Who Killed the Inner Circle? The Decline of the American Corporate Interlock Network

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ABSTRACT

U.S. corporations shared members of their boards of directors since the early 1900s, creating a dense interlock network in which nearly every major corporation and director was connected through short paths and elevating a handful of well-connected directors to an influential "inner circle." This network remained highly-connected throughout the 20th century, serving as a mechanism for the rapid diffusion of information and practices, as well as a device for promoting elite cohesion. Some of the most well-established findings in the sociology of networks spring from this milieu. In the 2000s, however, board recruiting practices changed: well-connected directors became less preferred, and due to this shift in preference, the inner circle disappeared and companies are less connected to each other. Revisiting three classic studies on the diffusion of corporate policies, on corporate executives' political unity, and on elite socialization, we find that established understandings of the effects of board interlocks on U.S. corporations, their directors, and social elites no longer hold.

In the century after Louis Brandeis published *Other Peoples' Money* in 1914, the U.S. corporate interlock network became perhaps the most studied network in the social sciences. Brandeis argued that a handful of bankers were able to dominate the corporate economy through positions as directors on the boards of their subject companies, creating an "endless chain" that served as "the most potent instrument of the Money Trust." Mills (1956) described how a power elite knit together business, government, and the military. Mintz and Schwartz (1985) showed that financial institutions held enduring positions at the apex of the network, while Useem (1984) uncovered the distinctive psychology and class consciousness of well-connected directors, whom he labeled the "inner circle." Dozens of studies since then have shown the potency of this network for diffusing ideas, promoting common corporate practices, and enabling coordinated action (Mizruchi, 1996; Dreiling and Darves, 2011).

Throughout the 20th century, the network had several enduring properties. While the vast majority of directors served on only one board, an elite group of a few dozen people—the inner circle—served on many boards. Similarly, a handful of corporations maintained large boards staffed with well-connected directors that gave them a distinct status as hubs of the network. As a result of these two features, the average geodesic, or shortest network distance, between any pair of directors or any pair of companies was remarkably short; that is, the network was a small world (Watts, 1999). 90.9% of large corporations were within three steps of the most-central board in 1904 (Mizruchi, 1982); the comparable figure in 1999 was 82.4%. A flu virus that infected the J.P. Morgan Chase board in January 2001 could have spread to 80% of the Fortune 1000 by May through monthly board meetings (Davis, Yoo and Baker, 2003).

All this has changed since the turn of the 21st century. In 1974, more than 90 directors served on five or more major corporate boards in the U.S. In 1994, at least 75 people held five board seats.

By 2012, there was only one director serving on five S&P 500 boards: Shirley Ann Jackson, president of Rensselaer Polytechnic Institute. The inner circle had vanished. Moreover, because the number of intercorporate connections rises geometrically with board memberships – five people who each serve on two boards create only five connections, while one person who serves on five boards creates ten – these well-connected directors were especially consequential for the overall density of the network. Without an inner circle, the shortest paths between firms grow much longer. A large body of work premised on densely-connected corporate boards may no longer be applicable in the United States (cf. Mizruchi, 1996).

In this article, we describe macrostructural changes in the U.S. corporate interlock network from 1997 to 2010, explain why these changes occurred, and outline their implications. We document the decline of some of the most enduring properties of the network since the turn of the 21st century. Using comprehensive time-series data on over 27,000 directors serving on almost 2,500 corporate boards in the U.S., we analyze both the dynamics of tie creation and dissolution and the aggregate properties of the resulting network. Our findings show that the inner circle, a durable feature of the U.S. corporate landscape over the 20th century, has disappeared, and distances between companies on the interlock network have lengthened to unprecedented levels. Regression and simulation analysis provides evidence that the cause of these changes was the breakdown of a process of preferential attachment. During the 20th century, well-connected directors who already served on multiple corporate boards were substantially more likely to gain new appointments than those who served on only one board; in short, the rich in board seats got richer. Since the turn of the 21st century, however, well-connected, multi-boarded directors have lost their advantage. This change had important consequences for the aggregate structure of the network.

