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Board social capital reduces implied cost of capital for private companies but not of state-owned companies

Alex Ferreira Goncalves and Luciano Rossoni
Graduate Program in Administration,
Universidade do Grande Rio, Rio de Janeiro, Brazil, and
Wesley Mendes-Da-Silva
Department of Corporate Finance,
Sao Paulo School of Business Administration of Fundacao Getulio Vargas,
Sao Paulo, Brazil

Abstract

Purpose – The purpose of this paper is to analyze how the type of ownership and control moderates the effect of the board social capital on the implied cost of capital. To do so, the authors analyzed the effect of the board social capital by the relational resources present in its direct and heterogenous ties, considering the predictions of analysts about the implied cost of capital.
Design/methodology/approach – The data panel comprised 137 companies listed on the Brazilian stock exchange between the years of 2002 and 2015, generating a total of 535 observations. The authors check the robustness of the results through instrumental variables and systems of equations, as well as compete for the effect of board social capital both by the board and ownership structures.
Findings – Results show that the board relational resources, both in direct and heterogeneous ties, significantly reduce the implied cost of capital for private companies, but not for state-owned companies. Board social capital reduces the cost of capital even when the results compete with the board structure and concentration of ownership, being able to mitigate the discount in the cost of capital by the presence of dominant shareholders.
Originality/value – This study uses a more theoretically and empirically comprehensive measure of board social capital than the majority of studies that use only network position indicators. So, contrasting the effect of this measure on the implied cost of capital between private and state-owned companies, the authors also demonstrate that the board social capital can mitigate the discount by ownership concentration on the implied cost of capital.

Keywords Social capital, Stock exchange, Cost of capital, Board interlock, State-owned companies
Paper type Research paper

Introduction

In this paper, we empirically investigate how the material and symbolic resources available in the board of directors' network can be a powerful mechanism to increase the board's strength in properly monitoring executives and controlling the opportunism of stockholders. Consequently, the board's greater strength and privileged position may mitigate agency problems and reduce information asymmetry between equity-holding companies and securities analysts (Ferris *et al.*, 2017; Uzzi, 1999). Therefore, we have tested the hypothesis that boards with valuable relational resources, i.e. greater board social capital, are a relevant mechanism to mitigate firms' cost of capital.

We define relational resources as those symbolic and material resources that do not belong to a company but that can potentially be mobilized through network relationships and by means of the board interlock (Rossoni *et al.*, 2018). Board interlocks occur when a board

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member of an "A" company acts simultaneously on the board of a "B" company, creating a bond for the exchange of benefits (Davis, 1996; Caiazza and Simoni, 2015; Mizruchi, 1996).

Relational resources, although they are one of the essential dimensions of social capital (Lin, 2001), are practically set aside in the board interlock literature (Johnson *et al.*, 2013; Rossoni *et al.*, 2018; Zona *et al.*, 2018), since most studies consider as proxy of board social capital the number of ties, at most, specifying the type of actor you are relating to (An and Jin, 2004; Connelly *et al.*, 2011; Ferris *et al.*, 2017; Fracassi and Tate, 2012; Kim, 2007; Stuart and Yim, 2010).

Faced with the recurrent limitation in the literature on board social capital, based on Lin (2001), Rossoni *et al.* (2018) and Zona *et al.* (2018), we use a social capital proxy that captures at the same time the number of interlocks weighted by the relational resources. Indeed, we operationalize the board relational resources from the sum of the market value of all the companies that a firm has an interlock with. Therefore, firms that have ties with more valuable firms, in our proxy, have greater social capital.

We advocate that our board social capital proxy especially has two advantages. First, ties with higher-value firms should potentially provide access to most valuable material and symbolic resources that firms of lower value (Burt, 1992; Davis, 1996; Kim, 2007; Ferris *et al.*, 2017; Rossoni *et al.*, 2018). Second, we understand that directors from higher-value firms tend to have a higher reputation and prestige, which makes them stronger on the board. Stronger directors can act as more rigorous monitors, mitigating the opportunism of executives and controlling shareholders (Dahya *et al.*, 2008), even because there is a greater moral charge in the boardroom for them to act professionally (Davis, 1996).

Additionally, because these board relational resources are means for obtaining privileged information and differentiated knowledge, we also consider the market value of relationships based on the heterogeneity of such ties, measured through structural holes. Structural holes are rich ties in non-redundant relationships, more likely to have new and valuable information (Burt, 1992).

According to these definitions, which are based on the premise that resources are unequally distributed in networks (Lin, 2001), we argue that board social capital allows effective access to financial capital by the companies with the most competitive costs (Ferris *et al.*, 2017; Finegold *et al.*, 2007; Hou *et al.*, 2012; Pombo and Gutiérrez, 2011; Rossoni *et al.*, 2018; Zona *et al.*, 2018) To demonstrate our argument, we analyze 137 companies listed in the Brazilian stock exchange between the years of 2002 and 2015, showing the effect of the board social capital on predictions of analysts regarding the implied cost of capital.

We chose the cost of financial capital because it is fundamental to firm leverage since it is one of the most important resources for publicly traded companies, whose financing strategies are fundamental for their survival and growth (Uzzi, 1999). For that, we have chosen estimates of the implied (*ex ante*) cost of capital, which is based on the prediction of analysts (Espinosa and Trombetta, 2007; Souissi and Khlif, 2012). This is because Fama and French (2002) and Gebhardt *et al.* (2001) demonstrated the superiority of *ex ante* models over *ex post* models.

So, we contrast our results with public and privately controlled companies. Problems and peculiarities inherent in public management restrict, or sometimes render unfeasible, the performance of the board members as a source of external resources. Among these problems, we can highlight, for example: expropriation of the interests of minority shareholders by the state (Yoshikawa *et al.*, 2014); management of antagonistic interests created by the state's regulatory and regulatory function (Shleifer and Vishny, 2002); and misappropriation of public resources to attend to their own interests, partisans or votes (Shleifer and Vishny, 1997, 2002; Pedersen and Thomsen, 2003). These problems, which are inherent in state-owned companies, at least hypothetically, make it difficult for board members to freely exercise their role of monitoring executives and dominant shareholders and collecting external resources, which would lead to a lesser impact from board social capital on the implied capital cost of state-owned companies.

