Director Networks, Mobility, and Governance: Evidence from Corporate Bankruptcy Filings*

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Abstract

I exploit a quasi-natural experiment to investigate how much directors rely on professional connections in their search for new board positions and how this reliance impacts monitoring decisions. For directors who have *never* held board positions or employment at bankruptcy-filing firms, I find that those who nevertheless have connections to *other* directors associated to bankrupt firms experience a decline in mobility at the time of bankruptcy filing: their chances of finding new directorships decrease by 9 percentage points. This is evidence that corporate bankruptcies can undermine director mobility through social networks, since these directors are only *indirectly* associated to bankruptcy-filing firms through shared boards or employment at non-bankruptcy-filing firms. Using this network shock as an instrument for director mobility, I show that an increase in overall director mobility on a board increases the board share of directors serving on the nomination committee and increases option grants of top executives.

Keywords: Bankruptcy, corporate governance, executive compensation, director mobility, social networks, agency problem.

JEL Classification Numbers: G30, G33, M12

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To what degree do directors rely on personal contacts in their search for new board positions? And how does this dependency affect corporate governance? The search for suitable directors can be costly for firms due to severe information asymmetry in the market for directors. Therefore, the use of board contacts in the recruitment of new board members is a cost effective strategy. However, this reliance on director networks is a potential liability. While the use of social networks can reduce search costs, it can also lead to cronyism, which is a possible source of agency problems. In this paper, I first design a quasi-natural experiment to test if a director's ability to find new board positions (i.e., "director mobility") is impeded when certain contacts in the director network are exogenously severed. Second, through the instrumental variable method, I test whether changes in overall board mobility, facilitated by changes in the director network, can affect board monitoring.

To identify the dependency on network ties in the market for directorships, I use corporate bankruptcies as events that plausibly deactivate social links between directors that are *directly* associated with bankrupt firms through past employment or board appointments ("Event Directors") and directors that are only *indirectly* associated with bankrupt firms through ties to Event Directors made from overlapping employment histories or directorships ("Treatment Directors"). Treatment Directors should be immune to any effects arising from corporate bankruptcies as they have no work histories with any firms that have filed for bankruptcy. Using directors that share the same boards as Treatment Directors and also have no work histories with Event Directors at the time of bankruptcy filings as the control group ("Control Directors"), I can effectively estimate the effects of "losing" professional connections.

In a difference-in-differences framework, I find that directors who are connected to Event Directors (or lose contact with Event Directors) at the time of bankruptcy filings experience a reduction in the probability of finding additional directorships by 9 percentage points within 1 year (the number of directorships acquired within a year decreases by 7.7 percent on average). Directors are essentially immobilized, as they lose on average 0.13 net board

positions 1 year after bankruptcy filings. These point estimates are statistically significant at the 1 percent level after controlling for observable director characteristics, and confirm the finding from director surveys that board and management contacts are heavily relied upon during director recruitment.[1]

I establish a causal relationship between director mobility and governance related outcome variables in two stages. In the first stage, I estimate a difference-in-differences model by regressing the interaction between a continuous treatment variable that measures the intensity of the director network shock at the firm level ("Network Shock Intensity") and a post-bankruptcy filing year dummy variable on board mobility, which is defined as net directorships acquired and dropped by directors on a board divided by board size. The Network Shock Intensity is defined as the number of Treatment Directors divided by the total number of Treatment and Control Directors for a given firm.[2] In the second stage, I regress the instrumented board mobility measure on outcome variables related to executive compensation and other corporate governance measures.

The literature findings on whether social networks create or destroy firm value are mixed. Firstly, social networks can function as a kind of human capital with externalities. Directors with the most skill and talent often have the largest number of connections or contacts. These individuals create positive externalities that spill over to other directors through the exchange of ideas, for example (Murphy, Shleifer, and Vishny 1992). Director networks can be viewed as an aggregation of human capital among directors, which can facilitate firm productivity as shown in Acemoglu and Angrist (2000). Moreover, information exchange generates trust, which reduces information uncertainty about the quality and skill relevance of directors. This network of trust can also reduce search costs for the firm and allow firms to benefit from preferential treatment (e.g. better access to external finance, etc.). The human capital perspective posits that director networks not only provides meaningful information

[1] PricewaterhouseCoopers' 2010 and 2012 Annual Corporate Directors Surveys document that over 80 percent of directors surveyed reported to have used personal contacts in director recruitment. See Figure 1 for summary.

[2] Network Shock Intensity takes on values between 0 and 1.

on directors to the firm, but also relay firm information throughout the network.

There is extensive empirical evidence of the benefits of social networks in the finance literature. Engelberg, Gao, and Parsons (2013a), for example, find that loans made between connected parties lead to improved firm performance. Hochberg, Ljungqvist, and Lu (2007) show that network centrality among venture capitalists lead to privileged access to better deals. Cohen, Frazzini, and Malloy (2008) find that shared educational background among mutual fund managers and corporate board members lead to the exchange of insider information that translates to better firm performance. Cai and Sevilir (2012) find that acquirer firms in M&A deals obtain significantly higher announcement returns (i.e., lower takeover premiums) when acquirer and target firms have interlocking directorates.

On the other hand, social networks can also be a source of agency costs. Board members may have incentives to appoint certain directors opportunistically to further their own careers. Within the moral hazard framework of Holmström (1979), Holmström (1982), and Fudenberg and Tirole (1986), board members could nominate those who have the capability of obtaining directorships for them in the future. That is, board members may rely on their social networks, specifically connections with directors who have appointments at other boards, for future directorships. Social networks therefore can mitigate director career concerns. In doing so, directors are using social networks to extract private benefits.

There is also an extensive body of work that documents empirical evidence of agency costs brought about by social networks. Kramarz and Thesmar (2013) and Nguyen (2012) show that being apart of the École network is highly predictive of whether one receives an executive position in French companies. Here, practicing favoritism and having a strong personal preference for a specific pedigree may not align with the interest of the firm. Related to firm performance, Fracassi and Tate (2012) find evidence that CEO-director ties weaken the effectiveness of board monitoring and reduce firm value. Similarly, Duchin and Sosyura (2013) show that managerial connections relate negatively with investment efficiency and firm value in firms with weak governance. Renneboog and Zhao (2011), Hallock (1997),

Fich and White (2003), and Engelberg, Gao, and Parsons (2013b), find that executives' network centrality is positively associated with their compensation. Likewise, Brown et al. (2012) and Guedj and Barnea (2009) show that CEO compensation increases with director interconnectedness.

In this paper, I explore the impact of director network changes on corporate governance through the director mobility channel. I find strong evidence that increased director mobility can lead to symptoms of agency problems, which is consistent with the "busy boards" hypothesis or the claim that directors holding multiple outside board seats are detrimental to firm value and performance (Beasley 1996, Core, Holthausen, and Larcker 1999, and Fich and Shivdasani 2006). For the top 3 most highly paid executives on a given firm, a one percentage point increase in board mobility increases total compensation by 2.2 percent (significant at the 10 percent level). This effect seems to be mainly driven by additional option grants. A one percentage point increase in board mobility increases the number option grants by 9.7 percent (significant at the 1 percent level), which translates to an increase in the option value portion of total compensation by 8.6 percent (significant at the 5 percent level). Results are similar if we restrict ourselves to just CEO compensation.

For other internal governance measures, I find that a one percentage point increase in board mobility leads to an increase of 0.7 percentage points of the board serving on the nomination committee (significant at the 10 percent level) and an increase of 7.2 percentage points in probability that the CEO is the chairman of the board (significant at the 5 percent level). The higher percentage of the board serving on the nomination committee reinforces the network dependency in director recruitment, which can lead to managerial entrenchment. Additionally, the higher likelihood that the CEO serves as chairman of the board suggests less control and monitoring performed by the other directors.

This paper contributes to the director network literature in two ways. First, this paper outlines a novel empirical strategy that can be generalized to study plausible exogenous effects of social network changes on corporate finance outcomes. While this paper uses

corporate bankruptcy filings as a source of change in director networks, any other events that destabilize or enhance director networks can be used. Secondly, applying this empirical strategy, I provide evidence that severed connections to a set of directors hinder director mobility. This hindrance actually benefits the firm through reductions in agency costs, as demonstrated through lower executive compensation levels and improved monitoring.

My paper is organized as follows. Section 1 describes my dataset and the construction of relevant variables. Section 2 discusses the role of social networks in the market for directorships. Section 3 discusses my empirical strategy. Section 4 documents my results. Section 5 concludes.

1 Data

1.1 Data Sources

I construct my dataset from six sources: 1) BoardEx of Management Diagnostics Ltd. to construct the director network, 2) Compustat for corporate accounting variables, 3) Execucomp for data on executive compensation, 4) ISS Directors for data on corporate boards, 5) SDC Capital for data on mergers and acquisitions, and 6) UCLA-LoPucki Bankruptcy Research Database (BRD) for data on corporate bankruptcies. BoardEx tracks the employment history of over 500,000 directors and senior managers globally, which serves as the core of my director level dataset. Given the sparse employment data prior to 1999, I restrict my experiment to only include bankruptcy filing years between 2000 and 2011. Table 2 summarizes the variables derived from BoardEx. The sample averages of my variables are similar to those of Engelberg, Gao, and Parsons (2013b).