We then illustrate the implications of a less-connected network on the effects of board ties, by verifying whether three well-established findings in the literature still hold true. First, we find that introductions from existing multi-board directors (Useem, 1984) no longer create a viable pathway to the corporate interlock network inner circle. There is no cohesive, far-reaching inner circle left to join, and re-creating one would be effectively impossible given current director hiring practices. Second, simulations show that the political unifying power of the interlock network (Mizruchi, 1992; Burris, 2005) is weakened, and the prospects for broad-based, moderate political action by corporate elites are lowered. Third, we show that multiple interlock ties to prior adopters (Davis, 1991) can no longer explain diffusion of practices across the network. Rapid, broad-based diffusion of new corporate practices, if it still occurs, happens through other mechanisms.

The U.S. corporate elite network

Corporate board interlocks are perhaps the most-studied network in the social sciences. In his analysis of early 20th century capitalism, Lenin (1939 [1916]) drew on Jeidels' 1905 study of bank interlocks in Germany to portray intrinsic tendencies toward the concentration of economic power. Brandeis (1914) echoed this theme in his description of early finance capitalism in the U.S., where a few bankers served on dozens of corporate boards. Generations of scholars have since investigated interlock networks in economies around the world (e.g., Mintz and Schwartz, 1985; Stokman, Ziegler, and Scott, 1985; Scott, 1997; Windolf, 2002). More recent cross-national comparisons show that countries vary widely in the structural properties of their interlock networks, both cross-sectionally and over time (Kogut, 2012).

What is at stake is how we understand the social structure of corporate control. The earliest work

on board interlocks took for granted that demonstrating the existence of a well-connected social elite was sufficient to show that it mattered. Mills (1956: 283) stated, "The key organizations, perhaps, are the major corporations themselves, for on the boards of directors we find a heavy overlapping among the members of these several elites." And: "We must remember that these men of the power elite now occupy the strategic places in the structure of American society; that they command the dominant institutions of a dominant nation; that, as a set of men, they are in a position to make decisions with terrible consequences for the underlying populations of the world" (286-7). An early agenda for studying elites was to highlight just how small the world of these elites was through shared affiliations such as board memberships.

By the late 1980s, sociologists moved beyond simply showing that interlocks were common to tracing their effects on corporate behavior. The political action committees of companies whose executives served on the same bank boards donated to similar candidates, suggesting that interlocks were a mechanism for political cohesion (Mizruchi, 1989; 1992). Contentious corporate governance practices quickly spread from board to board through shared directors, indicating that the network was a substrate for diffusion (Davis, 1991). Dozens of subsequent studies showed shared directorships to be a pervasive influence on board-level decisions: perhaps unsurprisingly, what directors experienced on one board shaped what they did on other boards (see Mizruchi, 1996, for an early review).

The aggregate effect of these dyadic ties depends on the shape of the larger network in which they are embedded. A virus can spread faster in midtown Manhattan than in an archipelago, and practices that diffuse through a dense network of shared directors can spread faster than those that diffuse through sparse geographic networks (Davis and Greve, 1997). Moreover, communities with dense local corporate networks are better able to mobilize than those without,

whether to lobby the state legislature for favorable policies (Vogus and Davis, 2005), to support local nonprofits (Marquis, Davis, and Glynn, 2013), or to launch a successful Olympics bid, as Atlanta's well-connected business elite did (Glynn, 2008). At the national level, students of elites have seen a dense corporate network as perhaps the most important mechanism for coherent—often politically moderate and pragmatic—political action on the part of business (Useem, 1984; Mizruchi, 2013). By implication, its absence could undermine the possibility of class conscious elites. That is, the macrostructure of the network is essential for many of the network's effects.

The interlock network has several distinctive features that shape how we understand it. In contrast to many social networks, where actors choose their partners directly, interlocks are created indirectly via affiliations. Companies connect to other companies as a by-product of their choice of directors who serve on other boards. