French connection: interlocking directorates and the ownership-control nexus in an insider governance system

Tristan Auvray, Olivier Brossard

French connection: interlocking directorates and the ownership-control nexus in an insider governance system

Tristan Auvray*
Olivier Brossard†

May 2013

Abstract

We reveal the non-separation of ownership and control for multiple blockholders in the French insider governance system. We show that overlapping directorships of large listed corporations are explained by their ownership connections. Both large and small stakes, from 20% to 1% of cash-flow rights or voting rights, have high explanatory power. Some shareholdings are control rather than monitoring related. We provide evidence also that cross-ownership allows CEOs to entrench themselves. Finally, we demonstrate that causality goes from ownership to interlocking directorates, for both unilateral stakes and cross-shareholdings.

(*JEL* G32, G34)

Corporate Governance, Ownership networks, Board interlocks, Multiple blockholders

*University of Paris 13, Sorbonne Paris Cité, CEPN (CNRS, UMR 7234). tristan.auvray@univ-paris13.fr

†University of Toulouse; Political Studies Institute and LEREPS-University Toulouse 1. olivier.brossard@ut-capitole.fr

1 Introduction

In most countries, 10% to 20% of the voting rights in a typical listed company are held by the main shareholder (La Porta, Lopez-de-Silanes, and Shleifer, 1999; Claessens, Djankov, and Lang, 2000; Barca and Becht, 2001; Faccio and Lang, 2002; Laeven and Levine, 2008; Holderness, 2009; Carney and Child, 2013). This leading owner "controls" (in the understanding in Berle and Means, 1932, Hart, 1995 and Tirole, 2006) the corporation: based on her majority at general meetings due to the confidence or passivity of the other minority shareholders, she can select the directors who then vote for the CEO. The CEO, therefore, can be assumed to represent the main shareholder. Nevertheless, La Porta, Lopez-de-Silanes, and Shleifer (1999, p. 496) acknowledge that, among the largest firms the percentage of equity needed to actually control them is lower than the conventional threshold of 20% or 10% of cash-flow rights (CFR) or voting rights (VR). For this reason, some authors (e.g. Shleifer and Vishny, 1986; Barca and Becht, 2001) refer to blockholders with at least 5% shareholdings. According to Zwiebel (1995) a threshold of 1% is already important because it allows small blockholders to be part of a controlling coalition and to share the partial benefits of control. Thus, although blockholders do not have *formal control*, i.e. more than 50% of the VR, they can obtain *real control*, i.e. more than 50% of the votes (Tirole, 2006). Therefore, exploring to what extent a multiplicity of minority shareholdings conveys decision-making authority to its respective holders is a crucial question to understand how corporations are controlled by their owners.

The aim of this paper is to assess whether there is separation of ownership and control not only for the largest blockholders but also for multiple small owners of a company. In accordance with control rights theories (Tirole, 2006; Gibbons, 2005; Hart, 1995), the relation between ownership and control is understood as a relation between ownership and the acquisition of *decision rights*, i.e., an ability to affect the course of action of a firm through membership of the board of directors.[1] In this respect, our main empirical contribution is to show that separation between ownership and control does not exist even for a large range of small shareholders. We contribute to knowledge on the role of shareholders in the selection of directors, in a context where a better understanding is required, especially in the context of non-Anglo-American firms (Adams, Hermalin, and Weisbach, 2010). Few studies focus on this specific relationship,[2] while its relevance is suggested by some stylized facts. For instance, La Porta, Lopez-de-Silanes, and Shleifer (1999), Claessens, Djankov, and Lang (2000) and Faccio and Lang (2002) illustrate the non-separation between ownership and control, showing that when the controlling shareholder is a family, then, in at least 60% of the cases they studied, the chairman of the board or the CEO is part of this family.[3] Regarding these univariate statistics our contribution is threefold. (i) We extend these results by considering ownership between corporations on the one hand, and by considering all members of boards of directors on the other. Companies can be important shareholders in insider governance systems which prevail in developed countries such as Japan, Germany and France. We focus on the entire board because even if directors are separated from management they have a say in CEO selection and all other board decisions. (ii) We do not use an *ad hoc* legal criterion of CFR or VR to

[1]Note that control rights are defined as an exit right in Hart's (1995) framework (Hart and Holmström, 2010), whereas they are defined as a right to interfere in management choices in Aghion and Bolton (1992) or Tirole's (2006) models.

[2]E.g., Cai, Garner, and Walkling (2009) study shareholder behavior during director elections in US corporations.

[3]In another worldwide sample (Dahya, Dimitrov, and McConnell, 2008), 47% of the directors are affiliated to the dominant shareholder but only 9% of the board members belong to the dominant shareholder's family. See also Yeh and Woidtke (2005) who find that such a relationship occurs for half of their sample of Taiwanese firms. Carney and Child (2013) extend Claessens, Djankov, and Lang's (2000) study and show that, in 2008, ownership is not separated from management in 70% of East Asian firms controlled by family shareholders.

postulate control. Rather, we test a range of thresholds from 1% to 20%, that allow a shareholder to obtain a seat on the board, and thereby to take part in board decisions. (iii) By analyzing various thresholds, we are able to consider control rights obtained by multiple shareowners of a corporation and not only by the first or the second one. Let us examine these three points to present our methodological contribution before reviewing the literature and formulating our empirical propositions.

First, we want to assess whether the non-separation of ownership and control applies to various types of shareholders or only for the largest ones. Therefore, we need to determine the strength of the correlation between ownership structure and board structure. The main difficulty is to identify whose interests are represented by the members of the board of directors. The methodology we propose is in two steps: we first consider that public companies use their directors as delegates to other companies' boards. Hence, overlapping directorates reflect controlling or monitoring ties between corporations, and we can focus on their correlation with ownership connections among the same set of companies to assess the relationship between ownership and control for a large number of shareholders. This requires estimating the correlation between two networks: a set of shareholding ties among listed companies and the web of overlapping directors of these same corporations. More precisely, we build a corporate-pair dataset that allows us to analyze the various connections of components of a dyad (i.e. a pair of companies) with all the other companies in the sample. This dyadic framework[4] is appropriate to explore multiple capital thresholds reflecting a large range of shareholdings. Indeed, this method has the great advantage of allowing estimation of the correlation between ownership con-

[4]Financial studies (e.g. Khanna and Thomas, 2009; Dittmann, Maug, and Schneider, 2010) and sociological studies (e.g. Mizruchi, 1992) use this dyadic framework to examine networks of firms.

nections and board ties for a multiplicity of blockholders. To our knowledge, this study is the first to evaluate the relationship between these financial and human networks.

This approach is particularly relevant for insider governance systems[5] distinguished by the existence of multiple blockholdings by other financial and non-financial companies (see e.g. Jenkinson and Ljungqvist, 2001, and Franks and Mayer, 2001, for Germany, and Franks, Mayer, and Miyajima, 2012, for Japan). We collect data from several sources to obtain reliable information on board structures and ultimate ownership structures of large French corporations. The rationale for using French data is the complexity and the density of the web of shareholdings among French corporations as a result of the waves of privatization that occurred since the 1980s. The declining government ownership in the main French companies was replaced in the 1990s by multiple core shareholdings between corporations (the so-called *noyaux durs*, Morin, 2000). Therefore, we can use these specific French connections to measure the correlation between multiple ownership ties and overlapping directors among firms. Like other shareowners, corporations vote for directors based on their voting rights. Our focus on ownership among French companies is an illustration of the general voting power associated with shareholding. Similar tests should be conducted on other countries with insider governance systems such as Germany and Japan where ownership networks are well-known,[6] or in other financial markets where

[5]In an insider governance system, management and board decisions are controlled by blockholders, while in an outsider governance system market discipline is carried out by outside shareholders through hostile takeovers (see Franks and Mayer, 1990, 1997, 2001; Jenkinson and Ljungqvist, 2001; Bebchuk and Weisbach, 2010). In other words, according to Tirole (2006), management choices are actively monitored by incumbents in insider systems and by entrants in outsider systems. Moreover, family and corporate blockholders enjoy both the public and private benefits of control in insider systems while outside shareholders derive benefits only in the form of financial returns (Franks, Mayer, and Miyajima, 2012).

[6]See e.g. Franks and Mayer (1997, 2001), Morin (2000) and Goergen, Manjon, and Renneboog (2008) for France and Germany, and Aoki (1988), Berglöf and Perotti (1994), Morck and Nakamura (1999), Aoki, Jackson, and Miyajima (2007) and Franks, Mayer, and Miyajima (2012) for Japan. See also references related to German governance below in the text.

business groups are widespread.[7] However, France offers the conditions of this "natural experiment" and its ownership networks are rarely studied (Morin, 2000) although French corporate governance has been the subject of an increasing number of studies in the financial literature.[8]

Next, to consider the multiplicity of shareholdings we collect data on all shareholders for whom we can find information. In our study, the smallest shareowner holds 0.2% of the CFR of a corporation. This allows us to consider a large range of VR and CFR thresholds, from 1% to the generally accepted 20%. The motivations for studying this cut-off range are the effect of market capitalization on the size of shareholdings on the one hand, and the potential existence of controlling coalitions on the other. Sullivan and Spong (2007) underline that the share of a holding in the portfolio of its owner is a more reliable figure than the percentage of her stake in the ownership structure of the owned firm.[9] Certainly, it reveals the shareowner's true incentives to monitor or control the corporation. This underlines the importance of analyzing multiple thresholds because stakes in large capitalizations – such as the ones of our sample – probably have more weight than stakes in small capitalizations in the portfolios of their holders. Moreover, a small percentage ownership in a company can be influential because the owner contributes to achieving a majority in the election of directors by a coalition of small shareholders.

Finally, in analyzing this range of thresholds this work contributes to the literature on controlling minority shareholders (see Bebchuk and Weisbach, 2010), and complex

[7]See e.g. Khanna and Yafeh (2007) and Almeida, Park, Subrahmanyam, and Wolfenzon (2011) for developing countries and Masulis, Pham, and Zein (2011) for a worldwide study.

[8]For other references on French corporate governance, see Chikh and Filbien (2011), Ginglinger, Megginson, and Waxin (2011), Kramarz and Thesmar (2006), Murphy (2005), Bloch and Kremp (2001), and Franks and Mayer (1997, 1990).

[9]Unfortunately, these kinds of figures are neither available nor exhaustively reconstitutable for the corporations in our sample.

ownership structures and multiple large shareholders (MLS).[10] In particular, we consider owners even if they are not in first or second place in the ownership structure or above the classical threshold of 5% of VR. Whatever the size of a shareholder's stake, it may elect one or more seats on the board by contributing to a shareholder coalition. According to the MLS literature, the motivations are various: multiple shareholders may develop an alliance to collude and share the private benefits of control or they may wish to monitor the incumbent controlling owner (Pagano and Röell, 1998; Zwiebel, 1995). In our study, we show that some large and small shareholdings are held with the aim of control rather than for monitoring purposes.

This paper is connected with two other strands of the financial literature. The first focuses on the relationship between ownership and board structures, especially among financial and non-financial companies; the second is related to interlocking directorates.

First, our work is related to studies examining the relationships between ownership and board structure. This issue is addressed in Denis and Sarin (1999), Mak and Li (2001) and Booth, Cornett, and Tehranian (2002) which show that the proportion of outside board members increases with managerial ownership dispersion in US and Singaporean companies. These correlations are based on aggregate measures of ownership and board structures. However, these aggregations can hide a diversity of interests in managerial ownership – as argued by Demsetz and Villalonga (2001), and in outside directors – as shown by many authors (e.g. Rosenstein and Wyatt, 1997; Bradbury and Mak, 2000; Singh and Davidson III, 2003; Hwang and Kim, 2009; Fracassi and Tate, 2012). In this

[10] For analytical works see Zwiebel (1995), Pagano and Röell (1998), Bebchuk, Kraakman, and Triantis (2000), Bennedsen and Wolfenzon (2000), Bloch and Hege (2001), Gomes and Novaes (2005), Dhillon and Rossetto (2009), Edmans and Manso (2011). For empirical evidence see e.g. Maury and Pajuste (2005), Laeven and Levine (2008), Attig, Guedhami, and Mishra (2008) and Attig, El Ghoul, Guedhami, and Rizeanu (2013).

paper, we provide evidence on the correlation between ownership and board structure on a dyadic not an aggregate basis. This allows us to control in our estimates for the characteristics of the owner and of the corporation in which she has a shareholding.

Some studies of ownership and board structure focus on management turnover. For instance, Kaplan and Minton (1994) show that in poorly managed Japanese firms corporate shareholders appoint representatives before a top executive change. Köke (2004) finds that, in German firms, management turnover increases after a change in ultimate control, whatever their past performance.[11] This evidence suggests that the causality between ownership and control goes from the former to the latter. However, it would seem logical that control ties cause ownership connections because interlocked directors encourage shareholdings between the two firms concerned. We take advantage of the panel structure of our data to address this causality issue.

Our focus on ownership and directorship ties among corporations is also related to studies on this relationship occurring between financial and non-financial companies. Edwards and Nibler (2000) and Gorton and Schmid (2000) demonstrate that the board structure of German firms is affected by bank shareholdings or by their voting power because they are able to appoint their representatives. Similarly, Franks and Mayer (2001) illustrate the representation of bankers on the boards of firms in which they hold shares or proxy votes while Dittmann, Maug, and Schneider (2010) show that in 2000-2005 the sale by a German bank of its holding in a corporation was associated with the removal of its representative from the firm's board. Morck and Nakamura (1999) also provide evidence on this ownership-board structure relationship, among banks and firms in Japan. Even

[11] However, the evidence is mixed for Germany. Using other samples, Kaplan (1994) and Franks and Mayer (2001) find that management turnover follows low performance but is not affected by ownership structure. However, Franks and Mayer (2001) also show that corporations ultimately controlled by banks exhibit higher turnover in the case of low performance.

in the US, banks are represented in firms in which they have voting power thanks to their fiduciary activities (Santos and Rumble, 2006). While financial studies tend to focus on the ownership-board link between banks and firms, there is no available evidence on this relationship when it involves other financial firms such as insurance companies, or when it occurs among non-financial corporations which are also typical shareholders in insider governance systems. Our contribution evaluates the intensity of this ownership-board correlation considering all possible relationships between banks, insurance companies, and non-financial companies.

Finally, our work adds to the interlocking directorate literature. A directorate interlock is created between two firms when a director of one of them is also on the board of the other firm: this is the board relationship we explain in this paper. Overlapping directors among corporations have been receiving increased attention in financial studies, alongside consideration of networks in economics (Jackson, 2008). Stuart and Yim (2010) and Chikh and Filbien (2011) show that interlocking directorates facilitate M&A activities. Cai and Sevilir (2012) find that they explain the positive returns to the acquirer. Interlocks also contribute to diffusing board structure characteristics (Bouwman, 2011) or stock option backdating practices (Bizjak, Lemmon, and Whitby, 2009). Hwang and Kim (2009), Fich and White (2005) and Hallock (1997) study the effects of interlocks between CEOs, or between CEOs and directors on CEO pay. Robinson and Stuart (2007) and Lindsey (2008) assess the impact of director networks and equity networks on strategic alliances. However, while ownership connections are potential determinants of interlocking directorates, there are no financial studies on this issue. Khanna and Thomas (2009) and Ferreira and Matos (2012) analyze both interlock and ownership ties, respectively between corporations and between banks and firms, to assess their effect on stock price synchronization or on loan rates, but do not address the causality issue between equity and personal linkages. Our work aims to fill this gap. A paper in the sociology literature by Bohman (2012) assesses the probability that two firms are interlocked if they have a common shareholder. Our study acknowledges and controls for this effect: when two firms have the same owner, then this owner is likely to appoint the same director to both firms. However, the shareholder can choose different representatives from his own board. Therefore, we can expect that the probability of being interlocked for two companies will be lower if they have a common shareholder than if one of these companies has an equity tie with the other. We find that interlocking directorates are better explained by ownership ties between two corporations than by the number of common shareholders in these two companies.

The above, and questions related to the diversity of control thresholds and the multiplicity of shareholdings among corporations suggest testing the following propositions.

