

this has occurred: in Japan and the United States. In Japan, where close bank-firm relationships have been pervasive since World War II, the opening of financial markets at the end of the 1980s provided companies with other sources of funds, such as nonsecured bonds. This debilitated the relationship between banks and companies and allowed risk-taking companies to grow faster than those that stayed linked to banks (Weinstein and Yafeh, 1998).

In the same way, in the United States, where close relations between banks and companies have been a common feature of the economy since at least 1904, Davis and Mizruchi (1999) have identified a major change after the financial liberalization of the late 1980s. These authors argue that when companies were faced with more financing options, such as commercial paper, the relationship with bankers became less necessary. In their work, Davis and Mizruchi document the declining number of corporate board interlocks with banks from 1980 to 1994 and explain how financial development weakened these ties.

This paper explores the structure of relations between banks and corporations in Brazil in 1909 from a comparative perspective. I argue that financial development and other institutional features of the Brazilian economy made corporations less dependent on bank relations than in other countries such as Mexico and the United States.

This hypothesis comes from the idea that there are trade-offs between financial market development and the creation of ties between corporations and banks. The logic is as follows: When corporations operate in markets with significant asymmetries of information, costly monitoring, and weak enforcement of contracts, they may seek to organize in groups or networks in order to reduce transaction costs, exchange information, and improve contract enforcement. In fact, in this context, contract renegeing by group members can be prevented by the threat of group retaliation, expulsion, and other punishments.<sup>1</sup> Therefore, in an environment with weak enforcement of financial contracts, poor information disclosure, and weak corporate governance, the personal

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<sup>1</sup> For groups see Khanna and Palepu (2000), Khanna and Rivkin (2000), Leff (1978), and Chang and Choi (1988). For a more complete discussion of network enforcement and formal institutions see Greif (1994 and 2004).

relationships that corporate managers have with financial intermediaries can be crucial to accessing outside finance. Such relationships can take the form of interlocking boards of directors between banks and corporations.

There are three main reasons bankers would sit on corporate boards of directors. First, interlocking boards of directors can enhance access to capital for firms and reduce monitoring costs for banks. If the enforcement of contracts is poor and obtaining information about borrowers too costly, banks will prefer to lend to the companies related to them. Lending to insiders is a way for banks to reduce asymmetries of information and monitoring costs. In the same way, corporations might be interested in having a board interlock with banks if credit is scarce and there are limited substitutes for it (Petersen and Rajan, 1994; Diamond, 1984; Aoki, 1990; Byrd and Mizruchi, 2003; Rajan and Zingales, 2004; Lamoreaux, 1994).

Second, having bankers on the board of directors of a company might work as a certification mechanism. Bankers can sit on corporate boards of directors as a way to guarantee investors that the company is going to perform and pay dividends or bond coupons on time. This was common in the United States at the turn of the twentieth century, when investment bankers sat on the boards of companies for which they underwrote securities (Carosso, 1970). Having a banker might also signal other lenders that a company is creditworthy (Petersen and Rajan, 1994).

Finally, companies might want to have bankers on their boards to obtain financial advice. Commercial bankers could sit on corporate boards of corporations that needed debt restructuring or wanted to change their financial structure (Mizruchi and Stearns, 1988; Byrd and Mizruchi, 2003).

However, there are two reasons why opening a corporate board to outsiders is not always beneficial. First, as explained above, when bankers develop close ties to firms they might obtain an information advantage that allows them to extract rents from the borrower. Second, bankers have interests not necessarily in harmony with those of corporate shareholders. For example, bankers might prefer companies to have a high

proportion of bank credit in their liabilities, or higher debt to equity ratios than what might be best for those companies' owners (Byrd and Mizruchi, 2003).

Therefore, in some institutional settings it might be best for companies to distance themselves from bankers. If financial markets are developed and there are other financing options available, then carrying relationships with banks to access capital might not be as beneficial. In addition, if lenders and investors can obtain information about companies easily, because of open disclosure rules, then having interlocking boards of directors between banks and corporations relationships in order to reduce asymmetries of information will be less necessary. In these instances, the role of bankers might be reduced to certification or advice only.

Brazil had relatively developed equity and debt markets at the turn of the twentieth century. Economic historians have argued Brazil had strong institutional settings between 1890 and 1930 that favored the creation of joint stock companies and the expansion of bond and equity markets (Haber, 1998, Hanley, 2005, and Musacchio, 2005). The capitalization of the stock exchange represented 17% of GDP on average between 1890 and 1940. The corporate bond market reached an all time high around 1914, when the stock of private bond issues represented around 15% of GDP.<sup>2</sup> (See Figure 1.)

The institutional settings in Brazil during this period of bonanza were particularly good to protect investors. The evidence shows that between 1902 and 1914 corporate bonds were very popular because of the stability of the exchange rate and because commercial courts in Rio de Janeiro were very eager to protect creditors when companies defaulted on their debts. On the other hand, during this period equity issues were very popular among small investors in Brazil. The excellent record of company disclosure and relatively strong protections for shareholders in the law made stock ownership an attractive way of investing.<sup>3</sup> The largest corporations in Brazil during this time had very

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<sup>2</sup> These values of the stock of private issues of corporate bonds (debentures) are higher than the average capitalization for the 1990s, which fluctuated at levels lower than 10% of GDP.

<sup>3</sup> Disclosure of corporate accounts in Brazil was not only regular, but very detailed. A survey of textile mill balances compiled by Haber (1991) shows very detailed balance sheets published semi annually

dispersed ownership, with hundreds and sometimes thousands of investors with small holdings of shares (Musacchio, 2005).

If the institutional settings of Brazil truly promoted the development of financial markets, with the participation of small investors, with good disclosure policies, and with strong enforcement of contracts, then we would not expect to find intermediaries, such as commercial bankers, playing the role of market makers. This is especially true given that the few Brazilian investment banks disappeared before 1905. Therefore, we would not expect commercial bankers to have been too important in brokering information, relations, and credit. Even more, we would not expect to find that commercial banks were at the center of the network of corporate interlocks during this period.

Brazil today is a country viewed as a typical case in which business groups play important roles to overcome information and monitoring problems. Many of these groups have strong ties to financial institutions that facilitate access to credit.<sup>4</sup> Moreover, the literature on groups sees Brazil as a country with a “variety of market failures, caused by information and agency problems” (Khanna and Palepu, 2000). Finally, Brazil, a Civil Law country, is ranked among the worst in terms of financial development, creditor rights, and investor rights enforcement as of 1995 (La Porta et al, 1998).

I compare Brazil to Mexico and the United States circa 1910 because those are two countries in which bankers have been identified as important actors. In the United States, interlocks of corporations with banks, especially investment banks, worked as signaling and monitoring mechanisms that guaranteed shareholders and bondholders their investments were protected (Carosso, 1970). Mizruchi (1982), testing a somewhat different hypothesis, found that banks were very central in the network of corporate interlocks.

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at the *Diario Oficial*, the federal government’s official gazette. These balances usually included a summary of the profit and loss statement, integrated into the liability side, and a detailed description of assets, capital accounts and short and long-term liabilities.

<sup>4</sup> In fact, the first work to theorize about the role of business groups in developing countries was done by a Brazilianist, who used his knowledge of Brazil in the 1970s as the basis of his theory. According to this work, business groups were a form of industrial organization that helped companies to overcome information and contractual problems (Leff, 1978).

On the other hand, in Mexico there is evidence that banks tended to lend to related parties because of the high asymmetries in information and the discretionary nature of legal mechanisms to enforce contracts. The importance of networks to improve contract enforcement and monitoring has been explored for the period 1876-1910 in Maurer (2003) and for 1940-1980 in Del Angel (2002). These works have found that in Mexico interlocks between banks and corporations have positively affected contract enforcement. Del Angel (2002) shows econometrically that better connected banks actually had a lower proportion of nonperforming loans.

Thus, if Brazil had financial markets that were relatively more developed and more impersonal than those in Mexico and the United States, we expect to find the following to be true. First, bankers were not market makers in Brazil. They were not central in the network of corporate interlocks relative to bankers in the United States or Mexico. Second, financial development should reduce the importance of bank connections. Connections to banks should be less prevalent in Brazil than in Mexico.

To test these hypotheses I study the network of corporate board interlocks in Brazil, Mexico, and the United States. I use the names of all the directors of major corporations included in the *Brazilian Yearbook 1909* and the *Mexican Yearbook 1909*. The comparison to the United States is done using the data available in Mizruchi (1982). I define an interlock as the presence of a person on the board of directors of two companies. The network consists of all the connections among companies (nodes) that share one or more interlocks.