[Insert Table 2]

Using BoardEx as the core of my dataset, I match director and executive bonus, salary, and total compensation from Execucomp. I obtain bankruptcy data from BRD, which

contains information on approximately 1,000 large public company bankruptcies. These firms have reported assets worth $100 million or more measured in 1980 dollars and have filed 10-Ks with the Securities and Exchange Commission. The bankruptcy filing dates are used to identify Treatment and Control Directors. Lastly, when possible, the companies for which BoardEx directors serve are also mapped to Compustat in order to link annual company accounting data.

Because BoardEx uses a different identification system than Compustat (i.e., GVKEY for firm identification) and Execucomp (i.e., EXECID for executive identification), I resort to fuzzy string matching algorithms to combine these three databases. I first map BoardEx firm identification numbers (COMPID) to Compustat identification numbers (GVKEY).[3] This allows me to identify bankrupt firms in BoardEx (BRD identifies firms by GVKEY). To map BoardEx's director identification numbers (DIRECTID) to Execucomp's identification numbers (EXECID), I first match on gender, generational title (e.g., Jr., Sr., etc.), surname, and company name. I again use fuzzy string matching to make the final full name match. All final matches are manually inspected. My matching procedure yields 8,431 unique company matches and 15,153 unique manager and director matches.[4] Among the bankrupt firms listed in BRD, I identify 523 of them in BoardEx.

1.2 Constructing Network Variables

1.2.1 Edges

I construct a set of "edges" or an "edgelist" for each year in which BoardEx has at least two executives working at a company. An edge is defined as an unordered set of two directors:

[3]Trigram phrase matching identifies phrases that have a high probability of being similar. Each phrase is represented by a set of character trigrams that are extracted from the phrase. The similarity of two phrases is then computed using the vector cosine similarity measure.

[4]The number of unique company matches is very close to the number of 8,428 achieved by Engelberg et al. (2012).

$$\{x, y\} \text{ such that } x, y \in f_t \tag{1}$$

where x and y are elements or "vertices" representing executives and f_t is the set of all executives employed at a particular firm f at a given time t. An edge is assumed to be formed when two executives share the same firm at a particular time period. An edgelist at time t across all firms is thus defined as:

$$E_t = \bigcup_{f_t \in \mathbb{F}_t} \{\{x, y\} | x, y \in f_t\} \tag{2}$$

where $\mathbb{F}_t$ is the universe of firms at time t. An aggregate edgelist is defined as the union of edgelists since the beginning of time:

$$L_t = \bigcup_{s=-\infty}^{t} E_s \tag{3}$$

Some executives and directors die, and their deaths are reported in Execucomp. However, I do not assume that the death data is exhaustive. To address the issue of missing death data, I modify the definitions above to account for directors permanently exiting the business universe either by dying or by reaching the age of 90:

$$\begin{aligned} W_t &= \{z | z \in Z \text{ is dead or is 90 years old at time } t\} \\ A_t &= \{\{x, y\} | \{x, y\} \cap W_t = \varnothing \text{ and } \exists s \leq t \text{ such that } \{x, y\} \in E_s\} \subseteq L_t \end{aligned} \tag{4}$$

where Z is the universe set of executives or vertices. A_t is the modified aggregate edgelist.[5]

1.2.2 Degree Centrality

Degree centrality is defined as the number of "ties" that a vertex has:

[5]My results are not sensitive to changes in the terminal age cutoff (e.g., varying it from 85 to 90 years).

$$
\begin{aligned}
D_t(z) &= \sum_{B \in E_t} \mathbb{1}_B(z) \\
\Delta_t(z) &= \sum_{B \in A_t} \mathbb{1}_B(z)
\end{aligned}
\tag{5}
$$

Degree Centrality $D_t(z)$ counts the number of coworkers that executive $z \in Z$ has at a company given a specific year t. Aggregate Degree Centrality $\Delta_t(z)$ counts the number of people who have shared the same firm with executive z at any point in time up to time t. Intuitively, $D_t(z)$ measures how central executive z is in the business world at a specific point in time. A more central executive could produce more network instability, for example, if she were to temporarily become inactive as a result of a corporate bankruptcy. $\Delta_t(\cdot)$ for an executive measures centrality accounting for employment history. $\Delta_t(\cdot)$ could proxy for long-term industry experience, which results from serving on several boards over time.

2 Description of the Market for Directorships

2.1 Evidence from Surveys

The notion that workers rely on their personal networks in their search for employment is a heavily researched topic in finance, labor economics, and sociology. Granovetter (1973), who made early headway in the social network field, demonstrate, in his field work, the importance of weak ties or indirect connections in various labor markets during job searches. This social norm in recruitment practices appears in the market for directorships as well. According to PricewaterhouseCoopers' 2010 and 2012 Annual Corporate Directors Surveys (see Figure 1), recruitment through internal contacts, either from management or the board, is the most common method in adding new members to the board of directors. Among roughly 1,000 directors surveyed each year, over 80 percent report using personal contacts and almost 60 percent report using management contacts. While roughly 60 percent use search

firms as well, it is clear that personal contacts from both management and the board play a larger role in the selection of directors. In fact, there is a strong positive relationship between the number of business connections and the number of directorships that a director holds. Within the dataset, the correlation between the number of directorships held and degree centrality (i.e., the number of direct connections to individual executives and directors) is around 40 percent for the two years prior to the bankruptcy filing year.

[Insert Figure 1]

These surveys therefore suggest that a director's likelihood of finding new board positions in the future depends on her being on the contact lists of other directors. In other words, director mobility should be partly determined by director networks. If the contacts of a director are no longer recruiting or able to serve as referrals, then the director's mobility should decrease. Thus, the first hypothesis I test is the following:

Hypothesis 1 (H1): *If director connections, which are made from overlapping work histories, are suspended or inactive, director mobility should slow or decrease on average.*

The decision to make or remove connections is endogenous, however. Directors may find ways to sit on boards to make connections with specific individuals strategically. Boards may also seek out a specific director to complement their team. Furthermore, it is difficult to determine whether a particular connection is actually lost or severed (other than from those arising from sudden deaths). This paper attempts to overcome the limited treatment sample problem of using director deaths through a network-based experimental design. By studying directors who are only *indirectly* associated to corporate bankruptcies through director networks, I test for the plausible causal relationship between professional connections and director mobility. While it is possible for directors to want to eschew firms that are prone to bankruptcy, it seems unlikely that directors purposely avoid other directors associated with bankruptcy-prone firms at boards of non-bankruptcy-filing firms.

2.2 Director Mobility and Corporate Governance

There are two prevailing theories that describe the function of social networks in the market for directorships. The human capital theory interprets social networks as an input for board productivity (Acemoglu and Angrist 2000). Because social networks facilitate information sharing, firms may benefit more from directors who are more central than others. If a director's productivity is a function of her personal connections, then any negative shock to her personal connections can undermine her performance in serving the company. For example, directors could become worse at monitoring managers due to more information asymmetry. If a director's mobility facilitates information sharing, then an increase in overall director mobility on the board could improve monitoring:

Hypothesis 2 (H2): *An increase in director mobility leads to better monitoring, as measured through lower executive compensation and less board presence of the CEO.*

On the other hand, agency cost theory interprets director networks as a hidden mechanism that shareholders do not fully observe from the board. The shareholders of a company entrust the board to nominate and elect directors to serve in the company's best interest. However, shareholders do not observe the board's effort levels in their search for the most capable or suitable directors. Because effort levels are hidden from shareholders, boards can hire directors for the purpose of furthering their own careers. The nominated directors could have roles in determining board and management compensation in the future (e.g., serving on the governance or nomination committee), which is a potential conflict of interest if they are not truly independent. Therefore, an increase in overall director mobility on the board could worsen monitoring:

Hypothesis 3 (H3): *An increase in director mobility leads to worse monitoring, as measured through higher executive compensation and more board presence of the CEO.*

In this paper, I test whether board mobility has an overall positive (H2) or negative (H3) impact on board monitoring.

3 Natural Experiment: Strategy

3.1 Director Level

The proposed quasi-natural experiment attempts to isolate changes in director mobility that are solely attributed to having shared employment histories or board appointments with Event Directors. As seen in Table 1, there is at least one bankruptcy filing for every given year between 2000 and 2011. For each year, I identify directors who never served on companies that have filed for bankruptcy and directors who serve or have served on at least one of the bankruptcy-filing firms as a board member or employee. This latter group is called Event Directors because of their direct association with the event (i.e., the bankruptcy filing). Using the former group, I construct a treatment group of directors (Treatment Directors) outside of the event group who have overlapping work histories with Event Directors at non-bankruptcy-filing firms. The control group (Control Directors) is therefore those directors that share at least one board with Treatment Directors, but lack a current or past connection with Event Directors. This implies that a Control Director either left a particular board before an Event Director joined or shared a board with Treatment Directors that has no history of Event Directors. To be precise, I define these groups using basic set notation.