PROPOSITION 1: the most influential determinants of the formation of interlocking directorates are ownership linkages because unique or multiple shareowners are able to influence board selection and appoint directors who will act on their behalf either to control board decisions or to monitor managers and other directors. This means that shareowners principally choose board members because they will represent their interests, and that *ownership is not separated from control if it is assumed that directors are able to affect the course of action of a corporation.*

Consequently: i) frequency of interlocking directorates should be more strongly correlated with ownership linkages than with any other factor such as directors' skills, board size, ownership concentration, and so on; ii) even ownership linkages generated by small shareholdings could produce interlocking directorates either because the market capitalization is large or because the owner's stake is part of a shareholders coalition; iii) the higher the shareholdings between two firms, the higher will be the odds of having at least one interlocking directorate between the owner firm and the owned firm.

It could be argue that a correlation between small ownership ties and overlapping directors is not enough to reflect the reality of control since we do not know whether this small shareholding actually belongs to a coalition of controlling interests. Moreover, a lone voice is not sufficient to control board decisions and influence corporate behavior. Hence, we have to define a criterion for inferring control. We rely upon analytical research (Tirole, 2006) that makes a clear distinction between monitoring and control objectives of shareholders: monitoring is an information gathering activity, control is a decision-making authority. Disentangling these two features is straightforward since buying shares in order to influence board composition is costly whereas a single director is enough to gather the information required for monitoring purposes. Therefore, multiple interlocks are a signal that at least one of the two connected firms seeks decision-making authority rather than simple monitoring ability. Furthermore, control enhancing mechanisms such as cross-ownership should indicate that shareholders seek to lock-in the ownership and board structures. This would be additional evidence of the controlling aim behind multiple interlocks if they are associated with ownership lock-in devices.

PROPOSITION 2: *i) Some shareowners are not satisfied by simple monitoring power; they want control power. ii) This power relies more strongly on ownership linkages than monitoring power. iii) This power depends more strongly on ownership lock-in devices than on unilateral ownership linkages.*

Since multiple interlocking directorates reveal that some firms seek control rather than simple monitoring, the frequency of multiple board interlocks will be significantly correlated with ownership linkages if (*i*) is true, and will be more strongly correlated to ownership linkages than the frequency of single interlocks if (*ii*) is true. Moreover, unilateral stakes and cross-shareholdings between corporations should increase the odds of having multiple interlocking directorates, with the latter effect being greater than the former if (*iii*) is true.

Lastly, we check three potential shortcomings of the testable empirical consequences of our propositions. First, we need to address the causality issue between ownership ties and directors' connections. Indeed, a corporation's board members can suggest to other firms where they are directors, to take a stake in one of these companies. This leads to a second potential caveat which we have to check for, i.e. our results might be driven by the CEOs' striving for entrenchment. Interlocking directorates could be a means for managers to insulate themselves from shareholder pressure by diverting corporations' assets into shareholdings in other companies. Third, the network of direct ownership linkages across companies may not capture the interests obscured by pyramidal ownership structures which produce indirect ownership ties among corporations. All these issues require adequate robustness tests.

The remainder of the paper is organized as follow. Section 2 presents the sample construction, data and empirical issues to be tested. Section 3 describes the econometric method and the main results. Section 4 focuses on robustness tests. Section 5 concludes and highlights some regulatory implications of this study.

2 Data and empirical testing issues

To test Proposition 1, we need to assess the correlation between ownership linkages and board connections after controlling for other possible determinants of interlocking directorates. Shareowners may develop strategies aimed at acquiring control power, i.e. they may seek to influence the composition of the board in order to determine manager selection and to influence their subsequent conduct. Consequently, we need to examine whether ownership linkages allow more than simple monitoring of firms' managers (Proposition 2).

Although it is difficult to obtain direct and reliable information on the interests that board members represent, their identities and some of their characteristics are public information. We can determine whether they belong to several directorates which would create human linkages between firms whose boards are *de facto* interconnected by directors' multiple attendances. The main hypothesis here is that, if some firms seek to obtain monitoring or control power over some other firms, they will try to get their own directors nominated to the boards of targeted firms. Of course, we do not expect perfect correlation because a shareowner seeking to obtain control over a firm can propose a director that is not already a member of his own firm's board: interlocking directorates give monitoring and control power but these can be obtained in other ways than interlocking directorates. However, there is good empirical evidence to support the idea that corporations send directors to other firms in order to influence the corporate governance standards of these companies (see, e.g., Bouwman, 2011).

2.1 Sample construction

The central empirical issue here is to assess the correlation between two kinds of networks: the network created by interlocking directorates and the network formed by companies' ownership linkages. Constructing these networks is therefore the starting point of the sampling approach.

Since gathering reliable information on board composition and ownership linkages requires manually compiling annual reports, there is a limit to the number of firms that can be included in a panel dataset that spans a sufficiently long time period. Moreover, part of the information we need is available only for listed companies; in particular the publication of board structure is not mandatory for non-listed companies. Therefore, we cannot observe the entire network of firms' interlocking directorates, and as is usual in structural network analysis, we focus on a relevant sub-network. We selected French companies in the CAC 40, the main Paris Stock Exchange index, which means that our results may be representative only of large listed corporations.[12] However, investigating to what extent multiple small stakes can give monitoring or control power to their owner is particularly relevant for large firms since the incentives to influence their governance increase with market capitalization. The 40 CAC 40 firms are selected, every quarter, from among the 100 most traded firms on the Euronext Paris stock exchange. The selection criterion is capitalization provided that shares are liquid enough. Of course, there are entries and exits from the CAC 40 index over the observation period (1997-2006): the sample is composed of 61 companies that were listed in the CAC 40 for at least one quarter between 1997 and 2006 (Table 1). The CAC 40 index is representative of the industry sectors in the SBF 250 index, which is also constructed to be representative of the Paris stock market.[13]

[12]However, the number of missing nodes and links in this CAC 40 sub-network is likely to be small: super large companies do not share directors with small firms; and small companies cannot afford to purchase large shareholdings in the massive capitalizations composing the CAC 40. Our econometric results show also that there is a significant homophily effect in the CAC 40 network of interlocking directorates, which shows that CAC 40 firms tend to connect themselves with similar firms.

[13]Representativity tests are available upon request. We implemented them year by year and for 4 sectoral categories in order to have a minimum of 5 observations by year and by category. The sectoral

Please insert Table 1

The resulting number of firm-years observations is 507. However, because the dependent variable is the probability of having one or more interlocking directors between any possible pair of firms in this sample, the regressions are implemented over all possible dyads between the 61 firms. The 61 firms provide 1,830 dyads ($= 61 \times 60/2$) but 20 firms are not listed over the entire 1997-2006 period, either because they entered the French stock exchange after 1997 or because they were delisted before 2006 (Table 1). We therefore implement our regressions on an unbalanced panel of 1,776 undirected firm pairs (or dyads), with 12,611 dyad-year observations (Table 1, and Table 2 Panel B).

Please insert Table 2

2.2 Dependent and independent variables

2.2.1 The dependent variable

As already explained, we consider that interlocking directorates are a good measure of the monitoring or control that some companies can exert on the governance of other companies. It is impossible to measure directly whose interests a director represents, but it can be assumed that if appointed to the boards of two or more companies, this director will have to consider the interests of each one when exerting her power in another. We therefore construct a count variable equal to the number of interlocks between each firm dyad, and transform it into the dummies presented in Table 3: DU_INTERLOCK1=1 when the dyad has one single interlock, and DU_INTERLOCK_MIN2=1 when the dyad has at

categories are aggregated according to the following 1-digit SIC industrial sectors i) A, B, C, and D (Agriculture, Mining, Construction and Manufacturing); ii) F and G (Wholesale and Retail Trade); iii) E and I (Transportation, Communications, Utilities, and Services; iv) H (Finance, Insurance).

least two interlocks; the categorical variable INTERLOCKS ranges from 0 to 2 and is equal to 1 if DU_INTERLOCK1=1 and is equal to 2 if DU_INTERLOCK_MIN2=1. Table 2 panel B, describes the evolution of overlapping directors over the period under study. The information on board composition comes from firms' annual reports and financial newspapers and is provided by the Dafsaliens database. Board composition of Dafsalien is as of 31 December each year. We systematically checked and where necessary corrected, the information on whether the board chairman was also the firm's CEO. Separation of these two functions is growing over the period in this sample, so we need to control for this in the regressions. Board identification is obvious for the one-tier board systems prevailing in most incorporated companies since in this case there is only one board. However, some incorporated companies in the sample have a two-tier board system comprising a supervisory board and an executive board, and there are also two companies that are partnerships limited by shares ("*Sociétés en commandite par actions*") with supervisory boards and one or several managing partners.[14] For the former companies we consider only the interlocks involving the supervisory board because the executive board is nominated by the supervisory board which is chosen by the shareholders. For the latter, we consider the interlocks involving both the supervisory board and the managing partners.

Please insert Table 3

[14]More detailed statistics on the distribution in the dataset of types of companies and board sizes are available on request. The share of two-tier board systems is diminishing from 2003, and the share of companies with separation of board chairman and CEO is growing constantly from 2000. Note also that board size depends on corporate governance laws, and that the NRE law of 2001 obliged French companies to limit the number of board members to 18 within 3 years. This law also reduced the maximum number of a director's simultaneous board memberships, from 8 to 5.

2.2.2 Independent variables

The main independent variables are measures of ownership linkages. Several types of shareholding relationships between CAC 40 companies can generate interlocking directorates between them. We can expect that interlocking directorates between a pair of companies will be more probable if: i) one firm in the dyad holds shares in the other firm; ii) there are cross-shareholdings between the firms forming the dyad; iii) a third shareholder (another listed firm or a private owner) holds shares in the two firms of the dyad. In any of these cases, a firm might wish to 'send' a director to other firms – consequently creating a board interlock – in order to monitor, influence, or even control their strategic choices. Two databases provide CFR for French firms: Thomson One Banker Ownership (TOBO) and Dafsaliens. Dafsaliens also identifies parent companies and business group subsidiaries, which are required to track firms' ultimate owners for each direct shareholding.[15] We checked the archives of financial newspapers and the information provided on the web site of the French Authority of Financial Markets (AMF: "*Autorité des Marchés Financiers*") regarding notification of major holdings. When the holding percentage of a particular shareowner differed across sources, we corrected aberrant numbers. We also obtained information on ownership from annual reports in order to check other data sources but also to collect VR figures, which are not reported in TOBO or Dafsaliens.[16] Where CFR were available in these two databases but not displayed in annual reports, we as-

[15]Tracking ultimate owners improves perception of the actual ownership network characterizing the firms in our sample: some CAC 40 firms have no direct ownership linkages but do have indirect ownership ties when we consider the pyramidal chain of their multiple ultimate owners. However, because the ownership linkages matrix has to be of the same size as the interlocking directorate matrix, we can only use information about ultimate owners belonging to the CAC 40. Finally, we show that using or not using the ultimate owner methodology to compute cash-flow rights does not markedly change the results.

[16]Note also that, because of the 2006 European "transparency" directive, some VR figures are expressed as a percentage of total equity even if some of the shares were deprived of VR because, e.g. they were held by the actual company. In such cases, we recalculated VR on the basis of total outstanding shares.

sumed that CFR equated with VR.[17] All regressions presented include ownership linkages computed from CFR; the results were unchanged when we use VR instead of CFR.

The resulting ownership dummy variables are presented in Table 3. We can measure the three types of ownership linkages i), ii) and iii) referred to above. For example, DU_UNIL_CFR1 is equal to 1 if one of the two firms in the dyad holds a direct share of the stock capital of the other firm; DU_CROSS_CFR1[18] is equal to 1 if each firm in the dyad holds a share of the other firm's CFR; IDEMOWNER is equal to the number of common private-sector shareholders in the dyad, and DU_STATE is equal to 1 if the French State holds shares in both companies in the dyad. It is important to control for the French State's shareholdings which apply to CAC 40 corporations despite the waves of privatization in the 1990s that led to blockholdings by other companies. Similarly, we constructed the variable DU_UNIL_VR which is equal to 1 if one of the two firms in the dyad holds a direct share of the VR of the other firm, DU_UNIL_CFR2 which is equal to 1 if one of the two firms in the dyad directly or indirectly holds a share of the CFR of the other firm, and so on. Finally, we split unilateral ownership ties to consider multiple VR or CFR cut-offs. For instance, the variables DU_UNIL_SUPα_CFR1 and DU_UNIL_INFα_CFR1 refer to the existence of an ownership tie when it brings respectively more than α% of the CFR and less than α% of the CFR, where α can take the value of 20, 10, 5, 4, 3, 2 or 1. Table 2 panel B, presents the evolution of DU_UNIL_CFR1 and DU_CROSS_CFR1. We identify 560 unilateral ownership ties among corporations,

[17] This assumption is in line with Faccio and Lang's (2002) study which shows that, in 1996, 19.96% of stock capital was required to obtain a 20% of VR in French corporations. Nevertheless, as computed for companies of our sample, the first shareowner is required to hold an average of 17.89% of CFR to obtain 20% of VR during the sample period. Under French corporate law, double voting is given to each share belonging to the same shareholder for at least 2 years. General meetings can increase this duration.

[18] Under French corporate law no shareholding involved in cross-ownership can exceed 10% of CFR but it can exceed 10% of VR due to double voting, which however is very rare in our sample (2 cases).

and 63 cases of cross-ownership. As for interlocking directorates, the frequency of these two variables is decreasing over the study period.

We also construct control variables for the other possible determinants of interlocking directorates usually considered in the literature. Interlocks can exist for various social and economic reasons. First, in the economic literature, board reputation and directors' expertise are considered important sources of interlocks (Kaplan and Reishus, 1990; Shivdasani, 1993; Yermack, 2004; Fich and Shivdasani, 2007; Bugeja, Rosa, and Lee, 2009; Adams, Hermalin, and Weisbach, 2010): on the demand side of the director labor market, skilled directors are sought-after by managers and shareholders for the supplementary value brought by their expertise; on the offer side, successful directors obtain supplementary directorships in other firms, which implies better compensation and creates an incentive to continue to be efficient. All these factors imply that firms whose board members are particularly renowned for their excellence will exhibit more directorate interlocks than average. To account for this determinant of interlocks, we create two variables for each dyad at time t: DEGREE_{it} is the number of outside directorships held by firm i's directors in other firms in the sample, and DEGREE_{jt} is the number of outside directorships held by firm j's directors in other firms in the sample. Note that DEGREE_{it} is simply the total number of firm i's interlocks with all the other firms in the sample, and correspondingly for DEGREE_{jt}. These two variables are proxies for the reputation of the board of each firm in the dyad ij. Since the total number of a firm's interlocks has a greater probability to be important when board size is large, we need to introduce a measure of board size to filter the reputation effect measured by DEGREE_{it} and DEGREE_{jt}. We therefore introduce the variable BOARDSIZE which is equal to the sum of the board sizes of both firms in the dyad.[19] In addition, it can be expected that board members of CAC 40 firms possess special expertise on this kind of very large listed firm. They may hold valuable tacit knowledge about the strategies necessary to continue to be ranked in top capitalizations. This implies that the same small group of persons composes the talent pool for large capitalizations' boards. If similar persons are always appointed to similar firms/boards, there is likely to be a homophily effect on interlocking directorates: firms that belong to the very selective club of CAC 40 firms tend to use the same talent pool to select their directors, and this professional elite will tend to prefer CAC 40 firms (see, e.g. Mace, 1971; Mizruchi, 1996; Burris, 2005). We assess this homophily effect with the dyadic variable DISTANCETOCAC equal to the absolute value of the difference between the number of years that firm i has been in the CAC 40 over the sampling period, minus the number of years that firm j was in the CAC 40 over the sampling period.[20] A high DISTANCETOCAC means low degree of homophily, and this variable therefore should have a negative impact on the probability that boards i and j are interlocked.

Another important rationale for interlocking directorates is cost-benefit optimization along various dimensions. Firms have to get access to resources and markets at the lowest costs, and they also have to reduce transaction and information costs as often as possible. Several studies show that sharing directors with suppliers and customers reduces these costs (see, e.g., Booth and Deli, 1996; Pfeffer and Salancik, 2003; Hillman, Cannella, and Paetzold, 2000). A similar argument is that firms may plan strategic alliances with suppliers, customers, or competitors operating in the same markets to try to reduce costs or to alleviate competitive pressures. Since strategic alliances often necessitate mutual control,

[19]We initially implemented all regressions with another size variable, log sum of the market capitalization of the two firms in a dyad, but excluded it because it was never significant.

