



Interlocking directorates, access to credit, and business performance in Chile during early industrialization

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ARTICLE INFO

Keywords:

Interlocking directorates
Credit constraints
Firm performance
Business history
Latin America

ABSTRACT

How do businessmen counteract credit constraints when the financial market does not provide adequate external financing? Based on novel primary corporate data, network techniques and regression analysis, we explore the role of interlocking directorates with banks as a way for companies to face this limitation in early twentieth century Chile. Since both linkages and credit were unregulated, this setting provides us with a quasi-natural laboratory to test the role of interlocking directorates as a device for dealing with credit constraints. The paper finds that firms connected to banks had better access to credit as reflected in higher leverage ratios, had higher valuations, and better chances of surviving. These facts show that business networks, through interlocking directorates, can play a valuable role for companies in dealing with an environment of financial constraints.

1. Introduction

Corporate networks through interlocking directorates are an essential feature shaping the business environment. Indeed, very few of the largest corporations around the world are not part of a network through interlocking of board directors (Stockman, Ziegler, & Scott, 1985) and this has been the case for a long time (David & Westerhuis, 2014). Theories relate these interlocking to a series of important functions (Mizruchi, 1996; Larcker, Sob, & Wang, 2013; Scott, 1991; Davids, 1996, among others). These include shaping relations across firms -such as easing contracting costs, coordination, and communication-, within firms and with others outside the business community – social, class cohesion, political-. Interlocks can also be related to market power and can be used as a mechanism to facilitate collusive agreements. It is increasingly clear that the relevance of each theory is very much context dependent but this exploration is only beginning. A case in point is the little understanding that we have of the recent phenomenon of the sharp decline in the density of the corporate network (David & Westerhuis, 2014).

Importantly, networks can serve as a device for enforcing contracts when formal institutions do not work properly (Lamoreaux, 1994). One particular sector in which, because of its very nature, the enforcement of contracts is crucial for transactions to be conducted is the financial one (La Porta, López de Silanes, Shleifer, & Vishny, 1997). Business ties could provide an alternative arrangement to increase corporate access to external financing when financial systems are underdeveloped

because of lack of institutions that guarantee the legal protection of creditors. Better access to finance, in turn, would translate into better firm performance and valuation (La Porta, Lopez-De-Silanes, Shleifer, & Vishny, 2002) and faster economic growth (King & Levine, 1993; Rajan & Zingales, 1998).

The aim of this paper is to explore these issues by means of studying the Chilean corporate sector at the early twentieth century based on novel primary balance sheet and market data covering up to 252 firms and more than 1800 board seats. We look at (interlock) linkages among companies that occur when at least one individual (director) belongs to more than one company board and with special focus on interlocking with banks. Using network techniques and regression analysis, we address three interrelated hypotheses: whether firms that were connected to banks through interlocking directorates: a) had higher leverage, b) commanded higher valuations in the market, and c) had higher probability of survival into the future. We provide evidence in support of all three.

Our case study is relevant because Chile was at a time a small open and natural resource-based developing economy, with an underdeveloped financial system like many other developing countries today. This was also a period without any legal restrictions to the numbers of boards a person could sit in, or to the bankers' presence either on board positions or as shareholders of non-financial firms. Moreover, banks faced no regulatory restrictions when dealing with related institutions or requirements to extend credit to firms or specific sectors. These last two features imply that we have a precious laboratory free from

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regulatory constraints that typically limit the scope of such analyses conducted with current data.

2. Literature review

There is a very large literature dealing with business networks on sociology, economics, management science, history, among other fields. Because it encompasses the very general issue of the relation between firms working together pursuing related goals, the body of managerial research on the issue is also rich. For instance, there has been significant research on the shape, location, evolution, and management of these relations (Anderson, Håkansson, & Johanson, 1994; Henneberg, Naudé, & Mouzas, 2010; Törnroos, Halinen, & Medlin, 2016). Interlocking directorates is one particular way in which firms can form networks, though it has been very studied and influential (Haunschild & Beckman, 1998; Mizruchi, 1996 and Mizruchi & Stearns, 1988). One of the primary focus of interlocking research has been to document and measure the relative importance of business networks thus conceived across countries, their evolution and the identification of central firms (see Windolf, 2002, Cronin, 2011, David & Westerhuis, 2014, for discussion and survey).

Based on resource dependence theory, board interlocking can be seen as a rational cost-benefit mechanism available to firms (Brennecke & Rank, 2017; Pfeffer & Salancik, 1978). According to this view interlocking allows firms to gain access to a wide spectrum of valuable external resources, including strategic information, technology (Westphal, Seidel, & Stewart, 2001) and serve as a substitute to regulation for dealing with agency problems (Booth, Cornett, & Hassan, 2002). It also appears that interlocking can improve firm performance through innovation, product development and the adoption of best managerial practices (Mazzola, Perrone, & Kamuriwo, 2016; Shropshire, 2010), while firms with better connected boards of directors exhibit better performance either by profitability (Richardson, 1987) or superior stock returns (Larcker et al., 2013). Our paper contributes to this literature on the reasons for the existence of linkages by showing that these positive effects are a pervasive feature of these interlinks since they exist in a context very different from the ones that have been studied before. We also add new evidence on how these affect the very long-term survival of the firm.

Resource dependence theory can also be applied to understand whether interlocking directorates can be used to gain better access to external financing, particularly when firms have board ties with credit suppliers. At these regards several studies find that banks appear to be central firms in interlocking networks, although a declining trend has been observed for the for the US since the 1980s (Davis & Mizruchi, 1999). The latter suggests that directorate ties with credit suppliers can matter and, more specifically, that banking ties can perform a central role in directing capital flows (Mintz & Schwartz, 1985; Mizruchi, 1996). Based on contemporary data, part of the research found that companies tied to bankers might face lower barriers for credit access, thus affecting its capital structure (Booth & Deli, 1999; Byrd & Mizruchi, 2005; Kroszner & Strahan, 2001; Sisli-Ciamarra, 2012). The link between the financial/banking channel and firm performance has been less explored though. Engelberg, Gao, and Parsons (2012) shows that firms connected with capital suppliers enjoy more favorable terms of lending and improved credit ratings and stock returns. On the other side, banking interlocking with nonbanking firms can have a negative effect on bank performance because of unsound lending (Kossev, 2009; Okazaki, Sawada, & Yokoyama, 2005) and reduced R&D and innovation (Ghosh, 2016).