Our results pointed out that the board social capital reduces the implied cost of capital for private companies but not for state-owned companies. For these reasons, we checked whether our board social capital proxy was robust when we contrasted the effect on the implied cost of capital with other board structure variables: board size, number of interlocks and outsiders. Given the ability of dominant shareholders to mitigate the board effect (Dahya *et al.*, 2008), we also check whether the board social capital was significant when contrasted with ownership concentration. Using instrumental variables and systems of equations, we have also demonstrated that the board social capital mitigates the discount of the ownership concentration on the implied cost of capital. Finally, we section the sample according to the level of corporate governance in the Brazilian stock market, demonstrating that the board social capital only operates at higher levels of governance quality.

Theory and hypotheses

The board of directors is a form of the collegiate body that constitutes one of the main tools of corporate governance (Davis, 1996; Mizruchi, 1996). When board members are part of different boards, they establish ties between boards. Studies show that board members with ties increase the possibility of business (Stuart and Yim, 2010), can influence decisions regarding international business expansion (Connelly *et al.*, 2011) and engage in acquisitions (Haunschild, 1994). There is evidence that boards with the highest number of ties are associated with higher values for the companies (Bohren and Strom, 2010) and high sales rates (Kor and Sundaramurthy, 2008). Davis (1996) and Mizruchi (1996) argue that good board members tend to participate in a larger number of companies, their centrality in the network being a measure of their prestige. Well-positioned board members in the network have access to information and privileged resources since they have access to groups that are not connected to each other, thus acting as "bridges" (Davis, 1996). This access to resources and information constitutes the so-called social capital.

Burt (1992) argues that through social capital – namely, through various relationships and their potential benefits – companies find opportunities to convert human and financial capital into profit. Burt's (1992) arguments are very close to the argument synthesized by Lin (2001), who postulates that social capital is the investment in social relations with expected returns in the market, that is, individuals engage in interactions and relationships to produce economic and social benefits. This is so relevant for the topic that Lin *et al.* (2001, p. 58) define social capital as "[…] resources immersed in a social structure accessed and/or through intentional actions […]." Ties and resources immersed in the network facilitate the flow of information, exert influence on agents who have critical roles in decisions, signal individual's credentials and reinforce identity and recognition (Lin, 2001).

Agreeing with the authors, Flap (2002) also states that social capital has three elements: number of people in the social network; the strength or intensity of relationships; and the resources of these people. This idea is reinforced by Coleman (1994), who emphasizes that social capital is comprised of the real or potential resources obtained through relationships. In other words, social capital consists of resources embedded in social relations and social structures, which can be mobilized when actors want to increase the probability of success of a certain action (Burt, 1992; Lin *et al.*, 2001).

Rossoni *et al.* (2018) argue that previous research on the board's role (Ferris *et al.*, 2017; Fracassi and Tate, 2012; Kor and Sundaramurthy, 2008; Kim, 2007; Pombo and Gutiérrez, 2011; Stuart and Yim, 2010) uses theories or metaphors of social capital focused on the influence of board position measures within the social network to determine boards and board members with more privileged positions within the network. They argue that previous studies did not consider the resources that board members bring to organizations, from their type, disposition and volume, thus disregarding one of the essential dimensions of social capital: relational resources. Seeing this gap in the empirical studies on board

interlock, the authors used as a measure of social capital the interaction between the number of interlocks between the board and the market value of the interconnected companies, finding a significant effect on the market performance of the Brazilian companies.

Relational resources are the symbolic and material resources that do not belong to a company but that can potentially be mobilized through network relationships and by means of the board interlock (Rossoni *et al.*, 2018). Given the usefulness of considering the relational resources embedded in board interlocks, we sought to evaluate whether the board social capital, as outlined by Rossoni *et al.* (2018), can also influence market analysts' predictions on the implied cost of capital. This is because the cost of capital is based on the role of ensuring sustainable growth of a company, given the scarcity of international resources and the high cost of domestic financing (Lee *et al.*, 2009). To do so, in empirical terms, it is worth noting that there are two different approaches to measuring the cost of capital. One is called *ex post* and is based on the history of returns. The other is called the implied cost of capital, or *ex ante*, and is based on the prediction of market analysts (Espinosa and Trombetta, 2007; Souissi and Khlif, 2012). In this study, we follow the latter approach, since Fama and French (2002) and Gebhardt *et al.* (2001) consider *ex ante* models more precise than *ex post* models. *Ex ante* models aim to obtain the expected rate of return on equity, considering that these rates of return are impacted by current stock prices and future earnings (Easton, 2004). In this way, the value of the assets and the cash flows can be observed in the market, and through these variables, it is possible to estimate the cost of capital, define as the rate that makes the present value of the cash flow equal to the value of the capital of the asset in question (Espinosa and Trombetta, 2007).

We advocate that two mechanisms of board social capital are fundamental to mitigate the implied cost of capital: one informational, and the other based on power. The first, informational, is important because the implied cost of capital is based on the interpretation of analysts and tends to be more sensitive to signals emitted by the circulation of company board members, especially as they try to articulate the different companies that are part of the board to try to raise access to finance and resources with lower rates (Ferris *et al.*, 2017; Uzzi, 1999). But this movement in attracting better rates to generate cash surpluses is clearly more successful for companies of higher value are involved, since these companies are expected to provide valuable knowledge and resources whose ambiguity is more easily disrupted through contacts and relationships directly (Rossoni *et al.*, 2018). We understand that directors from higher-value firms tend to have a higher reputation and prestige, which makes them stronger on the board.

The second mechanism is based on the power or strength of the board. Stronger directors can act as more rigorous monitors, mitigating the opportunism of executives and controlling shareholders (Dahya *et al.*, 2008), even because there is a greater moral charge in the boardroom for them to act professionally (Davis, 1996; Connelly and Van Slyke, 2012) assuming a commitment to higher levels of governance quality (Dahya *et al.*, 2008). In our case, we have deliberately assumed that directors from higher-value companies are stronger and, at the same time, have more reason to engage in higher levels of governance, especially in countries such as Brazil, whose agency conflict occurs between controlling and minority shareholders; Hence, it shows the importance of considering the role of board interlock with the value of interconnected firms (Ferris *et al.*, 2017). From those arguments, we propose that:

H1. The greater the amount of relational resources present in direct board relationships, the lower is the cost of capital for the company.