[20]The time in the CAC 40 is divided by the number of years the firm is present in the sample, for each firm in the dyad.

this may generate intra-industry interlocks. Therefore, the probability of interlocking directorates should be higher if firms belong to the same industry sector. To account for these alliance-related interlocks we create two dummy variables DU_IDEMSIC and DU_FIN2: the first is equal to 1 if the two firms in the dyad are non-financial firms belonging to the same 2-digit SIC industrial sector; the second is equal to 1 if the two firms are financial companies. Firms also want to secure bank funding at the best possible price. Again, this may produce interlocks because banks send directors to large debtors to reduce problems of asymmetric information, and large borrowers try to be represented on banks' boards to obtain better financing conditions.[21] However, this may also prevent interlocks because banks are aware of monitoring costs and potential conflicts of interests and do not want to become captive monitors (Kroszner and Strahan, 2001). We assess this effect with the dummy DU_FIN1 which is equal to 1 when only one of the two firms is a financial company.[22]

We also need to address the specificity of CEO interlocks. First, there is evidence that CEOs are particularly eager to sit on each other's boards because it provides job security and higher compensation (see e.g., Hallock, 1997; Fich and White, 2005; Kramarz and Thesmar, 2006; Adams, Hermalin, and Weisbach, 2010). It might be suspected that our results for all interlocks are driven by CEOs interlocks. To check this, we re-run all the regressions with modified dependent variables, excluding CEO interlocks from the count of interlocking directorates (see "Robustness check 1" in next section). While managers' entrenchment strategies may produce CEO interlocks, they do not necessarily favor the

[21]E.g. evidence is provided by Morck and Nakamura (1999), Byrd and Mizruchi (2005), Santos and Rumble (2006), Güner, Malmendier, and Tate (2008), Dittmann, Maug, and Schneider (2010), and Ferreira and Matos (2012).

[22]Note that insurance companies are included in the category "financial companies" because, like in Germany, they are important providers of equity for French corporations and this may generate overlapping directors.

formation of interlocks between non-CEO directors: managers may prefer a degree of closure of the firm's governance system to avoid the introduction of external directors that could challenge their decisions. If so, then the more powerful the CEO in the firm the less likely will be the nomination of outside directors from shareholder companies keen to monitor his or her actions. Therefore, we can expect a negative correlation between measures of boards' closure and the probability of interlocking directorates. We introduce two variables to address two dimensions of this problem. The first is a measure for board independence DU_NODUALITY which is equal to 1 if both firms have a rule that the CEO cannot be the chairman of the board.[23] We expect a positive effect on interlocks probabilities. The second measures average ownership concentration of the two firms in the dyad, C1MEAN, which is equal to the average voting rights held by the main shareholder in the two companies (Table 2 Panel A provides the distribution of CAC 40 companies according to the percentage of VR held by the first owner). The existence of controlling shareowners should have a negative impact on interlock probabilities because such large blockholders will not easily accept sharing of power with other firms; consequently they will prefer directors that represent only their interests, rather than interlocked directors that may represent the interests of other firms.

3 Econometric method and results

The main dependent variable, INTERLOCKS, is a dyadic categorical variable equal to 0 if there is no interlock between the two firms in the dyad, equal to 1 if there is one interlocked director, and equal to 2 if there are at least two interlocks between the firms.

[23] We also built a count variable equal to zero if the chairman is the CEO in both firms, equal to 1 if the CEO is not the chairman in one firm in the dyad, and equal to 2 if DU_NODUALITY equals 1. The results were unchanged when using this variable.

It is natural to use multinomial logit models in this context. The panel structure of our dataset allows us to account for time dependence; in all the regressions we introduce the nine time dummies corresponding to our 1997-2006 observation period. The panel structure also may generate autocorrelation within each firm dyad, and heteroskedasticity between dyads; we systematically adjust standard errors for clustering at dyad level with the Huber-White correction. There is also a specific autocorrelation issue generated by the dyadic nature of the dependent variable: considering that we have n firms and $n \times (n-1)/2$ dyads, errors are autocorrelated between dyads because any firm i present in dyad ij is also present in the $n-1$ other possible dyads that include firm i. As a consequence, any unobserved characteristic of firm i that would fall into the error term ε_{ij} could also be present in the errors $\varepsilon_{ik}(k = 1 \ldots (n-1); k \neq j)$ related to firm i. The simplest way to address this problem is inspired by gravity models of foreign trade flows (see, e.g., Mátyás, 1997) and consists of introducing weights variables measuring the gravity of each firm in each dyad (see, e.g., Hoekman, Frenken, and Tijssen, 2010, who apply the same methodology to scientific collaboration networks). The already described variables DEGREE_{it} and DEGREE_{jt} which control for reputation effect provide the required gravity measures. We introduce time averaged degrees, AVDEGREE_i and AVDEGREE_j as firm fixed effects. Since the model includes a distance measure as well (the variable DISTANCETOCAC described above), it is rather similar to a gravity model.

Table 4 displays the results – odd ratios and standard errors – of the multinomial logit regressions of the categorical variable INTERLOCKS on ownership and the control variables described above. The Log Pseudolikelihood and other usual statistics not displayed here show that the overall fit of the model is very satisfactory. The Small-Hsiao tests validate the assumption of independence of irrelevant alternatives. All regressions are implemented for the period 1997-2006 on 1,776 firm dyads, resulting in an unbalanced panel of 12,611 dyad-year observations.

The odds of having one interlocking directorates rather than zero, and at least two interlocking directorates rather than zero, are strongly and positively affected by the three forms of ownership linkages. For example, if one of the two dyad firms holds at least 20% of the shares of the other firm, the odds of having one interlock rather than zero are multiplied by 10.92 and the odds of having two or more interlocks change by a factor of 92.09. The factor change coefficients of the ownership variables DU_UNIL, DU_CROSS, DU_UNIL_SUP, and DU_UNIL_INF are much larger than the coefficients of the other significant variables. These results unambiguously validate Proposition 1, point i): interlocking directorates are strongly correlated to ownership linkages, which can be interpreted as evidence that ownership ties are used to produce monitoring or control linkages. As already discussed, this result counters the view that control is separated from ownership. On this sample of firms, stock owners seem to be able to achieve nominations of directors that will represent their interests. We see that the other corollaries of proposition 1 are also validated by these regressions: the variable DU_UNIL_INF is significant in all cases, showing that even small shareholdings very much increase the odds of having interlocks (point ii, proposition 1).[24] Also, even if the percentage of shareholdings between the firms in the dyad is very small (Table 4 columns 9 to 12), the coefficients of factor change are more important than the other significant variables. However, as stated in Proposition 1 point iii), the higher the shareholding, the higher should be the odds of having one or more interlocks. Indeed, the Wald tests displayed under Table 4 (note (5) "UNIL $\geq \alpha$

[24] If we use VR instead of CFR, DU_UNIL_INF no longer explains the existence of one interlock for the 1% threshold. It suggests that some small shareholders benefit from double voting which allows them to have more than 1% of the VR. Shareholdings below the 1% cut-off of CFR but without double voting are not a determinant of single interlocks but still explain multiple interlocks.

vs. UNIL < α") show that, for all outcomes and all ownership thresholds except the 1% limit, the coefficients of the dummy measuring large blockholdings are always significantly greater than the coefficients of the dummy measuring small blockholdings. Here again, ownership appears to be an important determinant of monitoring or control ties, and the higher the ownership linkage the higher the ability to affect the course of action of a firm.

Please insert Table 4

Proposition 2, point i) states that the correlation between multiple interlocks and ownership ties can be interpreted as evidence that some shareowners seek control power rather than simple monitoring capacity. Our results support this proposition: indeed, the odds of having at least two rather than zero interlocks increase by a factor 11.89 when two firms have a unilateral ownership linkage. Moreover, the theory predicts that decision-making authority might be sought by both large and small blockholders. If these shareholders have a real incentive to seek such control power, then multiple interlocks are likely to be even more strongly correlated to ownership linkages than single interlocks, which latter reveal either a monitoring power or control power (Proposition 2, point ii). The Wald tests (notes (3), (4), (6) and (7) to Table 4) provide clear evidence supporting this proposition: all ownership linkage variables tested affect the odds of having multiple interlocks more than the odds ratios of having a single interlock, and according to the Wald Chi2 statistics, these differences are always significant. Finally, Proposition 2, point iii) states that control power depends more strongly on ownership lock-in devices than on unilateral ownership linkages. The discrepancy between VR and CFR cannot validate this proposition because as already underlined, the results are the same with both types of measures. Nevertheless, Table 4 shows that cross-ownership has a higher impact on the odds of having multiple interlocking directorates, than a unilateral stake. Indeed, this specific corporate ownership lock-in device changes the odds of having at least two interlocks by a factor of 85.34 and unreciprocated ownership changes the odds by a factor 11.89. The Wald test (note (4) to Table 4) shows that this difference is significant. Moreover, notice that the difference between unilateral and cross-ownership is not significantly different from zero in the case of a single interlock. Therefore, cross-ownership seems to have a particular influence on multiple overlapping directors reflecting the control purpose of this ownership lock-in device.

Before commenting on the control variables, it is also useful to notice that common ownership by a third party, measured by the variables IDEMOWNER and DU_STATE, has a much lower effect on board interlocking between a pair of firms than the existence of unilateral or cross-ownership linkages between them.

In relation to the control variables, the factor change coefficients are in line with what is predicted in the literature. First, even after controlling for board size,[25] our measures of board reputation and competence (DEGREE_{it} and DEGREE_{jt}) display coefficients that are significant and greater than 1 factor change. Similarly, the inverted measure of similarity between pairs of firms (DISTANCETOCAC) has the expected significant and less than 1 factor change coefficient. The dummy DU_FIN1 (equal to 1 if one and only one of the two firms is a financial company) has a significant and less than 1 factor change coefficient, which means that pairs of financial and non-financial companies have fewer interlocking directorates than pairs of non-financial companies belonging to different sec-

[25]Note that BOARDSIZE, which is a natural control variable for interlocking directorates, is significant only if the companies have one overlapping director. This effect disappears if the dyad has at least two interlocks. In other words, controlling ties between corporations must be explained by other factors than the natural determinant of interlocking directorates. The effect of BOARDSIZE is significantly different from zero for at least two interlocks only when we remove the board reputation variables DEGREE_{it} and DEGREE_{jt}.

tors: in line with the argument in Kroszner and Strahan (2001), financial companies seem to avoid interlocking directorates with potential customers because they want to avoid potential conflicts of interests. The idea that industry alliances will generate interlocks is not supported in this sample: we find non-significant factor change coefficients for the dummy DUIDEMSIC designed to detect alliances between two non-financial firms; the dummy DU_FIN2 constructed to detect alliances between financial firms, shows significantly reduced odds ratios but only for the multiple interlock outcome. Finally, our measures of board openness (C1MEAN and DU_NODUALITY) are not significant.

4 Robustness checks

We next address several potential shortcomings of the above estimates: 1) the results may be driven by CEO interlocks, and therefore may reflect a managerial entrenchment strategy rather than the possibility for the corporate owner to have directors who will act on its behalf; 2) measures of *direct* ownership linkages may not capture correctly the reality of ownership connections; 3) the causality between ownership linkages and human linkages (interlocks) may be inverted.

4.1 Robustness check 1: Are the results driven by CEO interlocks?

Although our measures of board openness (DU_NODUALITY and C1MEAN) do not have significant effects on the odds of having interlocked directors, which suggests that managerial entrenchment is not driving the results, we check whether removing CEO interlocks changes the findings.

The regressions in Table 5 are similar to the above regressions, except the multinomial dependent variable is now constructed excluding CEO interlocks.[26] Nothing changes concerning propositions 1 and 2, points i) and ii). However, in relation to Proposition 2, point iii) the factor change coefficients of the variable DU_CROSS_CFR1 are no longer significant, which means that the positive impact of cross-shareholdings on interlocking directorates was driven by CEO interlocks. This modification can be interpreted in two ways: 1) either managers use cross-ownership as a means of obtaining a position on each other's boards for entrenchment purpose; or 2) they promote cross-shareholdings when they sit on each other's boards. However, this finding does not challenge proposition 1 or proposition 2, points i) and ii): ownership is required to obtain control – even to control the firm at the expenses of other shareholders.

Please insert Table 5

4.2 Robustness check 2: varying the measures of ownership linkages

In the results presented in Tables 4 and 5, ownership connections are measured on the basis of *direct* CFR figures. However, pyramid structures[27] and cross-shareholdings mean that some ultimate owners have the possibility of a seat on the board even when the value of their indirect CFR is lower than the value of the direct CFR. Indeed, multiple

[26]The count variable INTERLOCKS takes the value zero if CEOs sit on each other's boards.

[27]In Faccio and Lang's (2002) study, in 15.7% of cases, French firms with a 20% controlling shareholder are controlled by a pyramid structure. In our data, this frequency is 22.5% of firms with a 20% controlling owner. When the first shareowner holds at least 10% or 5% of the VR, there is a pyramid structure in respectively 21.2% and 26.6% of cases. The frequency rises to 30.8% of our year-firm sample if we consider all first shareowners even if they hold less than 5% of the VR. Consequently, the use of a pyramid by the first shareholder seems to increase with ownership dispersion, suggesting that this structure plays an important role for various capital thresholds of main French corporations.

indirect owners may be eligible for board membership either because they ultimately control a direct shareholding or because they contribute to pyramid structure used to control it. Consequently, accounting for these indirect owners may change the correlation between ownership connections and board interlocks. We utilize the information on parent companies and group subsidiaries provided in annual reports and the Dafsaliens database to investigate ownership chains and compute indirect CFR. Before presenting the method, we highlight two points. First, we apply this approach not to VR but to CFR, that is we apply a linear not a threshold methodology (Vitali, Glattfelder, and Battiston, 2011). The reason for this choice is that indirect VR provide effective control rights only when the indirect owner holds more than 50% of the VR for each link in the ownership chain (or 20% or 10% depending on control chain definition). It is only in this case that we can consider that the indirect owner controls the votes of the direct owner. Using VR would imply that we could only select the controlling owner of the direct shareholding whereas we are interested in all indirect owners. Conversely, indirect owners can be tracked by computing indirect CFR which is a non-exclusive method because it produces a non-zero value for an indirect owner even if he is not the controlling owner. Second, while ultimate controlling owners were identified for each shareholding, they cannot be included in the regressions if the companies were not listed on the CAC 40 over the 1997-2006 observation period. The reason for this selection is the dyadic approach employed here: the ownership connections matrix and the interlocking directorates' matrix have to be of same size and composed of the same firms. Nevertheless, we investigate the entire ultimate ownership structure of the corporations in the sample to detect all possible indirect shareholdings across these companies. Thus, for the whole period we collect 3,174 shareholdings across a total of 249 entities including the 61 corporations we investigate in this paper. This number (listed or unlisted companies and ultimate family owners) varies from a minimum of 142 to a maximum of 188 depending on the year considered. The number of shareholdings across these entities ranges from a minimum of 257 to a maximum of 357.

Exploiting this set of ties and entities, for each year we compute a matrix Y of direct and indirect CFR according to the formula[28]:

$$\mathbf{Y} = \sum_{\alpha=1}^{\infty} \mathbf{X}^{\alpha} = (\mathbf{I}_n - \mathbf{X})^{-1}\mathbf{X},$$

where $\mathbf{X} = (x_{i,j})_{1 \leq i,j \leq n}$; $x_{i,j}$ is the percentage of direct CFR held by i over j; $0 \leq x_{i,j} \leq 1$ and $0 \leq \sum_{i=1}^{n} x_{i,j} \leq 1$. α is the number of links considered in the ownership chain and $\mathbf{I}_n$ is the unit matrix of size $n = (min = 142; max = 188)$. This formula generates more than 2000 direct and indirect shareholdings between corporations belonging to the CAC 40 index. Nevertheless, we consider indirect ownership ties only if they bring at least 0.25% of the CFR, which is equivalent to an ownership chain with two links of 5%. As a result of this inclusion of indirect ownership ties between the sample firms, the number of unilateral ties increases from 560 to 714, and the number of cross-shareholdings rises from 63 to 84.

We then re-estimate the multinomial logit equations, replacing the independent variables DU_UNIL_CFR1, DU_CROSS_CFR1, DU_UNIL_SUP_CFR1, DU_UNIL_INF_CFR1 by DU_UNIL_CFR2, DU_CROSS_CRF2,

[28] Another possible approach is to exclude direct participations when the indirect owners of the direct owners benefit from the integrality of the CFR of the latter. In this case, the ownership ties matrix is : $\mathbf{Z} = \mathbf{DY}$,
where $\mathbf{D} = diag(\mathbf{U} - \mathbf{S})$, $\mathbf{U}$ is the unit row vector and $\mathbf{S} = (s_j)_{1 \leq j \leq n}$ is a row vector whose elements are: $s_j = \sum_{i=1}^{n} x_{i,j}$.
However we did not adopt this approach because it suppresses direct ownership connections which are shown to be effective determinants of board interlocks. Similar methodologies are used and discussed in, e.g., Brioschi, Buzzacchi, and Colombo (1989), Flath (1989), Dietzenbacher, Smid, and Volkerink (2000), Dietzenbacher and Temurshoev (2008), Chapelle and Szafarz (2005), Gutiérrez, Pombo, and Taborda (2008), Vitali, Glattfelder, and Battiston (2011), Almeida, Park, Subrahmanyam, and Wolfenzon (2011).

DU_UNIL_SUP_CRF2, DU_UNIL_INF_CRF2 computed with direct *and indirect* CFR instead of direct CFR. The results are presented in Table 6.

Please insert Table 6

The significance of the odds ratios and Wald tests is not affected by this change. The level of some odds ratios is slightly modified but not in a way that changes interpretation of the results in relation to Propositions 1 and 2.

4.3 Robustness check 3: addressing the endogeneity of ownership ties and board connections

The causality between ownership linkages and human linkages (interlocks) may be inverted because directors sitting on several boards may encourage companies to hold shares in these firms. A simple and preliminary way to address this issue is to lag the ownership linkage variables in the regressions.[29] We lag the variables DU_UNIL_CFR1, DU_CROSS_CFR1, DU_UNIL_SUP_CFR1, DU_UNIL_INF_CFR1, IDEMOWNER and DU_STATE by one year and three years. Since current interlocks cannot cause past ownership linkages, if the latter have a significant impact on present interlocks this can be interpreted as evidence that there is causality from ownership ties to board linkages, even if the reverse causality is also present at time t.

The factor change coefficients of the ownership connection variables remain large and significant even in the specifications with a three year lag. However, their level is sometimes reduced in comparison to the corresponding coefficients in Table 4. For example, cross-shareholdings at year t raise the odds of having one board interlock at year t by a

[29]These regressions, not displayed here for space reasons, are available upon request.

factor 5.7 (Table 4) whereas a cross-ownership at year $t-1$ increases the odds of having one interlock at year t by a factor of only 4.3, and by a factor 3.2 if the variable is three year lagged. Therefore, even if past ownership ties increase the odds of interlocks, suggesting that at least part of the causality goes from ownership ties to board interlocks, we cannot exclude that the larger contemporaneous correlation is due to a partial inversion of contemporaneous causality.

Since we cannot exclude that causality inversion may be biasing the results, we investigate this issue further using instrumented versions of our multinomial logit regressions. Two instrumental variables techniques can be implemented to correct for endogeneity biases in nonlinear models: the two-stage residual inclusion (2SRI) method and the two-stage predictor substitution (2SPS) approach. Both methods use consistent first stage regressions to instrument the variables that are supposed to be endogenous. In 2SPS, the results of the first stage regressions are used to generate predicted values for the endogenous variables. The second-stage regression is conducted after replacing the endogenous variables by their predicted values. In 2SRI, the endogenous variables are not replaced in the second-stage regression. Instead, the first-stage residuals are included as additional regressors. If their coefficients are significant, endogeneity is confirmed. This method was suggested by Hausman (1978) to test for endogeneity in linear models. Consistent 2SRI methods for various types of non-linear models were proposed by Smith and Blundell (1986), Newey (1987), Rivers and Vuong (1988), and Blundell and Smith (1989, 1993). Wooldridge (2008) suggests the use of the 2SRI method for count data models. Terza, Basu, and Rathouz (2008) show that, in contrast to the 2SPS estimator, the 2SRI estimator is consistent for non-linear models such as, for example, the multinomial logit we use in this paper. The use of 2SPS can generate substantial bias and this is not attenuated by large sample sizes. Thus, there are strong arguments favoring the use of 2SRI for the econometric estimation of nonlinear models with endogenous regressors.

We suspect that cross-shareholdings (DU_CROSS_CFR1) and large and small shareholdings (DU_UNIL_SUPα_CFR1 and DU_UNIL_INFα_CFR1) at various holdings thresholds α% may be endogenous because directors sitting on several boards promote cross-ownership between, or unilateral ownership in, the multiple firms of which they are directors. Since we do not possess external instruments for these possibly endogenous variables we use internal ones. Lagging and differentiating some of the independent variables generates an important decrease in the number of observations and, even if their number remains large ($> 7,000$), this is problematic because of the categorical nature of the dependent and independent variables. Indeed, INTERLOCKS is equal to 0 in 90% of the 12,611 observations, DU_CROSS_CFR1 is equal to 1 in only 0.5 % of cases, DU_UNIL_SUP5%_CFR1 is equal to 1 in 1% of cases, and DU_UNIL_SUP20%_CFR1 is equal to 1 in 0.5% of cases. As a consequence, the loss of too many observations generates situations in which some independent dummy variables do not vary within the dependent variable categories, which implies that their coefficients cannot be estimated. This problem forces us to limit the number of instrumented variables, and also to limit the number of lags used to instrument these variables.

Therefore, we adopt the following strategy. First, we address endogeneity in the simplest specification of our model including only DU_UNIL_CFR1 and DU_CROSS_CFR1 because unilateral ownership captured by DU_UNIL_CFR1 is not differentiated between large and small shareholdings. Only one variable, DU_CROSS_CFR1, is suspected of endogeneity in this equation. We implement the 2SRI method to re-estimate this equation and show that the endogeneity test rejects the hypothesis that DU_CROSS_CFR1 is endogenous. We can now implement the 2SRI estimation in the other equations where DU_UNIL_CFR1 is split into two categories for large and small shareholdings. Of course, "large" stakes have to be defined according to the various thresholds already utilized: 20%, 10%, 5%, 2%, and 1%. However, it was not possible to find tractable instruments in the case of the 20% threshold because the variable DU_UNIL_SUP20_CFR1 is too infrequently equal to 1 (0.5% of cases). The need for a large enough number of cases where the independent dummy variable suspected of endogeneity is equal to 1 led us to implement the 2SRI method, with the unilateral ownership threshold set at 5% only, for the variables DU_UNIL_SUP5_CFR1 and DU_UNIL_INF5_CFR1 as potentially endogenous, and all the other independent variables, including DU_CROSS_CFR1, as exogenous.

Table 7 shows the outcomes of the 2SRI re-estimation of the first interlock equation of Table 4, with the variables DU_CROSS_CFR1 considered potentially endogenous. The first stage equation is a simple logit model (with standard errors adjusted for clustering) where DU_CROSS_CFR1 is regressed on the independent variables in the main equation plus two instruments:[30] DIFFCROSS_CFR1$_{t-1}$ (= CROSS_CFR1$_{t-2}$− CROSS_CFR1$_{t-1}$), which is the one year lagged first difference of the average percentage of the CFR of the cross-shareholdings of the two firms in the dyad, and CROSS_CFR1$_{t-3}$, which is the average of the CFR of the two firms when they have cross-shareholdings, three year lagged. The coefficients of these instruments are both highly significant, showing that they are not weak instruments. We then compute the residuals of this regression and add them into the multinomial logit equation already presented. Note however that, in this second stage equation, the standard errors have to be adjusted to account for the fact that the residuals included come from a first stage estimation. We obtain consistent

[30]We had to exclude DU_UNIL_CFR1 because of perfect prediction by construction, and we dropped DU_IDEMSIC because it does not vary when DU_CROSS_CFR1= 1.

standard errors for this second stage equation via bootstrapping (100 replications). Moreover, we implement an over-identifying restrictions test that consists simply of adding the instruments as explanatory variables in the second stage equation and testing their joint significance. This test validates the instruments that appear to be uncorrelated with the dependent variable INTERLOCKS. The residuals from the first stage regression are not significant, which suggests rejecting the hypothesis that DU_CROSS_CFR1 is endogenous.

Please insert Table 7

Therefore, we can treat the potential endogeneity of DU_UNIL_SUP5_CFR1 and DU_UNIL_INF5_CFR1 without instrumenting the variable DU_CROSS_CFR1.

Table 8 shows the result obtained using two first-stage equations to instrument DU_UNIL_SUP5_CFR1 and DU_UNIL_INF5_CFR1. We introduce the two residuals from these first-stage equations in the second stage multinomial logit regression, again with bootstrapped residuals. The first stage equations shows that our instruments[31] are not weak, and the over-identifying restrictions test implemented in the second stage regressions shows that they are also valid instruments. Again, the residuals from the two first stage regressions are not significant, which suggests rejecting the hypothesis that DU_UNIL_SUP5_CFR1 and DU_UNIL_INF5_CFR1 are endogenous.

Please insert Table 8

We can conclude that the specifications in Table 4 for which we could implement the 2SRI method are not biased by an endogeneity problem. However, we do acknowledge

[31]The four instruments are DIFFUNIL_SUP_CFR1$_{t-1}$ (=UNIL_SUP_CFR1$_{t-2}-$UNIL_SUP_CFR1$_{t-1}$), UNIL_SUP_CFR1$_{t-3}$, DIFFUNIL_INF_CFR1$_{t-1}$ (=UNIL_INF_CFR1$_{t-2}-$UNIL_INF_CFR1$_{t-1}$), and UNIL_SUP_CFR1$_{t-3}$. By construction, DU_CROSS_CFR1 is removed from the first stage equations.

that the large number of observations required to implement this technique with internal instruments and bootstrapped residuals does not allow us to implement the test in the specifications with the largest ownership thresholds (more than 10% or 20% of shares).

In summary, this series of robustness tests provides convincing supplementary evidence regarding propositions 1 and 2: varying ownership measures, removing CEOs interlocks, or addressing potential endogeneity problems does not change our conclusions. However, proposition 2 point iii) is invalidated by the exclusion of CEO interlocks from the dependent variable: the strong correlation between cross-ownership ties and board interlocks is driven by CEO interlocks, which can be interpreted as evidence of a managerial entrenchment strategy. CEOs use cross-shareholdings as a means of obtaining a seat on each other's boards for entrenchment purposes, and as demonstrated by the instrumental variables approach, the causality goes from cross-ownership to CEO interlocks and not in the reverse direction.

5 Conclusion

The aim of this paper was to provide empirical evidence on the non-separation of ownership and control for a wide range of large and small blockholdings held by corporations, which are typical shareowners in insider governance systems. We adopted the definition of control in the existing analytical work (Tirole, 2006): control rights are decision rights since they provide their holder the ability to affect the course of action of the firm. According to the seminal empirical work by Berle and Means (1932), obtaining one or more seats on the board is the main way to achieve control rights in corporations. Our empirical strategy is original because it evaluates the ability of multiple categories of blockholders to be represented on the boards of their holdings, by measuring the correlation between two networks: the network of overlapping directors between corporations, and the network of shareholding linkages between the same set of companies.

By focusing on multiple categories of owners of a corporation, we contribute in three ways to the literature dealing with minority controlling shareholders (Bebchuk and Weisbach, 2010). We show first that both large and small ownership linkages across companies, from 20% to 1% of CFR or VR, are strong predictors of overlapping directors among these corporations. The impact of ownership ties on interlocking directorates is much stronger than any of the other potential determinants of overlapping directors, such as reputation and competences of board members. This result is congruent with studies on controlling shareholders because we show that the probability that two firms are interlocked is increased more if one of them holds a large stake in the other than if it holds a small stake. Nevertheless, since we also find that small shareholdings can create interlocking directorates, our work underlines the need to consider not only the first or the second shareholder but also the entire ownership structure, particularly when it involves other listed companies. A second important contribution is that we distinguish between the two possible goals of shareholders when they want a seat on the board: a) they may want to monitor the firm, which requires ability to gather information that can be enabled by a single seat on the board; b) they may want control power, that is, real making-decision authority which can be achieved only by a strong position on the board. We interpret multiple interlocks between two companies as a signal that at least one of the two connected corporations seeks decision-making authority rather than simple monitoring ability. We show that large and small shareholdings are even more strongly correlated with multiple than single interlocks, which suggests that the control purpose depends more on ownership, than the monitoring purpose. The third main contribution of our study is that we provide evidence that cross-ownership is a way for CEOs to entrench themselves. Indeed, cross-shareholdings are the main determinant of multiple interlocking directorates but this effect disappears when we remove CEO interlocks from the count of overlapping directors. Finally, we show that our results are not biased by endogeneity problems which might be due to causality issues: ownership linkages are the main determinant of interlocking directorate, and not the reverse. Ownership remains the main way to gain monitoring or controlling power even if this is at the expense of other minority shareholders in the case of cross-ownership.

Beyond these methodological and empirical contributions, we think that our study provides recommendations for regulation of corporate governance in Europe. Transparency has improved in European countries since the late 1990s (Enriques and Volpin, 2007). Nevertheless, it remains difficult to gather systematic information on small shareholdings below the 5% threshold of stock capital. We have demonstrated that small stakes held by other corporations play an important role in corporate governance. In this study, we matched five sources of information to collect reliable data on ownership structures. A unified legally-based source of information that identifies all corporations that are minority shareholders of a given listed firm, is lacking in Europe. European countries, mainly characterized by insider governance systems, could take inspiration from US regulation which requires disclosure of all shareholdings held by large institutional owners. Our results suggest that similar regulation should be imposed in Europe to achieve disclosure of all stakes held by large financial and non-financial listed companies. Of course, this requires more research in the European context on the impact of ownership networks, cross-holdings, and pyramidal ownership structures on corporate governance.

References

Adams, R. B., B. E. Hermalin, and M. S. Weisbach, 2010, "The Role of Boards of Directors in Corporate Governance: A Conceptual Framework and Survey," *Journal of Economic Literature*, 48(1), 58–107.

Aghion, P., and P. Bolton, 1992, "An Incomplete Contracts Approach to Financial Contracting," *The Review of Economic Studies*, 59(3), 473–494.

Almeida, H., S. Y. Park, M. G. Subrahmanyam, and D. Wolfenzon, 2011, "The structure and formation of business groups: Evidence from Korean chaebols," *Journal of Financial Economics*, 99(2), 447–475.

Aoki, M., 1988, *Information, Incentives and Bargaining in the Japanese Economy: A Microtheory of the Japanese Economy.* Cambridge University Press, Cambridge.

Aoki, M., G. Jackson, and H. Miyajima (eds.), 2007, *Corporate governance in Japan: Institutional change and organizational diversity.* Oxford University Press, New-York.

Attig, N., S. El Ghoul, O. Guedhami, and S. Rizeanu, 2013, "The governance role of multiple large shareholders: evidence from the valuation of cash holdings," *Journal of Management & Governance*, 17(2), 419–451.

Attig, N., O. Guedhami, and D. Mishra, 2008, "Multiple large shareholders, control contests, and implied cost of equity," *Journal of Corporate Finance*, 14(5), 721–737.

Barca, F., and M. Becht (eds.), 2001, *The Control of Corporate Europe.* Oxford University Press, New York.

Bebchuk, L. A., R. Kraakman, and G. Triantis, 2000, "Stock pyramids, cross-ownership, and dual class equity: the mechanisms and agency costs of separating control from cash-flow rights," in *Concentrated corporate ownership*, ed. by R. K. Morck. University of Chicago Press, pp. 295–318.

Bebchuk, L. A., and M. S. Weisbach, 2010, "The State of Corporate Governance Research," *Review of Financial Studies*, 23(3), 939–961.

Bennedsen, M., and D. Wolfenzon, 2000, "The balance of power in closely held corporations," *Journal of Financial Economics*, 58(1/2), 113–139.

Berglöf, E., and E. Perotti, 1994, "The governance structure of the Japanese financial keiretsu," *Journal of Financial Economics*, 36(2), 259–284.

Berle, A. A., and G. C. Means, 1932, *The modern corporation and private property*. The Macmillan Company, New York.

Bizjak, J., M. Lemmon, and R. Whitby, 2009, "Option Backdating and Board Interlocks," *Review of Financial Studies*, 22(11), 4821–4847.

Bloch, F., and U. Hege, 2001, "Multiple Shareholders and Control Contests," Working paper n° 01A16, GREQAM.

Bloch, L., and E. Kremp, 2001, "Ownership and Voting Power in France," in *The Control of Corporate Europe*, ed. by F. Barca, and M. Becht. Oxford University Press, New York, chap. 4, pp. 106–127.

Blundell, R. W., and R. J. Smith, 1989, "Estimation in a Class of Simultaneous Equation Limited Dependent Variable Models," *The Review of Economic Studies*, 56(1), 37–57.

Blundell, R. W., and R. J. Smith, 1993, "Simultaneous microeconometric models with censored or qualitative dependent variables," in *Handbook of Statistics*, ed. by G. S. Maddala, C. R. Rao, and H. D. Vinod. North Holland Publishers, Amsterdam, vol. 2, pp. 1117–1143.

Bohman, L., 2012, "Bringing the owners back in: An analysis of a 3-mode interlock network," *Social Networks*, 34(2), 275 – 287.

Booth, J. R., M. M. Cornett, and H. Tehranian, 2002, "Boards of directors, ownership, and regulation," *Journal of Banking & Finance*, 26(10), 1973–1996.

Booth, J. R., and D. N. Deli, 1996, "Factors affecting the number of outside directorships held by CEOs," *Journal of Financial Economics*, 40(1), 81–104.

Bouwman, C. H. S., 2011, "Corporate Governance Propagation through Overlapping Directors," *Review of Financial Studies*, 24(7), 2358–2394.

Bradbury, M. E., and Y. Mak, 2000, "Ownership structure, board composition and the adoption of charter takeover procedures," *Journal of Corporate Finance*, 6(2), 165–188.

Brioschi, F., L. Buzzacchi, and M. G. Colombo, 1989, "Risk capital financing and the separation of ownership and control in business groups," *Journal of Banking & Finance*, 13(4-5), 747–772.

Bugeja, M., R. D. S. Rosa, and A. Lee, 2009, "The Impact of Director Reputation and Performance on the Turnover and Board Seats of Target Firm Directors," *Journal of Business Finance & Accounting*, 36(1-2), 185–209.

Burris, V., 2005, "Interlocking Directorates and Political Cohesion among Corporate Elites," *American Journal of Sociology*, 111(1), 249–283.

Byrd, D. T., and M. S. Mizruchi, 2005, "Bankers on the board and the debt ratio of firms," *Journal of Corporate Finance*, 11(1-2), 129–173.

Cai, J., J. L. Garner, and R. A. Walkling, 2009, "Electing Directors," *The Journal of Finance*, 64(5), 2389–2421.

Cai, Y., and M. Sevilir, 2012, "Board connections and M&A transactions," *Journal of Financial Economics*, 103(2), 327–349.

Carney, R. W., and T. B. Child, 2013, "Changes to the ownership and control of East Asian corporations between 1996 and 2008: The primacy of politics," *Journal of Financial Economics*, 107(2), 494–513.

Chapelle, A., and A. Szafarz, 2005, "Controlling firms through the majority voting rule," *Physica A: Statistical Mechanics and its Applications*, 355(2–4), 509–529.

Chikh, S., and J.-Y. Filbien, 2011, "Acquisitions and CEO power: Evidence from French networks," *Journal of Corporate Finance*, 17(5), 1221–1236.

Claessens, S., S. Djankov, and L. H. P. Lang, 2000, "The separation of ownership and control in East Asian Corporations," *Journal of Financial Economics*, 58(1/2), 81–112.

Dahya, J., O. Dimitrov, and J. J. McConnell, 2008, "Dominant shareholders, corporate boards, and corporate value: A cross-country analysis," *Journal of Financial Economics*, 87(1), 73–100.

Demsetz, H., and B. Villalonga, 2001, "Ownership structure and corporate performance," *Journal of Corporate Finance*, 7(3), 209–233.

Denis, D. J., and A. Sarin, 1999, "Ownership and board structures in publicly traded corporations," *Journal of Financial Economics*, 52(2), 187–223.

Dhillon, A., and S. Rossetto, 2009, "Corporate Control and Multiple Large Shareholders," Working paper n° 891, The Warwick Economics Research Paper Series.

Dietzenbacher, E., B. Smid, and B. Volkerink, 2000, "Horizontal Integration in the Dutch Financial Sector," *International Journal of Industrial Organization*, 18(8), 1223–1242.

Dietzenbacher, E., and U. Temurshoev, 2008, "Ownership relations in the presence of cross-shareholding," *Journal of Economics*, 95(3), 189–212.

Dittmann, I., E. Maug, and C. Schneider, 2010, "Bankers on the Boards of German Firms: What They Do, What They Are Worth, and Why They Are (Still) There," *Review of Finance*, 14(1), 35–71.

Edmans, A., and G. Manso, 2011, "Governance Through Trading and Intervention: A Theory of Multiple Blockholders," *The Review of Financial Studies*, 24(7), 2395–2428.

Edwards, J., and M. Nibler, 2000, "Corporate Governance in Germany: The Role of Banks and Ownership Concentration," *Economic Policy*, 15(31), 237–267.

Enriques, L., and P. Volpin, 2007, "Corporate Governance Reforms in Continental Europe," *Journal of Economic Perspectives*, 21(1), 117–140.

Faccio, M., and L. H. P. Lang, 2002, "The ultimate ownership of Western European corporations," *Journal of Financial Economics*, 65(3), 365–395.

Ferreira, M. A., and P. Matos, 2012, "Universal Banks and Corporate Control: Evidence from the Global Syndicated Loan Market," *Review of Financial Studies*, 25(9), 2703–2744.

Fich, E. M., and A. Shivdasani, 2007, "Financial fraud, director reputation, and shareholder wealth," *Journal of Financial Economics*, 86(2), 306–336.

Fich, E. M., and L. J. White, 2005, "Why do CEOs reciprocally sit on each other's boards?," *Journal of Corporate Finance*, 11(1-2), 175–195.

Flath, D., 1989, "Vertical integration by means of shareholding interlocks," *International Journal of Industrial Organization*, 7(3), 369–380.

Fracassi, C., and G. Tate, 2012, "External Networking and Internal Firm Governance," *The Journal of Finance*, 67(1), 153–194.

Franks, J., and C. Mayer, 1990, "Takeovers: Capital Markets and Corporate Control: A Study of France, Germany and the UK," *Economic Policy*, 5(10), 189–231.

——— , 1997, "Corporate Ownership and Control in the U.K., Germany, and France," *Journal of Applied Corporate Finance*, 9(4), 30–45.

——— , 2001, "Ownership and Control of German Corporations," *The Review of Financial Studies*, 14(4), 943–977.

Franks, J., C. Mayer, and H. Miyajima, 2012, "The Ownerhip of Japanese Corporations in the 20th Century," Working paper.

Gibbons, R., 2005, "Four formal(izable) theories of the firm?," *Journal of Economic Behavior & Organization*, 58(2), 200–245.

Ginglinger, E., W. Megginson, and T. Waxin, 2011, "Employee ownership, board representation, and corporate financial policies," *Journal of Corporate Finance*, 17(4), 868–887.

Güner, A. B., U. Malmendier, and G. Tate, 2008, "Financial expertise of directors," *Journal of Financial Economics*, 88(2), 323–354.

Goergen, M., M. C. Manjon, and L. Renneboog, 2008, "Recent developments in German corporate governance," *International Review of Law and Economics*, 28(3), 175–193.

Gomes, A., and W. Novaes, 2005, "Sharing of Control versus Monitoring as Corporate Governance Mechanisms," Working paper n° 277111, SSRN.

Gorton, G., and F. A. Schmid, 2000, "Universal banking and the performance of German firms," *Journal of Financial Economics*, 58(1-2), 29–80.

Gutiérrez, L. H., C. Pombo, and R. Taborda, 2008, "Ownership and control in Colombian corporations," *The Quarterly Review of Economics and Finance*, 48(1), 22–47.

Hallock, K. F., 1997, "Reciprocally Interlocking Boards of Directors and Executive Compensation," *Journal of Financial and Quantitative Analysis*, 32(03), 331–344.

Hart, O. D., 1995, *Firms, Contracts, and Financial Structure*. Clarendon Press, Oxford.

Hart, O. D., and B. Holmström, 2010, "A Theory of Firm Scope," *Quarterly Journal of Economics*, 125(2), 483–513.

Hausman, J. A., 1978, "Specification Tests in Econometrics," *Econometrica*, 46(6), 1251–1271.

Hillman, A. J., A. A. Cannella, and R. L. Paetzold, 2000, "The Resource Dependence Role of Corporate Directors: Strategic Adaptation of Board Composition in Response to Environmental Change," *Journal of Management Studies*, 37(2), 235–256.

Hoekman, J., K. Frenken, and R. J. Tijssen, 2010, "Research collaboration at a distance: Changing spatial patterns of scientific collaboration within Europe," *Research Policy*, 39(5), 662–673.

Holderness, C. G., 2009, "The Myth of Diffuse Ownership in the United States," *Review of Financial Studies*, 22(4), 1377–1408.

Hwang, B.-H., and S. Kim, 2009, "It pays to have friends," *Journal of Financial Economics*, 93(1), 138–158.

Jackson, M. O., 2008, *Social and economic networks.* Princeton University Press.

Jenkinson, T., and A. Ljungqvist, 2001, "The role of hostile stakes in German corporate governance," *Journal of Corporate Finance*, 7(4), 397–446.

Kaplan, S. N., 1994, "Top Executives, Turnover, and Firm Performance in Germany," *Journal of Law, Economics, and Organization*, 10(1), 142–159.

Kaplan, S. N., and B. A. Minton, 1994, "Appointments of outsiders to Japanese boards: Determinants and implications for managers," *Journal of Financial Economics*, 36(2), 225 – 258.

Kaplan, S. N., and D. Reishus, 1990, "Outside directorships and corporate performance," *Journal of Financial Economics*, 27(2), 389–410.

Khanna, T., and C. Thomas, 2009, "Synchronicity and firm interlocks in an emerging market," *Journal of Financial Economics*, 92(2), 182–204.

Khanna, T., and Y. Yafeh, 2007, "Business Groups in Emerging Markets: Paragons or Parasites?," *Journal of Economic Literature*, 45(2), 331–372.

Köke, J., 2004, "The market for corporate control in a bank-based economy: a governance device?," *Journal of Corporate Finance*, 10(1), 53–80.

Kramarz, F., and D. Thesmar, 2006, "Social Networks in the Boardroom," Working paper n° 878678, SSRN.

Kroszner, R. S., and P. E. Strahan, 2001, "Bankers on boards: monitoring, conflicts of interest, and lender liability," *Journal of Financial Economics*, 62(3), 415–452.

La Porta, R., F. Lopez-de-Silanes, and A. Shleifer, 1999, "Corporate Ownership Around the World," *Journal of Finance*, 54(2), 471–517.

Laeven, L., and R. Levine, 2008, "Complex Ownership Structures and Corporate Valuations," *Review of Financial Studies*, 21(2), 579–604.

Lindsey, L., 2008, "Blurring Firm Boundaries: The Role of Venture Capital in Strategic Alliances," *Journal of Finance*, 63(3), 1137–1168.

Mace, M. L., 1971, *Directors: Myth and Reality*. Harvard Business School Press, Boston.

Mak, Y., and Y. Li, 2001, "Determinants of corporate ownership and board structure: evidence from Singapore," *Journal of Corporate Finance*, 7(3), 235–256.

Masulis, R. W., P. K. Pham, and J. Zein, 2011, "Family Business Groups around the World: Financing Advantages, Control Motivations, and Organizational Choices," *Review of Financial Studies*, 24(11), 3556–3600.

Mátyás, L., 1997, "Proper econometric specification of the gravity model," *The world economy*, 20(3), 363–368.

Maury, B., and A. Pajuste, 2005, "Multiple large shareholders and firm value," *Journal of Banking & Finance*, 29(7), 1813–1834.

Mizruchi, M. S., 1992, *The structure of corporate political action: Interfirm relations and their consequences*. Harvard University Press, Cambridge, United States.

——— , 1996, "What Do Interlocks Do? An Analysis, Critique, and Assessment of Research on Interlocking Directorates," *Annual Review of Sociology*, 22(1), 271–298.

Morck, R. K., and M. Nakamura, 1999, "Banks and corporate control in Japan," *The Journal of Finance*, 54(1), 319–339.

Morin, F., 2000, "A Transformation in the French Model of Shareholding and Management," *Economy and Society*, 29(1), 36–53.

Murphy, A., 2005, "Corporate Ownership in France: The Importance of History," in *A History of Corporate Governance around the World: Family Business Groups to Professional Managers*, ed. by R. K. Morck. University of Chicago Press, Chicago and London, chap. 3, pp. 185–222.

Newey, W. K., 1987, "Efficient estimation of limited dependent variable models with endogenous explanatory variables," *Journal of Econometrics*, 36(3), 231–250.

Pagano, M., and A. Röell, 1998, "The choice of ownership structure: agency costs, monitoring, and the decision to go public," *Quarterly Journal of Economics*, 113(1), 187–225.

Pfeffer, J., and G. Salancik, 2003, *The external control of organizations: A resource dependence perspective*. Stanford Business Books.

Rivers, D., and Q. H. Vuong, 1988, "Limited information estimators and exogeneity tests for simultaneous probit models," *Journal of Econometrics*, 39(3), 347–366.

Robinson, D. T., and T. E. Stuart, 2007, "Network Effects in the Governance of Strategic Alliances," *Journal of Law, Economics & Organization*, 23(1), 242–273.

Rosenstein, S., and J. G. Wyatt, 1997, "Inside directors, board effectiveness, and shareholder wealth," *Journal of Financial Economics*, 44(2), 229–250.

Santos, J. A. C., and A. S. Rumble, 2006, "The American keiretsu and universal banks: Investing, voting and sitting on nonfinancials' corporate boards," *Journal of Financial Economics*, 80(2), 419–454.

Shivdasani, A., 1993, "Board composition, ownership structure, and hostile takeovers," *Journal of Accounting and Economics*, 16(1-3), 167–198.

Shleifer, A., and R. W. Vishny, 1986, "Large Shareholders and Corporate Control," *Journal of Political Economy*, 94(3), 461–488.

Singh, M., and W. N. Davidson III, 2003, "Agency costs, ownership structure and corporate governance mechanisms," *Journal of Banking & Finance*, 27(5), 793–816.

Smith, R. J., and R. W. Blundell, 1986, "An Exogeneity Test for a Simultaneous Equation Tobit Model with an Application to Labor Supply," *Econometrica*, 54(3), 679–685.

Stuart, T. E., and S. Yim, 2010, "Board interlocks and the propensity to be targeted in private equity transactions," *Journal of Financial Economics*, 97(1), 174–189.

Sullivan, R. J., and K. R. Spong, 2007, "Manager Wealth Concentration, Ownership Structure, and Risk in Commercial Banks," *Journal of Financial Intermediation*, 16(2), 229–248.

Terza, J. V., A. Basu, and P. J. Rathouz, 2008, "Two-stage residual inclusion estimation: Addressing endogeneity in health econometric modeling," *Journal of Health Economics*, 27(3), 531–543.

Tirole, J., 2006, *The theory of corporate finance*. Princeton University Press, Princeton.

Vitali, S., J. B. Glattfelder, and S. Battiston, 2011, "The Network of Global Corporate Control," *PLoS ONE*, 6(10), e25995.

Wooldridge, J. M., 2008, *Econometric analysis of cross section and panel data*. MIT Press, Cambridge, MA.

Yeh, Y.-H., and T. Woidtke, 2005, "Commitment or entrenchment? Controlling shareholders and board composition," *Journal of Banking & Finance*, 29(7), 1857–1885.

Yermack, D., 2004, "Remuneration, Retention, and Reputation Incentives for Outside Directors," *Journal of Finance*, 59(5), 2281–2308.