The paper shows that in Brazil banks were not central in the network of corporate interlocks. Using different measures of centrality, I find that Mexico and the United States had bankers playing a more central role than in Brazil. In the latter case, different measures of centrality show that of the most central corporations, only two or three were banks. For Mexico, the same methodology shows between six or seven banks out of the top 15 corporations. For the United States, Mizruchi (1982) shows that out of the top 15 corporations, five were banks.

One could argue that the differences I find between the networks of Brazil and say Mexico are a product of the geographical dispersion of the network. In a large country, such as Brazil, we would not expect to find very close and dense networks of entrepreneurs and bankers. On the other hand, in a country like Mexico, with a tradition of political centralization we would expect to find a dense network of relations around banks in the capital of the country. However, the evidence does not support this claim for two main reasons. First, population density was higher in the cities of Brazil than in Mexico and still the density of the network in Brazil was lower. Second, geographic distance does not seem to have created a dispersed structure for the Brazilian network of corporate interlocks because companies were not clustered by geographic regions. On the contrary the network of interlocks shows companies from different states interacting through interlocks. In fact, banks were, in many instances, important bridges between the companies of these different regions.

Finally, I also test the hypothesis that companies that had access to substitutes of bank credit, such as corporate bonds, would tend to have fewer commercial bankers on their boards, both in Brazil and Mexico. The test is done using a simple multivariate regression model. This model studies the impact that having access to other sources of financing (such as access to foreign financial markets or to the issue of corporate bonds) had on the average number of bank connections per company. Specifically, we would expect that companies that had access to foreign financial markets or that issued bonds would have less bank connections on average than their competitors.

For this purpose, I compiled financial information for 127 Brazilian companies and 69 Mexican companies that allows me to analyze the impact of access to capital on bank connections. This information mostly comes from the *Brazilian Yearbook 1909* and the *Mexican Yearbook 1909*. I do not perform the same type of analysis for the United States because of the lack of detailed data that I have for Mexico and Brazil.

The regression results show that for the case of Brazil having access to bond markets implied companies had lower average connections to banks. For Mexico,

companies with access to foreign capital and foreign financial markets had on average fewer connections with banks too. In this country, companies that had high bond to equity ratios actually tended to have more bank connections. But once we control for the fact that most companies issuing bonds were foreign, we find that access to foreign financial markets to issue equity or bonds actually came together with a lower average number of interlocks with banks.

This paper is divided into five parts. Part II explains why the comparison between Brazil, Mexico, and the United States is relevant for the hypotheses I am testing. Part III explains the data and methodology used for the paper. Part IV presents the main findings, and Part V concludes.

## **II. Bankers and the Financial System in Brazil, Mexico, and the United States circa 1909**

### *Bankers as Market Makers: The Case of the United States*

It has been documented that investment bankers played the role of market makers in the United States at the turn of the twentieth century. Financial markets in this country were relatively developed by international standards (Rajan and Zingales, 2003), but access to capital for big corporations did not work on an impersonal basis. This period is commonly known as the era of the “Robber Barons” or of “financial capitalism.”

According to Carosso (1970), one characteristic of large corporations during this period, is that they shared their boards of directors with investment bankers as a way to access external financing. These bankers had the capacity to sell large amounts of equity and bonds to their customers in Europe and the United States. The guarantee investment banks offered to bond and equity buyers was that they would be closely involved in the business they were underwriting, watching and manipulating managerial decisions through positions on the board of directors.

In most deals, investment bankers, such as J.P. Morgan, had as their primary concern the protection of “the interests of investors and [their] own.” For example, in the case of railroads, the investors of J.P. Morgan “held him accountable for the prosperity of

the roads he endorsed, an obligation that Morgan accepted seriously, and he expected the managers of these lines to exercise a similar responsibility toward him.” The way to achieve this was by naming a “man he considered prudent” as director of the venture for which he was selling securities (Carosso, 1970, p.38).

Another important problem for investors in the United States during the Robber Barons era was that manufacturing companies did not commonly disclose financial information. According to a study of company disclosure practices at the turn of the twentieth century, “so secretive were some manufacturing companies that even into the twentieth century they failed to make available to investors any financial information other than the company’s capitalization and dividend records” (Hawkins, 1963, p. 135). According to Carosso (1970), “Few manufacturers before 1900 considered it necessary or advisable to issue regular operating statements and balance sheets; and, those that did, too often published reports that either were incomplete or, because of the absence of standard accounting practices, were of ‘dubious value’” (p. 44). Even more, “not only was there inadequate financial disclosure, but some companies were irregular in the frequency with which they issued reports.” In fact, “between 1897 and 1905, the Westinghouse Electric and Manufacturing Company neither published an annual financial report to its stockholders, nor held an annual meeting” (Hawkins, 1963, p. 137).

This is why investment bankers also helped to solve these information problems. For example, many companies controlled by investment bankers, or that wanted to trade securities, developed better financial disclosure systems. Some of the most detailed reports after 1900 were from companies such as American Tobacco, Continental Tobacco, General Electric, National Biscuit Company, and Federal Steel Company, some of which were under the control of investment bankers.<sup>5</sup>

With a prevalent lack of financial information, the promoters of securities needed strong reputations in order to sell. Many investors in the United States bought securities

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<sup>5</sup> Interestingly, many of these companies became active in trading securities at the turn of the century and had a close relationship with investment bankers. J.P. Morgan & Co. was behind the consolidation of General Electric. For balance sheet comparisons see Hawkins (1963), for J.P. Morgan’s deals see Carosso (1970).

based on their confidence in the promoters or investment bankers that offered the issue. It was believed that investment bankers endorsed issues of securities only after investigating the securities deeply and then guaranteeing the issues through their control of the company. Interlocks between investment bankers and corporations in this context also allowed the former to access financial information that was restricted to the public and helped to solve information asymmetries. According to Hawkins (1963), “few buyers and apparently fewer sellers [of securities] were disturbed by the absence of financial statements” (p. 143).<sup>6</sup>

Therefore, in the case of the United States, investment bankers did work as market makers. That is why we would expect the United States to have been a place where bankers were central to the network of corporate board interlocks. Mizuchi (1982) undertook the task of mapping the network of corporate interlocks around 1904 and found that among the most central companies there were many banks.

#### *Insider Lending: Bank ties to Corporations in Mexico*

In Mexico, economic historians have agreed that relationships between corporations and banks were common. These relations helped corporations to access capital and banks to reduce information asymmetries and enforce credit contracts. For example, Maurer and Sharma (2001) argue that one reason for the strong connections between companies and banks in Mexico was the poor protection of property rights. This was because, in Mexico, it was hard to repossess collateral in case of default, thus banks and firms developed business groups that allowed close monitoring of corporate activities and helped to enforce credit contracts.

Close relationships between banks and corporations were even more important because of the lack of financing options. In Mexico, market entry for banks was complicated, and there were only a handful of banks lending. According to Haber, Razo and Maurer (2003, p.87), bank entry in Mexico during the Porfirian period encountered

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<sup>6</sup> This also stems from the fact that secrecy in company accounts came from a long tradition of family ownership in the United States. Under family or close ownership it was believed that by revealing “financial information they would unwittingly assist their competitors” (Hawkins, 1963, p. 143).

five main obstacles. First, bankers needed charter approval by the minister of finance (who at the same time was a stockholder and director of many banks). Second, there was a high minimum capitalization to get a charter (approximately US \$125,000, later raised to US \$250,000). Third, given the prohibitive taxes on notes issued by second-comer banks, only the first state banks to charter were able to successfully issue notes, which limited entry to further competition (Maurer, 2003). Fourth, only the Banco Nacional de Mexico and the Banco de Londres y Mexico could establish branches in all states. Finally, only the Banco Nacional de Mexico and the Banco de Londres y Mexico could issue notes for three times their reserves, instead of two times, as the rest of the banks were allowed. In addition, only the notes of these two banks were considered legal tender nationwide.

Thus, by 1909, the Mexican banking system was composed of a handful of national and around 40 state banks. Banco Nacional de Mexico (BANAMEX), Banco Central (Mexican Central Bank), Banco de Londres y Mexico (Bank of London and Mexico), Mexican Bank of Commerce and Industry, and Mortgage and Credit Foncier Bank of Mexico were the national banks. There were also one or two state banks (around 40 banks total).