[Insert Table 1]

Let time $t = 0$ denote the time of bankruptcy filing. Without loss of generality, let x, y, and z represent three distinct directors. Let f_t^N represent a set of directors at time t for firm f^N that has never filed for bankruptcy and $f_{s,t}^B$ denote a set of directors at time s for firm f^B that filed for bankruptcy at time t. Assume x has a board appointment at f_0^N (i.e., at time horizon t equal to zero) and has or has had a work history at $f_{s,0}^B$ at some time $s \leq 0$. By definition, x is an Event Director. If y is a director at f_0^N but is or was not a director at

$f^B_{s,0}$ or any other bankruptcy-filing firm at time zero for all time $s \leq 0$, he or she is then a Treatment Director. In other words, y is a Treatment Director if and only if:

$$\begin{aligned} y \notin f^B_{s,0}, \text{ for all } f^B_{s,0} \text{ and for all } s \leq 0 \\ \{x, y\} \in A_0 \end{aligned} \tag{6}$$

where A_0 is the aggregate edgelist up to time 0. Moreover, z is a Control Director if and only if

$$\begin{aligned} \{x, z\} \notin A_0 \text{ for all } x \\ \{y, z\} \in A_0 \text{ for some } y \end{aligned} \tag{7}$$

The Event, Treatment, and Control Director sets can then be formally defined as following:

$$\begin{aligned} \text{Event: } V &\equiv \{x | x \in f^N_0 \cap f^B_{s,0} \text{ for some } f^N_0,\ f^B_{s,0}, \text{ and } s \leq 0\} \\ \text{Treatment: } T &\equiv \{y | y \notin V,\ \{x, y\} \in A_0 \text{ for some } x \in V\} \\ \text{Control: } C &\equiv \{z | \{x, z\} \notin A_0 \text{ for all } x \in V \text{ and } \{y, z\} \in E_0 \text{ for some } y \in T\} \end{aligned} \tag{8}$$

The null hypothesis is that Treatment Directors are immune to any negative network effects resulting from having shared employment histories or board appointments with Event Directors. To test this hypothesis, I estimate the following multi-period difference-in-differences model:

$$Mobility_{it} = \alpha_i + \alpha_t + \tau(\mathbb{1}_{i \in T} \times Post) + \gamma' C_{it} + \epsilon_{it} \tag{9}$$

where $Mobility_{it}$ is director mobility, α_i and α_t are director-bankruptcy-filing-year and year fixed effects, respectively, $\mathbb{1}_{i \in T}$ is an indicator for whether a director is Treatment Director

or Control Director (i.e., $\mathbb{1}_{i \in T} = 1$ or $\mathbb{1}_{i \in T} = 0$, respectively), *Post* is an indicator for the period after bankruptcy filings, C_{it} is a vector of covariates (i.e., an indicator variable for being the CEO, an indicator variable for being the chairman, the natural logarithm of director age, an indicator variable for being an independent director, total number of directorships being held, degree centrality, and aggregate degree centrality), and ϵ_{it} is an error term. The coefficient τ measures the treatment of having a connection with Event Directors at the time of bankruptcy filing. Under the null hypothesis, we expect $\tau = 0$. However, if having a connection with an Event Director has a negative impact on $Mobility_{it}$, we should find that $\tau < 0$. Director mobility is measured by directorships added minus dropped over a year, a dummy variable for whether a directorship was added over a year, and a dummy variable for whether a directorship was dropped over a year for each director.

[Insert Table 2]

Equation 9 is estimated with error clustering at the director level. In this difference-in-differences specification, time trends across groups are captured by year fixed effects. Additionally, time-constant unobserved firm heterogeneity are canceled out by the included firm fixed effects. However, in order to credibly make causal claims, the changes in outcome variables between treatment and control groups need to remain constant in the absence of the treatment. This assumption can be visually inspected by plotting past outcome values to ensure that the trends are stable and relatively parallel. Figures 2 plots the mean measures of director mobility with 95 percent confidence intervals for Event, Control and Treatment Directors.[6] In all panels, the pre-treatment trends for different director mobility measures between the average Control and Treatment Director are roughly parallel.

The exogeneity of $\mathbb{1}_{i \in T}$ requires directors to be unable to select themselves into or out of the treatment or control groups. There are two scenarios in which a director can self-select themselves into the control group. First, a director can avoid an Event Director by leaving

[6]Confidence intervals are constructed based on the assumption that the error distributions are approximately normal.

boards of non-bankruptcy filing firms prior to the joining of an Event Director. Second, a director can sit on a different board that has no historical link with any Event Directors. In both cases, the director intentionally avoids an Event Director, with the latter scenario being the stronger case of Event Director aversion, as the director abstains from a firm even if Event Directors no longer occupy any board seats. This behavior of Event Director aversion is difficult to rationalize. While it is possible that social stigma could motivate one to avoid others, it seems unlikely for a director to avoid another before the actual occurrence of bankruptcy, the reputation damaging event.

Are there incentives to self-select into the treatment group? A director may want to make connections with an Event Director to access a larger social network. Indeed, Event Directors do have higher degree and aggregate degree centralities as noted in Table 2. However, it seems unlikely that a director has any incentive to seek out Event Directors when a corporate bankruptcy is imminent. As a robustness check, I excluded Treatment Directors whose connection with Event directors only existed at most two years prior to the year of bankruptcy filing and found no material difference in estimated results.

In order to estimate the average treatment effect of losing connections with Event Directors, Control Directors ideally should be equally as likely as Treatment Directors to receive the treatment (i.e., satisfying the overlap assumption). This, however, is unlikely given that Treatment Directors on average have a wider professional network than Control Directors within our sample. As shown in Table 2, the degree and aggregate degree centralities of the average Treatment Director is much higher than the average Control Director. Treatment Directors have on average 16 more current connections and 29 more lifetime connections one years before the bankruptcy filing year. Treatment Directors additionally differ from Control Directors in several other dimensions. They are 3.7 percent more likely to be CEOs. They also hold on average 1 more directorship than Control Directors. Nonetheless, assuming exogeneity of $\mathbb{1}_{i \in T}$, estimation of the average treatment effect of the treated is still feasible. I do my best to control for these differences in observable director characteristics.

3.2 Firm Level

To estimate the treatment effects of aggregate connection losses at the firm level, I construct the following continuous treatment variable for each firm j:

$$S_j \equiv \frac{|T_j|}{|T_j| + |C_j|} \tag{10}$$

where T_j and C_j are defined in Equation 8, but now aggregated by firm (i.e., calculating the cardinality or number of elements of the sets of T_j and C_j). Network Shock Intensity S_j in Equation 10 measures the intensity of the director network shock aggregated at the firm level. To estimate the causal effects of director mobility on firm level outcome variables, I combine the difference-in-differences and instrumental variable methods. First, I estimate the following difference-in-differences model using S_j over a 4-year window around the bankruptcy filing year:

$$BoardMobility_{jt} = \alpha_j + \alpha_t + \tau(S_j \times Post) + \gamma' C_{jt} + \epsilon_{jt} \tag{11}$$

where α_j and α_t are firm-bankruptcy-filing year and year fixed effects, respectively, C_{jt} is a vector of time-varying firm characteristics (i.e., Tobin's Q, the natural logarithm of firm age, ROA, book leverage, cash flow, the natural logarithm of market capitalization, cash holdings, capital intensity, and the natural logarithm of book assets), and ϵ_{jt} is the error term. $BoardMobility_{jt}$ is defined as net directorships acquired and dropped by directors on a board divided by board size. Second, I use the instrumented $BoardMobility_{it}$ to estimate the following regression model for firm level outcome variable y_{jt}:

$$y_{jt} = \beta_j + \beta_t + \theta \widehat{BoardMobility}_{jt} + \omega' C_{jt} + u_{jt} \tag{12}$$

where β_j and β_t are firm-bankruptcy-filing year and year fixed effects, respectively, and u_{jt} is the error term. The parameter of interest is θ, the two-stage least squares estimator,

which establishes a causal relationship between board mobility and the firm level outcome variable of interest, if it is statistically different from zero. Standard errors are clustered at the firm level. The firm level outcome variables of interest include executive compensation and monitoring related board actions.

4 Natural Experiment: Results

4.1 Director Mobility

I test whether being connected to Event Directors (or temporarily losing connections to Event Directors) have material consequences on director mobility by comparing measures of director mobility before and after each bankruptcy filing event between Treatment Directors and Control Directors. The measures of director mobility used are net directorships added minus dropped and the probability of adding a directorship over a one-year period. These measures are similar to those used by Kaplan and Reishus (1990).

As documented in the literature, there is a positive relationship between firm performance and director mobility. Fama and Jensen (1983) and Vafeas (1999) view that director mobility is strongly linked with firm performance in a reputational sense. Several papers provide empirical support to this idea. Gilson (1990) finds that directors of bankrupt firms or firms undergoing debt restructuring hold 35 percent fewer board seats three years after resigning. Brickley, Linck, and Coles (1999) show that the likelihood of a retired CEO serving on any board as a director is strongly related to firm performance under her tenure. Assuming dividend reductions and being targeted for takeovers are related to firm performance, Kaplan and Reishus (1990) and Shivdasani (1993) also provide evidence for the reputation story. Controlling for industry and asset size, Kaplan and Reishus (1990) observe that only 10 percent of top managers from dividend-reduction companies obtain additional directorships within three years of the dividend cut compared to 22.6 percent of top mangers from comparable firms. Similarly, also controlling for industry and asset size, Shivdasani (1993)

discovers that directors of firms targeted for hostile takeover hold fewer outside board positions than other directors at comparable non-targeted firms. These results are consistent with the notion established by Fama (1980), who argues that additional directorships serve as incentive for directors to be diligent monitors. In other words, the external labor market punishes directors for poor performance that can be attributable to them.