Zwiebel, J., 1995, "Block investment and partial benefits of corporate control," *Review of Economic Studies*, 62(2), 161–185.

Table 1: Annual frequency of corporations in the sample

Number of years in the sample	10	9	8	7	6	5	4	3	2	1	Total corp. or dyad	Total obs.
Number of corporations that belong to the CAC 40 index at least one quarter during 1997-2006	41	1	4	2	2	0	2	5	3	1	61	507
Number of dyads	820	41	170	89	94	4	96	235	159	68	1776	12611

Table 2: Evolution of ownership by corporation and by dyad

Years	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**1997-2006** Total	%
Panel A: % α of the voting rights ultimately owned by the first owner												
Number of corporations (n)	**50**	**51**	**54**	**51**	**52**	**52**	**50**	**49**	**49**	**49**	**507**	***100***
$\alpha \geq 50\%$	14	16	16	11	12	11	10	8	8	9	115	*22.68*
$20\% \geq \alpha < 50\%$	14	13	17	16	16	16	13	16	16	15	152	*29.98*
$10\% \geq \alpha < 20\%$	10	11	10	11	10	10	11	10	9	11	103	*20.32*
$5\% \geq \alpha < 10\%$	9	8	6	9	10	9	12	10	10	9	92	*18.15*
$\alpha < 5\%$	3	3	5	4	4	6	4	5	6	5	45	*8.88*
Panel B: Evolution of main dyadic variables												
Number of dyads ($n \times (n-1)/2$)	**1225**	**1275**	**1431**	**1275**	**1326**	**1326**	**1225**	**1176**	**1176**	**1176**	**12611**	***100***
	Number of interlocking directorates (in % of dyads in italic)											
1 interlock	178	191	214	198	175	171	158	157	152	131	1725	*13.68*
	14.53	*14.98*	*14.95*	*15.53*	*13.20*	*12.90*	*12.90*	*13.35*	*12.93*	*11.14*		
At least 2 interlocks	77	59	60	56	43	37	35	32	25	26	450	*3.57*
	6.29	*4.63*	*4.19*	*4.39*	*3.24*	*2.79*	*2.86*	*2.72*	*2.13*	*2.21*		
	Number of ownership ties (in % of dyads in italic)											
Unilateral ownership	60	57	67	58	68	60	58	54	47	31	560	*4.44*
	4.90	*4.47*	*4.68*	*4.55*	*5.13*	*4.52*	*4.73*	*4.59*	*4.00*	*2.64*		
Cross-ownership	17	14	8	8	3	3	3	3	2	2	63	*0.50*
	1.39	*1.10*	*0.56*	*0.63*	*0.23*	*0.23*	*0.24*	*0.26*	*0.17*	*0.17*		

Table 3: Descriptive Statistics

Variable		Mean	Std. Dev.	Min.	Max.
INTERLOCKS	overall	0.208	0.486	0	2
	between		0.418	0	2
	within		0.281	-1.292	1.986
DU_INTERLOCK1	overall	0.137	0.344	0	1
	between		0.262	0	1
	within		0.238	-0.763	1.037
DU_INTERLOCK_MIN2	overall	0.036	0.186	0	1
	between		0.155	0	1
	within		0.120	-0.764	0.936
DU_UNIL_CFR1	overall	0.044	0.206	0	1
	between		0.178	0	1
	within		0.117	-0.856	0.944
DU_CROSS_CFR1	overall	0.005	0.071	0	1
	between		0.055	0	1
	within		0.047	-0.895	0.905
DU_UNIL_CFR2	overall	0.057	0.231	0	1
	between		0.198	0	1
	within		0.137	-0.843	0.957
DU_CROSS_CFR2	overall	0.007	0.081	0	1
	between		0.066	0	1
	within		0.050	-0.893	0.907
DU_UNIL_SUP20_CFR1	overall	0.004	0.066	0	1
	between		0.065	0	1
	within		0.039	-0.896	0.893
DU_UNIL_INF20_CFR1	overall	0.040	0.196	0	1
	between		0.165	0	1
	within		0.114	-0.860	0.940
DU_UNIL_SUP5_CFR1	overall	0.008	0.091	0	1
	between		0.092	0	1
	within		0.049	-0.892	0.908
DU_UNIL_INF5_CFR1	overall	0.036	0.186	0	1
	between		0.153	0	1
	within		0.111	-0.864	0.936
DU_UNIL_SUP1_CFR1	overall	0.036	0.186	0	1
	between		0.163	0	1
	within		0.110	-0.864	0.936
DU_UNIL_INF1_CFR1	overall	0.008	0.091	0	1
	between		0.058	0	1
	within		0.067	-0.692	0.908
IDEMOWNER	overall	0.223	0.503	0	5
	between		0.409	0	5
	within		0.344	-2.077	3.123
DU_STATE	overall	0.191	0.393	0	1
	between		0.276	0	1
	within		0.268	-0.709	1.091
C1MEAN	overall	28.969	16.424	0.670	95.910
	between		15.893	3.137	91.213
	within		7.766	-4.219	87.066
BOARDSIZE	overall	26.889	5.110	9	45
	between		4.605	13	40
	within		2.558	14.889	39.889
DU_NODUALITY	overall	0.114	0.318	0	1
	between		0.241	0	1
	within		0.212	-0.743	1.014

Table 3: Continued

Variable		Mean	Std. Dev.	Min.	Max.
DU_FIN1	overall	0.231	0.422	0	1
	between		0.435	0	1
	within		0	0.231	0.231
DU_FIN2	overall	0.015	0.121	0	1
	between		0.137	0	1
	within		0	0.015	0.015
DU_IDEMSIC	overall	0.031	0.174	0	1
	between		0.155	0	1
	within		0.090	-0.869	0.931
DISTANCETOCAC	overall	0.299	0.290	0	0.900
	between		0.277	0	0.900
	within		0	0.299	0.299
DEGREE_{it}	overall	11.200	8.145	0	48
	between		7.420	0	48
	within		4.239	-5	30.900
DEGREE_{jt}	overall	11.235	8.261	0	48
	between		7.507	0	42
	within		4.443	-8.598	30.935
AVDEGREE_{i}	overall	11.200	6.955	0	48
	between		7.420	0	48
	within		0	11.200	11.200
AVDEGREE_{j}	overall	11.235	6.964	0	42
	between		7.507	0	42
	within		0	11.235	11.235

Between statistics are calculated for an unbalanced panel of 1,776 dyads (pairs of firms i and j). The average number of years a dyad is observed is 7.1. Overall and within statistics are calculated over 12,611 dyad-year observations. "DU_" means that a variable is a dummy. INTERLOCKS is a categorical variable ranging from 0 to 2. It is equal to 1 if DU_INTERLOCK1=1, and it is equal to 2 if DU_INTERLOCK_MIN2=1. DU_INTERLOCK1=1 if there is one overlapping director between firms i and j, and DU_INTERLOCK_MIN2=1 if the dyad has at least two overlapping directors. DU_UNIL_CFR1=1 if one of the two firms in the dyad directly holds a share of the stock capital of the other firm. DU_UNIL_CFR2=1 if one of the two firms in the dyad directly or indirectly holds a share of the cash-flow rights of the other firm. DU_CROSS_CFR1 (DU_CROSS_CFR2) is equal to 1 if each firm in the dyad directly (or indirectly) holds a share of the other firm. DU_UNIL_SUPα_CFR1 (DU_UNIL_INFα_CFR1) is equal to 1 if one of the two firms in the dyad directly holds more (less) than α% of the CFR of the other firm, where α can take the value of 20, 10, 5, 4, 3, 2, or 1. IDEMOWNER is equal to the number of common private-sector shareholders of the dyad, and DU_STATE=1 if the French State holds shares in both dyad companies. C1MEAN is equal to the average voting rights held by the first shareholder of the two companies. BOARDSIZE is equal to the sum of the two board sizes of the dyad. DU_NODUALITY=1 if the two firms have adopted the rule that the CEO cannot be the chairman of the board. DU_FIN1=1 if only one of the two firms is a financial company. DU_FIN2=1 if the two firms are financial companies. DU_IDEMSIC=1 if the two firms in the dyad are non-financial firms belonging to the same 2-digit SIC industrial sector. DISTANCETOCAC is equal to the absolute value of the difference between the number of years that firm i was in the CAC40 index over the sampling period minus the number of years that firm j was in the CAC40 over the sampling period. Time in the CAC40 index is divided by number of years that the firm was in the sample, for each firm in the dyad. DEGREE_{it} is the number of outside directorships held by firm i's directors in other firms in the sample, and DEGREE_{jt} is the number of outside directorships held by firm j's directors in other firms in the sample. AVDEGREE_{i} and AVDEGREE_{j} are time averaged degrees.

Table 4: The impact of *direct* ownership ties on the odds of having interlocking directorates

This table presents the results of the multinomial logistic regressions. Observations are pairs of firms i and j (dyads). The dependent variable has three outcomes representing the number of interlocking directorates between i and j: 0 (there is no interlock between i and j) is the base category; the other outcomes are 1 (firms i and j have one interlock) and 2 (firms i and j have at least two interlocks). Results are presented for different α thresholds of unilateral ownership between i and j. α is the percentage of direct cash-flow rights. The two variables varying with this α cut-off are DU_UNIL_SUP_CFR1 and DU_UNIL_INF_CFR1. "DU_" means that the independent variable is a dummy. UNIL_SUP (UNIL_INF) means that the unilateral ownership is superior (inferior) to the α threshold. Each regression includes 9 dichotomous time variables (not displayed here). Coefficients β are replaced by factor change coefficients (odds ratios), defined as $\exp(\beta)$. Robust standard errors of odds ratios (in parentheses) are adjusted for clustering at dyad level. *, **, and *** indicate significance of the exponentiated coefficients at the 10%, 5%, and 1% levels, respectively.

SUP-INF α cutoff	(1)All		(2)20%		(3)10%		(4)5%		(5)2%		(6)1%	
INTERLOCKS category	1	2	1	2	1	2	1	2	1	2	1	2
DU_UNIL_CFR1	2.346***	11.892***										
	(0.527)	(3.873)										
DU_CROSS_CFR1	5.739***	85.342***	5.605***	74.495***	5.516***	76.517***	5.549***	77.654***	5.637***	81.075***	5.742***	84.200***
	(3.831)	(64.740)	(3.713)	(55.664)	(3.641)	(57.126)	(3.658)	(58.158)	(3.736)	(61.146)	(3.828)	(63.731)
DU_UNIL_SUP_CFR1			10.920***	92.087***	13.354***	60.991***	8.838***	39.449***	3.754***	19.341***	2.338***	12.487***
			(5.572)	(66.589)	(6.284)	(41.210)	(4.125)	(24.024)	(1.230)	(7.977)	(0.591)	(4.309)
DU_UNIL_INF_CFR1			1.985***	8.031***	1.762**	8.198***	1.693**	7.982***	1.633**	7.511***	2.345**	9.368***
			(0.472)	(2.407)	(0.415)	(2.549)	(0.409)	(2.512)	(0.406)	(2.613)	(0.860)	(4.414)
IDEMOWNER	1.223**	1.533***	1.225**	1.546***	1.226**	1.541***	1.220**	1.530***	1.222**	1.532***	1.223**	1.531***
	(0.108)	(0.240)	(0.109)	(0.242)	(0.109)	(0.241)	(0.109)	(0.239)	(0.108)	(0.240)	(0.108)	(0.241)
DU_STATE	1.368**	1.221	1.368**	1.223	1.375**	1.236	1.371**	1.225	1.375**	1.227	1.368**	1.226
	(0.171)	(0.342)	(0.171)	(0.345)	(0.172)	(0.347)	(0.171)	(0.345)	(0.172)	(0.344)	(0.171)	(0.343)
C1MEAN	1.003	1.013	1.003	1.011	1.002	1.011	1.002	1.011	1.003	1.012	1.003	1.013
	(0.004)	(0.008)	(0.004)	(0.009)	(0.004)	(0.009)	(0.004)	(0.008)	(0.004)	(0.008)	(0.004)	(0.008)
BOARDSIZE	1.027**	1.015	1.028**	1.019	1.027**	1.018	1.027**	1.016	1.027**	1.016	1.027**	1.015
	(0.013)	(0.027)	(0.013)	(0.027)	(0.013)	(0.027)	(0.013)	(0.027)	(0.013)	(0.027)	(0.013)	(0.027)
DU_NODUALITY	1.235	1.282	1.238	1.313	1.239	1.309	1.240	1.299	1.234	1.284	1.235	1.279
	(0.203)	(0.487)	(0.203)	(0.492)	(0.202)	(0.492)	(0.202)	(0.487)	(0.203)	(0.482)	(0.203)	(0.488)
DU_FIN1	0.720**	0.312***	0.745**	0.378***	0.763*	0.361***	0.763*	0.361***	0.733**	0.335***	0.719**	0.317***
	(0.103)	(0.095)	(0.107)	(0.106)	(0.109)	(0.103)	(0.108)	(0.105)	(0.104)	(0.099)	(0.103)	(0.096)
DU_FIN2	0.685	0.200**	0.716	0.236*	0.701	0.218*	0.667	0.203**	0.674	0.199**	0.686	0.201**
	(0.318)	(0.160)	(0.331)	(0.187)	(0.323)	(0.171)	(0.312)	(0.162)	(0.312)	(0.158)	(0.318)	(0.161)
DU_IDEMSIC	0.935	2.980*	0.905	2.701	0.845	2.491	0.856	2.586	0.906	2.777*	0.936	2.955*
	(0.292)	(1.760)	(0.292)	(1.725)	(0.269)	(1.692)	(0.273)	(1.701)	(0.285)	(1.718)	(0.292)	(1.757)
DISTANCETOCAC	0.596**	0.448*	0.584**	0.370**	0.582**	0.414*	0.584**	0.421*	0.587**	0.418*	0.597**	0.438*
	(0.136)	(0.200)	(0.134)	(0.176)	(0.133)	(0.188)	(0.134)	(0.191)	(0.134)	(0.190)	(0.136)	(0.197)
DEGREE$_{it}$	1.098***	1.106***	1.098***	1.106***	1.098***	1.105***	1.099***	1.106***	1.098***	1.105***	1.098***	1.106***
	(0.011)	(0.019)	(0.011)	(0.019)	(0.011)	(0.019)	(0.011)	(0.019)	(0.011)	(0.019)	(0.011)	(0.019)
DEGREE$_{jt}$	1.046***	1.125***	1.046***	1.123***	1.046***	1.124***	1.046***	1.124***	1.045***	1.123***	1.046***	1.125***
	(0.010)	(0.021)	(0.010)	(0.021)	(0.010)	(0.021)	(0.010)	(0.021)	(0.010)	(0.021)	(0.010)	(0.021)
AVDEGREE$_i$	0.982	1.065***	0.981	1.062***	0.981	1.064***	0.980	1.063***	0.982	1.065***	0.982	1.065***
	(0.012)	(0.023)	(0.012)	(0.022)	(0.012)	(0.022)	(0.012)	(0.022)	(0.012)	(0.023)	(0.012)	(0.022)
AVDEGREE$_j$	1.030**	1.022	1.029**	1.023	1.030**	1.022	1.030**	1.023	1.031***	1.025	1.030**	1.023
	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)
Observations	12611		12611		12611		12611		12611		12611	
Number of clusters	1776		1776		1776		1776		1776		1776	

Table 4: Continued

SUP-INF α cutoff	(1)All		(2)20%		(3)10%		(4)5%		(5)2%		(6)1%	
INTERLOCKS category	1	2	1	2	1	2	1	2	1	2	1	2
Log pseudolikelihood	-5660.00		-5642.21		-5639.01		-5641.45		-5650.87		-5659.50	
[1]Small-Hsiao IIA test	ok		ok		ok		ok		ok		ok	
WALD Tests												
[2]UNIL vs. CROSS	1.81	7.24										
pvalue	0.178	0.007										
[3]UNIL: o1 vs. o2	27.49											
pvalue	0.000											
[4]CROSS: o1 vs. o2	26.57											
pvalue	0.000											
[5]UNIL $\geq \alpha$ vs. UNIL $< \alpha$			9.68	10.26	15.74	7.84	10.08	6.07	5.12	4.73	0.00	0.35
pvalue			0.002	0.001	0.000	0.005	0.002	0.014	0.024	0.030	0.994	0.551
[6]UNIL $\geq \alpha$: o1 vs. o2			10.08		5.06		7.41		17.82		26.23	
pvalue			0.002		0.024		0.006		0.000		0.000	
[7]UNIL $< \alpha$: o1 vs. o2			25.96		29.32		29.07		22.87		10.07	
pvalue			0.000		0.000		0.000		0.000		0.002	

[1] The Small-Hsiao test validates the IIA assumption in all cases.