The limited number of banks in Mexico was a problem for companies looking for financing because connections were needed to access credit.<sup>7</sup> The most common way to get loans from banks was by having connections that would help to roll over short-term loans (Ludlow and Marichal, 1986). Gomez-Galvarriato (1999), in her study of CIVSA, the largest cotton mill in Mexico during the *Porfiriato*, found that “reports given in the board meeting’s minutes indicate that bank credit was ... provided through short-term loans, [thus] it did not appear in the annual balance sheets” (p. 121). Thus, relationships with bankers were very important for companies that depended on banking credit.

Also in Mexico around 1909, connections were needed to protect property rights. According to Haber, Razo, and Maurer (2003), the protection of property rights for

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<sup>7</sup> For examples of the trouble even big corporations had to get bank loans see Gomez-Galvarriato (1999), chapter 2. For a general description of the inadequacy of the banking system for the industrialization of Mexico see Haber (1989), chapter 5.

businesses in Mexico depended on the “vertical political integration” of the government and investors. In this view, government officials and businessmen partnered to distribute privileges and to enforce property rights by selectively giving concessions to and protecting the property of parties that shared rents with the political brokers. Thus, in the Mexican system, contract enforcement depended more on connections than on the general application of legal principles. This affected the way in which companies had to relate to the financial system in dramatic ways.

Foreign companies that operated in Mexico were part of the network of relations but did not depend so heavily on domestic banks. Foreign companies established partnerships with Mexican political operators to get concessions to do business in Mexico. But they had access to foreign capital markets. All of the foreign companies issued equity and bonds in their countries of origin. In fact, only two Mexican companies had bonds outstanding in 1909. They were two railroad companies bought by the government from foreign investors between 1903 and 1907, which by 1909 still had outstanding debts in other countries.

Therefore, in Mexico we would expect to find bankers as central actors in the network of corporate interlocks. Given the limited options that corporations had to obtain financing, we would expect to find many companies establishing interlocks with banks.

### *Brazil: Markets vs. Banks*

The comparison of Brazil to Mexico and the United States is relevant for two reasons. First, in Brazil corporations had options other than banks to obtain financing in the domestic market, something that was harder in Mexico. Second, in contrast with the United States, there is evidence showing that in Brazil the institutional environment protected shareholders and creditors.

The institutions that fomented the participation of investors holding small lots of stock included a system of financial information disclosure. This system, one could argue, was more complete than the one prevalent in the United States at that time.

Brazilian laws required corporations issuing debentures to file semiannually and all companies to issue reports annually.

Disclosure of corporate accounts in Brazil was not only regular but detailed. A survey of textile mill financial statements compiled by Haber (1991) shows detailed balance sheets published semiannually at the *Diario Oficial*, the federal government's official publication. These balances usually included a summary of the profit and loss statement integrated into the liability side and a detailed description of assets, capital accounts, and short- and long-term liabilities.

Corporations relied on debentures and equity intensively to obtain financing in Brazil, which helps to explain why banks did not actively finance industrialization. By the early twentieth century corporations were issuing small amounts of bonds to finance short- and medium-term operations on a regular basis. Also, the studies by Triner (2000) and Hanely (1995) show that Brazilian banks provided companies mostly with short-term operational capital and did not necessarily foster long-term relations that could reduce their cost of capital. Both studies provide evidence showing that long term loans to corporations represented a small share of bank loan portfolios.

In Brazil, in contrast to Mexico, foreign companies had few advantages over large domestic corporations. First, domestic companies could issue bonds in other countries and trade part of the debt in the different domestic stock exchanges (e.g., in Rio de Janeiro, São Paulo, Santos, and others). Capital markets were much more integrated with the world markets. Second, domestic and foreign firms actually had very similar corporate governance. There were fewer differences in governance issues such as shareholder rights in foreign companies operating in Brazil than those operating in Mexico.<sup>8</sup>

Finally, in contrast with Mexico, branch banking was widely operational in Brazil and there were no major legal obstacles for the entry of new banks in Brazil. Opening a

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<sup>8</sup> For example, the *Mexican Yearbook 1909* and the *Brazilian Yearbook 1909* allow a comparison of voting rules and other statute rights for shareholders between foreign and domestic firms in Mexico and Brazil. Brazilian companies tended to have similar voting rights to those of their foreign counterparts, including British companies.

new bank or corporation was merely an administrative procedure. After 1891, 10% of total capitalization was required to establish a firm in Brazil. The approval of a charter depended only on presenting all the necessary documents (e.g., the charter, the bank deposit slip, and a list of at least seven subscribers) at the local *Junta Comércial*, the local Commercial Registry. The only banks that needed Ministry of Finance approval were those issuing notes. But this was only true until 1893, when the government established a monopoly of note issuing (Triner, 2000). Banco do Brasil, Brasilianische Bank für Deutschland, the London & Brazilian Bank, and the The British Bank of South America were among the Brazilian banks with more branches across the country. There were also more than 3 smaller banks in most states, and more than 10 banks in states like Rio de Janeiro and São Paulo.

Thus, given that Brazilian companies had many options to obtain credit and that relatively good financial information was available by lenders and investors, we would expect Brazilian banks to have been less central in the network of corporate interlocks than Mexican banks. In fact, given the differences in disclosure rules and creditor protections in Brazil and the United States, we would expect banks to have been less central in the Brazilian network.

### **III. Methodology**

This paper is divided into two tests. First, I test whether banks were central in the corporate network of interlocks in Brazil, in comparison with Mexico and the United States. The Second test explores whether having more financial options reduces the importance of bank relations for companies.

#### *Bank Centrality*

To study bank centrality, I used a database with the names of all major corporations in Brazil and Mexico in 1909. The data is taken from the *Brazilian Yearbook 1909* and the *Mexican Yearbook 1909*. Links between companies are created when their boards share a director. These links create a web of relations that I refer to as the network of corporate board interlocks.

The first step was to understand the structure of the network in Brazil, Mexico and the United States. I plotted the networks of interlocks of Brazil and Mexico (I do not have the data for the United States to reproduce this exercise) using a networks visualization program called Pajek. I then mark the banks that are part of the network in order to visualize their place in the network.

The second step to understand the structure of the network is to look at the density of the networks in Brazil, Mexico, and the United States. Network density is a ratio of the total number of interlocks between companies to the total number of possible ties that companies could have (i.e., if all the directorships were interlocks). This is an important indicator of the reliance of companies on interlocks.

To see how important banker's connections were and how central banks were within the network of corporate interlocks, I used different measures of network centrality. There are multiple ways to study bank centrality in the network of interlocks. The most basic measure of centrality is called "degree." It measures the total number of interlocks a company has and creates an index relative to other companies. This is a very imperfect measure of centrality for several reasons. In particular, a company can have many connections without necessarily being central to the network. It can have connections with many companies disconnected from the network and thus be central within this group but isolated from most of the network.

Therefore, for this work I also rely on two other measures of centrality: betweenness and Bonacich. Betweenness measures the brokerage power of an actor. It measures how often an actor is in the path that links two actors in the network. Betweenness is not always optimal because it gives too much weigh to the bridging power of an actor, even if she is unconnected to important people or many people directly.

Bonacich centrality iteratively takes into account an actor's connections and those of actors directly related to her. So, this is a measure that "weights interlock ties according to the interlock partner's number of ties such that sharing a director with a firm

whose other directors serve on many boards is weighted more heavily than sharing a director with a firm with few ties” (Davis and Mizruchi, 1999, 227).<sup>9</sup>

To compare Brazil and Mexico, I list top central corporations according to betweenness and Bonacich centrality. All the estimates for Brazil and Mexico were done using a program called UCINET (Borgatti, Everett, and Freeman, 1999).

Bonacich and degree centrality data are also presented for the United States. These data were obtained from the study that Mizruchi (1982) made of the network of corporate interlocks in the United States in different years over the last century. For the purposes of this paper, I take the data for the 15 most central corporations in the American network of interlocks in 1904. Even though his data per se do not perfectly compare with the data I created for Brazil and Mexico, his sample includes most of the largest corporations in the United States, and his final results compare with my results.

#### *Financing options and bank connections*

Operationalizing a test of the impact of available financing options on the importance of bank connections per company is not easy. That is why I use two proxies. First, in Brazil and Mexico I found some companies with access to bond markets. In Brazil, the bond market was very developed around 1909. A majority of the firms registered at the Rio de Janeiro Stock Exchange were issuing bonds in large amounts. In Mexico, the corporate bond market did not exist. It was not even regulated. Thus, corporations issuing bonds were usually foreign. Access to foreign capital markets allowed some companies in Mexico to access other financing options.