We also address the heterogeneity of board relational resources present in the structural holes of networks. The common sense thought is that the larger the size of the network, the greater the access to resources (Connelly and Van Slyke, 2012). However, maintaining relationships involves time, energy and money investments that can mitigate the positive

effects of the greater number of ties. In fact, Burt (1992) argues that what matters is the number of non-redundant contacts. Contacts are redundant as they lead to the same person through different intermediaries, and thus provide the same information benefits. According to Burt (1992), the solution would be to focus on non-redundant contacts, full of structural holes, which have unique resources and information.

Thus, relational resources are heterogeneous when they are not redundant (Rossoni *et al.*, 2018). Hite and Hesterly (2001) argue that networks full of structural holes have access to more resources that lead to better company performance. Board members with more structural holes tend to be more valued since their presence in a company signals management legitimacy (Davis, 1996). In addition, as non-redundant knowledge, information and resources may be more valuable in companies whose board ties are poorly redundant, it is expected that the same mechanisms that make companies with higher board equity get better ratings by analysts about their cost of capital are amplified by the heterogeneity of the ties. Therefore, from the arguments presented, we propose:

H2. The greater the heterogeneity of the board's relational resources, the lower is the cost of capital of the company.

Companies in which government is the dominant shareholder imply that bureaucrats and politicians might be eager to divert resources into their own interests (Dahya *et al.*, 2008; Shleifer and Vishny, 1997). According to Yoshikawa *et al.* (2014), the main agency problem in state-owned companies is the expropriation of the interests of minority shareholders, since, in addition to the controlling role, government has a regulatory function, having to balance often antagonistic interests, such as pursuit of profit, social welfare and protection against external competition (Shleifer and Vishny, 2002). Because of the often abundant but poorly managed public resources and the search for power through corporate policies, state owners tend to pay little attention to outside board members, the latter being mere "rubber stampers" who are not supposed to monitor, nor do they provide resources (Yoshikawa *et al.*, 2014).

External actors are also affected by social distancing since boards of state-owned companies are mostly composed by politicians or politically connected board members whose ideologies often dominate the board (Yoshikawa *et al.*, 2014). This exclusion of external board members limits their role of monitoring and the seeking of resources. Pedersen and Thomsen (2003) also argue that inefficient governments favor interest groups and buy votes, thus reducing the value of companies, which may be related to limiting the role of board members as fund managers.

In countries with underdeveloped governance institutions, such as Brazil, the absence of well-developed investor protection regulations allows the state to easily rescue the company by providing subsidies, credit, information or other forms of protection at the expense of shareholders (Aharoni, 1986), which makes the role of fundraisers of external board members irrelevant. In this way, we expect that the influence of social capital on the reduction of companies' cost of capital can be minimized by the negative influence of public ownership dominance on companies. Therefore, we propose that:

H3a. The influence of the board's social capital in reducing the cost of capital is lower in publicly controlled companies than in those that are privately controlled.

H3b. The influence of the board's social capital through the structural holes in the reduction of the cost of capital is lower in publicly controlled companies than in those that are privately controlled.

Method

Data

Our sample comprised 137 State and private Brazilian-owned companies listed on B3 (formerly BM&FBovespa) covered by securities analysts. Since the implied cost of capital is

composed precisely by the projections of such analysts, data collection between 2002 and 2015 generated a total of 535 observations, which is lower than the population (18.1 percent). For reasons of cost and relevance, rating agencies select companies with greater liquidity and market capitalization in the Brazilian stock market (see Figure 1). Despite the limited sample, because of the availability of implied cost of capital, companies covered by analysts accounted for 81 percent of market capitalization in the period; total assets are on average four times higher, whose shares have 3.6 more liquidity. We started collecting data in 2002 because that year began to operate the B3's *Novo Mercado*, closing the collection in 2015, which was the last year that data were available from the Securities and Exchange Commission (CVM).

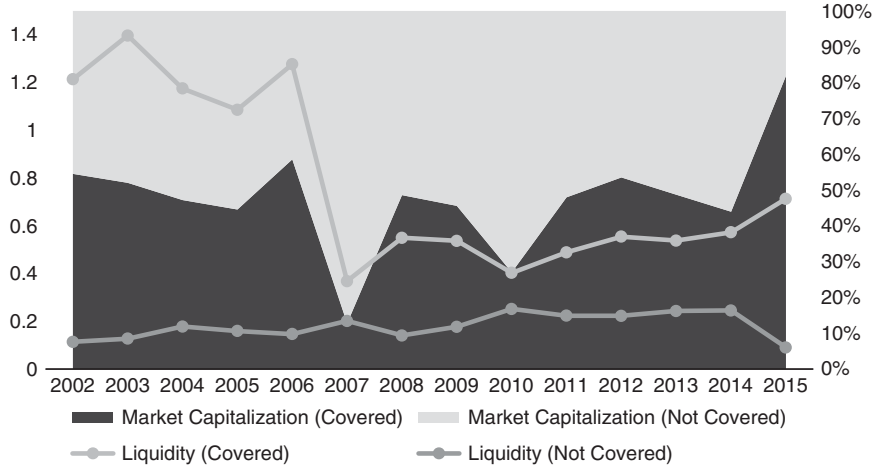
Variables

The operational definition of the variables is shown in Table I.

Econometric models and robustness checks

To test the hypotheses, we used panel data analysis. Panel data are indicated when we have several cases (N) with a few observations in time (T), generating $N \times T$ observations (Baltagi, 2005). Three econometric regression models were used: ordinary least squares pooled, fixed effects (EF) and random effects (GLS). The best fit for each model followed the Greene's (2000) hypotheses. Thus, to test our *H3a* and *H3b*, we divided the sample into two subgroups: one of the private companies, another of public (state-owned) companies, generating a panel model for each one.