However, Treatment and Control Directors in this paper do not necessarily come from firms that are performing poorly. The firms used to construct the treatment and control groups have avoided bankruptcy. Here, I essentially control for possible confounding effects on director mobility originating from firm performance. I am therefore able study the isolated network impact on director mobility. Directors in my sample have never served on bankrupt firms. The only link Treatment Directors have with bankrupt firms is through their network connection with Event Directors.

[Insert Figure 2]

In the top panel of Figure 2, there is a sharp discontinuity in the number at which Treatment Directors add and drop directorships over a one-year period around bankruptcy filings. Prior to the bankruptcy filing events, both Treatment and Control Directors were adding more than they were dropping directorships on average. After the bankruptcy filing event, Treatment Directors became immobile on average. The Control Directors, who also experienced a slight slow-down in mobility, essentially added as many as they dropped on average after the bankruptcy event.

Normalizing directorship additions to a single unit, we observe a similar discontinuity in the probability of adding directorships in the bottom panel of Figure 2. Visually, these panels support the hypothesis that directors do indeed rely on professional connections to find new board positions. When a director suddenly loses connections as a result of other firms declaring bankruptcy, her ability to find additional directorships is hampered. This implies that some Treatment Directors may stay longer on certain boards than desired.

The probability of dropping directorships, on the other hand, seems to be fairly stable for the Treatment Directors, which again suggests that these directors are not switching boards (see Figure 3). What is reassuring is that the probability of dropping directorships reaches a peak for Event Directors at the time of bankruptcy filing, as shown in Figure 3. This gives credibility to the claim that corporate bankruptcies themselves do have a direct adverse effect on director mobility.

[Insert Table 3]

The estimated treatment effects on director turnover over a 4-year window around the bankruptcy filing year is documented in Table 3. I find that directors who are connected to Event Directors (or lose contact with Event Directors) at the time of bankruptcy filings experience a reduction in the probability of finding additional directorships by 9 percentage points within a 1-year period; the number of directorships added decreases by 7.7 percent on average. Directors become immobile as they lose on average 0.13 board positions. These point estimates are statistically significant at the 1 percent level after controlling for observable director characteristics. Likewise, the probability that they drop existing directorships is essentially zero within a 1-year period.

4.2 Board Mobility and Firm Level Outcomes

The estimation of the first stage firm-level difference-in-differences model mirrors the director mobility results at the director level. As shown in Table 7, I find that on average a 10 percentage point increase in Network Shock Intensity increases Board Mobility, which is defined as net directorships acquired and dropped by directors on a board divided by board size, by 1 percentage point, which is statistically significant at the 1 percent level. The use of Network Shock Intensity as an instrumental variable requires the assumption that it can be excluded from the second stage regression in Equation 12. I assume here that the Network Shock Intensity, which captures overall board exposure to being associated to

Event Directors, is irrelevant to internal firm decisions such as executive compensation and board monitoring, unless its impact translates through board mobility, which is a proxy for career concerns. A director's link to Event Directors should have no direct bearing on how to optimally pay the executives of her firm. Likewise, the governance decisions of the board should not be affected by links to Event Directors.

4.2.1 Executive Compensation

Tables 5 and 8 document the two-stage IV estimation results on executive compensation variables for the top 3 highest paid executives and the CEO of each firm, respectively.[7] In both tables, columns 1, 3, and 5 are OLS regression results relating board mobility to total compensation, option value compensation, and number of option grants, respectively. Columns 2, 4, and 6 are the IV regression results. For the top 3 most highly paid executives for a given firm, a one percentage point increase in board mobility increases total compensation by 2.2 percent (significant at the 10 percent level). This effect seems to be mainly driven by additional option grants. A 1 percentage point increase in board mobility increases the number option grants by 9.7 percent (significant at the 1 percent level), which translates to an increase in the option value portion of total compensation by 8.6 percent (significant at the 5 percent level).

[Insert Figure 5]

I find similar results for CEOs in terms of option value and grants. On average, a one percentage point increase in board mobility increases the number of option grants to CEOs and option value compensation of CEOs by 8.2 percent (significant at the 5 percent level) and 6.6 percent (significant at the 10 percent level), respectively. These results support the hypothesis that busy boards, as proxied by board mobility, weakens director monitoring of executives. Since directors are distracted by opportunities of serving new board appointments, they rely more on financial instruments when designing executive compensation packages.

[7] Over 90 percent of firms in Execucomp report their 3 highest paid executives.

[Insert Figure 8]

4.2.2 Governance

Table 6 documents the two-stage IV estimation results on internal governance related variables. I find that a 10 percentage point increase in board mobility leads to an increase of 7 percentage points of the board serving on the nomination committee (significant at the 10 percent level) and an increase of 72 percentage points in probability that the CEO is the chairman of the board (significant at the 5 percent level). The higher percentage of the board serving on the nomination committee reinforces the network dependency in director recruitment, which can lead to managerial entrenchment. Directors that are on the nomination committee are in a position to exchange favors with other directors within her network. Additionally, the higher likelihood that the CEO serves as chairman of the board suggests that highly mobile boards, which are likely to be busy boards, are more willing to yield control to management.

[Insert Figure 6]

5 Conclusion

Information is often difficult to verify. For instance, references and letters of recommendations from those with established credibility (i.e., those who are in the network) are usually mandatory with any job application as a way to attribute credibility to someone who is not in the network. These practices are low cost methods of overcoming information uncertainty. That is, reducing the universe of possible job candidates to just those with direct or indirect ties speeds up the hiring process dramatically. However, this may not always yield optimal outcomes; a capable director can be overlooked because nobody in the network can vouch for her qualifications.

My results show that director recruitment depends heavily on personal contacts from

company board and management. Using the experimental setup outlined in this paper, I show that director mobility is significantly impeded when certain connections are temporarily suspended by corporate bankruptcy filings. Moreover, I show that the directorship market dependency on network ties can be a source of agency problems.

This paper provides a methodology that can be easily extended to other corporate events that are strongly related to executive networks. The methodology outlined in this paper allows one to make plausibly causal arguments on the treatment effect resulting from connection losses, assuming the corporate event is convincingly related to breakdowns in executives' social networks.

The findings of this paper should also bring to light what it really means to be an "independent" director or board independence in general. An independent director's ability to add directorships measures her external demand for her board service. However, all else equal, independence may be compromised if the director relies on her personal connections to acquire additional directorships. System-wide reliance of such a practice inherently generates quid pro quo relationships, which prevents directors to be truly disinterested.

Director and board independence is a social network issue underpinned in several fields including law, pscyhology, economics, and finance. In the case of *re Oracle Corp. Derivative Litigation, 824 A.2nd* (Del. Ch. 2003), the court found that non-economic ties need to be considered in determining the independence of a board committee. Pscyhology provide us with several cognitive biases that prevent people to be objective. For example, people are often susceptible to confirmation bias (Nickerson 1998) and in-group favoritism (Taylor and Doria 1981). While this paper contributes to the literature by exploring the impact of social networks on director mobility, further research may explore the relationship between executive-level and firm-level networks. The evolution of these networks over time needs further examination as well.

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A Tables and Figures: Director Level Experiment

Figure 1: Resources used to recruit new board members according to industry surveys

Surveys are from PricewaterhouseCoopers' 2010 and 2012 Annual Corporate Directors Surveys. The sample size of the 2010 and 2012 surveys are 1110 and 860, respectively.

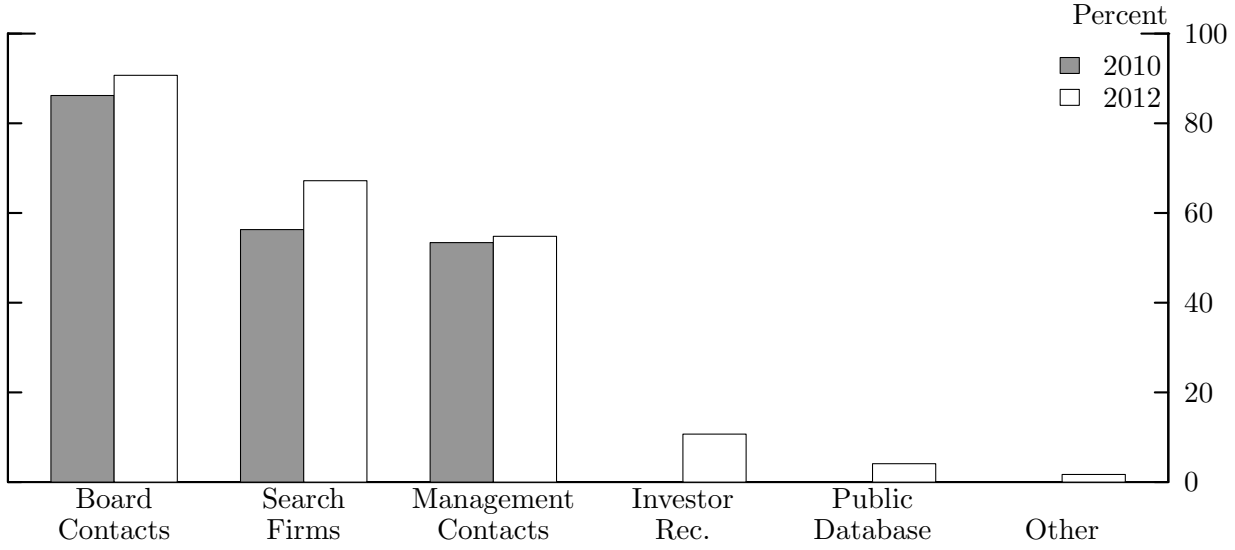


Table 1: Experimental group sample sizes by bankruptcy filing year

These samples consist of directors holding board positions at the bankruptcy filing year. Event Directors are directors that hold or have held a board position for at least one firm that has filed for bankruptcy. Treatment Directors are directors that hold or have held board or executive positions with Event Directors at the bankruptcy filing year. Control Directors are directors that share boards with Treatment Directors at the bankruptcy filing year but have no employment histories with Event Directors. Both Treatment and Control Directors have never served on a board of a firm that has filed for bankruptcy. Treatment Directors can become Control Directors in subsequent years; this alleviates the concern that the two sets of directors may differ along other dimensions (Bertrand and Mullainathan 2003). However, once a director is treated, she is excluded from the treatment group in subsequent years.