One difficulty when conducting research linking interlocks and credit with contemporary data is that neither credit nor linkages are the outcome of unrestricted choice by the agents involved. Nowadays, either directly -through directed credit or instruments such as subsidized lending, or state guarantees- or indirectly -via the computation of bank capital requirements- bank lending is almost nowadays completely

unhindered. Likewise, firm linkages have been restricted or controlled on grounds of antitrust reasons (Baccini & Marroni, 2016; Jacobs, 2014; OECD, 2008). In addition, regulatory mandates such as the Sarbanes-Oxley Act in the US had impacted the board structure of firms (Linck, Netter, & Yang, 2007), while Codes of Best Practices in Corporate Governance around the world make recommendations on board structure and composition (Denis & McConnell, 2003) that includes restrictions on interlocks in several countries (Van den Berghe, 2012). In Chile board positions per person were limited to a maximum of three between 1970 and 1981, and since 1960 board interlocks are prohibited between banks. More recently, in 2017, the Chilean antitrust law forbidden the participation on boards of competing firms. Our paper looks at a time and place where the linkages and credit we see are more likely to be the outcome of the optimal choice of agents facing particular credit conditions, which is a basic requirement for using these data to test the theory.

In Latin America, several studies have analyzed interlocking directorates. These include Lluich and Salvaj (2012) who compare the Chilean and Argentinean corporate networks at the beginning of the 1970s, Couyoumdjian and Salvaj (2016) on the relation between the state Chilean business groups during the 1970–2010 period and Silva, Paredes, and Majluf (2006) on the effect of interlocking and family ties in Chile in the early 2000, and Santos, Silveira, and Barros (2012) on the effect of interlocking on firm performance in Brazil from 2001 to 2005. Using data from a similar period than the one we analyze in this paper, Musacchio and Read (2007) and Musacchio (2009) document the importance of business networks, including its ties to banks, in Mexico Brazil and the US during in early XXth century.

We contribute to the understanding of interlocking directorates and business networks in Latin America by looking at a country (Chile) in a period not as well-studied relatively to the others. This allows having additional data to test not only the financial channel as we do here but also other theories by comparing the Chilean network of firms and their performance with their Latin American peers undergoing different institutional developments.

One novelty of our work is that we look at the entire chain of the credit mechanism. That is, we start by documenting the role of bank interlocking in easing credit access -the impact on the firm's leverage-, we then move into showing that there is an effect on the firms' performance -as measured by market value-, and then finally in its long-term survival. We address these interrelated hypotheses using network techniques and regression analysis. To our knowledge this is the first paper that explores this question in such a comprehensive manner for a developing economy, thus making a significant contribution to the related literature.

The remainder of this paper is structured in three sections: Section 3 presents our methodology, data description and the main characteristics of the Chilean interlocking network, Section 4 discuss our results and Section 5 concludes.

3. Data and methods

If the reason that firms link to banks is that arms-length lending is expensive because there are market failures in financial markets -such as poor creditor protection or information quality-, firms that are connected to banks would have better access to credit. Enhanced financing would allow these firms to increase investment to its optimum level and therefore perform better and be more valuable. This will ensure the long-term survival of the firm. We measure the impact of connections, particularly with banks, on firm market valuation and on its survival probability. In particular, our three hypotheses are:

H1. Firms connected to banks have higher leverage.

H2. Firms connected to banks command higher market valuations.

H3. Firms connected to banks have a higher probability of long-term

survival.

To test these hypotheses, our main source of data is the stock market guide *La riqueza mobiliaria de Chile*, (Undurraga, 1922). We extract information for 252 corporations covering all economic activities, including the most important banks (21) and nearly all the companies traded in the Santiago Stock Exchange.¹ Consequently, our sample is quite representative of the universe of publicly traded corporations at that time. We collect the name of all board members in every company, totaling 1873 seats and identify each person by a unique ID, finding 1198 unique directors.

Financial information and stock market prices are collected when available. Stock prices and trading information was obtained from different sources, such as the *Anuario Estadístico* of the National Statistics Office and newspapers. Balance sheet data and ownership information was obtained from firm annual reports.²

We define two firms as being connected when they share at least one member of the board of directors. Aside from this simple measure, we compute the intensity of connections, identify the most central firms and the “big-linkers” on the networks (individuals with the higher number of board positions). To measure network centrality, we use the two most commonly used indicators developed by the relevant literature: Local Centrality (or simply degree) and Bonacich Degree. The simplest measure is the former, which corresponds to the number of connected directors that two firms share. Local Centrality is very easy to calculate but it has several weaknesses, the most important being the fact that it ignores the indirect relations existing in the network. A company of low degree can have an important intermediary role and therefore be very important in the network. The Bonacich measure solves this problem. In the Bonacich degree the centrality of firm “i” equals the sum of its connections to other points, weighted by the centrality of each of these other points (Scott, 1991). Therefore, it considers not only a company’s direct connections, but also the intensity to which the companies that are connected to it are connected to others.

Table 1 reports the summary statistics of the firms included in our dataset. The descriptive statistics for 1922 reveal that the average size of the board (7.7) is similar the levels seen today. Firms are relatively young, with a mean age (years since incorporation) of 13.4 years. A little over half the firms subsisted until 1939 and only one third until 1962. The average firm (at market value) was at £180,000 of 1922 (around 50 million dollars in today’s money). The stock market was quite concentrated in a few very large firms. The combined value of the four largest companies accounted for about half of the value of all the firms in the market, while the ten largest firms represented a proportion of nearly 70%.³ Table 2 shows the twenty largest firms by market value. The fact that firms were relatively young and small is important given that these are typically likely more credit constrained.

Several additional business structure and ownership features are worth noting. One salient fact is that ownership concentration in Chile was low, especially compared to contemporary levels. For instance, while the largest shareholder (either a family or another firm) accounted for 18.2% of the total stock in 1922, the figure climbs to close to 50% today (Islas, 2015). Families and individual investors were the main shareholders in most firms, while insurance companies and foreign banks were among the most important institutional investors. Ownership was more dispersed in the financial sector and more concentrated in mining. The use of pyramidal structures was not frequent and, when present, was related to business operations and not used as a

mechanism to achieve control.⁴ The relatively dispersed ownership and the absence of pyramidal structure means that the linkages we document below do not simply reflect the existence of business groups as is most likely to be the case today.