I created two tests. For the case of Brazil I explore whether companies that had access to the bond market had a lower number of interlocks with banks. This is a reasonable test because the databases for Brazil and Mexico include only commercial banks, so the argument that having a commercial banker on the board of directors of a company could increase its bond issues does not necessarily apply. In fact, Davis and Mizruchi (1999, p. 219) argue that “corporations with investment bankers on the board

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<sup>9</sup> More detailed explanations of these centrality measures and their estimation procedure can be found in Wasserman and Faust (1994) and Scott (1991).

are more likely to issue bonds, whereas firms with commercial bankers on the board are likely to take on short-term debt.”

I test whether access to bond markets reduced the number of commercial bankers on the boards of corporations, on average, using the following model:

$$Num. \text{ of Bank Connections}_i = age_i + \log(equity)_i + sector \text{ dummy}_i + (debenture/equity)_i$$

where  $i$  denotes each company in the sample,  $age$  is the number of years since the company was established,  $\log(equity)$  is the natural logarithm of the social capital declared by the company in the *Brazilian Yearbook 1909*, and  $sector \text{ dummies}$  are a series of variables that capture differences by sectors.<sup>10</sup> Finally, I include a measure of alternative financing options, which is the debenture-to-paid-up capital ratio (I call it debenture-equity ratio for simplicity). The hypothesis tested is that companies that had the possibility to issue more debentures, as a proportion of their paid up capital, would have less bank connections on average.

For Mexico, the same test is replicated with one caveat. Since in Mexico only foreign companies had access to other financing options, I test whether being a foreign company reduced the dependence on connections with domestic bankers. Moreover, I test whether being a foreign company and issuing debentures comes hand in hand with a lower number of connections in general. For Brazil, the inclusion of a dummy variable for foreign companies yielded no significant results.

The test for Mexico is performed using a model that includes the following changes:

$$Y_i = age_i + \log(equity)_i + sector \text{ dummy}_i + foreign \text{ dummy}_i + (debenture/equity)_i$$

where  $Y_i$  is either the number of bank connections by company  $i$  or the number of interlocks company  $i$  has.

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<sup>10</sup> The sector dummies included for Brazil and Mexico differed because of the different diversification of their economies. For Brazil the controlled sectors are: agriculture and the coffee trade, banking, insurance, mining, manufacturing, railroads and utilities, and shipping and ports. For Mexico, the sectors included are manufacturing, mining, railroads and utilities, and banks. These sectors were included because there was complete data only for companies in those areas.

The *foreign dummy* in this case is capturing better access to capital, for three reasons. First, from the information contained in the *Mexican Yearbook* one could argue that foreign companies had a better corporate governance structure, e.g., most shareholders in foreign companies had one vote per share.<sup>11</sup> In addition, foreign companies had to follow the rules of their native countries and could be legally prosecuted there, so they had to abide to the chartering rules and the rule of law of their own countries. Finally, foreign companies had access to European and American markets of capital, so they could issue bonds and equity in different countries.

The database used for the analysis of this work was created with financial information from several sources. The Brazilian information comes mainly from the *Brazilian Yearbook 1909*. Since financial disclosure was regular in Brazil, the editors of this yearbook were able to publish many of the balance sheets of the companies they list. Some information on bond issues had to be obtained from the annual reports of the Stock Brokers Association of the Rio de Janeiro Stock Exchange (*Relatório Anual da Câmara de Corretores de Fundos Públicos da Bolsa de Valores do Rio de Janeiro*). These reports also helped to complete the information on equity and year the company was established.

For Mexico, compiling financial information for a large number of corporations was a complicated task. The *Mexican Yearbook 1909* had financial information for mining companies and for some banks. But manufacturing companies did not have very complete reports. For that reason I had to complement the financial information from the yearbook with information from secondary sources and financial newspapers.

For banks, equity data were provided by Noel Maurer, from the databases used for Maurer (2003). Additional profit data came from “Banco Hipotecario y de Credito Territorial Mexicano,” *El Economista Mexicano*, May 21, 1910; and Banco Peninsular Mexicano, from “El Banco Peninsular Mexicano en 1909,” *El Economista Mexicano*, April 29, 1910.

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<sup>11</sup> Authors like La Porta, Lopez de Silanes, Shleifer and Vishny (1998) have argued that one vote per share provisions in company statutes actually make it easier for minority shareholders to have a voice in company matters. According to their view better protections to small shareholders give more incentives for investors to participate in financial markets. Thus, one could argue that companies with statutes that protect small investors should have an easier time raising funds in stock markets.

## IV. Findings

### *Graphical representations and density of the network*

Figure 2 shows the corporate network of interlocks in Brazil in 1909. Given its size I do not include labels in the general picture, just to give a general idea of the structure of the network. Given that Brazil is an extended country, we would expect geographical distances undermined the capacity of directors to interlock among companies that were in distant geographical points. Nevertheless, the Brazilian corporate network extended all over the country. We find companies in Rio de Janeiro and São Paulo interlocking with companies in the states of Pernambuco and Bahia, in the northeast, and companies in Rio Grande do Sul, in the south.

Figures 3 to 6 show the Brazilian network in more detail. I marked with a circle all the banks present in the Brazilian network. From these pictures clear pattern emerged: banks are not the most central actors in most cases and they usually have a very limited number of connections with other companies.

Figure 7 shows the Mexican network of corporate interlocks in 1909. The density and shape of the network is very different. The Mexican network is denser and has more interlocks among companies. The network is also very national in scope, linking companies from the Northern industrial states to those of the center, east and west.

There is clear difference in the role played by banks in the Mexican and Brazilian networks. In Figure 7 I circled and shaded the names of banks that are part of the network. In this figure we can see that banks played a very central role in the Mexican network of corporate relations.

Table 1 shows the density estimates for Brazil, Mexico and the United States circa 1909. We can see that the Brazilian network was less dense than that of Mexico and the United States. In fact, the total number of interlocks over the number of directorships in the latter two countries was very similar, ranging between 8% and 14%.

*Bank Centrality in Brazil, Mexico, and the United States.*

The literature on the relationship between bankers and corporations in the United States has shown that bankers were very important in the network of corporate interlocks because they certified companies in financial markets. That is why when Mizruchi (1982) studied the centrality of banks within the network of interlocks of the largest U.S. corporations in 1904 he found that, of the top 15 corporations, five were banks.

Table 2 presents the top central companies in the United States according to Bonacich centrality in 1904. We find the National Bank of Commerce, the National City Bank, First National Bank, and New York Trust within the 10 most central corporations. Even more, the number of interlocks these banks had with other corporations was very high. National Bank of Commerce, the top-ranked bank, had 153 interlocks, and other banks had between 45 and 75 interlocks. These results bespeak about a system in which interlocks with banks were very important.<sup>12</sup>

In Mexico, the literature that has studied banking during the Porfirian period (1876-1910) has attributed to bankers a central role in the network of corporate relations. According to Maurer and Sharma (2001) and Maurer (2003), close relations between banks and manufacturing companies helped to overcome information asymmetries and monitor borrowers.

Table 3 lists the top companies in terms of Bonacich centrality in Mexico. Of the top 15 actors, six were banks. Most of the top central banks have been identified by the literature as very important brokers of relations with corporations. For example, the National Bank of Mexico (Banamex) was connected to manufacturing groups and the government. Banamex, in Mexico City, had special privileges to establish national

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<sup>12</sup> A more in-depth analysis of bankers on the boards of directors of corporations in the United States done by Mizruchi (1982) revealed the importance of the J.P. Morgan house in sending directors to the boards of different companies. Mizruchi undertook the task of identifying when a director of a corporation was actually an officer of a bank, sent to monitor and control the activities of that company. Unfortunately, this type of analysis cannot be performed for Mexico and Brazil. But for the United States this analysis shows J.P. Morgan as the most central actor in the network of corporate interlocks, followed by many other banks. Mizruchi found that the top 10 corporations were 1) J.P. Morgan & Co.; 2) Great Northern; 3) New York Life; 4) First National Bank (N.Y.); 5) International Harvester; 6) National City Bank; 7) U.S. Trust; 8) New York Trust; 9) Standard Oil; and, 10) U.S. Steel. (p. 66).

branches, issue more notes relative to reserves, and have its notes considered legal tender nationally (Ludlow and Marichal, 1986).

Table 4 presents the top companies in terms of betweenness centrality in Mexico. Banks in Mexico City tended to be important brokers of information, credit, and influences within the system. Of the 15 most central corporations, seven were banks. In fact, when we look at the degree (number of interlocks) of each of the top actors, we find that in Mexico banks tended to have 30 or more interlocks with other banks and corporations.

Both in Mexico and the United States, banks were very central to the network. Of the most central corporations, we find a large proportion of banks. The number of interlocks of the top-connected banks is also impressive. In the United States, the most connected bank had over 150 interlocks, while in Mexico the most connected bankers had on average 30 connections.

The Brazilian case is very different from those of Mexico and the United States for two reasons. First, we do not find a large proportion of banks within the most central corporations in the network. Second, in Brazil, interlocks with banks were not very important for corporations.

In Table 5 we see the 15 most central corporations in the network of corporate interlocks in Brazil when we rank them using Bonacich centrality. According to this measure of centrality, Brazil had only three banks within the 15 most central corporations. The top-ranked banks were the Societe Financiere et Commerciale Franco-Bresilienne and Banca Commerciale Italo-Brasiliano. Both of them were identified by Dean (1976) as being tied to the commercial and manufacturing enterprises of immigrants.<sup>13</sup>

The differences with Mexico and the United States in terms of the number of connections (degree centrality) are clear in tables 2 and 3 . While in Mexico and the United States most banks had over 20 connections, in Brazil two banks had 11 interlocks,

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<sup>13</sup> Dean (1976, pp. 63-64) has speculated that many immigrants founded businesses in Brazil with funds gathered in their countries of origin. Both banks, Financiere and Banca Commerciale, might have channeled funds to companies or helped as advisors to many of the immigrant ventures.

and one had eight interlocks. Moreover, the most central corporation in Brazil, the Internacional de Armazens Gerais, a company involved in the coffee trade in Sao Paulo, had only 13 interlocks.

Table 6 presents the top companies in terms of betweenness centrality in Brazil. When we look at the role of banks as brokers or intermediaries between network members using the betweenness measure of centrality, we find only two banks in the top 15 corporations. In fact, only one bank in the previous list appears again, the Banco do Recife. The top central bank according to betweenness, the Banco de Crédito Rural e Internacional, a commercial and mortgage bank in Rio de Janeiro, had only five interlocks. This bank was most likely very central because through its connections with manufacturing companies it helped to link the network of corporate interlocks in the southeast of Brazil to that of other regions of the country.

The Brazilian network of board interlocks extended over a large geographical area, thus many corporations were important in terms of betweenness because of their role in bridging different groups from different regions. This is the case with Banco do Recife, which bridged companies in Pernambuco (a northeastern state) to the main network of interlocks in Sao Paulo and Rio de Janeiro. Many of the 11 interlocks this bank had were to corporations in different economic centers like Rio de Janeiro.

That the Banco de Recife in the northeast of Brazil was so central in the network should be expected according to the setup of financial markets in Brazil around 1909. We would expect to find that banks in regions far from the big financial centers had closer relations to companies. In those states banks were almost the only source of finance. Only large corporations could venture into the Rio de Janeiro Stock Exchange and issue debt. In fact, the regional dimension is so strong that most of the clusters in the Brazilian network are related to geographical factors.

One could argue that the differences in the networks of Brazil and Mexico were explained by geographic factors. For instance, that in Brazil the large distances between the cities created a more dispersed network (with less interlocks) and complicating the interaction between companies and banks. Although I cannot fully reject the importance

of geography, it plays less of an important role for the following reasons. First, I find that clusters with companies from the state of Minas Gerais (central part of Brazil) are adjacent and connected to the clusters that included firms and banks from Rio Grande do Sul (far south) and Rio de Janeiro (southeast). In a similar pattern, we find companies of Rio de Janeiro with connections to clusters of firms of northern states, such as Pernambuco and Bahia. Second, banks were, in many instances, important bridges between the companies of these different regions. One of the top central actors was the Banco de Credito Rural e Internacional, a bank from Rio de Janeiro that played an important role linking a large group of São Paulo companies with the web of interlocks of the rest of the country. Still, many clusters from distant states like Maranhão tended to be isolated from the rest of the country. Since the clusters are not always grouped by region, geography cannot be the only factor influencing the network structure.

*Financial Markets vs. Banks: Financing options and reliance on bank connections?*

Table 7 presents one way to test whether having more options for financing should make connections to banks less necessary for corporations in Brazil. It shows that companies that had a higher debenture-to-equity ratio (i.e., issued more bonds relative to equity) had fewer connections with banks on average. For example, in specification 2, an increase in the debenture-to-equity ratio by 100% implied having, on average, one less banker on its board of directors. This is a large number if we think that the average number of bankers on a board of directors for Brazil in 1909 was close to one and the median was zero. Actually, the maximum number of bank connections a company had was two. On the other hand, increases in debenture-to-equity ratios at the turn of the twentieth century went, many times, from zero to 100% or more. The legal limit for most companies was 100%, and railroad, port, shipping, and public works companies were allowed to issue debentures for more than their total equity.

Can we reproduce this result for the case of Mexico? In Mexico, financing options for companies were limited. Stock exchanges were not very developed around 1909, and most of the companies issuing bonds were foreign. In fact, the only two Mexican

companies that had outstanding bond issues were two originally foreign railroad companies nationalized in 1903.

Table 8 shows the determinants of bank connections for Mexico. We can see that foreign companies had on average seven fewer interlocks with banks than the average Mexican company. In a financial system as closed as Mexico's, we would expect foreign companies to have access to financing options other than Mexican banks. Thus, finding that foreign companies relied less on connections supports the idea that more financing options led to less need of connections with bankers.

Table 8 also tests the impact that issuing bonds had over the number of bank connections per company. We would expect that companies that had access to other sources of financing, such as issuing bonds abroad, were less likely to have connections with bankers. We do not find strong evidence to make this point, though. Since most of the companies issuing bonds were foreign, the effect got captured with the foreign dummy.

Specifications 4 to 6 of table 8 take the argument a little further and test whether, in Mexico, having access to other sources of finance actually reduced the reliance of companies on interlocks in general. The results show that foreign companies had on average 17 fewer interlocks than Mexican companies. However, we find that companies issuing debentures tended to have more interlocks than the average Mexican company. For example, the average debenture-to-equity ratio of an issuing company in Mexico was 0.54. Thus, if we look at specification 5 of table 8, we find that a company issuing debentures would tend to have 22 more interlocks than the average Mexican company.

Now, since most companies issuing debentures were foreign, we need to take into account the interaction between a debenture-issuing company and being foreign to see the net effect. In specification 6, we see that the average foreign company issuing debentures (with an average debenture/equity ratio of 0.5) would on average have six less interlocks. This is the result of adding the three coefficients at the bottom of specification 6:  $(43.9 - 33.7) * 0.5 - 10.85$ .

Therefore, companies in Brazil and Mexico with access to bond markets had, on average, less interlocks with banks. In Brazil, companies with access to bond markets had, on average, no interlocks with banks. In Mexico, foreign companies were the group that had access to other financing options and they had on average seven fewer interlocks with banks than domestic companies.

## **V. Conclusions**

This paper shows that in Brazil corporations did not need to establish interlocks with banks as often as in Mexico and the United States around 1909. This result indicates the importance of the institutional settings that prevailed in Brazil at the turn of the twentieth century. When comparing to Mexico, the main difference was that Brazil offered corporations other options of financing such as stock and debt markets eased the need to establish relationships with banks. In addition, unlike the United States, in Brazil bankers did not have to play the role of market makers to provide credible commitments for investors buying corporate securities. The evidence presented in this and previous work supports the hypothesis that financial markets in Brazil were sustained by an institutional framework that protected investors, enforced credit contracts, and promoted regular financial disclosure of company accounts.

The case of the United States tells us an important lesson on the implications of networks for financial development. While most people see networks and financial markets as substitutes, in the United States networks actually worked as complements to financial markets. Companies needed investment bankers as a certification that they were going to honor their financial obligations to shareholders and debtors. On the other hand, investors needed a credible commitment from companies that they would receive the promised cash flows when buying securities. Investment bankers played that role. They influenced managerial decisions from the board of directors and credibly committed corporations to avoid investor rights violations.

Therefore, we can say that networks can successfully substitute some institutions and generate the credible commitments that are necessary for the expansion of markets.

But, networks can also be important complements for the development of securities markets. On the other hand, as the case of Brazil seems to prove, having a good institutional framework can help a developing economy to generate the necessary credible commitments and contract enforcement to make those markets work.