Filing Year	Control Directors	Treament Directors	Event Directors	Total
1986	12	6	1	19
1987	21	38	6	65
1991	46	55	7	108
1992	170	169	19	358
1993	4	6	1	11
1994	113	71	6	190
1995	256	180	10	446
1996	128	65	9	202
1997	208	116	10	334
1998	405	170	18	593
1999	269	261	32	562
2000	885	1098	94	2077
2001	975	1467	161	2603
2002	918	916	125	1959
2003	835	368	74	1277
2004	871	262	42	1175
2005	804	326	66	1196
2006	1064	344	57	1465
2007	1036	184	19	1239
2008	912	556	133	1601
2009	529	1097	358	1984
2010	520	115	48	683
2011	919	77	30	1026
Total	11900	7947	1326	21173

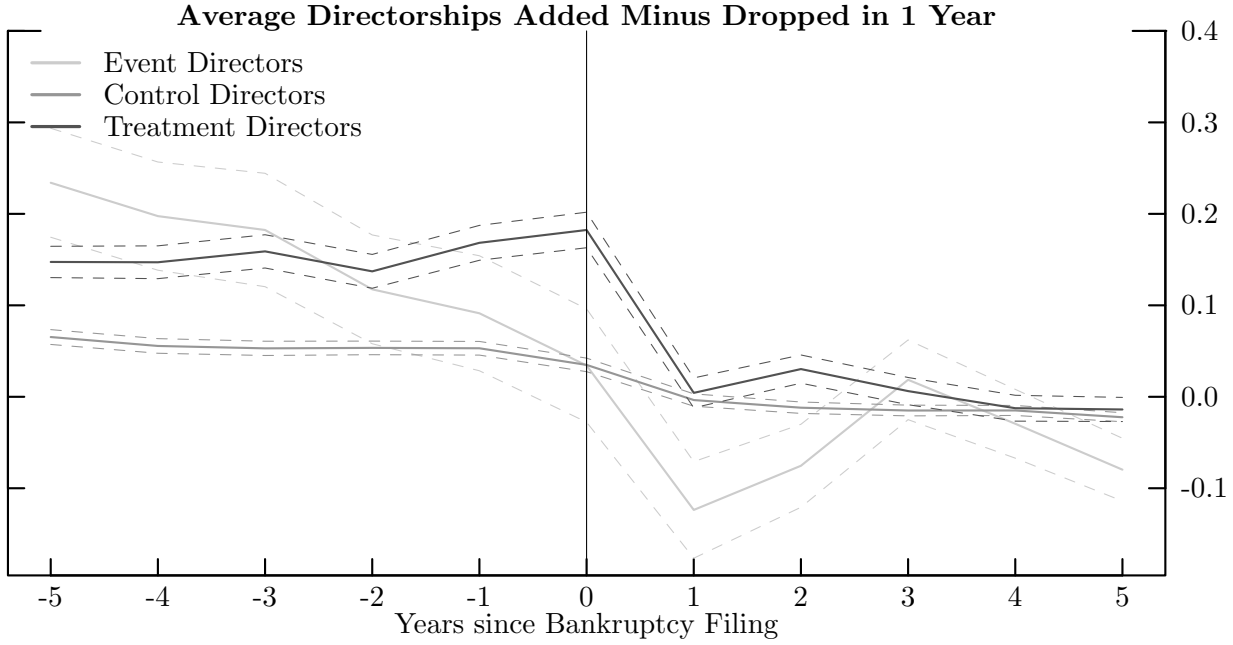
Table 2: Summary statistics of director characteristics

The following table shows the comparison of sample means of several characteristics of treatment and control group directors included in the natural experiment one year prior to the treatment period. Event Directors are directors that hold or have held a board position for at least one firm that has filed for bankruptcy. Treatment Directors are directors that hold or have held board or executive positions with Event Directors at the bankruptcy filing year. Control Directors are directors that share boards with Treatment Directors at the bankruptcy filing year but have no employment histories with Event Directors. Both Treatment and Control Directors have never served on a board of a firm that has filed for bankruptcy. Bankruptcy filing years are restricted to years between 2000 and 2011.

	Control Directors		Treatment Directors			
	Mean	Std. Dev.	Mean	Std. Dev.	Δ	Std. Error
CEO	0.287	0.452	0.323	0.467	−0.037	0.007
Male	0.932	0.252	0.890	0.313	0.042	0.004
Chairman	0.357	0.479	0.396	0.489	−0.039	0.007
Age	59.381	9.900	57.079	9.066	2.302	0.134
Independent	0.481	0.635	0.476	0.652	0.007	−0.017
Number of Directorships	1.747	1.011	2.609	1.575	−0.863	0.021
Degree Centrality	14.227	7.256	30.124	25.951	−15.897	0.320
Aggregate Degree Centrality	35.659	42.907	64.879	64.461	−29.219	0.848
Directorships Added Minus Dropped in 1 Year	0.031	0.388	0.137	0.630	−0.106	0.008
Probability of Adding a Directorship in 1 Year	0.083	0.276	0.229	0.420	−0.145	0.006
Probability of Dropping a Directorship in 1 Year	0.062	0.240	0.135	0.342	−0.074	0.005

Figure 2: Average director mobility measures

Event Directors are directors that hold or have held a board position for at least one firm that has filed for bankruptcy. Event Directors are directors that hold or have held a board position for at least one firm that has filed for bankruptcy. Treatment Directors are directors that hold or have held board or executive positions with Event Directors at the bankruptcy filing year. Control Directors are directors that share boards with Treatment Directors at the bankruptcy filing year but have no employment histories with Event Directors. Both Treatment and Control Directors have never served on a board of a firm that has filed for bankruptcy. Each solid line in each plot represents the mean of a director mobility measure for an experimental group. The dashed lines are 95 percent confidence intervals assuming the error distribution is approximately normal with unknown variance. Bankruptcy filing years are restricted to years between 2000 and 2011.



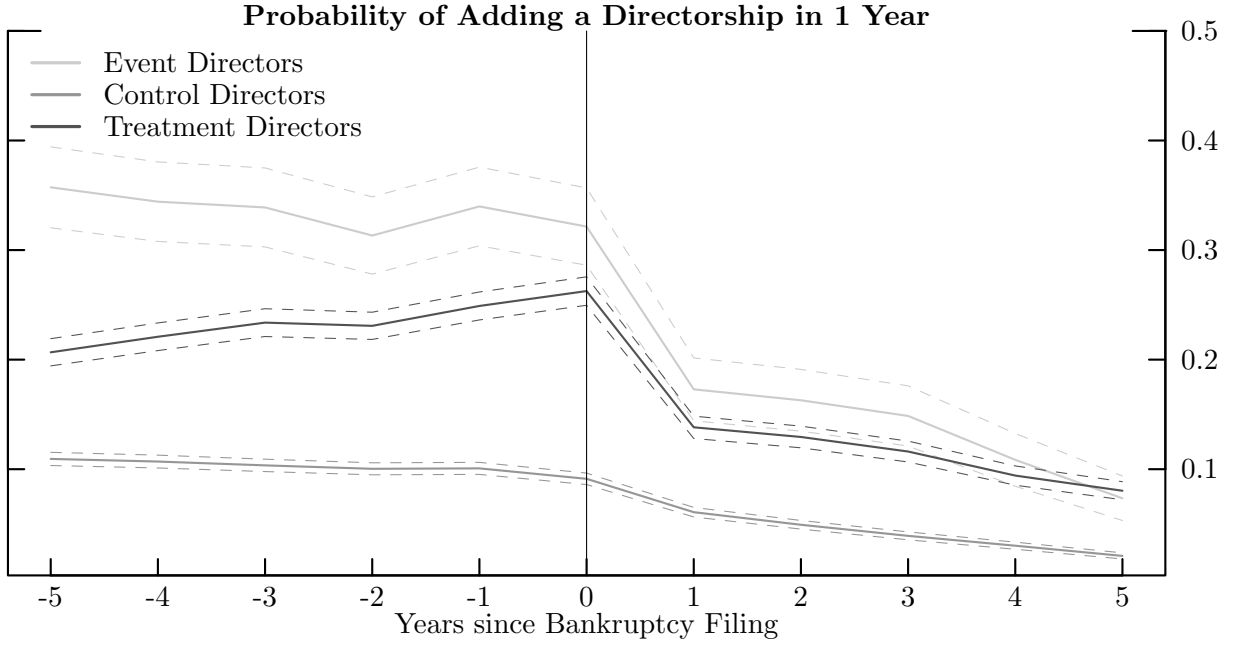


Table 3: Impact of bankruptcy induced network shock on director mobility

Significance levels 10%, 5%, and 1% are denoted by *, **, ***, respectively. Standard errors in parentheses are clustered at the director level. Treatment is a dummy variable that equals 1 if a director is a Treatment Directors or 0 if a director is a Control Director. Event Directors are directors that hold or have held a board position for at least one firm that has filed for bankruptcy. Treatment Directors are directors that hold or have held board or executive positions with Event Directors at the bankruptcy filing year. Control Directors are directors that share boards with Treatment Directors at the bankruptcy filing year but have no employment histories with Event Directors. Both Treatment and Control Directors have never served on a board of a firm that has filed for bankruptcy. Bankruptcy filing years are restricted to years between 2000 and 2011. Event study window covers 2 years before and 2 years after the bankruptcy filing year.