3.1. Chile’s corporate network

Business connections through interlocking directorates in Chile were quite important during the beginning of the XXth century: 96% of firms had interlocks in 1922. This is a large percentage even when compared to other Latin American countries at a similar time (79% in Mexico, 67% in Brazil or 60% in the case of Argentina).⁵ While interlockers represented 28% of total Chilean directors in the 1920s, in Argentina the proportion was only 12% (Lluch & Salvaj, 2015). In addition, as depicted in Fig. 1 that shows a graphical representation of the interlocking network (each node represents a firm and each arc a linkage), nearly all the firms were connected to the main network, even though there were two very distinct business centers in Chile at that time (Santiago and Valparaíso).

Table 3 shows the matrix of interconnections per economic activity. The figures correspond to the number of interlocks of firms of a given industry with firms of each other sector over the total number of possible combinations. The chance that a firm is connected to another firm in the same industry is shown in the diagonal. The average number of interlocks over the possible ones is 0.034. It is important to distinguish between two kinds of connections: across industries and within industries. One motivation for horizontal connections (across) is to coordinate actions to achieve market power. Although it is not the only possibility, this goal is plausible in a context with no antitrust regulation to speak of (the first antitrust regulation in Chile dates to 1958). Regarding the second type (within), one can distinguish two categories: the vertical ones, in which two firms that are in a buyer-supplier relationship link themselves, and the unrelated ones, where the firms are in industries that are not associated in a material way. Vertical integration, especially, can be motivated on the need to reduce transaction costs, those related to the enforcement of contracts.

Both within and across-industry connections are important in the Chilean context of the 1920s. The average within-industry ratio of 0.038 is 11.6% greater than that across industries and, therefore, one cannot rule out the market power motivation. But is clear that is not the only reason for the existence of these interlocks. The magnitude of the difference is not particularly large and the evidence is only suggestive because the difference is not statistically significant.⁶ Cross-industry linkages are not more frequent between firms that are related in a vertical fashion. For instance, industries in the tradable sector are even less likely to being linked to shipping companies and railroads (0.031). This result may be related to the fact that property rights institutions and their enforcement system developed comparatively early in Chile.⁷

Having said that, one of the most salient type of contracts that is particularly sensitive to these institutions are the financial ones. For those we do see a critical difference: the intensity of connections of industries with the banking sector (at 0.045) is 39% higher than with other kinds of firms. As depicted in Fig. 1, it is already apparent that

⁴ For example, the Chilean Largest brewery company - “Compañía de Cervecerías Unidas” - was among the largest shareholders of “Fábrica Nacional de Vidrios”, its main bottle supplier.

⁵ Figures for Mexico and Brazil are for 1909. Source: Musacchio and Read (2007). Figures for Argentina are for 1923. Source by Lluch and Salvaj, available at <http://www.cgeh.nl/corporate-networks-data>, Centre for Global Economic History. See also Lluch and Salvaj (2015) for a comprehensive long run study in the case of Argentina.

⁶ Moreover, one would expect, for instance, firms in non-tradable sectors to have a stronger incentive to establish links to achieve market power, but links are as likely within these industries as within those more exposed to international competition.

⁷ The first Chilean Bankruptcy law dates back to 1837. Norms about credit-privileges were established on 1848. The first Commercial Code (1865) included the bankruptcy law.

¹ Even though the data is based on information from the Santiago Stock Exchange it also includes firms based on Valparaíso (the other main financial center of the time), and other cities, therefore our data covers nearly all of the publicly traded companies at the time.

² The sample shrinks after merging the stock market and financial data.

³ The concentration is very high even for today’s emerging markets standards. Just to have a sense, the combined value of the top 4 firms in the main Chilean index today is around 40%.

Table 1
Firm characteristics.

	Mean	Std. deviation	Maximum	Minumum	Observations
Board size	7.70	2.68	21.0	3.00	252
Age (years)	13.4	13.2	64.0	0.00	235
Book value of equity (£, 1922)	179,808	458,586	4,413,454	3426	183
Market capitalization (£, 1922)	650,613	2,293,454	22,934,542	1641	129
Mkyl/book equity value	1.69	1.71	0.09	10.3	119
Leverage (%)	0.44	0.26	0.98	0.00	60
Exits in 1939	0.56	0.50	1.00	0.00	252
Exits in 1962	0.33	0.47	1.00	0.00	252
Largest stockholder	0.18	0.00	0.70	0.15	46
Five largest shareholders combined	0.39	0.01	0.86	0.20	46
Number of shareholders	387	13	2200	13	46
Ownership by board members	0.14	0.00	0.72	0.003	46
Degree	10.7	9.61	56.0	0.00	251
Connection with other firms	0.95	0.21	1.00	0.00	252
Connection with banks	0.51	0.50	1.00	0.00	252

Table 2
Largest firms in Chile.

Firm	Sector	Mkt Vale
Lota y Coronel (minera e industrial de Chile)	Mining	£ 22,900,000
Salitres Antofagasta	Mining	£ 8,584,348
Banco de Chile	Banks	£ 5,157,810
Tierra del Fuego	Agriculture	£ 4,533,816
Cia chilena electricidad	Utilities	£ 4,428,341
Schwager	Mining	£ 3,488,996
Llallagua	Mining	£ 3,440,264
Vapores	Transportation	£ 3,438,325
Banco Espanol Chile	Banks	£ 1,931,723
Cia Salitrera Loa	Mining	£ 1,891,734
Azucar de Vina	Manufacturing	£ 1,370,094
Cia Salitrera Lastenia	Mining	£ 1,245,823
Cervecerias Unidas	Manufacturing	£ 1,225,174
Cia Minera Domeyko	Mining	£ 1,157,877
Cia Chilena de Tabacos	Manufacturing	£ 1,082,260
Refineria de Azucar penco	Manufacturing	£ 996,377
Salitres Boquete	Mining	£ 901,771
Banco Hipotecario Chile	Banks	£ 825,550
Banco Nacional	Banks	£ 776,838
Compañía Minera Oploca	Mining	£ 750,310

banks (red nodes), are among the most central firms in the network. Besides, Fig. 2 shows the many firms were linked to Banco de Chile, the most important bank at that time. Moreover, the firms most connected to banks are those in the utilities, shipping, and pulp and paper sectors (Table 3), all sectors that require large investments. All this is suggestive of a financial motive for the linkages, which connects directly with our general view on the relation between interlocking directorates and finance.