This paper also shows that, for both Brazil and Mexico, companies with access to other financing options reduced their reliance on bank connections. This supports the idea that connections with bankers might be good in an environment where access to credit is limited or where close relations help to reduce asymmetries of information. But once financial markets develop, these connections to lenders are less necessary. In fact, Mexico and Brazil actually grew at a very similar pace between the 1880s and 1910. That means that at low levels of development there may be basically no difference in how a country grows, either through strong formal institutions or by substituting for some of those institutions with networks.

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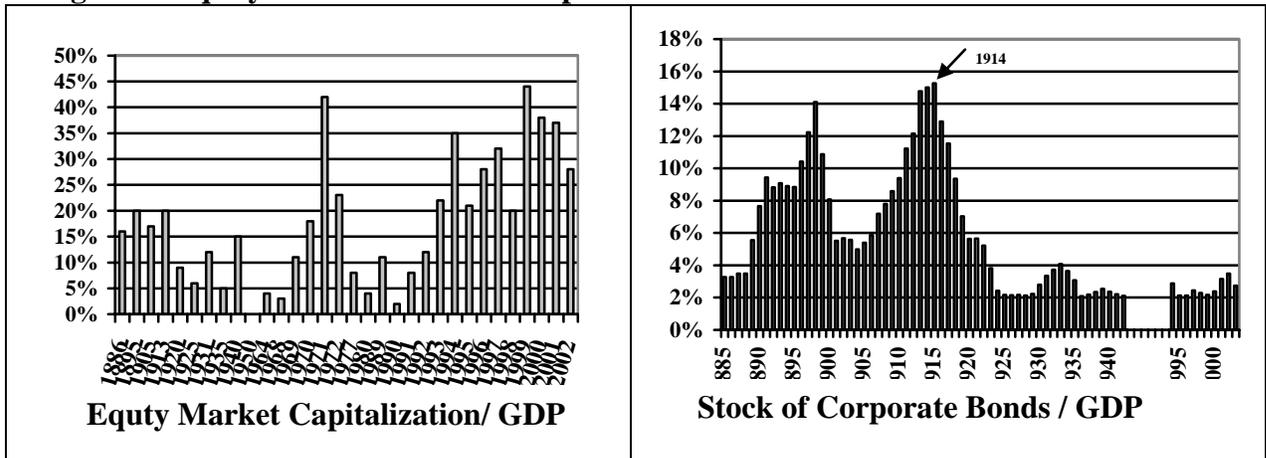
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## VII. Figures and Tables

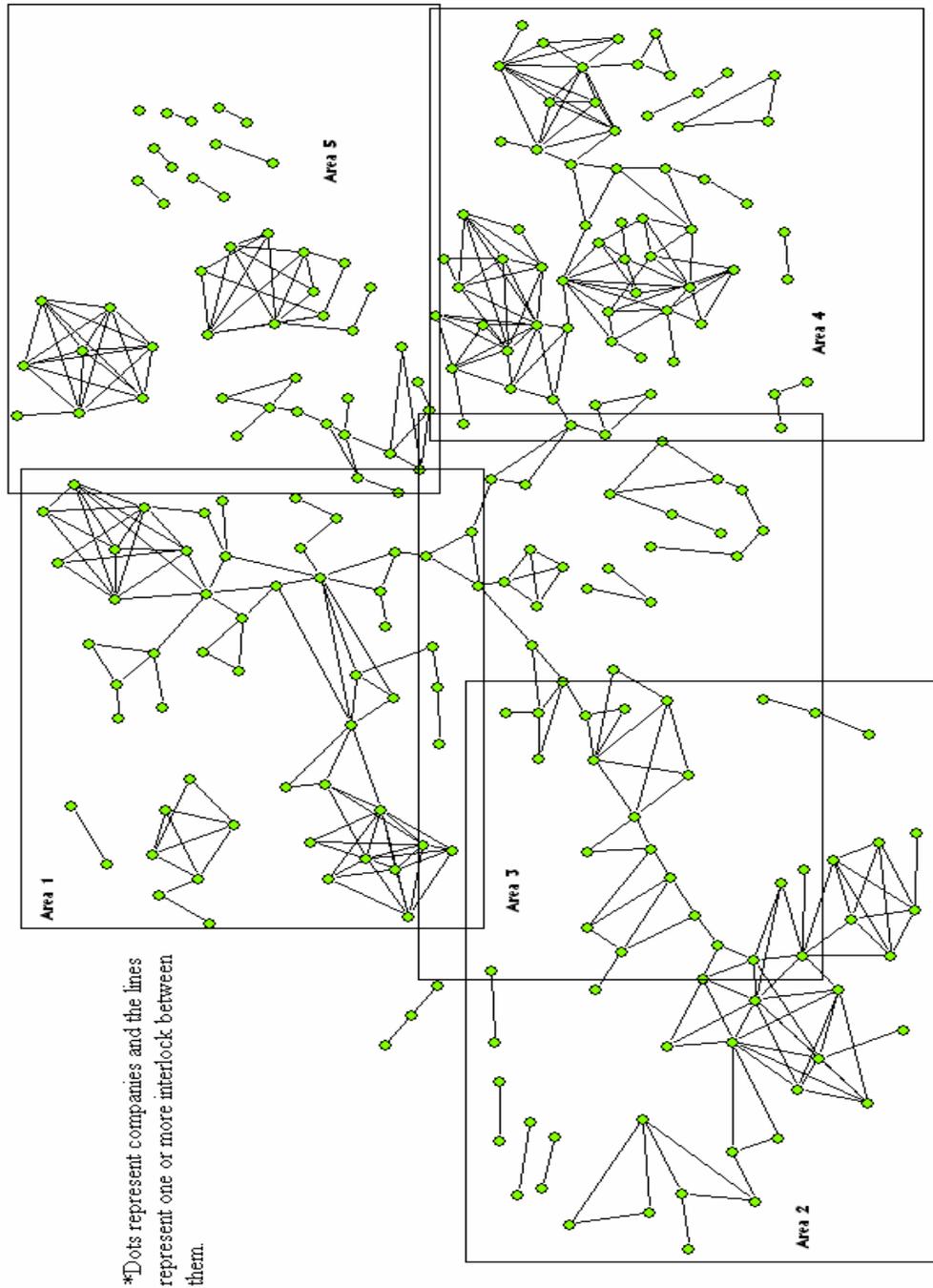
**Figure 1. Equity and Bond Market Capitalization over GDP in Brazil 1886 –2002**



Source: Musacchio (2005).

Notes: Equity market capitalization at market prices. Sao Paulo Stock Exchange data for 1920, 1925, and 1935 is missing. Data for 1947 –1964 excluded because legislation forced all joint stock companies to register at the stock exchange, thus creating data not comparable to other periods and with other countries.

**Figure 1. Brazil's Network of Corporate Interlocks, 1909**



Source: All network figures plotted using Pajek (software for graphical representations of networks), with data from the Brazilian Yearbook 1909.



Figure 3. Area 2 (Brazil's Network of Corporate Interlocks, 1909)