	Net Directorships Added Minus Dropped over 1 Year	$\mathbb{1}$(Add a Directorship over 1 Year)	$\mathbb{1}$(Drop a Directorship over 1 Year)	ln(Number of Directorships Added over 1 Year)	ln(Number of Directorships Dropped over 1 Year)
	(1)	(2)	(3)	(4)	(5)
Treatment × Post-Bankruptcy-Filing	−0.125***	−0.091***	0.006	−0.077***	0.007**
	(0.008)	(0.005)	(0.004)	(0.004)	(0.003)
CEO	0.051**	0.011	−0.033***	0.008	−0.026***
	(0.022)	(0.014)	(0.012)	(0.011)	(0.009)
Chairman	−0.023	−0.027**	−0.030**	−0.030***	−0.026***
	(0.021)	(0.013)	(0.012)	(0.011)	(0.009)
ln(Age)	−5.428***	−3.725***	0.738***	−3.053***	0.553***
	(0.412)	(0.258)	(0.236)	(0.210)	(0.177)
Independent	−0.047***	0.024*	0.061***	0.013	0.056***
	(0.018)	(0.013)	(0.012)	(0.010)	(0.009)
ln(No. of Directorships)	2.039***	1.060***	−0.633***	0.903***	−0.522***
	(0.033)	(0.022)	(0.020)	(0.018)	(0.015)
ln(Degree Centrality)	−0.000	−0.150***	−0.193***	−0.128***	−0.144***
	(0.014)	(0.010)	(0.010)	(0.008)	(0.007)
ln(Aggregate Degree Centrality)	−0.179***	0.238***	0.470***	0.200***	0.363***
	(0.020)	(0.016)	(0.015)	(0.012)	(0.012)
Year FE	Yes	Yes	Yes	Yes	Yes
Director-Filing Year FE	Yes	Yes	Yes	Yes	Yes
Bankruptcy-Filing Firm(s)-Year FE	Yes	Yes	Yes	Yes	Yes
Obs.	68012	68012	68012	68012	68012
Adj. R^2	0.241	0.300	0.194	0.319	0.206

B Tables and Figures: Firm Level Experiment

Table 4: Summary statistics of firm characteristics

The following table describes statistics for the full sample one year prior to the treatment period at the firm level. Network Shock Intensity is defined as the number of Treatment Directors divided by the total number of Treatment and Control Directors for a given firm. Event Directors are directors that hold or have held a board position for at least one firm that has filed for bankruptcy. Treatment Directors are directors that hold or have held board or executive positions with Event Directors at the bankruptcy filing year. Control Directors are directors that share boards with Treatment Directors at the bankruptcy filing year but have no employment histories with Event Directors. Both Treatment and Control Directors have never served on a board of a firm that has filed for bankruptcy. See Table 13 for additional variable definitions. Bankruptcy filing years are restricted to years between 2000 and 2011.

				Quantiles		
	N	Mean	Std. Dev.	25%	50%	75%
Network Shock Intensity	14711	0.350	0.363	0.000	0.222	0.500
Tobin's Q	3684	2.266	3.094	1.078	1.471	2.464
Firm Age	4976	15.294	13.657	6.000	11.000	20.000
ROA	4036	0.013	0.316	0.015	0.062	0.114
Book Leverage	4032	0.224	0.248	0.019	0.168	0.346
Cash Flow	3850	−0.002	0.457	0.011	0.066	0.118
log(Market Capitalization)	3782	6.340	1.959	5.109	6.391	7.561
Capital Intensity	3960	0.247	0.251	0.046	0.152	0.387
Cash Holdings	4043	0.191	0.232	0.023	0.084	0.289
ln(Book Assets)	4043	6.486	2.050	5.085	6.383	7.785

Table 5: Impact of director mobility on executive compensation: OLS and IV estimates

Significance levels 10%, 5%, and 1% are denoted by *, **, ***, respectively. Standard errors in parentheses are clustered at the firm level. The dependent variables measure compensation of the top 3 most highly paid executives for a given firm based on salary and bonus. Board Mobility is defined as net directorships acquired and dropped by directors on a board divided by board size. Network Shock Intensity, which is defined as the number of Treatment Directors divided by the total number of Treatment and Control Directors for a given firm, interacted with the post-bankruptcy filing dummy variable is used as an instrument for Board Mobility. See Table 13 for additional variable definitions. Bankruptcy filing years are restricted to years between 2000 and 2011.

	ln(Total Compensation)		ln(Option Value)		ln(No. Option Grants)	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Board Mobility	0.120**	2.146*	0.016	8.610**	0.238	9.763***
	(0.055)	(1.164)	(0.103)	(4.275)	(0.164)	(3.766)
Tobin's Q	0.021	0.021	−0.045	−0.044	−0.021	−0.020
	(0.021)	(0.021)	(0.037)	(0.042)	(0.047)	(0.048)
ln(Firm Age)	−0.046	0.034	−0.733	−0.392	−0.819**	−0.442
	(0.104)	(0.114)	(0.518)	(0.536)	(0.398)	(0.443)
ROA	0.637***	0.571**	−0.009	−0.292	−0.189	−0.502
	(0.217)	(0.238)	(0.723)	(0.752)	(0.664)	(0.689)
Book Leverage	−0.274*	−0.218	0.427	0.667	−0.950*	−0.684
	(0.148)	(0.144)	(0.524)	(0.575)	(0.503)	(0.577)
Cash Flow	−0.518***	−0.433**	0.168	0.528	−0.752	−0.353
	(0.170)	(0.190)	(0.411)	(0.477)	(0.463)	(0.438)
ln(Market Capitalization)	0.182**	0.183**	0.168	0.170	0.085	0.087
	(0.077)	(0.076)	(0.138)	(0.142)	(0.096)	(1.015)
Capital Intensity	−0.773***	−0.848***	−0.774	−1.091	−0.764	−1.116
	(0.254)	(0.275)	(1.129)	(1.228)	(0.950)	(0.673)
Cash Holdings	0.121	0.145	−0.835	−0.733	−0.838	−0.727
	(0.164)	(0.182)	(0.524)	(0.620)	(0.557)	(0.673)
ln(Book Assets)	0.236***	0.231***	−0.003	−0.026	0.279*	0.253
	(0.082)	(0.083)	(0.194)	(0.191)	(0.155)	(0.168)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Filing Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	23945	23945	23937	23937	23945	23945
Adj. R^2	0.621		0.671		0.431	
F Statistic						
Cragg-Donald		80.842		81.001		80.842
Kleibergen-Paap rK		41.342		34.212		41.342

Table 6: Impact of director mobility on monitoring: OLS and IV estimates

Significance levels 10%, 5%, and 1% are denoted by *, **, ***, respectively. Standard errors in parentheses are clustered at the firm level. The dependent variables are various board actions that could affect monitoring. Board Share of Nomination Committee is the percentage share of the board that are members of the nomination committee. CEO Chairman is a dummy variable that equals 1 if the CEO is the chairman of the board of directors. ln(Board Size) is the natural logarithm of the number of directors occupying a board. Board Mobility is defined as net directorships acquired and dropped by directors on a board divided by board size. Network Shock Intensity, which is defined as the number of Treatment Directors divided by the total number of Treatment and Control Directors for a given firm, interacted with the post-bankruptcy filing dummy variable is used as an instrument for Board Mobility. See Table 13 for additional variable definitions. Bankruptcy filing years are restricted to years between 2000 and 2011.