[2] Chi2 statistic for the hypothesis that the difference of the β coefficients of DU_UNIL_CFR1 and DU_CROSS_CFR1 is zero.

[3] Chi2 statistic for the hypothesis that the difference of the DU_UNIL_CFR1 β coefficients of outcome 1 and outcome 2 is zero.

[4] Chi2 statistic for the hypothesis that the difference of the DU_CROSS_CFR1 β coefficients of outcome 1 and outcome 2 is zero.

[5] Chi2 statistic for the hypothesis that the difference of the β coefficients of DU_UNIL_SUP_CFR1 and DU_UNIL_INF_CFR1 is zero.

[6] Chi2 statistic for the hypothesis that the difference of the DU_UNIL_SUP_CFR1 β coefficients of outcome 1 and outcome 2 is zero.

[7] Chi2 statistic for the hypothesis that the difference of the DU_UNIL_INF_CFR1 β coefficients of outcome 1 and outcome 2 is zero.

Table 5: The impact of *direct* ownership ties on the odds of having interlocking directorates: CEO interlocks excluded

This table presents the results of the multinomial logistic regressions. Observations are pairs of firms i and j (dyads). The dependent variable has three outcomes representing the number of interlocking directorates between i and j when CEO's interlocks are removed from the count of interlocks: 0 (either there is no interlock between i and j or CEOs of firms i and j reciprocally sit on each other's boards) is the base category; the other outcomes are 1 (firms i and j have one interlock) and 2 (firms i and j have at least two interlocks). Results are presented for different α thresholds of unilateral ownership between i and j. α is the percentage of direct cash-flow rights. The two variables varying with this α cut-off are DU_UNIL_SUP_CFR1 and DU_UNIL_INF_CFR1. "DU_" means that the independent variable is a dummy. UNIL_SUP (UNIL_INF) means that the unilateral ownership is superior (inferior) to the α threshold. Each regression includes 9 dichotomous time variables (not displayed here). Coefficients β are replaced by factor change coefficients (odds ratios), defined as $\exp(\beta)$. Robust standard errors of odds ratios (in parentheses) are adjusted for clustering at dyad level. *, **, and *** indicate significance of the exponentiated coefficients at the 10%, 5%, and 1% levels, respectively.

SUP-INF α cutoff	(1)All		(2)20%		(3)10%		(4)5%		(5)2%		(6)1%	
INTERLOCKS category	1	2	1	2	1	2	1	2	1	2	1	2
DU_UNIL_CFR1	1.905***	7.133***										
	(0.438)	(1.982)										
DU_CROSS_CFR1	0.512	1.377	0.503	1.319	0.498	1.336	0.506	1.358	0.510	1.364	0.512	1.364
	(0.478)	(1.378)	(0.470)	(1.311)	(0.462)	(1.329)	(0.469)	(1.356)	(0.475)	(1.364)	(0.478)	(1.364)
DU_UNIL_SUP_CFR1			4.400**	17.804***	6.671***	16.427***	4.338***	11.234***	2.601***	8.770***	1.898**	7.535***
			(2.886)	(11.512)	(4.026)	(9.750)	(2.317)	(6.342)	(0.906)	(3.215)	(0.487)	(2.235)
DU_UNIL_INF_CFR1			1.708**	6.020***	1.499*	5.935***	1.517*	6.227***	1.487	5.974***	1.912*	5.519***
			(0.413)	(1.820)	(0.359)	(1.853)	(0.366)	(1.942)	(0.374)	(2.077)	(0.741)	(2.616)
IDEMOWNER	1.187*	1.330*	1.189*	1.335*	1.190**	1.333*	1.186*	1.326*	1.186*	1.330*	1.187*	1.328*
	(0.105)	(0.226)	(0.105)	(0.226)	(0.105)	(0.225)	(0.105)	(0.225)	(0.105)	(0.225)	(0.105)	(0.225)
DU_STATE	1.418***	1.636*	1.419***	1.638*	1.426***	1.643*	1.421***	1.637*	1.422***	1.640*	1.418***	1.643*
	(0.175)	(0.469)	(0.175)	(0.471)	(0.176)	(0.471)	(0.175)	(0.470)	(0.175)	(0.471)	(0.175)	(0.472)
C1MEAN	1.002	1.008	1.002	1.007	1.002	1.007	1.002	1.008	1.002	1.008	1.002	1.008
	(0.004)	(0.009)	(0.004)	(0.009)	(0.004)	(0.009)	(0.004)	(0.009)	(0.004)	(0.009)	(0.004)	(0.009)
BOARDSIZE	1.028**	1.018	1.028**	1.019	1.028**	1.018	1.027**	1.018	1.028**	1.018	1.028**	1.017
	(0.013)	(0.028)	(0.013)	(0.028)	(0.013)	(0.028)	(0.013)	(0.028)	(0.013)	(0.028)	(0.013)	(0.028)
DU_NODUALITY	1.192	1.217	1.194	1.228	1.197	1.226	1.195	1.228	1.192	1.218	1.192	1.215
	(0.195)	(0.482)	(0.195)	(0.483)	(0.195)	(0.485)	(0.195)	(0.483)	(0.195)	(0.480)	(0.195)	(0.483)
DU_FIN1	0.763*	0.420***	0.782*	0.452***	0.803	0.444***	0.798	0.432***	0.774*	0.428***	0.763*	0.427***
	(0.108)	(0.122)	(0.111)	(0.133)	(0.113)	(0.132)	(0.111)	(0.132)	(0.109)	(0.125)	(0.108)	(0.124)
DU_FIN2	0.623	0.214	0.641	0.228	0.637	0.222	0.611	0.216	0.616	0.214	0.623	0.215
	(0.292)	(0.210)	(0.300)	(0.223)	(0.297)	(0.216)	(0.289)	(0.210)	(0.288)	(0.208)	(0.292)	(0.210)
DU_IDEMSIC	0.925	3.257**	0.901	3.088*	0.840	2.989*	0.864	3.109*	0.902	3.169**	0.925	3.228**
	(0.282)	(1.821)	(0.281)	(1.794)	(0.255)	(1.802)	(0.262)	(1.823)	(0.275)	(1.805)	(0.283)	(1.816)
DISTANCETOCAC	0.588**	0.477	0.580**	0.446*	0.576**	0.467	0.579**	0.474	0.581**	0.470	0.588**	0.468
	(0.133)	(0.225)	(0.132)	(0.216)	(0.131)	(0.220)	(0.132)	(0.225)	(0.132)	(0.223)	(0.133)	(0.222)
DEGREE$_{it}$	1.094***	1.100***	1.094***	1.100***	1.095***	1.099***	1.095***	1.100***	1.094***	1.100***	1.094***	1.100***
	(0.011)	(0.020)	(0.011)	(0.020)	(0.011)	(0.020)	(0.011)	(0.020)	(0.011)	(0.020)	(0.011)	(0.020)
DEGREE$_{jt}$	1.043***	1.122***	1.043***	1.121***	1.042***	1.121***	1.043***	1.122***	1.042***	1.121***	1.043***	1.122***
	(0.010)	(0.020)	(0.010)	(0.020)	(0.010)	(0.020)	(0.010)	(0.020)	(0.010)	(0.020)	(0.010)	(0.020)
AVDEGREE$_i$	0.979*	1.047*	0.978*	1.046*	0.978*	1.046*	0.978*	1.046*	0.979*	1.047*	0.979*	1.046*
	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)
AVDEGREE$_j$	1.029**	1.014	1.029**	1.015	1.029**	1.015	1.029**	1.015	1.030**	1.015	1.029**	1.015
	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)
Observations	12611		12611		12611		12611		12611		12611	

Table 5: Continued

SUP-INF α cutoff	(1)All		(2)20%		(3)10%		(4)5%		(5)2%		(6)1%	
INTERLOCKS category	1	2	1	2	1	2	1	2	1	2	1	2
Number of clusters	1776		1776		1776		1776		1776		1776	
Log pseudolikelihood	-5634.11		-5629.35		-5622.36		-5626.74		-5630.76		-5633.58	
[1]Small-Hsiao IIA test	ok		ok		ok		ok		ok		ok	
WALD Tests												
[2]UNIL vs. CROSS	0.32	0.88										
pvalue	0.570	0.347										
[3]UNIL: o1 vs. o2	26.30											
pvalue	0.000											
[4]CROSS: o1 vs. o2	2.69											
pvalue	0.101											
[5]UNIL $\geq \alpha$ vs. UNIL $< \alpha$			16.82	10.43	14.62	7.45	13.19	9.24	4.73	7.13	0.62	2.45
pvalue			0.000	0.001	0.000	0.006	0.000	0.002	0.030	0.008	0.430	0.117
[6]UNIL $\geq \alpha$: o1 vs. o2			10.24		3.93		5.51		14.52		24.49	
pvalue			0.001		0.048		0.019		0.000		0.000	
[7]UNIL $< \alpha$: o1 vs. o2			21.14		23.25		23.95		20.13		6.45	
pvalue			0.000		0.000		0.000		0.000		0.011	

[1] The Small-Hsiao test validates the IIA assumption in all cases.
[2] Chi2 statistic for the hypothesis that the difference of the β coefficients of DU_UNIL_CFR1 and DU_CROSS_CFR1 is zero.
[3] Chi2 statistic for the hypothesis that the difference of the DU_UNIL_CFR1 β coefficients of outcome 1 and outcome 2 is zero.
[4] Chi2 statistic for the hypothesis that the difference of the DU_CROSS_CFR1 β coefficients of outcome 1 and outcome 2 is zero.
[5] Chi2 statistic for the hypothesis that the difference of the β coefficients of DU_UNIL_SUP_CFR1 and DU_UNIL_INF_CFR1 is zero.
[6] Chi2 statistic for the hypothesis that the difference of the DU_UNIL_SUP_CFR1 β coefficients of outcome 1 and outcome 2 is zero.
[7] Chi2 statistic for the hypothesis that the difference of the DU_UNIL_INF_CFR1 β coefficients of outcome 1 and outcome 2 is zero.

Table 6: The impact of direct *and indirect* ownership ties on the odds of having interlocking directorates

This table presents the results of the multinomial logistic regressions. Observations are pairs of firms i and j (dyads). The dependent variable has three outcomes representing the number of interlocking directorates between i and j: 0 (there is no interlock between i and j) is the base category; the other outcomes are 1 (firms i and j have one interlock) and 2 (firms i and j have at least two interlocks). Results are presented for different α thresholds of unilateral ownership between i and j. α is the percentage of direct and indirect cash-flow rights. The two variables varying with this α cut-off are DU_UNIL_SUP_CFR2 and DU_UNIL_INF_CFR2. "DU_" means that the independent variable is a dummy. UNIL_SUP (UNIL_INF) means that the unilateral ownership is superior (inferior) to the α threshold. Each regression includes 9 dichotomous time variables (not displayed here). Coefficients β are replaced by factor change coefficients (odds ratios), defined as $\exp(\beta)$. Robust standard errors of odds ratios (in parentheses) are adjusted for clustering at dyad level. *, **, and *** indicate significance of the exponentiated coefficients at the 10%, 5%, and 1% levels, respectively.

SUP-INF α cutoff	(1)All		(2)20%		(3)10%		(4)5%		(5)2%		(6)1%	
INTERLOCKS category	1	2	1	2	1	2	1	2	1	2	1	2
DU_UNIL_CFR2	2.520***	9.344***										
	(0.466)	(2.995)										
DU_CROSS_CFR2	5.532***	71.882***	5.434***	62.205***	5.335***	60.841***	5.370***	61.323***	5.469***	65.416***	5.532***	68.382***
	(3.451)	(53.319)	(3.374)	(45.372)	(3.289)	(43.955)	(3.302)	(44.271)	(3.387)	(47.797)	(3.441)	(50.313)
DU_UNIL_SUP_CFR2			10.121***	91.184***	12.919***	68.333***	8.803***	46.551***	3.974***	21.310***	2.749***	12.075***
			(4.550)	(66.162)	(5.451)	(46.112)	(3.883)	(28.370)	(1.223)	(8.724)	(0.622)	(4.162)
DU_UNIL_INF_CFR2			2.244***	6.507***	2.018***	5.949***	1.984***	5.568***	1.965***	4.854***	2.068***	4.352***
			(0.432)	(1.896)	(0.384)	(1.761)	(0.382)	(1.692)	(0.375)	(1.587)	(0.519)	(1.686)
IDEMOWNER	1.211**	1.458**	1.214**	1.484**	1.214**	1.480**	1.209**	1.464**	1.211**	1.460**	1.211**	1.464**
	(0.108)	(0.233)	(0.108)	(0.236)	(0.108)	(0.236)	(0.108)	(0.234)	(0.108)	(0.235)	(0.108)	(0.238)
DU_STATE	1.370**	1.258	1.370**	1.258	1.379**	1.311	1.375**	1.291	1.377**	1.279	1.373**	1.278
	(0.171)	(0.343)	(0.171)	(0.349)	(0.172)	(0.359)	(0.172)	(0.356)	(0.172)	(0.351)	(0.172)	(0.350)
C1MEAN	1.003	1.010	1.003	1.008	1.002	1.008	1.002	1.008	1.003	1.009	1.003	1.011
	(0.004)	(0.008)	(0.004)	(0.009)	(0.004)	(0.009)	(0.004)	(0.009)	(0.004)	(0.008)	(0.004)	(0.008)
BOARDSIZE	1.029**	1.022	1.029**	1.025	1.029**	1.025	1.028**	1.023	1.028**	1.022	1.028**	1.019
	(0.013)	(0.027)	(0.013)	(0.027)	(0.013)	(0.028)	(0.013)	(0.028)	(0.013)	(0.028)	(0.013)	(0.027)
DU_NODUALITY	1.257	1.291	1.258	1.317	1.260	1.330	1.261	1.310	1.253	1.294	1.256	1.279
	(0.207)	(0.497)	(0.207)	(0.502)	(0.207)	(0.507)	(0.207)	(0.499)	(0.207)	(0.489)	(0.207)	(0.501)
DU_FIN1	0.683***	0.306***	0.704**	0.376***	0.721**	0.376***	0.720**	0.386***	0.693**	0.347***	0.685***	0.322***
	(0.099)	(0.096)	(0.102)	(0.108)	(0.104)	(0.108)	(0.103)	(0.113)	(0.100)	(0.103)	(0.099)	(0.099)
DU_FIN2	0.641	0.187**	0.665	0.222*	0.654	0.209*	0.623	0.189**	0.629	0.184**	0.637	0.197**
	(0.305)	(0.153)	(0.315)	(0.180)	(0.309)	(0.168)	(0.298)	(0.156)	(0.298)	(0.150)	(0.302)	(0.159)
DU_IDEMSIC	0.899	2.979**	0.875	2.662	0.792	2.117	0.809	2.216	0.864	2.462	0.893	2.788*
	(0.279)	(1.638)	(0.278)	(1.612)	(0.254)	(1.465)	(0.258)	(1.471)	(0.270)	(1.490)	(0.277)	(1.578)
DISTANCETOCAC	0.565**	0.317***	0.558**	0.272***	0.561**	0.312***	0.565**	0.315**	0.565**	0.308***	0.566**	0.330**
	(0.129)	(0.141)	(0.128)	(0.130)	(0.129)	(0.141)	(0.129)	(0.142)	(0.129)	(0.139)	(0.129)	(0.146)
DEGREE$_{it}$	1.095***	1.100***	1.095***	1.102***	1.095***	1.101***	1.096***	1.103***	1.095***	1.101***	1.095***	1.102***
	(0.011)	(0.019)	(0.011)	(0.019)	(0.011)	(0.019)	(0.011)	(0.019)	(0.011)	(0.019)	(0.011)	(0.019)
DEGREE$_{jt}$	1.044***	1.124***	1.044***	1.122***	1.044***	1.122***	1.044***	1.122***	1.044***	1.120***	1.044***	1.124***
	(0.010)	(0.021)	(0.010)	(0.021)	(0.010)	(0.021)	(0.010)	(0.021)	(0.010)	(0.021)	(0.010)	(0.021)
AVDEGREE$_i$	0.982	1.059***	0.982	1.056**	0.982	1.059***	0.981	1.057**	0.983	1.061***	0.983	1.059***
	(0.012)	(0.023)	(0.012)	(0.023)	(0.012)	(0.023)	(0.012)	(0.023)	(0.012)	(0.023)	(0.012)	(0.023)
AVDEGREE$_j$	1.030**	1.018	1.029**	1.019	1.029**	1.018	1.029**	1.020	1.031**	1.024	1.030**	1.020
	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)	(0.012)	(0.025)
Observations	12611		12611		12611		12611		12611		12611	
Number of clusters	1776		1776		1776		1776		1776		1776	