Table 4 shows the fifteen most central firms in the network.⁸ Aside from the central position of largest bank in the country (“Banco de Chile”), we also find that three other local banks played a prominent role. Those four banks accounted for 51.4% of total bank assets.⁹ Again, the presence of large banks among the central players in the network points out to the relevance of being related to a bank. The list also includes some firms that were also among the largest firms at the time, such as Compañía de Cervecerías Unidas, Sudamericana de Vapores and Exploradora de Tierra del Fuego.

Holding multiple board positions was widespread in Chile: 38 persons (3% of total directors) seated in five or more companies (representing 18% of total board seats). Most of them held positions on

⁸ For now on we leave aside insurance companies, which had small positions in many firms in their portfolio, as part of their business.

⁹ Most of these banks remained central to the network well into the 1960s, as documented by Lluich and Salvaj (2012).

companies related to different economic activities. Were connections simply the result of having family business conglomerates exerting control in several industries (as it happens in today’s Chilean economy)? Two interesting pieces of evidence suggest that this is not the case. First, directors did not control the firms: on average, directors owned less than 15% of the stock of the firms. More important, the majority of the most connected persons, were not large investors but usually senior executives and lawyers. This point out that business connections in the Chilean market could have served a different role as simply being an artifact of companies sharing a common owner.

4. Results

In the previous section, we have described the main characteristics of the Chilean corporate network through interlocking directorates. In this section, we empirically test our three hypotheses and estimate the economic business impact of being connected to banks. Establishing causality would be a daunting task given the data limitations, but we document several relations that consistently suggest that interconnections existed for easing financial constraints.

4.1. Credit access

Bank financing was particularly important for Chilean firms at the time. Even though there was an active local market for mortgage, government and municipality bonds, the corporate bond market had not developed yet in Chile. From 1920 to 1922 no corporate bonds were traded either in Santiago or Valparaíso. Furthermore, access to international bond markets was limited to only a handful of large firms. Indeed, by 1921 only two Chilean-based companies had bonds trading in the London market (Coyoumdjian, 1986). At the same time, the local stock market was not likely to be an important source of financing to firms (the levels of investor protection were low). Compared to other economies, Chile appears to lag in terms of the relative size of its stock market and banking industry, after controlling for GDP per head (Rajan & Zingales, 2003). In other words, there were no good alternative financing sources to bank credit in Chile, and given that bank financing was also limited, it is very likely that firms were credit constrained. Thus, getting a hold on the few funds available would have been very valuable.

In a context of credit access constraints, our first hypothesis to be tested is that being connected to a bank allows firms to have easier access to credit. We do this by asking whether firms that are connected to a bank by having (at least) one banker in their board tend to have higher leverage ratios. Leverage, the dependent variable, is defined as total liabilities over total assets. The Ordinary Least Square estimate of the effect of being linked to a bank on leverage is positive and

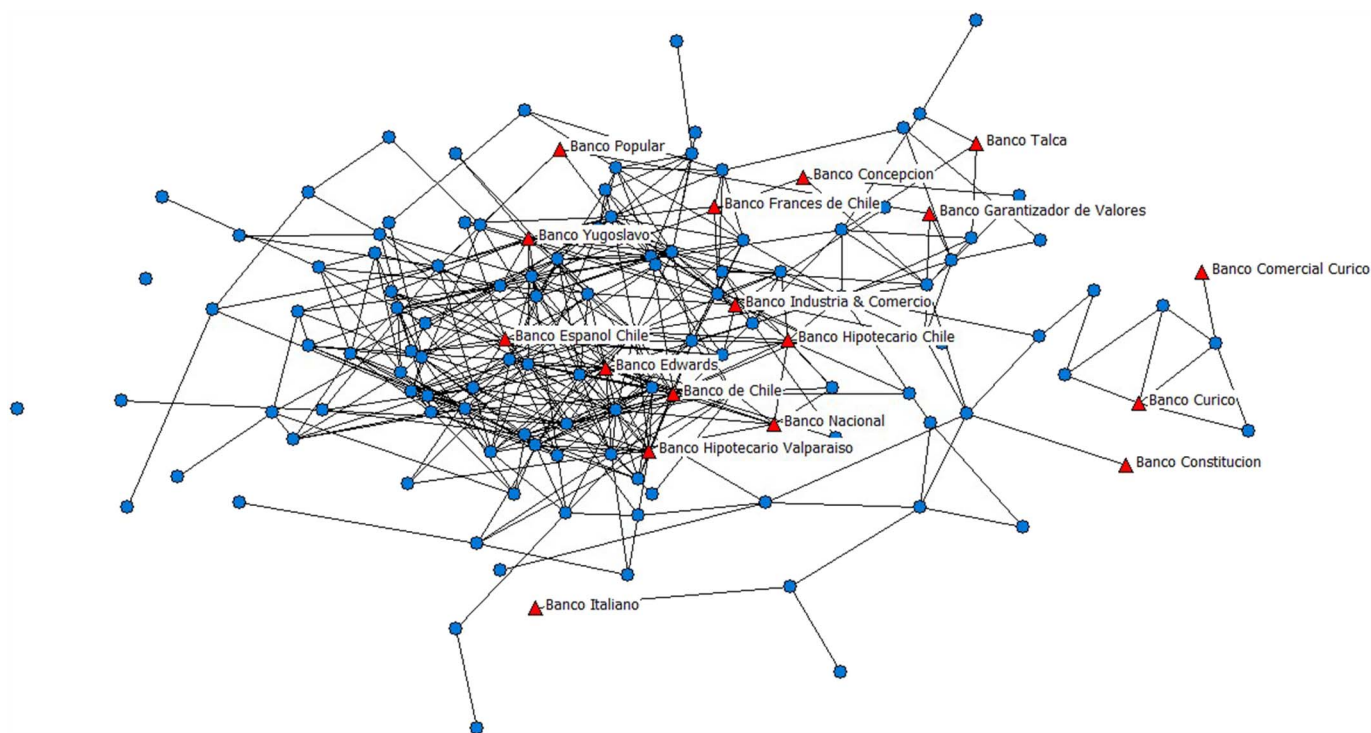


Fig. 1. Chile's interlocking directorates in 1922.