After specifying the most appropriate model for each of the analyses, we verified the consistency of the results through seven strategies. First, we evaluated the existence of co-linearity problems among the independent variables of the study. We separate the models of social capital from direct and heterogeneous relationships for these reasons. We also assessed whether the models had heteroscedasticity problems using the White test, using robust standard errors to correct them. Then, we checked whether the coefficients were consistent when we regressed the models without the non-significant variables, as well as if they had the same trend without the outliers. We also verified whether other functional forms of the independent variables had a significantly greater



Note: Sample formed by companies covered by analysts

Figure 1.
Brazilian companies covered by the securities analysts (2002–2015)

Variables	Description
Dependent variable: implied cost of capital	
RPEG	Based on the model developed by Ohlson and Juettner-Nauroth (2000), Easton (2004) created an estimate of the cost of capital called the "Price Earnings to Growth model" (RPEG). Also called implicit or *ex ante* cost of capital, it determines that the value of the assets and their cash flows can be observed in the market and based on them it is possible to estimate the discount rate that makes the present value of the cash flow equal to the market value of the capital of the asset analyzed (Espinosa and Trombetta, 2007). Used in previous studies (Espinosa and Trombetta, 2007), the RPEG cost of capital can be defined as: $Pt = \left(EPS_{(t+2)} - EPS_{(t+1)}\right)/(R_{PEG})^2$, where RPEG is *ex ante* cost of capital on date t, in which PEG refers to the price-earnings model of growth as per Ohlson and Juettner-Nauroth (2000) (price-earnings to growth ratio); $EPS_{(t+2)}$ is (earnings per share) medium value of earnings predicted by analysts in t+2; EPS refers to the liquid earnings per share obtained by the company in period t; $EPS_{(t+1)}$ is (earnings per share) medium value of earnings predicted by analysts in t+1; P_t is price of stock in the last day of pricing for which the own cost of capital is being calculated in t_0
MPEG	Alternative proxy obtained according to the modified price to earnings growth model. Used in previous studies (Easton, 2004), the MPEG cost of capital can be defined as: $Po = \left(EPS_{(t+2)} + R_{MPEG}dps_{(t+1)} - EPS_{(t+1)}\right)/(r_{MPEG})^2$ where R_{MPEG} is *ex ante* cost of capital on date t, in which MPEG refers to the modified price to earnings growth model (Easton, 2004); $EPS_{(t+2)}$ is (earnings per share) medium value of earnings predicted by analysts in t+2; $EPS_{(t+1)}$ is (earnings per share) medium value of earnings predicted by analysts in t+1; $dps_{(t+1)}$ is expected dividend per share in $_{t+1}$; Po is price of stock in the last day of pricing for which the own cost of capital is being calculated in t_0
Independent variables	
Board social capital: direct relations	Following Rossoni *et al.* (2018), this variable was operationalized through the sum of the relational resources present in direct board ties with other companies listed on the Brazilian stock exchange. Thus, an *ij* tie was formed when two companies had a director in common. In equation below, for each company n_i, in each year between 2002 and 2015, we added the relational resources X_{ij}, where X_{ij} is the market value of company j that is board interlocked with the company n_i: $\text{Board Social Capital}(n_i) = \sum_j X_{ij}$, were $i \neq j$
Board social capital: heterogeneous relations	This variable was similarly operationalized as the board social capital. However, for each company n_i, we added the interaction term relational resources X_{ij} by $(1-r_{ij})$, which indicates the heterogeneity of each tie *ij*. Before this, we generated the redundancy value r_{ij} of each of the interlocks *ij* through the structural holes method (Burt, 1992). Companies with high redundancy ties have few structural holes. So, the rational is that the effect of the relational resources (market value of each interlocked company) is weighted by the structural holes. The equation below formalizes this argument, where we repeated the operation between the years 2002 and 2015 for each of the companies n_i: $\text{Heterogeneous Board Social Capital}(n_i) = \sum_j X_{ij}\ \left(1-r_{ij}\right)$, were $i \neq j$
Board structure variables	
Board size	Number of directors of a company participating in a board of directors in a year t
Board interlocks (degree)	Number of adjacent ties a board has other boards by share the same director (Davis, 1996)
Outsiders	This variable was represented by the percentage share of the number of members of the board of directors of a company i, in year t, who did not accumulate executive functions in the same company (Rossoni *et al.*, 2018)

Table I.
Variables

(*continued*)

Variables	Description
Ownership structure variables	
Dominant shareholder	That is represented by the biggest percentage of the shares with voting rights detained by an individual shareholder in a specific company (Dahya *et al.*, 2008)
Sum 3 larger shareholders	That is represented by the sum of the percentage of the shares with voting rights detained by the three larger shareholders in a specific company
HHI 5 larger shareholder	We use an adaptation of the Herfindahl–Hirschman Index (HHI) to measure the ownership concentration. Their values vary between 0 and 1, in that the higher the index, the higher the concentration. It is calculated by summing the square of the individual shares owned by each of the five larger shareholders holding the ownership of a particular company (see the following equation): $\text{HHI} = \sum_{i=1}^{M} (\beta_i^2)$ where $M = 5$ (five larger shareholders); $\beta_{i=} Q_i / \sum_{i=1}^{M} Q_i$. It is the individual ownership share from the owner i
Control variables: finance and firm level	
Company size	Natural logarithm of the total assets volume in a given year, as did previous studies (Ferris *et al.*, 2017)
Tobin's Q	Sum of the market value of its shares, plus its debts, which is divided by the book value of its total assets (Bozec, Dia and Bozec, 2010; Chung and Pruitt, 1994). The calculation was operationalized according to the following equation, through information collected for each company in each of the years between 2002 and 2015, obtained through the Bloomberg database: $\text{Tobin}'\text{s } Q = (\text{VMaO} + \text{VMaP} + (\text{VCPC} - \text{VCAC} + \text{VCE} + \text{VCDLP}))/\text{VCAT}$, in which VMaO is market value of ordinary shares; VMaP is market value of preferential shares; VCAT is book value of the organization's total assets; VCPC is book value of current liabilities; VCAC is book value of current assets; VCE is book value of stock; and VCDLP is book value of long-term debt
Return on asset (ROA)	The index was collected for each company listed in B3 through annual consolidated data (2002 to 2015), with December as the reference month for each year
Stock volatility	The intensity and frequency of the oscillations in the price of an asset in a given period. We considerate the series of daily quotations, in which the calculation of the annual volatility of stock returns of each company was based on the last 12 months, as per Fombrun and Shanley (1990) and Rossoni and Mendes-Da-Silva (2018)
Asset tangibility	Sum of the value of inventories with fixed assets, divided by the value of the company's total assets (Pombo and Gutiérrez, 2011)
Sales growth	Percentage growth of one-year revenue compared to the previous year (Cao and Li, 2015), in which growth was operationalized according to: $\text{Sales growth}_{(t)} = (\text{Sales volume}_{(t)} - \text{Sales volume}_{(t-1)})/\text{Sales volume}_{(t-1)}$