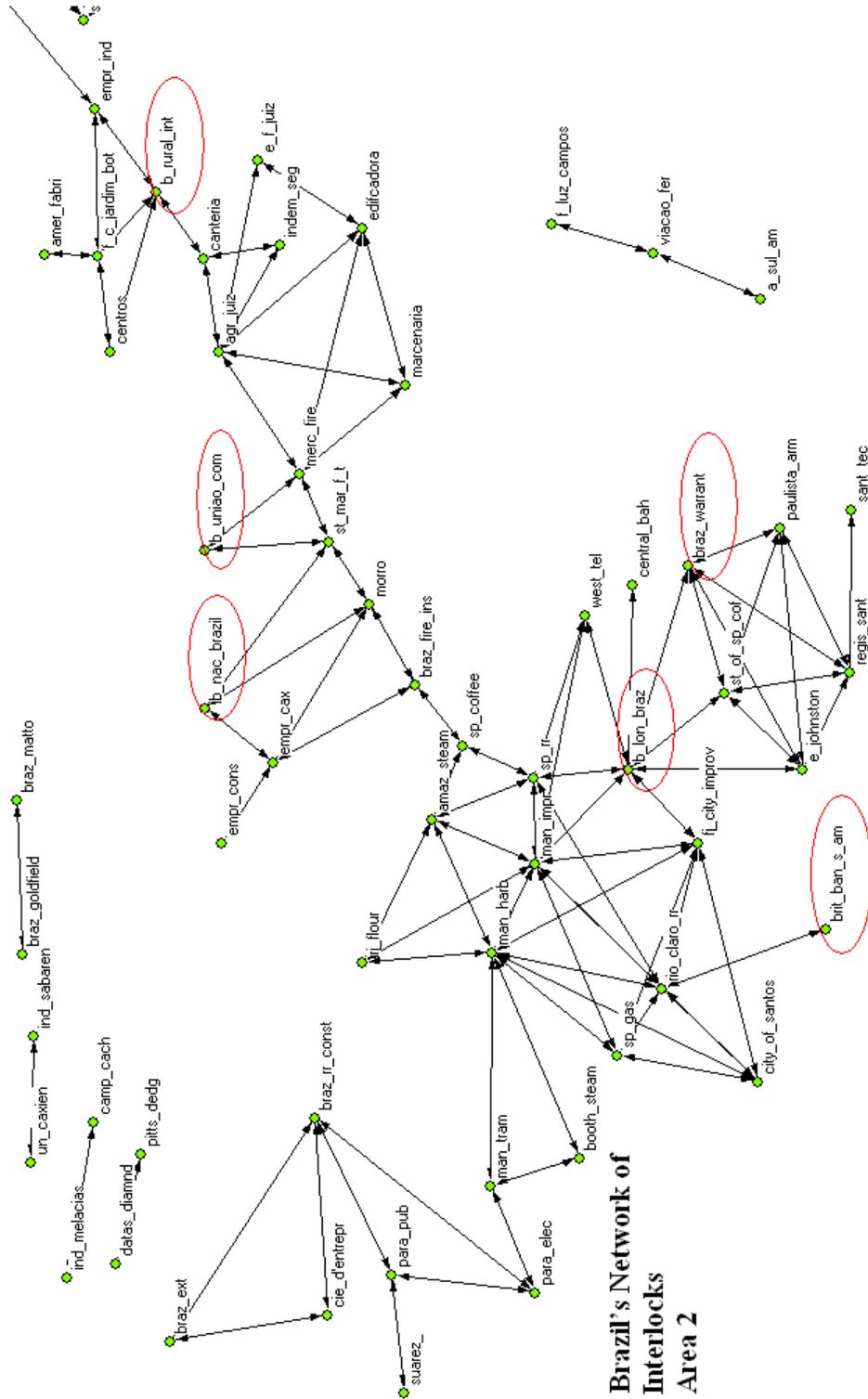
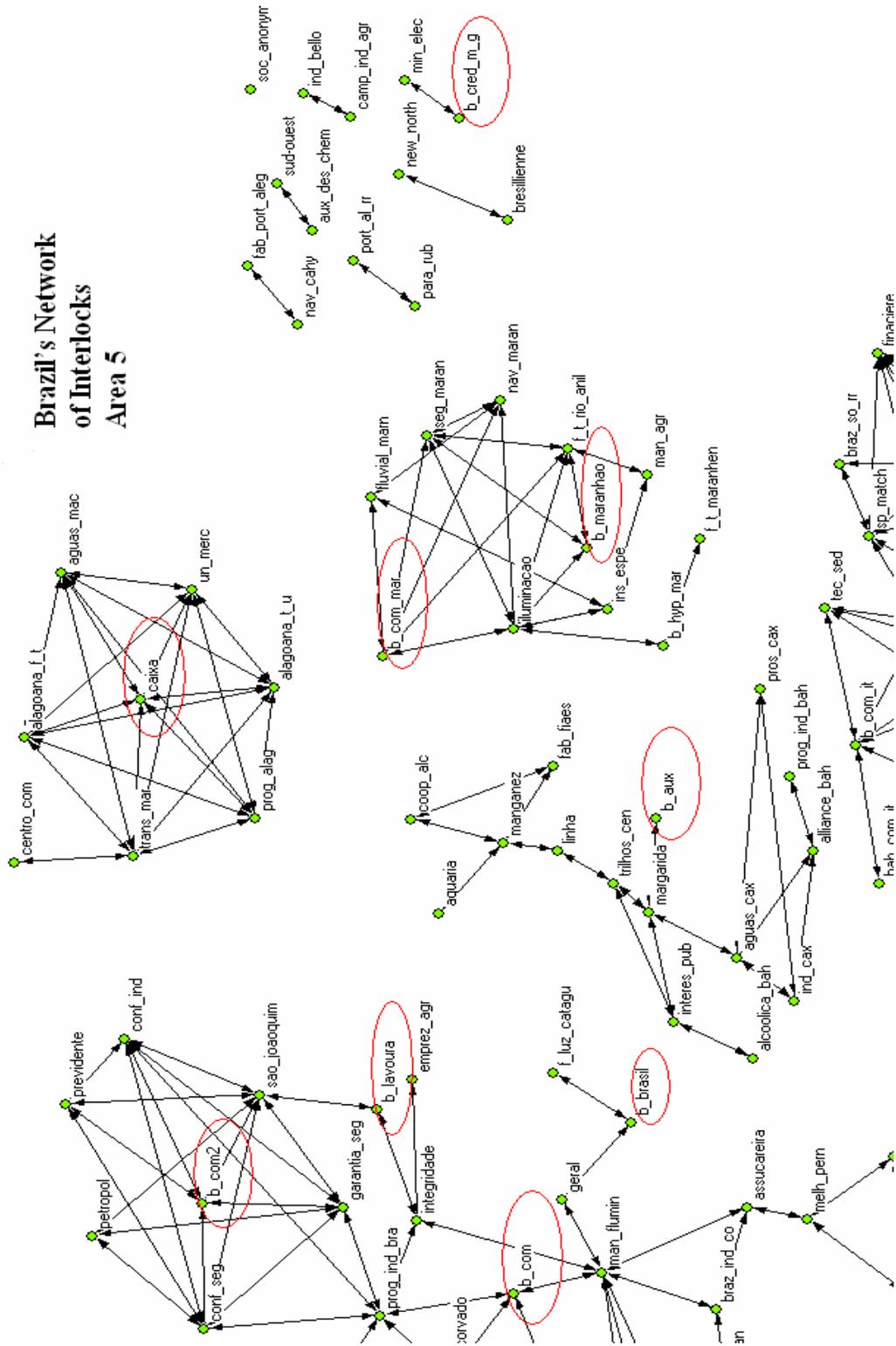






Figure 6. Area 5 (Brazil's Network of Corporate Interlocks, 1909)





**Table 1. Density of the corporate network of interlocks in Brazil, Mexico, and the United States circa 1909**

<b>Density</b>	
<b>Brazil, 1909</b>	
Binary	1.35%
All interlocks	1.79%
<b>Mexico, 1909</b>	
Binary	9.53%
All interlocks	14.41%
<b>United States</b>	
All interlocks 1904	8.30%
All interlocks 1910	10.80%

Note: Density is estimated as the total number of interlocks over the total number of directorships. Mexican and Brazilian data estimated in two ways: Binary density restricts the possible number of connections between companies to one interlock. In other words, if two companies share two directions, binary density considers this to be only one connection. Non-binary density (i.e. “all interlocks”) would count this as two connections. Source: Density for Mexico and Brazil estimated by the authors with data from the Brazilian Yearbook 1909 and the Mexican Yearbook 1909, using UCINET network centrality function. Borgatti, S.P., M.G. Everett, and L.C. Freeman. *UCINET 6.0 Version 1.00*. Natick: Analytic Technologies (1999). U.S. network density from Mizruchi (1982), p. 105..

**Table 2. Top Companies in the United States, Bonacich Centrality, 1904**

<b>Company name</b>	<b>Sector</b>	<b>Degree</b>	<b>Bonacich Rank</b>
Erie	Transportation	76	1
New York Central	Transportation	68	2
U.S. Steel	Industrial	88	3
Baltimore & Ohio	Transportation	76	4
Great Northern	Transportation	58	5
<b>National Bank of Commerce</b>	<b>Bank</b>	153	6
<b>National City Bank</b>	<b>Bank</b>	69	7
<b>First National Bank (N.Y.)</b>	<b>Bank</b>	45	8
<b>New York Trust</b>	<b>Bank</b>	75	9
New York Life	Insurance	62	10
International Harvester	Industrial	44	11
Union Pacific	Transportation	71	12
Chicago & Alton	Transportation	56	13
Lehigh & Wilkes-Barre Coal	Industrial	N.A.	14
<b>U.S. Trust</b>	<b>Bank</b>	58	15

Source: Mizruchi (1982), p. 64.