* Dots represent firms, red dots banks. Two dots are connected by an arc if the two firms share at least one director. (Excludes insurance companies). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Table 3
Interlockings per industry.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)	Agriculture	0.06	0.06	0.05	0.01	0.02	0.02	0.02	0.06	0.03	0.04	0.03	0.03	0.04	0.03
(2)	Banks	0.06	0.03	0.03	0.01	0.07	0.07	0.03	0.04	0.13	0.05	0.02	0.04	0.05	0.00
(3)	Capital goods	0.05	0.03	0.06	0.01	0.03	0.05	0.02	0.04	0.02	0.05	0.03	0.03	0.06	0.06
(4)	Commercial	0.01	0.01	0.01	0.00	0.00	0.00	0.03	0.00	0.00	0.04	0.01	0.01	0.02	0.00
(5)	Utilities	0.02	0.07	0.03	0.00	0.03	0.12	0.03	0.02	0.18	0.05	0.02	0.02	0.06	0.00
(6)	Food	0.02	0.07	0.05	0.00	0.12	0.00	0.03	0.03	0.17	0.00	0.04	0.05	0.07	0.00
(7)	Manufacturing	0.02	0.03	0.02	0.03	0.03	0.03	0.02	0.01	0.00	0.06	0.01	0.03	0.00	0.00
(8)	Mining	0.06	0.04	0.04	0.00	0.02	0.03	0.01	0.06	0.04	0.04	0.02	0.03	0.05	0.02
(9)	Naviera	0.03	0.13	0.02	0.00	0.18	0.17	0.00	0.04	0.00	0.00	0.00	0.03	0.10	0.00
(10)	Pulp & paper	0.04	0.05	0.05	0.04	0.05	0.00	0.06	0.04	0.00	0.00	0.04	0.05	0.07	0.00
(11)	Railroads	0.03	0.02	0.03	0.01	0.02	0.04	0.01	0.02	0.00	0.04	0.14	0.02	0.03	0.00
(12)	Insurance	0.03	0.04	0.03	0.01	0.02	0.05	0.03	0.03	0.03	0.05	0.02	0.04	0.05	0.02
(13)	Services	0.04	0.05	0.06	0.02	0.06	0.07	0.00	0.05	0.10	0.07	0.03	0.05	0.10	0.05
(14)	Textiles	0.03	0.00	0.06	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.05	0.00

statistically significant at conventional levels, as reported in Table 5, column 1. The economic magnitude of the effect is relevant: being connected to a bank is associated with an increase of little under one standard deviation in leverage.

Furthermore, and reinforcing the view of the importance of the financial channel, it is not the linkages to other firms (or omitted variables related to that) what matters, but only connections to banks. Indeed, the second column shows that relating to other firms (measured by degree) does not have a statistical impact on leverage. Furthermore, when both the degree to which the firm is connected to others and whether it is linked to a bank are included together, there is almost no effect on the coefficient for the latter and it remains statistically significant.

These results are also consistent with some evidence for other Latin American countries. When comparing corporate networks in Brazil, Mexico and the U.S. circa 1910, Musacchio (2009) finds that banks were more central in the country where the financing options were more limited (Mexico) and less important where an active bond market

was available to firms (Brazil). Chile is in between these countries in the sense that banks were more central than in Brazil but less so than in Mexico. In 1909 in Mexico there were five banks among the 15 most connected firms, whereas in Brazil there were only two. With four banks, the centrality of Chilean banks was in between.

This fits well with our hypothesis because access to credit was by many measures more plentiful in Chile than in Mexico but scarcer than in Brazil. Musacchio (2009) also finds that firms with outside financing options available (those with access to the international market) are less likely to relate to a bank. Our results provide further evidence by showing that being connected had an impact on the leverage ratio.

While our data does not allow us to identify the source of credit for each firm, some anecdotal evidence points out that related lending could have been a common practice. For instance, in 1925 (3 years after our period of analysis) a new banking law established several restrictions at these regards. The law limited the investment of banks in shares of other corporations and stated that loans to a firm that shared directors with the bank needed to have the written approval of the