Source: Economatica®, Bloomberg® and CVM

Table I.

effect. After, we evaluated if the coefficients were robust in the GLS models since all our models were shown of the type fixed effects like more robust. Finally, as the sample of state-owned companies was small, we checked whether the regression coefficients were robust, considering the power of the test (Faul *et al.*, 2009). For a sample of 41 cases with seven variables, based on a 95 percent significance, on the correlation between the variables, and on the R^2 value of the models, the power of the exact test was 99.6 percent, of the coefficient estimate was 99, 9 percent and the F-test was 98.7 percent, demonstrating that there is no detriment in the effect for the sample of state-owned companies, although the coefficients of the independent variable were not significant.

As our panel comprised the years 2002–2015, which permeate the 2008–2009 crisis, we tested the structural break in the models through the structural change regression based on the Chow test (Shehata, 2011), considering the pre-crisis (2002–2007) and post-crisis (2008–2015) periods. In addition, we check the effect of the 2008–2009 crisis on the structural

break using the Dufour (1980) model, which suggests performing the interaction of all the independent variables with the crisis period dummy. These analyses, as well as all additional analyses, were done only for private companies, since only in this sample the coefficients were significant.

To check the robustness of the results, we initially contrasted the independent variables with other board structure variables, since most studies are based on measures such as board size (Fracassi and Tate, 2012), outsiders (Dahya *et al.*, 2008; Johnson *et al.*, 2013) and number of interlocks (Ferris *et al.*, 2017; Johnson *et al.*, 2013). Afterward, we also evaluated whether our results were robust as controlled by the ownership concentration since there is a possibility that dominant shareholders could try to limit the influence of more powerful directors (Dahya *et al.*, 2008). So, we used variables that captured the concentration of voting rights in the hands of the dominant shareholder, the three largest shareholders and the top five.

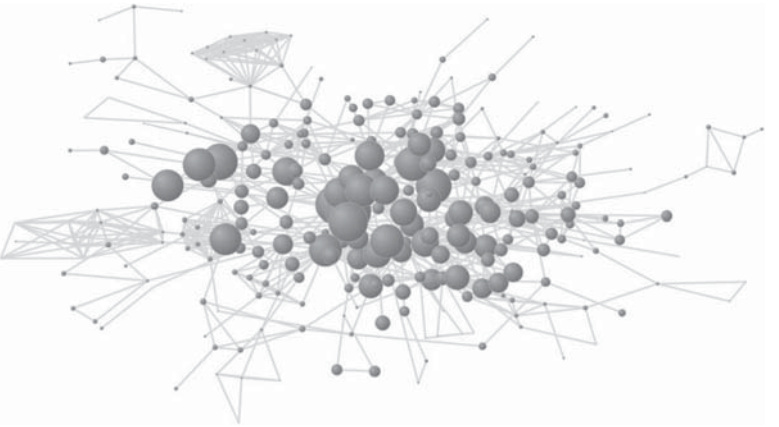
For how there is evidence in the literature on corporate governance about the problem of self-selection and endogeneity (Wintoki *et al.*, 2012), we used instrumental variables by robust two-stage least square models (H2SLS) and simultaneous equations by robust three-stage least square models (H3SLS). Two-stage models have been widely used (Black and Kim 2012; Fracassi and Tate, 2012), but simultaneous equations models are more robust. In such models, at first, we evaluated whether the board social capital was robust when it was instrumentalized by ownership concentration. In a second moment, we analyzed whether the board social capital was able to mitigate the discount on the cost of capital caused by the ownership concentration.

We also used an alternative proxy of implied cost of capital (MPEG) to check if our results were still consistent. Finally, we checked whether the effect of board social capital on the cost of capital was still consistent when evaluated in three different samples according to the level of corporate governance.

Results

To illustrate the board interlock relationships between companies and their respective social capital, we present in Figure 2 the main component of the companies' network in 2015. The larger nodes illustrate the companies that present greater sum of relational resources.

The main results of the econometric analysis can be seen in Table II. About control variables, in the full sample (models 1 and 2), the results indicate that companies with greater relative market value (Tobin's *Q*) have a lower cost of capital ($\hat{\beta} = -0.046$, $p < 0.05$). But he



Note: Visualization Method: Kamada–Kawai

Figure 2.
Board interlocks network (main component, year of 2015)

Table II.
The effect of social capital on the implied cost of capital

	Full sample		Fixed models State-owned		Private		Dufour dummy models[b] Private		Structural change models[c] Private	
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Social capital[a]	−0.167 (0.135)		−0.941 (1.370)		−0.146*** (0.056)		−0.157** (0.078)		−0.120** (0.057)	
Social capital hetero[a]		−0.180 (0.154)		−0.895 (1.373)		−0.155** (0.065)		−0.170** (0.082)		−0.130** (0.066)
2008–2009 crisis							0.006 (0.170)	0.030 (0.168)		
Asset (ln)	−0.009 (0.035)	−0.010 (0.035)	−0.017 (0.603)	−0.041 (0.604)	−0.046*** (0.014)	−0.048*** (0.014)	−0.051*** (0.016)	−0.051*** (0.016)	−0.033** (0.015)	−0.034** (0.015)
ROA (ln)	0.006 (0.018)	0.005 (0.018)	0.273 (0.209)	0.275 (0.209)	−0.020*** (0.008)	−0.020*** (0.008)	−0.025*** (0.009)	−0.025*** (0.009)	−0.023*** (0.008)	−0.023*** (0.007)
Volatility	0.001 (0.001)	0.001 (0.001)	−0.021 (0.016)	−0.020 (0.016)	0.001*** (0.001)	0.001*** (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.000)	0.001 (0.000)
Tobin's Q	−0.046**(0.021)	−0.046** (0.021)	−0.859 (0.680)	−0.848 (0.679)	−0.029*** (0.008)	−0.030*** (0.008)	−0.029*** (0.008)	−0.029*** (0.008)	−0.029*** (0.008)	−0.030*** (0.008)
Tangibility	0.428*** (0.085)	0.428*** (0.085)	2.12*** (0.623)	2.11*** (0.621)	0.035 (0.039)	0.035 (0.039)	0.049 (0.084)	0.049 (0.085)	0.001 (0.041)	0.001 (0.041)
Sales growth	0.002 (0.028)	0.002 (0.028)	0.306 (1.247)	0.286 (1.244)	0.002 (0.011)	0.002 (0.011)	0.013 (0.017)	0.014 (0.017)	0.001 (0.011)	−0.001 (0.011)
Constant	0.234 (0.602)	0.263 (0.598)	0.664 (10.963)	1.064 (11.011)	0.929*** (0.242)	0.955*** (0.241)	1.026*** (0.283)	1.033*** (0.283)	0.956*** (0.354)	0.970***

(*continued*)

Table II.