**Table 3. Top Central Companies in Mexico, Bonacich Centrality, 1909**

Name	Sector	Degree	Eigenvector
Mexican Eagle Oil Co	Oil	67	39.9
Fundidora de Fierro y Acero de Monterrey	Capital goods	46	35.3
<b>Caja de Prestamos</b>	<b>Bank</b>	42	34.4
<b>General Bonded Warehouses of Mexico and Veracruz</b>	<b>Bank</b>	50	34.3
<b>National Bank of Mexico</b>	<b>Bank</b>	47	32.1
Chapala Hydro-Electric And Irrigation Co	Utilities	37	31.9
Buen Tono Cigarette Factory	Manuf.	39	31.4
<b>Mexican Bank of Commerce and Industry</b>	<b>Bank</b>	47	31.3
National Railways of Mexico	Railroad	50	30.9
<b>Mortgage and Credit Foncier Bank of Mexico</b>	<b>Bank</b>	36	30.0
Pan-American Railway	Railroad	39	28.0
Dos Estrellas Mining Co	Mining	21	26.9
<b>Mexican Central Bank</b>	<b>Bank</b>	31	23.1
Agujita Coal Co	Mining	18	22.4
Fabricas de Papel de San Rafael y Anexas	Manuf.	24	22.3

Source: Network of corporate interlocks created by the author from lists of directors by company in *Mexican Yearbook 1909*. Bonacich centrality estimated by the author using UCINET (Borgatti, Everett, and Freeman, 1999).

**Table 4. Top Central Companies in Mexico, Betweenness Centrality, 1909**

Name	Sector	Degree	Betweenness
Mexican Eagle Oil Co	OIL	67	15.0
Mexico Tramways Co	Utilities	32	11.0
Fundidora de Fierro y Acero de Monterrey	Capital goods	46	10.1
Mexican Northern Railway	Railroad	11	8.9
<b>General Bonded Warehouses of Mexico and Veracruz</b>	<b>Bank</b>	50	7.4
<b>National Bank of Mexico</b>	<b>BANK</b>	47	6.8
<b>Laguna Bank of Encouragement</b>	<b>BANK</b>	10	6.3
Santa Maria de La Paz Co	Mining	15	6.3
National Railways of Mexico	Railroad	50	4.0
Buen Tono Cigarette Factory	MAN	39	3.4
<b>Bank of London And Mexico</b>	<b>BANK</b>	26	3.3
<b>Caja de Prestamos</b>	<b>BANK</b>	42	3.2
<b>Banco Mercantil de Monterrey</b>	<b>BANK</b>	7	2.5
<b>Mexican Bank of Commerce And Industry</b>	<b>BANK</b>	47	2.5
Interoceanic Railway of Mexico	Railroad	10	2.3

Source: Network of corporate interlocks created by the author from lists of directors by company in *Brazilian Yearbook 1909* and *Mexican Yearbook 1909*. Bonacich centrality estimated by the author using UCINET (Borgatti, Everett and Freeman, 1999).

**Table 5. Top Central Companies in Brazil, Bonacich Centrality, 1909.**

Company Name	Sector	Degree	Eigenvector
Internacional de Armazens Geraes	Coffee	13	-63.6
Refinadora Paulista	Food	9	-58.3
Companhia de Industria e Commercio	Food	7	-42.5
<b>Societe Financiere et Commerciale Franco-Bresilienne</b>	<b>Bank</b>	8	-42.5
São Paulo Match Factory	Manuf.	8	-42.5
São Paulo and Minas Railway Company Ltd	Railroad	7	-42.5
<b>Banca Commerciale Italo-Brasiliano</b>	<b>Bank</b>	11	-35.5
Moinho Santista	Agric.	8	-31.6
Fabrica de Cimento Italo Brasileira	Manuf.	5	-30.3
Tecelagem de Seda Italo Brasileira	Textile Manuf.	5	-30.3
Aliança Fiação e Tecidos	Textile Manuf.	4	-19.4
Docas do Porto da Bahia, Cessionaria Das	Port	4	-19.1
Brazil Great Southern Railway	Railroad	2	-13.7
Mchardy Manufactureira e Importadora	Capital goods	2	-13.7
<b>Banco do Recife</b>	<b>Bank</b>	11	-5.8

Source: Network of corporate interlocks created by the author from lists of directors by company in *Brazilian Yearbook 1909* and *Mexican Yearbook 1909*. Bonacich centrality estimated by the author using UCINET (Borgatti, Everett and Freeman, 1999).

**Table 6. Top Central Companies in Brazil, Betweenness Centrality, 1909**

Company Name	Sector	Degree	Betweenness
Estrada De Ferro Victoria A Minas	Railroad	5	18.1
São Felix, Fiação e Tecidos	Textile Manuf.	3	18.0
Docas De Santos	Port	5	17.9
Estrada De Ferro Noroeste do Brazil	Railroad	4	17.8
Docas do Porto Da Bahia, Cessionaria Das	Port	4	16.9
Empreza Industrial De Melhoramentos do Brazil	Agricultural	3	16.3
Melhoramentos De Pernambuco, Geral De	Construction	3	15.7
<b>Banco De Crédito Rural e Internacional</b>	<b>Bank</b>	5	15.6
Manufactora Fluminense	Textile Manuf.	9	15.5
Assucareira, Companhia	Food	3	15.5
Cantareria e Viação Fluminense, Companhia	Shipping	3	15.2
Agrícola De Juiz De Fora	Agricultural	10	14.8
<b>Banco do Recife</b>	<b>Bank</b>	11	14.1
Aliança, Fiação e Tecidos	Textile Manuf.	4	13.7
Mercurio Fire And Marine Insurance	Insurance	7	13.7

Source: Network of corporate interlocks created by the author from lists of directors by company in *Brazilian Yearbook 1909* and *Mexican Yearbook 1909*. Bonacich centrality estimated by the author using UCINET (Borgatti, Everett and Freeman, 1999).

**Table 7. Determinants of Bank Connections in Brazil, 1909**

	Spec 1	Spec 2 <sup>a</sup>
Age	0.0047 (0.89)	0.003 (0.006)
Ln (Equity)	0.023 (0.008)***	-0.0007 (0.01)
Agriculture/Trade		0.33 (0.18)*
Bank		0.13 (0.21)
Insurance		0.46 (0.23)*
Manufacturing		0.387 (0.159)**
Railroads/Utilities		0.58 (0.40)
Shipping and Ports		0.62 (0.29)**
<b>Debenture/Equity Ratio</b>	-0.10 (0.0589)*	-0.13 (0.07)*
N Observations	127	127
R-squared	0.009	0.05
Durbin-Watson stat.	2.24	2.25

Note: Dependent variable is number of bank connections per company in 1909. Significance levels of 10%, 5%, and 1% represented as \*, \*\*, and \*\*\*, respectively (standard errors in parentheses are heteroskedasticity consistent).

**Table 8. Determinants of Bank Connections and Degree of Connections in Mexico, 1909**

Dependent Var.	Num. of Bank Connections			Number of Board Interlocks (Degree)		
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 5	Spec 6
Age	-0.046 (0.065)	-0.054 (0.046)	-0.043 (0.048)	0.077 (0.205)	0.071 (0.176)	0.115 (0.190)
Ln (Equity)	0.397 (0.072)***	0.504 (0.134)***	0.475 (0.138)***	1.359 (0.227)***	1.590 (0.360)***	1.479 (0.366)***
Bank		-2.194 (2.104)	-1.900 (2.162)		-4.531 (6.389)	-3.381 (6.522)
Mining		-0.456 (1.706)	-1.026 (1.804)		-3.121 (5.120)	-5.351 (5.655)
Railroads/Utilities		-0.830 (1.469)	-1.544 (1.229)		-2.722 (5.020)	-5.514 (4.586)
<b>Foreign Company</b>	-6.890 (1.74) ***	-7.726 (1.71) ***	-5.911 (1.59) ***	-17.273 (5.46) ***	-17.958 (5.50) ***	-10.857 (4.719)**
<b>Debenture/Equity Ratio</b>	4.894 (3.192)	4.604 (2.917)	10.386 (6.297)*	22.327 (10.02)***	21.302 (8.44) ***	43.924 (18.840)**
<b>Foreign*Debent/Equity Ratio</b>			-8.619 (6.422)			-33.725 (20.582)*
N Observations	69	69	69	69	69	69
R-squared	0.226	0.248	0.266	0.204	0.213	0.242
Durbin-Watson stat.	1.366	1.517	1.504	1.284	1.366	1.356

Note: Dep. variable is number of number of bank connections and total interlocks per company in 1909. Significance levels of 10%, 5%, and 1% represented as \*, \*\*, and \*\*\* respectively (Standard Errors in parentheses are heteroskedasticity consistent).