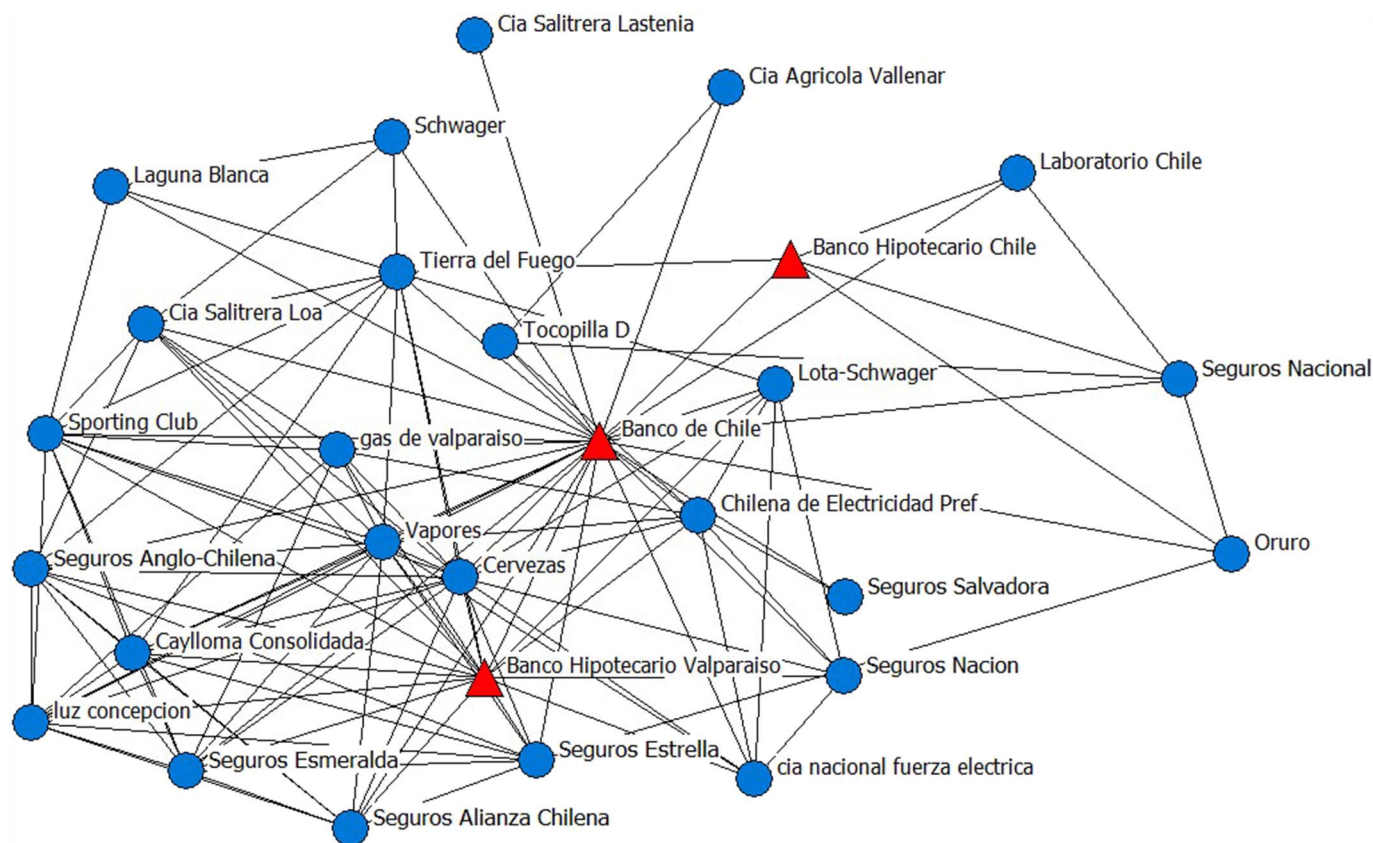


Fig. 2. Banco de Chile's interlocks.

* Dots represent firms, red dots banks. Two dots are connected by an arc if the two firms share at least one director. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Table 4
Network central firms in Chile.

Name	Industry	Degree	Bonacich
Compañía de Cervecerías Unidas	Manufacturing	56	24,5
Banco de Chile	Banks	47	21.3
Banco Hipotecario de Valparaíso	Banks	42	19.7
Banco Español Chile	Banks	37	11.2
Compañía Sudamericana de Vapores	Transportation	37	21.4
Compañía Explotadora de Tierra del Fuego	Agriculture	34	19.1
Banco Edwards	Banks	31	19.8
Compañía de Salitres de Antofagasta	Mining	30	11
Compañía Agrícola Ñuble Rupanco	Agriculture	29	11.1
Refinería de Azúcar de Penco	Manufacturing	29	12.9
Fábrica de Vidrios de Lirquen	Manufacturing	28	12.4
Compañía de Luz Eléctrica de Concepción	Utilities	28	13.5
Compañía de Gas de Valparaíso	Utilities	27	14.2
Cía. Nacional de Fuerza Eléctrica	Utilities	25	14.9
Compañía Minera e industrial de Chile	Mining	24	12.8

Table 5
Effect of connections on leverage.

Ordinary least squares regressions			
Dependent variable: leverage ratio			
	(1)	(2)	(3)
Degree			
Connected to bank	0.216* (0.0848)	0.00402 (0.0034)	0.00191 (– 0.0037)
Observations	48	48	48
Adjusted R2	0.114	0.0082	0.101

Robust Standards error on parenthesis (*) Significant 5%, (**) Significant 1%, (***) Significant 0.1%.

majority of the board.

4.2. Firm valuation

Having shown that ties to banks are related with higher firm leverage, the next step is to ask whether these interlocks were associated with improved firm performance. Controlling for industry characteristics, we study this issue focusing on the relation of valuations –as measured with the ratio of the market value of equity to the book value of equity- of non-financial firms to the degree of connections with both banks and other firms. For market value, we use the closing price for December 1922, as reported at the *Anuario Estadístico*.

The results are presented in Table 6. The first column shows that the

Table 6
Effect of connections on market valuations.

Ordinary least squares regressions				
Dependent variable: market to book value of equity ratio				
	(1)	(2)	(3)	(4)
Degree	0.0530* (0.0206)			
Connected to another firm		0.959 (2.089)		– 0.708 (2.019)
Connected to bank			1.620** (0.490)	1.667** (0.520)
Industry dummies	Yes	Yes	Yes	Yes
Observations	79	79	79	79
Adjusted R2	0.169	0.0853	0.213	0.202

Robust Standards error on parenthesis (*) Significant 5%, (**) Significant 1%, (***) Significant 0.1%.

more connected is a firm to others in the network, the higher its market valuation, a result that is in line with the literature and the various possible channels that can be at work. However, the salient feature of our analysis is that we find that this overall positive effect is mainly driven by interlocking directorates with banks. Indeed, when we separate between connections (columns 2, 3 and 4) to banks and connections to other firms, we find that the linkages with banks are robustly and strongly associated to valuations while the effect of connections with non-financial firms is not statistically significant. The economic magnitude of the effect is, again, quite relevant: approximately a one standard deviation increase in the value of the firm.

Moreover, we found that the magnitude of the effect is larger for the group of firms that are expected to have lower access to public equity financing: young firms and firms with lower stock market turnover (not reported). The conclusions do not change with the inclusion of firm size, either qualitative or quantitatively.

4.3. Survival

Having shown that interlocking boards had a measurable impact on the capital structure and performance of firms. Our third hypothesis relates the connection with a bank with the survival of firms over time. The hypothesis is that having connections with banks allows firms to better survive. On the one hand, better credit access should result in higher investment. On the other hand, it would allow firms to face economic downturns because these would provide the necessary liquidity. Our period of analysis is particularly interesting because it covers the impact of the great depression with the collapse of the nitrate industry leading to significant changes in Chilean economic policy (Cabezón, 1971).

We can rely on information from the Santiago Stock Exchange to determine whether the firm was still publicly listed in the future and use that as a measure of firm survival. We then correlate this indicator with whether the firm was connected using probit regressions in Table 7. We look at approximately two and four decades into the future: 1939 and in 1962. The results show that having connections with banks significantly increases the survival probability of a firm well into the future. And, again, our results show that it is not the relation to other firms that is associated to higher survival rates (which enters insignificantly) but just the links to banks that matter.

5. Conclusions

Having access to finance matters and when credit is not easy to come by, it is natural to expect firms to somehow react. One way to do this is by linking to banks and, by easing these financial constraints, improve performance, and ultimately enhance valuation and ensure survival. Based on a novel dataset for 252 companies with almost 2000 board members in Chile circa 1920, this paper documents that there were important linkages between firms and banks, that firms connected to banks via interlocking directorates had higher leverage, higher

Table 7
Effect of connections on firm survival.