Full sample		Fixed models State-owned		Private		Dufour dummy models[b] Private		Structural change models[c] Private	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Companies									
137	137	7	7	130	130	130	130	130	130
Observations (N)									
535	535	41	41	494	494	494	494	494	494
Chow structural change test									
–	–	–	–	–	–	–	–	5.874**	6.516**
F									
4.68***	4.65***	2.24*	2.24*	9.53***	9.33***	–	–	4.39***	4.38***
R^2									
0.077	0.077	0.367	0.366	0.157	0.155	0.172	0.170	0.627	0.627

Notes: [a]Value in billions (R$); [b]2008–2009 crisis interaction terms omitted; [c]companies dummies ommited. SE between parenthesis. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

results remained significant only for private companies ($\hat{\beta} = -0.029$, $p < 0.01$, in model 5). Companies with greater asset tangibility tend to have a higher cost of capital in the full sample ($\hat{\beta} = 0.428$, $p < 0.01$). However, this result is persistent only in state-owned companies (models 3 and 4). Total assets, return on assets and stock volatility are only significantly among private companies (models 5 and 6).

Regarding the hypotheses, we could not corroborate *H1* and *H2* directly, since, in the complete sample, the coefficients of the board social capital in the direct and heterogeneous relations were not significant. However, among private companies, these coefficients were significant both for the social capital of the direct relations ($\hat{\beta} = -0.146$, $p < 0.01$) and for the heterogeneous relations ($\hat{\beta} = -0.155$, $p < 0.05$). As for the state-owned companies, the coefficients of these variables were not significant, we corroborate *H3a* and *H3b*.

To make sure that the results were consistent considering the impact of the 2008–2009 crisis, we tested the effects of a structural break. In models 7 and 8, social capital reduces the cost of capital significantly both for direct relations ($\hat{\beta} = -0.157$, $p < 0.05$) and for heterogeneous relations ($\hat{\beta} = -0.170$, $p < 0.05$). From the Dufour dummy models, which check the effect of the structural break by interacting each variable by a crisis period dummy (2008–2009), the only variable with a significant coefficient change was Tobin's *Q* ($\hat{\beta} = -0.023, p < 0.05$), that this dummy coefficient was omitted in the models. The effect of social capital on the cost of capital also remained consistently significant when we used Chow structural change regressions (models 9 and 10). Since Chow's tests pointed to structural change between the period before and after the crisis (5.874, and 6.516, $p < 0.05$), there was a slight drop in the social capital effect both for direct ($\hat{\beta} = -0.120, p < 0.05$) and heterogeneous relations ($\hat{\beta} = -0.130, p < 0.05$).

Further analysis

First, we investigated whether the effect of the board social capital on the cost of capital remained significant when competing with other board structure variables. In Table III, models 2 and 3, both social capital through direct ties ($\hat{\beta} = -0.121$, $p < 0.05$) and heterogeneous ties ($\hat{\beta} = -0.118$, $p < 0.1$) reduced the cost of capital when contrasted with the board size. In models 5 and 6, the reduction of cost of capital also remained significant when controlled by the number of interlocks for both direct ($\hat{\beta} = -0.141$, $p < 0.05$) and heterogeneous ($\hat{\beta} = -0.148$, $p < 0.05$) board social capital. This also occurred when we controlled by the percentage of outsider directors on the board, both for direct ($\hat{\beta} = -0.133$, $p < 0.05$) and heterogeneous ($\hat{\beta} = -0.142$, $p < 0.05$) social capital.

Second, in Table IV, we analyzed whether the effect of the social capital on the cost of capital remained significant when controlled by the voting rights concentration. Models 2 and 3 indicate that, when controlled by the concentration of the voting rights by the dominant shareholder, there is a reduction in the cost of capital by the board social capital only in direct ties ($\hat{\beta} = -0.107$, $p < 0.1$). When we controlled by concentrating on the five largest shareholders, the effect of social capital was also significant only for direct ties ($\hat{\beta} = -0.097$, $p < 0.1$, model 8). But when we controlled by the sum of the voting rights of the three largest shareholders (models 5 and 6), both social capital through direct ($\hat{\beta} = -0.111$, $p < 0.1$) and heterogeneous ties ($\hat{\beta} = -0.113$, $p < 0.1$) showed to be significant.

Third, using more robust models, in Table V, we tested whether the effect of social capital was still consistent when instrumented by the concentration of voting rights by the five largest shareholders. In models 1 and 2, Wooldridge's endogeneity test and robust regression test point to the endogeneity of both forms of board social capital, as well as the Shea's Partial R^2 shows that concentration of voting rights is significantly strong instruments to ensure there is no bias in the endogenous variable coefficients. Despite this endogeneity, the reduction of the cost of capital remained significant, both for the board social capital by direct ($\hat{\beta} = -0.070$, $p < 0.1$) and heterogeneous relations ($\hat{\beta} = -0.092$,

Table III.
Effect of board structure variables and social capital on implied cost of capital (private companies)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Social capital[a]		−0.121** (0.058)			−0.141** (0.058)			−0.133** (0.056)	
Scal capital hetero[a]			−0.118* (0.070)			−0.148** (0.067)			−0.142** (0.066)
Board size	−0.004** (0.002)	−0.003 (0.002)	−0.003 (0.002)						
Board interlocks (degree)				−0.002 (0.002)	−0.001 (0.002)	−0.001 (0.002)			
Outsiders percentual							−0.196** (0.081)	−0.176** (0.081)	−0.180** (0.081)
Control variables[b]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F	9.260***	8.710***	8.500***	8.560***	8.340***	8.180***	9.380***	9.020***	8.880***
R^2	0.154	0.164	0.160	0.144	0.158	0.155	0.155	0.168	0.166