	Board Share on Nomination Committee		CEO Chairman		ln(Board Size)	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Board Mobility	−0.010	0.731*	−0.017	7.215**	−0.049*	−1.332
	(0.026)	(0.389)	(0.071)	(3.616)	(0.029)	(0.886)
Tobin's Q	0.000	0.006	−0.019	0.024	−0.013*	−0.020**
	(0.006)	(0.008)	(0.025)	(0.041)	(0.007)	(0.010)
ln(Firm Age)	0.203***	0.213***	0.400*	0.422*	0.227***	0.225***
	(0.057)	(0.059)	(0.207)	(0.254)	(0.079)	(0.084)
ROA	0.038	0.038	−0.080	0.016	−0.060	−0.081
	(0.068)	(0.081)	(0.278)	(0.499)	(0.094)	(0.117)
Book Leverage	−0.049	−0.069	0.414**	0.207	0.123**	0.157**
	(0.053)	(0.052)	(0.196)	(0.334)	(0.063)	(0.079)
Cash Flow	0.007	−0.016	0.060	−0.223	0.090*	0.139*
	(0.039)	(0.050)	(0.178)	(0.331)	(0.055)	(0.076)
ln(Market Capitalization)	−0.030*	−0.042**	0.073	−0.015	0.043**	0.060**
	(0.015)	(0.017)	(0.074)	(0.100)	(0.020)	(0.127)
Capital Intensity	0.025	0.000	0.370	0.099	0.012	0.049
	(0.117)	(0.127)	(0.373)	(0.543)	(0.118)	(0.089)
Cash Holdings	0.076	0.048	−0.179	−0.418	0.004	0.044
	(0.077)	(0.094)	(0.211)	(0.407)	(0.066)	(0.089)
ln(Book Assets)	0.038*	0.056**	0.055	0.191	−0.026	−0.052
	(0.023)	(0.026)	(0.110)	(0.140)	(0.033)	(0.042)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Filing Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	17347	17347	18526	18526	18377	18377
Adj. R^2	0.582		0.535		0.861	
F Statistic						
Cragg-Donald		32.860		35.665		35.386
Kleibergen-Paap rK		13.042		14.931		14.747

C Additional Results from the Natural Experiment

Figure 3: Other director mobility measures

Event Directors are directors that hold or have held a board position for at least one firm that has filed for bankruptcy. Treatment Directors are directors that hold or have held board or executive positions with Event Directors at the bankruptcy filing year. Control Directors are directors that share boards with Treatment Directors at the bankruptcy filing year but have no employment histories with Event Directors. Both Treatment and Control Directors have never served on a board of a firm that has filed for bankruptcy. Each solid line in each plot represents the mean of a director mobility measure for an experimental group. The dashed lines are 95 percent confidence intervals assuming the error distribution is approximately normal with unknown variance. Bankruptcy filing years are restricted to years between 2000 and 2011.

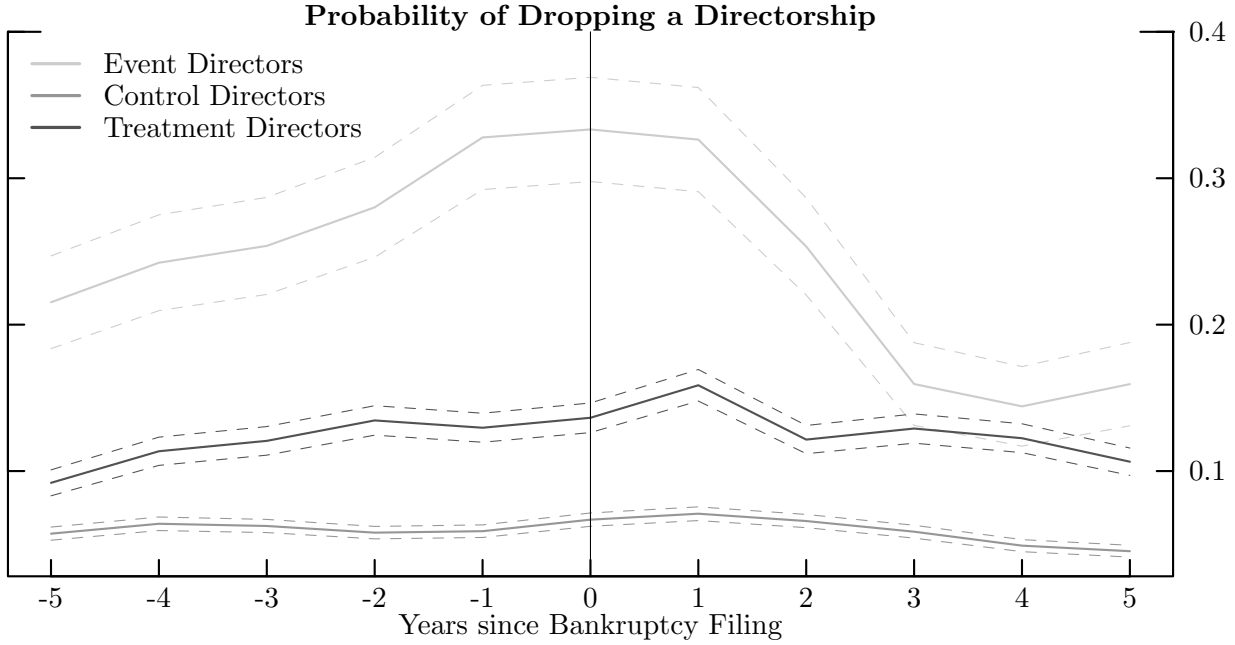


Table 7: Impact of bankruptcy induced network shock on board mobility

Significance levels 10%, 5%, and 1% are denoted by *, **, ***, respectively. Standard errors in parentheses are clustered at the firm level. Board Mobility, the dependent variable, is defined as net directorships acquired and dropped by directors on a board divided by board size. Network Shock Intensity is defined as the number of Treatment Directors divided by the total number of Treatment and Control Directors for a given firm. Binary Network Shock Intensity is equal to 1 if Network Shock Intensity is equal to 1 and equal to 0 if Network Shock Intensity is equal to 0. See Table 13 for additional variable definitions. Bankruptcy filing years are restricted to years between 2000 and 2011.

	Board Mobility	
Binary Network Shock Intensity × Post-Bankruptcy$(t-2)$		−0.037
		(0.033)
Binary Network Shock Intensity × Post-Bankruptcy$(t-1)$		0.027
		(0.034)
Binary Network Shock Intensity × Post-Bankruptcy$(t+1)$		−0.098***
		(0.032)
Binary Network Shock Intensity × Post-Bankruptcy$(t+2)$		−0.068**
		(0.029)
Network Shock Intensity × Post-Bankruptcy	−0.090***	
	(0.010)	
Tobin's Q	0.000	0.000
	(0.000)	(0.003)
ln(Firm Age)	−0.043***	−0.301***
	(0.010)	(0.067)
ROA	0.001	0.007
	(0.006)	(0.014)
Book Leverage	−0.005	0.002
	(0.007)	(0.016)
Cash Flow	0.002	−0.002
	(0.007)	(0.014)
ln(Market Capitalization)	0.002	0.008
	(0.004)	(0.019)
Capital Intensity	0.015	−0.253
	(0.035)	(0.157)
Cash Holdings	0.006	0.034
	(0.023)	(0.113)
ln(Book Assets)	0.000	0.019
	(0.006)	(0.026)
Year FE	Yes	Yes
Firm-Filing Year FE	Yes	Yes
Obs.	46062	5292
Adj. R^2	0.042	0.016

Table 8: Impact of director mobility on CEO compensation: OLS and IV estimates

Significance levels 10%, 5%, and 1% are denoted by *, **, ***, respectively. Standard errors in parentheses are clustered at the firm level. The dependent variables measure CEO compensation. Board Mobility is defined as net directorships acquired and dropped by directors on a board divided by board size. Network Shock Intensity, which is defined as the number of Treatment Directors divided by the total number of Treatment and Control Directors for a given firm, interacted with the post-bankruptcy filing dummy variable is used as an instrument for Board Mobility. See Table 13 for additional variable definitions. Bankruptcy filing years are restricted to years between 2000 and 2011.

	ln(Total Compensation)		ln(Option Value)		ln(No. Option Grants)	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Board Mobility	0.133*	1.476	0.064	6.605*	0.307*	8.161**
	(0.069)	(1.789)	(0.116)	(3.884)	(0.171)	(3.480)
Tobin's Q	0.034	0.033	−0.015	−0.017	−0.017	−0.020
	(0.026)	(0.026)	(0.037)	(0.040)	(0.053)	(0.054)
ln(Firm Age)	−0.035	0.018	−0.921*	−0.654	−0.719*	−0.409
	(0.128)	(0.150)	(0.477)	(0.498)	(0.374)	(0.415)
ROA	0.236	0.215	−0.246	−0.345	0.443**	0.322
	(0.152)	(0.151)	(0.190)	(0.254)	(0.221)	(0.200)
Book Leverage	−0.145	−0.106	0.228	0.417	−1.014**	−0.790
	(0.210)	(0.203)	(0.515)	(0.541)	(0.477)	(0.518)
Cash Flow	−0.385	−0.342	0.425	0.624	−0.904*	−0.660
	(0.313)	(0.307)	(0.454)	(0.577)	(0.505)	(0.469)
ln(Market Capitalization)	0.219**	0.218**	0.129	0.126	0.042	0.037
	(0.096)	(0.096)	(0.147)	(0.149)	(0.100)	(1.012)
Capital Intensity	−0.956***	−1.002***	−0.935	−1.158	−1.162	−1.427
	(0.301)	(0.312)	(1.071)	(1.142)	(0.948)	(0.729)
Cash Holdings	−0.103	−0.078	−0.971**	−0.862	−0.613	−0.474
	(0.217)	(0.225)	(0.493)	(0.565)	(0.652)	(0.729)
ln(Book Assets)	0.180*	0.176	0.103	0.086	0.305*	0.286*
	(0.107)	(0.108)	(0.191)	(0.191)	(0.157)	(0.168)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Filing Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	24004	24004	23945	23945	24104	24104
Adj. R^2	0.615		0.596		0.365	
F Statistic						
Cragg-Donald		84.990		85.164		83.094
Kleibergen-Paap rK		35.758		36.087		35.198

Table 9: Impact of network shock on compensation: reduced form

Significance levels 10%, 5%, and 1% are denoted by *, **, ***, respectively. Standard errors in parentheses are clustered at the firm level. The dependent variables measure CEO and top 3 executive compensation. Network Shock Intensity, which is defined as the number of Treatment Directors divided by the total number of Treatment and Control Directors for a given firm, interacted with the post-bankruptcy filing dummy variable is used as an instrument for Board Mobility. See Table 13 for additional variable definitions. Bankruptcy filing years are restricted to years between 2000 and 2011.