Probit regressions Probability of survival by 1939 and 1962		
	1939 (1)	1962 (2)
Connected to bank	0.509* (0.212)	0.504* (0.227)
Connected to another firm	- 0.745 (0.683)	- 0.044 (0.676)
Industry effects	Yes	Yes
Observations	173	173
Pseudo R2	0.072	0.032

Robust Standards error on parenthesis (*) Significant 5%, (**) Significant 1%, (***) Significant 0.1%.

valuations in the market, and higher probability of survival.

Looking at a period in which interlocking and credit were largely unregulated provides a useful natural laboratory to explore the financial channel of corporate networks. It also allows to measure long-term outcomes such as the survival of the firm. However, focusing on a very earlier time comes at a cost in terms of data availability. This is the main weakness of this paper. Indeed, if one had had more data, further robustness checks could have been conducted in terms of the dependent variables (other measures of valuation, indebtedness, and performance), and controls. Likewise, data for a greater number of firms would have allowed to split the sample according to firm characteristics and test whether the effects were stronger for the firms that are more likely to be affected by financial constraints.

A second weakness is that we see the network and the performance of firms under only one institutional context. There are many indications that financial constraints were important at the time, but one would be surer that this is related to finance if one had variation in these conditions. In this sense, there are two main avenues in the research agenda: to extend the analysis to other countries and to look at Chile in other periods.

A longitudinal study can help us understand how the network adapted to the institutional changes. The extent to which interlocking with banks continued to serve as a mechanism to counteract a weak financial environment and scarce credit availability. How did the network density and its central players changed over time? Did the impact of being connected decreased in the context of the State becoming a central player in the economic and lending activity? Did the importance of banks as central actors within the interlocking network declined as a result of domestic capital market development and international financial integration? Chile is a good place to explore these issues because there have been very dramatic institutional changes in the last hundred years. Our results are relevant to understanding the dynamics of network density over time. Different authors have shown that network density across the world has decreased significantly since the 1980s, a period in which financial systems grew rapidly and became increasingly integrated (David & Westerhuis, 2014; Davis & Mizruchi, 1999).

Regarding the other dimension, we provided some evidence in favor of our hypotheses by comparing bank centrality in Brazil, Mexico and the U.S., but a deeper cross-sectional study would also be useful. In particular, one would like to see the effects of this on access to credit, value and survival. The first two might be more difficult due to lack of data but the former is more straightforward.

Testing ancillary implications of the financial mechanism should also be pursued. The effects on the production structure of the countries are particularly interesting because of its persistence in time and impact on political developments. For instance, how much of the strong concentration of production in the commodities sector in Latin American countries owes to the fact that financing is relatively easy via foreign trade credit? How did this affect the political forces and ultimately the policies carried out?

Finally, the agenda also involves going beyond the financial channel and exploring other dimensions for which interlocking directorates might be relevant, both in Chile and other developing economies. Interlocking analysis could be useful to help us understanding the origins of business groups and their prevalence in developing economies until today.

Our results also have important policy implications. New regulations on interlocking directorates are being undertaken and discussed around the world. This is true regarding antitrust arguments stating that interlocking might restrict competition and therefore should be prohibited or restricted, but also from pressures from regulators of the financial sector. In addition, Codes of Corporate Governance enacted around the world in recent years often recommend some restrictions on interlocking directorates. Importantly, our results suggest that this discussion and institutional arrangements should not neglect that

interlocking with banks can be a welfare-increasing tool, particularly in economies where firms face financial restrictions.

Acknowledgments

The authors gratefully acknowledge the suggestions to earlier versions of this paper made by participants at PUC Clío Conference, SECHI annual conference, SMLA Conference and two anonymous referees. The authors alone are responsible for all limitations and errors that made relate to the paper. Matías Braun wishes to thank the Latin American Centre at The University of Oxford, where part of the research that led to this paper was conducted while he was a visiting fellow there.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not for profit sectors.