Notes: $N = 494$, 130 companies. [a]Amounts in billions (R$); [b]control variables are omitted. Fixed Models. Robust SE between parentheses. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Table IV.
Effect of ownership structure variables and social capital on implied cost of capital (private companies)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Social capital[a]		−0.107* (0.060)			−0.111* (0.060)			−0.097* (0.059)	
Social capital Hetero[b]			−0.108 (0.070)			−0.113* (0.070)			−0.096 (0.070)
Dominant shareholder[b]	0.002** (0.001)	0.001* (0.001)	0.001* (0.001)						
Sum 3 larger shareholders[b]			0.001* (0.001)	0.001 (0.001)	0.001 (0.001)				
HHI 5 larger shareholders[b]						0.218*** (0.074)	0.196*** (0.075)	0.199*** (0.075)	
Control variables[c]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F	6.540***	6.180***	6.060***	6.310***	5.990***	5.870***	7.310***	6.770***	6.650***
R^2	0.132	0.142	0.139	0.128	0.138	0.135	0.145	0.153	0.151

Notes: $N =$ 494, 130 companies. [a]Amounts in billions (R$); [b]shareholders with voting rights; [c]control variables are ommited. Fixed Models. Robust SE between parentheses. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Table V.
Robustness of social capital using two-equations models by H2SLS and H3SLS estimations (private companies)

	H2SLS		H3SLS		H2SLS		H3SLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Social capital[a]	−0.702* (0.386)		−0.879** (0.396)					
Social capital hetero[a]		−0.918* (0.518)		−1.180** (0.535)				
HHI 5 larger shareholders[b]					0.240 (0.154)	0.198 (0.165)	0.303 (0.206)	0.248 (0.225)
Instrumental/ exogenous variable	HHI larger 5 shareholders	HHI larger 5 shareholders	HHI larger 5 shareholders	HHI larger 5 shareholders	Social capital	Social capital hetero	Social capital	Social capital hetero
Control variables[c]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
χ^2	68.540***	60.800***	71.750***	70.030***	108.310***	111.050***	97.55***	94.29***
Wooldridge's endogeneity test	2.925*	3.095*	–	–	1.521	0.743	–	–
Robust regression test	3.009*	3.193*	–	–	1.576	0.753	–	–
Shea's partial R^2	0.023***	0.018***	–	–	0.023	0.018	–	–
R^2	0.1649	0.1438	0.289	0.444	0.093	0.089	0.038	0.084

Notes: $N = 504$, 130 companies. [a]Amounts in billions (R$); [b]shareholders with voting rights; [c]control variables are omitted. As identification strategy in the models of instrumental variables (H2SLS), in models 1 and 2, we used the proxies of social capital as endogenous, and we included HHI larger 5 shareholders as instruments, following what was done by Dahya *et al.* (2008). The control variables were introduced in the two stages. In models 5 and 6, we inverted the relation, considered included HHI larger 5 shareholders as endogenous and the board social capital variables as instruments. In relation to the models of three stages (H3SLS), we considered in models 5 and 6 as exogenous variables HHI larger 5 shareholders. In the first equation, we define as endogenous variable social capital proxies, which, in turn, are also affected recursively by HHI larger 5 shareholders and control variables. In the second equation, in all models, we consider RPEG implied cost of capital as an endogenous variable. We inverted the relationship between endogenous and exogenous variables in model 7 and 8, putting HHI larger 5 shareholders as endogenous in the first equation, and board social capital and control variables as exogenous. First equations ommited. SE between parentheses. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

$p < 0.1$). In the use of robust simultaneous equations models (H3SLS), models 3 and 4, results are very similar, $\hat{\beta} = -0.088$, $p < 0.05$, for board social capital by direct ties, and $\hat{\beta} = -0.118$, $p < 0.05$ for heterogeneous ties.

Fourth, using our board social capital proxies, we also use more robust models to test Dahya's *et al.* (2008) hypothesis that a strong board of directors reduces the value discount of firms with ownership concentration. In our case, we use the implied cost of capital rather than Tobin's *Q*. Models 5–8 in Table V indicate that the board social capital mitigates the effect of ownership concentration discount on the cost of capital. Whether through instrumental variables (H2SLS, models 5 and 6) or through equation systems (H3SLS), the HHI 5 larger shareholders variable is no longer significant.

Fifth, we also check the robustness of our results using another proxy for the implied cost of capital: MPEG. In models 1 and 2 of Table VI, the board social capital by both direct ($\hat{\beta} = -0.178, p < 0.05$) and heterogeneous ties ($\hat{\beta} = -0.178, p < 0.05$) also reduces the cost of capital for the MPEG proxy.

Finally, we checked in models 3–8 of Table VI how the board social capital operates on the cost of capital at different levels of corporate governance quality on the Brazilian stock exchange, B3. In the listing with the highest quality requirement of corporate governance, New Market, both social capital through direct ($\hat{\beta} = -0.071, p < 0.1$) and heterogeneous ties ($\hat{\beta} = -0.077,\ p < 0.1$) reduce the cost of capital. At intermediate levels of quality of corporate governance, only the board social capital by direct ties reduced the cost of capital ($\hat{\beta} = -0.249,\ p < 0.1$). At the lower level of corporate governance, the effect of the board social capital was not significant.

Discussion and conclusion

In this article, we analyzed how the type of ownership and control moderates the effect of the board social capital on the implied cost of capital. Our results show that both the social capital of direct relations and heterogeneous relations significantly reduce the cost of capital among private companies, and not for state-owned companies. The results were still consistent when we used models to control the effect of the structural break of the coefficients due to the 2008–2009 crisis. First, these results suggest that the implied cost of capital is affected by the reliability and legitimacy of the companies, in view of the position and prestige of their board members (Rossoni *et al.*, 2018), which increase the chances of making good decisions, precisely because they have access to differentiated relational resources present in the board network. Second, our results point out that a strong board composed of outsiders with ties to more valuable companies hypothetically has more incentives to properly monitor companies (Dahya *et al.*, 2008). Third, this result corroborates the view that outsiders board members do not effectively exercise their role of collecting external resources in state-owned companies, either through the social isolation of other board members linked to political parties or through the ease of reallocation of financial resources by the state (Yoshikawa *et al.*, 2014).