	Top 3 Executive Compensation			CEO Compensation		
	ln(Total Comp.) (1)	ln(Option Value) (2)	ln(Option Grants) (3)	ln(Total Comp.) (4)	ln(Option Value) (5)	ln(Option Grants) (6)
Network Shock Intensity × Post-Bankruptcy Filing	−0.136*	−0.637*	−0.662***	−0.106	−0.500*	−0.571**
	(0.077)	(0.330)	(0.258)	(0.130)	(0.302)	(0.247)
Tobin's Q	0.023	−0.044	−0.012	0.034	−0.014	−0.002
	(0.020)	(0.034)	(0.043)	(0.024)	(0.035)	(0.049)
ln(Firm Age)	−0.080	−0.858*	−0.851**	−0.036	−0.973**	−0.673*
	(0.096)	(0.480)	(0.369)	(0.116)	(0.440)	(0.350)
ROA	0.333	−0.076	−0.522	0.180	−0.258**	0.175
	(0.208)	(0.451)	(0.386)	(0.129)	(0.128)	(0.202)
Book Leverage	−0.246*	0.417	−0.680	−0.117	0.162	−0.751*
	(0.136)	(0.501)	(0.482)	(0.191)	(0.485)	(0.455)
Cash Flow	−0.252	0.288	−0.359	−0.267	0.442	−0.331
	(0.174)	(0.287)	(0.368)	(0.224)	(0.307)	(0.486)
ln(market Capitalization)	0.190***	0.178	0.107	0.218**	0.131	0.050
	(0.072)	(0.130)	(0.092)	(0.088)	(0.135)	(0.094)
Capital Intensity	−0.700***	−0.681	−0.859	−0.804***	−0.805	−1.197
	(0.230)	(1.031)	(0.873)	(0.276)	(0.983)	(0.880)
Cash Holdings	−0.009	−0.914*	−0.842	−0.132	−0.982**	−0.682
	(0.159)	(0.498)	(0.534)	(0.203)	(0.475)	(0.622)
ln(Book Assets)	0.216***	−0.013	0.239*	0.177*	0.096	0.269*
	(0.078)	(0.178)	(0.142)	(0.099)	(0.176)	(0.144)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Filing Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	26007	25999	26007	26057	26188	26174
Adj. R^2	0.621	0.6657	0.4323	0.6207	0.5928	0.3669

Table 10: Impact of network shock on monitoring: reduced form

Significance levels 10%, 5%, and 1% are denoted by *, **, ***, respectively. Standard errors in parentheses are clustered at the firm level. Network Shock Intensity, which is defined as the number of Treatment Directors divided by the total number of Treatment and Control Directors for a given firm, interacted with the post-bankruptcy filing dummy variable is used as an instrument for Board Mobility. See Table 13 for additional variable definitions. Bankruptcy filing years are restricted to years between 2000 and 2011.

	% Share Nom. Committee	CEO Chairman
	(1)	(2)
Network Shock Intensity × Post-Bankruptcy Filing	−0.061***	−0.496***
	(0.021)	(0.182)
Tobin's Q	0.002	−0.019
	(0.006)	(0.022)
ln(Firm Age)	0.217***	0.328*
	(0.053)	(0.188)
ROA	0.027	−0.051
	(0.066)	(0.276)
Book Leverage	−0.051	0.458**
	(0.051)	(0.187)
Cash Flow	0.006	0.089
	(0.039)	(0.174)
ln(market Capitalization)	−0.029**	0.081
	(0.014)	(0.062)
Capital Intensity	0.014	0.584*
	(0.111)	(0.347)
Cash Holdings	0.079	−0.135
	(0.074)	(0.201)
ln(Book Assets)	0.038*	0.029
	(0.021)	(0.097)
Year FE	Yes	Yes
Firm-Filing Year FE	Yes	Yes
Obs.	18684	20024
Adj. R^2	0.577	0.543

Table 11: Impact of network shock dynamics on compensation

Significance levels 10%, 5%, and 1% are denoted by *, **, ***, respectively. Standard errors in parentheses are clustered at the firm level. The dependent variables measure CEO and top 3 executive compensation. Network Shock Intensity is defined as the number of Treatment Directors divided by the total number of Treatment and Control Directors for a given firm. Binary Network Shock Intensity is equal to 1 if Network Shock Intensity is equal to 1 and equal to 0 if Network Shock Intensity is equal to 0. See Table 13 for additional variable definitions. Bankruptcy filing years are restricted to years between 2000 and 2011.

	Top 3 Executive Compensation			CEO Compensation		
	ln(Total Comp.) (1)	ln(Option Value) (2)	ln(Option Grants) (3)	ln(Total Comp.) (4)	ln(Option Value) (5)	ln(Option Grants) (6)
Binary Network Shock Intensity × Post-Bankruptcy($t-2$)	0.053	0.210	0.075	−0.051	0.269	−0.065
	(0.175)	(0.216)	(0.271)	(0.133)	(0.210)	(0.179)
Binary Network Shock Intensity × Post-Bankruptcy($t-1$)	−0.012	0.100	−0.197	0.004	0.198	−0.027
	(0.127)	(0.195)	(0.241)	(0.098)	(0.188)	(0.130)
Binary Network Shock Intensity × Post-Bankruptcy($t+1$)	−0.048	0.040	−0.370	−0.027	0.098	−0.227*
	(0.067)	(0.255)	(0.265)	(0.118)	(0.224)	(0.137)
Binary Network Shock Intensity × Post-Bankruptcy($t+2$)	0.007	0.364	−0.552*	0.033	0.502	−0.148
	(0.149)	(0.329)	(0.333)	(0.173)	(0.342)	(0.175)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Filing Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1680	1680	1680	1696	1726	1724
Adj. R^2	0.529	0.722	0.529	0.692	0.686	0.506

Table 12: Impact of network shock dynamics on monitoring

Significance levels 10%, 5%, and 1% are denoted by *, **, ***, respectively. Standard errors in parentheses are clustered at the firm level. Network Shock Intensity is defined as the number of Treatment Directors divided by the total number of Treatment and Control Directors for a given firm. Binary Network Shock Intensity is equal to 1 if Network Shock Intensity is equal to 1 and equal to 0 if Network Shock Intensity is equal to 0. See Table 13 for additional variable definitions. Bankruptcy filing years are restricted to years between 2000 and 2011.

	% Share Nom. Committee	CEO Chairman
	(1)	(2)
Binary Network Shock Intensity × Post-Bankruptcy$(t-2)$	0.033	0.200
	(0.026)	(0.142)
Binary Network Shock Intensity × Post-Bankruptcy$(t-1)$	0.009	0.022
	(0.017)	(0.096)
Binary Network Shock Intensity × Post-Bankruptcy$(t+1)$	-0.036^{**}	-0.172
	(0.017)	(0.140)
Binary Network Shock Intensity × Post-Bankruptcy$(t+2)$	-0.017	-0.355^{***}
	(0.026)	(0.130)
Controls	Yes	Yes
Year FE	Yes	Yes
Firm-Filing Year FE	Yes	Yes
Obs.	1245	1245
Adj. R^2	0.620	0.776

Table 13: Variable Definitions

Variable Name	Description
Event Directors	Event Directors are directors that hold or have held a board position for at least one firm that has filed for bankruptcy.
Treatment Directors	Treatment Directors are directors that hold or have held board or executive positions with Event Directors at the bankruptcy filing year. These directors have never served on a board of a firm that has filed for bankruptcy.
Control Directors	Control Directors are directors that share boards with Treatment Directors at the bankruptcy filing year but have no employment histories with Event Directors.
Treatment	Treatment is a dummy variable that equals 1 if a director is a Treatment Directors or 0 if a director is a Control Director.
Network Shock Intensity	Network Shock Intensity is defined as the number of Treatment Directors divided by the total number of Treatment and Control Directors for a given firm.
Post-Bankruptcy Filing	Post-Bankruptcy Filing is a dummy variable that equals 1 if a given year is after a bankruptcy filing year.
Degree Centrality	Degree Centrality counts the number of director and executive associations at firms on which a director is currently a board member.
Aggregate Degree Centrality	Aggregate Degree Centrality is the professional component of the "Rolodex" variable from Engelberg, Gao, and Parsons (2013b): This is the sum of a director's current and past professional connections.