References

- Anderson, J., Håkansson, H., & Johanson, J. (1994). Dyadic business relationships within a business network context. *Journal of Marketing*, 58(4), 1–15.
- Baccini, A., & Marroni, L. (2016). Regulation of interlocking directorates in the financial sector. A comparative case study. *European Journal of Law and Economics*, 41(2), 431–457.
- Booth, J. R., Cornett, M., & Hassan, T. (2002). Boards of directors, ownership, and regulation. *Journal of Banking & Finance*, 26(10), 1973–1996.
- Booth, J. R., & Deli, D. N. (1999). On executives of financial institutions as outside directors. *Journal of Corporate Finance*, 5, 227–250.
- Brennecke, J., & Rank, O. N. (2017). Tie heterogeneity in networks of interlocking directorates: A cost–benefit approach to firms' tie choice. *Journal of Business Research*, 10(1), 97–122.
- Byrd, D. J., & Mizruchi, M. S. (2005). Bankers on the board and the debt ratio of firms. *Journal of Corporate Finance*, 11, 129–173.
- Cabezón, P. (1971). Antecedentes Históricos de las Importaciones y de la Política Comercial Chilena. *Cuadernos de Economía*, 8(25), 1–35.
- Couyoumdjian, J. P., & Salvaj, E. (2016). “Interlocked” business groups and the state in Chile (1970–2010). *Business History*, 58(1), 129–148.
- Couyoumdjian, R. (1986). *Chile y Gran Bretaña durante la Primera Guerra mundial y la Postguerra, 1914–1921*. Santiago de Chile: Editorial Andrés Bello.
- Cronin, B. (2011). Networks of corporate power revisited. *Procedia - Social and Behavioral Sciences*, 10, 43–51.
- David, T., & Westerhuis, G. (Eds.). (2014). *The power of corporate networks: A comparative and historical perspective*. Routledge International.
- Davids, G. (1996). The significance of board interlocks for corporate governance. *Corporate Governance: An International Review*, 4(3), 154–159.
- Davis, G. F., & Mizruchi, M. (1999). The money enter cannot hold: Commercial banks in the US system of corporate governance. *Administrative Science Quarterly*, 44(2), 215–239.
- Denis, D., & McConnell, J. (2003). International corporate governance. *Journal of Financial and Quantitative Analysis*, 38(1), 1–36.
- Engelberg, J., Gao, P., & Parsons, Ch. A. (2012). Friends with money. *Journal of Financial Economics*, 103(1), 169–188.
- Ghosh, S. (2016). Banker on board and innovative activity. *Journal of Business Research*, 69(10), 4205–4214.
- Haunschild, P. R., & Beckman, C. M. (1998). When do interlocks matter? Alternate sources of information and interlock influence. *Administrative Science Quarterly*, 43(4), 815–844.
- Henneberg, S. C., Naudé, P., & Mouzas, S. (2010). Sense-making and management in business networks—Some observations, considerations, and a research agenda. *Industrial Marketing Management*, 39(3), 355–360.
- Islas, G. (2015). Corporate governance and ownership in Chile, 1854–2012. In G. Jones, & A. Lluch (Eds.). *The impact of globalization on Argentina and Chile*. Edgar Publishing.
- Jacobs, M. (2014). Combatting anticompetitive interlocks: Section 8 of the Clayton act as a template for small and emerging economies. *Fordham International Law Journal*, 37(3), 643–685.
- King, R., & Levine, R. (1993). Finance and growth: Schumpeter might be right. *The Quarterly Journal of Economics*, 108(3), 717–737.
- Kossev, K. (2009). The phenomenon of interlocking, early development banks and their efficiency: The pre-1945 European periphery in a wider context. *Oxonomics*, 4(2), 32–37.
- Kroszner, R., & Strahan, P. (2001). Bankers on boards: Monitoring, conflicts of interest, and lender liability. *Journal of Financial Economics*, 62(3), 415–452.
- La Porta, R., López de Silanes, F., Shleifer, A., & Vishny, R. (1997). Legal determinants of external finance. *Journal of Finance*, 52, 1131–1150.
- La Porta, R., Lopez-De-Silanes, F., Shleifer, A., & Vishny, R. (2002). Investor protection and corporate valuation. *The Journal of Finance*, 57(3), 1147–1170.
- Lamoreaux, N. (1994). *Insider lending: Banks, personal connections, and economic development in industrial New England*. New York: Cambridge University Press.
- Larcker, D., Sob, E. C., & Wang, C. C. Y. (2013). Boardroom centrality and firm performance. *Journal of Accounting and Economics*, 55(2–3), 225–250.
- Linck, J., Netter, J., & Yang, T. (2007). The determinants of board structure. *Journal of Financial Economics*, 87(2), 308–328.
- Lluch, A., & Salvaj, E. (2012). A comparative study of interlocking directorates at the end of the import-substituting industrialization period in Argentina and Chile. *Redes. Revista Hispana para el Análisis de Redes Sociales*, 23, 80–112.
- Lluch, A., & Salvaj, E. (2015). Longitudinal study of interlocking directorates in Argentina and foreign firms' integration into local capitalism, 1923–2000. In D. Thomas, & G. Westerhuis (Eds.). *The power of corporate networks: A comparative and historical perspective*. Routledge.
- Mazzola, E., Perrone, G., & Kamuriwo, D. S. (2016). The interaction between inter-firm and interlocking directorate networks on firm's new product development outcomes. *Journal of Business Research*, 69, 672–682.
- Mintz, B., & Schwartz, M. (1985). *The power structure of American business*. Chicago: The University of Chicago Press.
- Mizruchi, M. (1996). What do interlocks do? An analysis, critique and assessment of research on interlocking directorates. *Annual Review of Sociology*, 22, 271–298.
- Mizruchi, M. S., & Stearns, L. B. (1988). A longitudinal study of the formation of interlocking directorates. *Administrative Science Quarterly*, 33(2), 194–210.
- Musacchio, A. (2009). *Drawing links between corporate governance and networks: Bankers in the corporate networks of Brazil, Mexico and the United States circa 1910*. 54(1), Entreprises D'Amérique Latine 16–36.
- Musacchio, A., & Read, I. (2007). Bankers, industrialists, and their cliques: Elite networks in Mexico and Brazil during early industrialization. *Enterprise and Society*, 8(4), 842–880.
- OECD (2008). *Antitrust issues involving minority shareholding and interlocking directorates*. 30. DAF/COMP.
- Okazaki, T., Sawada, M., & Yokoyama, K. (2005). Measuring the extent and implications of director interlocking in the prewar Japanese banking industry. *The Journal of Economic History*, 65(4), 1082–1115.
- Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations: A resource dependence perspective*. New York: Harper and Row.
- Rajan, R., & Zingales, L. (1998). Financial dependence and growth. *American Economic Review*, 88, 559–586.
- Rajan, R., & Zingales, L. (2003). The great reversals: The politics of financial development in the twentieth century. *Journal of Financial Economics*, 69, 5–50.
- Richardson, R. J. (1987). Directorship interlocks and corporate profitability. *Administrative Science Quarterly*, 32(3), 367–386.
- Santos, R. L., Silveira, A. M., & Barros, L. A. (2012). Board interlocking in Brazil: directors' participation in multiple companies and its effect on and profitability. *Latin American Business Review*, 13(1), 1–28.
- Scott, J. (1991). *Social network analysis: A handbook*. 1991. Sage Publications.
- Shropshire, C. (2010). The role of the interlocking director and board receptivity in the diffusion of practices. *Academy of Management Review*, 35(2), 246–264.
- Silva, F., Paredes, R., & Majluf, N. (2006). Family ties, interlocking directors and performance of business groups in emerging countries: The case of Chile. *Journal of Business Research*, 59, 315–321.
- Sisli-Ciamarra, E. (2012). Monitoring by affiliated bankers on Board of Directors: Evidence from corporate financing outcomes. *Financial Management*, 41(3), 665–702.
- Stockman, F., Ziegler, R., & Scott, J. (Eds.). (1985). *Networks of corporate power: A comparative analysis of ten countries*. Cambridge: Polity Press.
- Törnroos, J. A., Halinen, A., & Medlin, C. (2016). Dimensions of space in business network research. *Industrial Marketing Management*, 61, 10–19.
- Undurraga, J. (1922). *La Riqueza Mobiliaria de Chile*. Santiago de Chile: Sociedad Imprenta y Litografía Universo.
- Van den Bergh, L. (2012). *International standardisation of good corporate governance: Best practices for the Board of Directors*. Springer Science & Business Media.
- Westphal, J. D., Seidel, M.-D. L., & Stewart, K. J. (2001). Second-order imitation: Uncovering latent effects of board network ties. *Administrative Science Quarterly*, 46(4), 717–747.
- Windolf, P. (2002). *Corporate networks in Europe and the United States*. Oxford: Oxford University Press.

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