Table 6: Continued

SUP-INF α cutoff	(1)All		(2)20%		(3)10%		(4)5%		(5)2%		(6)1%	
INTERLOCKS category	1	2	1	2	1	2	1	2	1	2	1	2
Log pseudolikelihood	-5654.97		-5633.83		-5628.07		-5629.92		-5636.91		-5647.66	
[1]Small-Hsiao IIA test	ok		ok		ok		ok		ok		ok	
WALD Tests												
[2]UNIL vs. CROSS	1.60	7.87										
pvalue	0.206	0.005										
[3]UNIL: o1 vs. o2	18.26											
pvalue	0.000											
[4]CROSS: o1 vs. o2	30.93											
pvalue	0.000											
[5]UNIL $\geq \alpha$ vs. UNIL $< \alpha$			10.07	12.75	17.56	12.07	9.94	10.86	4.69	12.64	0.84	6.30
pvalue			0.002	0.000	0.000	0.001	0.002	0.001	0.030	0.000	0.360	0.012
[6]UNIL $\geq \alpha$: o1 vs. o2			10.29		6.66		9.00		19.29		20.98	
pvalue			0.001		0.010		0.003		0.000		0.000	
[7]UNIL $< \alpha$: o1 vs. o2			15.35		14.89		12.72		8.32		3.66	
pvalue			0.000		0.000		0.000		0.004		0.056	

[1] The Small-Hsiao test validates the IIA assumption in all cases.
[2] Chi2 statistic for the hypothesis that the difference of the β coefficients of DU_UNIL_CFR2 and DU_CROSS_CFR2 is zero.
[3] Chi2 statistic for the hypothesis that the difference of the DU_UNIL_CFR2 β coefficients of outcome 1 and outcome 2 is zero.
[4] Chi2 statistic for the hypothesis that the difference of the DU_CROSS_CFR2 β coefficients of outcome 1 and outcome 2 is zero.
[5] Chi2 statistic for the hypothesis that the difference of the β coefficients of DU_UNIL_SUP_CFR2 and DU_UNIL_INF_CFR2 is zero.
[6] Chi2 statistic for the hypothesis that the difference of the DU_UNIL_SUP_CFR2 β coefficients of outcome 1 and outcome 2 is zero.
[7] Chi2 statistic for the hypothesis that the difference of the DU_UNIL_INF_CFR2 β coefficients of outcome 1 and outcome 2 is zero.

Table 7: *Direct* ownership ties and the odds of having interlocking directorates. Endogeneity test 1

This table presents the results of the 2SRI endogeneity tests for multinomial logistic regressions. Observations are pairs of firms i and j (dyads). The first stage equation is a logit model (with standard errors adjusted for clustering) wherein DU_CROSS_CFR1 is regressed on the independent variables of the main equation plus two internal instruments: DIFFCROSS_CFR1$_t - 1$ (= CROSS_ CFR1$_t - 2-$ CROSS_ CFR1$_t - 1$), which is the one year lagged first difference of the average percentage of the cash-flow rights of the cross-shareholdings of the two firms of the dyad, and CROSS_CFR1$_t - 3$, which is the average of the cash-flow rights of the two firms when they have cross-shareholdings, 3-year lagged. Residuals of the first stage equation are included in the second stage equation. The third model implements an over-identifying restrictions test that consists of adding the instruments as explanatory variables in the second stage equation and testing their joint significance. The dependent variable in models (2) and (3) has three outcomes representing the number of interlocking directorates between i and j: 0 (there is no interlock between i and j) is the base category; the other outcomes are 1 (firms i and j have one interlock) and 2 (firms i and j have at least 2 interlocks). "DU_" means that the variable is a dummy. Each regression contains 6 dichotomous time variables (not displayed here). Coefficients β are replaced by factor change coefficients (odds ratios), defined as exp(β). Robust standard errors of odds ratios (in parentheses) are adjusted for clustering at dyad level. *, **, and *** indicate significance of the exponentiated coefficients at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)		(3)	
	Instrumentation	*Endogeneity Test*		*Overidentification test*	
Dependent variable	DU_CROSS_CFR1	INTERLOCKS		INTERLOCKS	
		1	2	1	2
DIFFCROSS_CFR1$_{t-1}$	24.306***			1.262	1.201
	(29.400)			(0.955)	(1.104)
CROSS_CFR1$_{t-3}$	11.867***			1.434	2.159
	(6.955)			(1.138)	(1.976)
RESIDUALS		1.138	1.060	1.246	1.253
		(0.355)	(0.490)	(0.882)	(0.916)
DU_UNIL_CFR1		2.894***	9.197***	2.853***	8.454***
		(0.437)	(2.232)	(0.449)	(2.192)
DU_CROSS_ CFR1		6.001	108.521***	2.382	9.605
		(6.590)	(103.951)	(7.162)	(34.145)
IDEMOWNER	0.309	1.120*	1.265*	1.122*	1.247
	(0.258)	(0.075)	(0.177)	(0.076)	(0.186)
DU_STATE	1.001	1.229**	1.245	1.226**	1.201
	(0.891)	(0.111)	(0.315)	(0.113)	(0.299)
C1MEAN	0.960	1.003	1.007	1.003	1.007
	(0.026)	(0.002)	(0.007)	(0.002)	(0.007)
BOARDSIZE	1.030	1.008	1.054**	1.008	1.055**
	(0.073)	(0.009)	(0.024)	(0.009)	(0.024)
DU_NODUALITY	0.494	1.155	1.485	1.155	1.464
	(1.023)	(0.131)	(0.405)	(0.130)	(0.414)
DU_FIN1	4.182*	0.691***	0.301***	0.691***	0.316***
	(3.379)	(0.078)	(0.072)	(0.078)	(0.078)
DU_FIN2	1.220	1.079	0.200**	1.062	0.186**
	(2.735)	(0.370)	(0.141)	(0.370)	(0.128)
DU_IDEMSIC		0.767	2.222	0.767	2.288*
		(0.169)	(1.100)	(0.171)	(1.128)
DISTANCETOCAC	0.405	0.502***	0.152***	0.502***	0.158***
	(0.969)	(0.065)	(0.067)	(0.067)	(0.070)
DEGREE$_{it}$	0.962	1.108***	1.141***	1.108***	1.139***
	(0.093)	(0.010)	(0.028)	(0.010)	(0.028)
DEGREE$_{jt}$	0.956	1.078***	1.173***	1.079***	1.173***
	(0.099)	(0.009)	(0.027)	(0.009)	(0.027)
AVDEGREE$_i$	1.024	0.979**	1.058**	0.979**	1.057**
	(0.109)	(0.010)	(0.028)	(0.010)	(0.028)
AVDEGREE$_j$	1.173**	1.003	1.007	1.002	1.004
	(0.086)	(0.008)	(0.024)	(0.008)	(0.024)
Observations	7578	7578		7578	
Number of clusters	1314	1314		1314	
Log pseudolikelihood	-47.711	-3313.185		-3309.606	
[1]Small-Hsiao IIA test		ok		ok	
WALD Tests					
[2]UNIL vs. CROSS		0.45	6.81		
pvalue		0.503	0.009		
[3]UNIL: o1 vs. o2		18.56			
pvalue		0.000			
[4]CROSS: o1 vs. o2		9.25			
pvalue		0.002			

Table 7: Continued

	(1)	(2)		(3)	
	Instrumentation	*Endogeneity Test*		*Overidentification test*	
Dependent variable	DU_CROSS_CFR1	INTERLOCKS		INTERLOCKS	
		1	2	1	2
[5]Chi2 joint test				1.20	
pvalue				0.878	

[1] The Small-Hsiao test validates the IIA assumption in all cases.
[2] Chi2 statistic for the hypothesis that the difference of the β coefficients of DU_UNIL_CFR1 and DU_CROSS_CFR1 is zero.
[3] Chi2 statistic for the hypothesis that the difference of the DU_UNIL_CFR1 β coefficients of outcome 1 and outcome 2 is zero.
[4] Chi2 statistic for the hypothesis that the difference of the DU_CROSS_CFR1 β coefficients of outcome 1 and outcome 2 is zero.
[5] Chi2 statistic for the hypothesis that the β coefficients of the instruments DIFFCROSS_CFR1$_{t-1}$ and CROSS_CFR1$_{t-3}$ are jointly different from zero.

Table 8: *Direct* ownership ties and the odds of having interlocking directorates. Endogeneity test 2

This table presents the results of the 2SRI endogeneity tests for multinomial logistic regressions. Observations are pairs of firms i and j (dyads). The first stage equation (models 1 and 2) is a logit model (with standard errors adjusted for clustering) where DU_UNIL_SUP5_CFR1 and DU_UNIL_INF5_CFR1 are regressed on the independent variables of the main equation plus four internal instruments (3-year lagged value and 1-year lagged first difference value of the percentage of the CFR of large and small shareholdings held by one of the two firms in the dyad). Residuals of the first stage equation are included in the second stage equation (model 3). The fourth model implements an over-identifying restrictions test that consists of adding the instruments as explanatory variables in the second stage equation and testing their joint significance. The dependent variable in models (3) and (4) has three outcomes representing the number of interlocking directorates between i and j: 0 (there is no interlock between i and j) is the base category; the other outcomes are 1 (firms i and j have one interlock) and 2 (firms i and j have at least 2 interlocks). "DU_" means that the variable is a dummy. Each regression includes 6 dichotomous time variables (not displayed here). Coefficients β are replaced by factor change coefficients (odds ratios), defined as $\exp(\beta)$. Robust standard errors of odds ratios (in parentheses) are adjusted for clustering at dyad level. *, **, and *** indicate significance of the exponentiated coefficients at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)		(4)	
	Instrumentation	*Instrumentation*	*Endogeneity Test*		*Overidentification test*	
Dependent variable	DU_UNIL_ SUP5_CFR1	DU_UNIL_ INF5_CFR1	INTERLOCKS		INTERLOCKS	
			1	2	1	2
DIFFUNIL_SUP5_CFR1$_{t-1}$	1.067**	1.078***			0.983	1.047
	(0.034)	(0.019)			(0.032)	(0.072)
UNIL_SUP5_CFR1$_{t-3}$	1.320***	1.079***			0.986	1.026
	(0.064)	(0.021)			(0.029)	(0.042)
DIFFUNIL_INF5_CFR1$_{t-1}$	2.152***	4.173***			0.914	1.201
	(0.555)	(1.311)			(0.156)	(0.370)
UNIL_INF5_CFR1$_{t-3}$	1.462	7.247***			0.922	1.120
	(0.512)	(1.759)			(0.133)	(0.351)
RESIDUALS(1)			1.006	0.942	0.993	0.978
			(0.054)	(0.139)	(0.193)	(0.177)
RESIDUALS(2)			0.968	1.000	0.941	1.035
			(0.045)	(0.140)	(0.059)	(0.197)
DU_UNIL_SUP5_ CFR1			7.736***	31.227***	10.962*	16.860**
			(3.283)	(16.184)	(13.531)	(24.039)
DU_UNIL_INF_ CFR1			2.401***	6.607***	2.820***	5.364**
			(0.459)	(2.710)	(0.899)	(3.872)
DU_CROSS_ CFR1			9.995***	119.746***	10.158***	116.115***
			(8.215)	(93.296)	(8.455)	(93.185)
IDEMOWNER	1.643	1.254	1.117	1.255	1.116	1.251
	(0.668)	(0.256)	(0.075)	(0.174)	(0.076)	(0.177)
DU_STATE	1.719	1.106	1.226**	1.257	1.224**	1.264
	(0.944)	(0.282)	(0.110)	(0.320)	(0.110)	(0.326)
C1MEAN	1.052***	0.958***	1.003	1.006	1.003	1.005
	(0.015)	(0.009)	(0.002)	(0.007)	(0.002)	(0.007)
BOARDSIZE	1.105***	1.001	1.008	1.053**	1.008	1.056**
	(0.041)	(0.031)	(0.009)	(0.024)	(0.009)	(0.025)
DU_NODUALITY	0.937	0.547*	1.158	1.494	1.163	1.483
	(0.661)	(0.181)	(0.130)	(0.406)	(0.130)	(0.406)
DU_FIN1	0.869	34.975***	0.717***	0.343***	0.712***	0.355***
	(0.541)	(16.868)	(0.082)	(0.086)	(0.082)	(0.093)
DU_FIN2	4.164	41.766***	1.097	0.227**	1.075	0.244**
	(4.087)	(30.481)	(0.372)	(0.153)	(0.372)	(0.160)
DU_IDEMSIC	4.190	2.593	0.736	2.011	0.731	2.105
	(4.318)	(2.619)	(0.166)	(1.072)	(0.165)	(1.134)
DISTANCETOCAC	1.254	0.360**	0.496***	0.145***	0.501***	0.127***
	(1.807)	(0.177)	(0.065)	(0.066)	(0.066)	(0.064)
DEGREE$_{it}$	1.033	1.049	1.108***	1.139***	1.107***	1.142***
	(0.089)	(0.032)	(0.010)	(0.028)	(0.010)	(0.029)
DEGREE$_{jt}$	1.162***	1.041	1.077***	1.169***	1.077***	1.173***
	(0.067)	(0.027)	(0.009)	(0.027)	(0.009)	(0.027)
AVDEGREE$_i$	1.016	0.949	0.978**	1.058**	0.978**	1.055*
	(0.093)	(0.032)	(0.010)	(0.029)	(0.010)	(0.029)
AVDEGREE$_j$	0.984	1.009	1.002	1.010	1.003	1.007
	(0.071)	(0.029)	(0.008)	(0.024)	(0.008)	(0.024)
Observations	7578	7578	7578		7578	
Number of clusters	1314	1314	1314		1314	
Log pseudolikelihood	-136.962	-500.218	-3306.603		-3303.339	
[1]Small-Hsiao IIA test			ok		ok	
WALD Tests						

Table 8: Continued

	(1)	(2)	(3)		(4)	
	Instrumentation	*Instrumentation*	*Endogeneity Test*		*Overidentification test*	
Dependent variable	DU_UNIL_	DU_UNIL_	INTERLOCKS		INTERLOCKS	
	SUP5_CFR1	INF5_CFR1	1	2	1	2
[2]UNIL $\geq$ 5% vs. UNIL $<$ 5%			5.86	5.50		
pvalue			0.016	0.019		
[3]UNIL $\geq$ 5%: o1 vs. o2			6.75			
pvalue			0.009			
[4]UNIL $<$ 5pvalue			0.017			
[5]Chi2 joint test					2.72	
pvalue					0.951	

[1] The Small-Hsiao test validates the IIA assumption in all cases.
[2] Chi2 statistic for the hypothesis that the difference of the β coefficients of DU_UNIL_SUP5_CFR1 and DU_UNIL_INF5_ CFR1 is zero.
[3] Chi2 statistic for the hypothesis that the difference of the DU_UNIL_SUP5_ CFR1 β coefficients of outcome 1 and outcome 2 is zero.
[4] Chi2 statistic for the hypothesis that the difference of the DU_UNIL_INF5_ CFR1 β coefficients of outcome 1 and outcome 2 is zero.
[5] Chi2 statistic for the hypothesis that the β coefficients of the instruments DIFFUNIL_SUP5_CFR1$_{t-1}$, UNIL_SUP5_CFR1$_{t-3}$, DIFFUNIL_INF5_CFR1$_{t-1}$, and UNIL_INF5_CFR1$_{t-3}$ are jointly different from zero.