Additionally, only for private companies, we demonstrated that our social capital board proxies were still robust when controlled by board structure measures. Our results were consistent when contrasted with the hypothesis of board size (Fracassi and Tate, 2012), outsiders (Dahya *et al.*, 2008; Johnson *et al.*, 2013), and a number of interlocks (Ferris *et al.*, 2017; Johnson *et al.*, 2013). Our results also were robust when controlled and instrumentalized by the ownership concentration of voting rights. Dominant shareholders could try to limit the influence of more powerful directors (Dahya *et al.*, 2008), but our data points out that this is less likely on strong boards. Boards rich in social capital – with outsider directors from higher-value companies – tend to have more incentives to adequately monitor the decision of dominant shareholders (Rossoni *et al.*, 2018).

Table VI.
Robustness of social capital on MPEG Cost of capital and governance level (private companies)

Dependent variable	MPEG cost of capital Private companies (1)	(2)	New market (3)	(4)	RPEG cost of capital Level 1 and 2 (5)	(6)	Traditional market (7)	(8)
Social capital[a]	−0.178** (0.010)		−0.071* (0.039)		−0.249* (0.135)		0.098 (0.120)	
Social capital hetero[a]		−0.023** (0.011)		−0.077* (0.046)		−0.210 (0.154)		0.255 (0.153)
Control variables[b]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	358	358	321	321	104	104	76	76
F	7.880***	8.060***	–	–	2.520**	2.260**	–	–
R^2	0.184	0.188	0.244	0.243	0.195	0.178	0.401	0.401

Notes: [a]Amounts in billions (R$); [b]control variables are omitted. Brazilian stock exchange B3 created a premium listing, in which the highest level is New Market, where there are two others with fewer requirements, Levels 1 and 2, and the Traditional Market. New Market comprises companies that voluntarily agreed to good governance practices, such as voting rights for all shareholders, dispute resolution in an arbitration chamber and the compulsory participation of independent board members. Levels 1 and 2 have similar rules of the new market, but do not follow the principle of one share, one vote. Companies listed in the Traditional Market follow only the Brazilian laws, which are admittedly weak for investors. Fixed models. Robust SE between parentheses. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

We also demonstrate that the board social capital is able to mitigate the discount by ownership concentration in the implied cost of capital. As pointed out by Dahya *et al.* (2008), in weak legal environments, such as Brazil, strong boards tend to be an effective mechanism to repair opportunism by dominant shareholders. It should also be noted that environments with weak legal protection create intermediary protection mechanisms for investors, as premium lists. When we segment our sample according to the level of quality of corporate governance through premium lists on the Brazilian stock exchange, the effect of the board social capital was significant only in the listings with the greater contractual requirement, New Market and Levels 1 and 2. For companies which operate in the Traditional Market, which has a low guarantee for investors, the effect was not significant. As Rossoni and Mendes-da-Silva (2018) have pointed out, mechanisms such as board quality tend to be effective in the Brazilian market only in listings with higher requirements at levels of corporate governance.

Contributions

This paper evaluated how board social capital can reduce the implied cost of capital, showing that stronger and well-connected boards can facilitate firms' access to external resources. We believe that this is the first contribution to the area of corporate finance. The second contribution involves analyzing board relational resources, as well as Rossoni *et al.* (2018), constituting an innovative way of evaluating the board social capital. Differently from Ferris *et al.* (2017), we use a board social capital proxy that weights the presence of the outsider directors by the market value of the interconnected company. Thus, we assume that outsider directors from more valuable firms have both greater power of influence and access to more valuable information and resources (Connelly and Van Slyke, 2012). Therefore, this study differs from the majority that uses only position indicators in the network to validate board interlock hypotheses (Johnson *et al.*, 2013). Third, using arguments of Burt (1992) and Rossoni *et al.* (2018), we also analyzed whether the board social capital from structural holes – heterogeneous ties – reduces the cost of capital. Directors from companies with less redundant ties tend to have more relevant and rare information and are more likely to resist pressures of controlling shareholders (Connelly and Van Slyke, 2012).

In addition, our fourth contribution refers to add important information about state-owned companies to the studies of Aharoni (1986), Dahya *et al.* (2008), Shleifer and Vishny (1997, 2002) and Yoshikawa *et al.* (2014), which evaluated specific characteristics of public management and corporate governance. As our study has shown, the social capital of the board in countries with low legal protection and management of highly politicized state-owned companies is ineffective in reducing the cost of capital. As a fifth contribution, although Caiazza and Simoni (2015), Dahya *et al.* (2008) and Ferris *et al.* (2017) emphasize that powerful boards in weak legal environments can mitigate agency problems with dominant shareholders, as in Brazil, our study points out that this tends to occur in properly monitored companies with safeguards beyond legal obligations.

Regarding the practical implications, this study provides evidence for investors, financial analysts, investment funds and society about the implication of the board social capital on the cost of capital. In this way, these actors, through what was ruled in this paper, have empirical support to better evaluate the direction of their investments, as well as the factors that influence the expected return on them.

Recommendations for future studies

The main suggestion of future studies is to test the board social capital hypothesis through the idea of relational resources in different countries with the intention of evaluating how

this governance mechanism operates in different legal and institutional contexts. Another opportunity would be to include as payment variable the payment of dividends. We can assume that when there is a dividend payment per share, which we can understand as an indicator of financial stability, i.e. dividends are paid if the debts have already been paid, the value of the company ceases to be relevant in estimating the cost of capital.

Another question that remains to be answered is: Do companies with ties to financial institutions have a lower cost of capital? Researching this question, we find that financial expertise on the board affects a variety of company issues, including debit strategies (Mizruchi and Stearns, 1994; Stearns and Mizruchi, 1993) and earnings management (An and Jin, 2004). If we assume that board members of financial institutions have access to privileged information, in addition to having specific knowledge of finance because they work directly with financial institutions, companies that have board interlocks with financial institutions may, through these relationship ties, obtain loans with differentiated costs of capital.

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Corresponding author
Luciano Rossoni can be contacted at: lrossoni@gmail.com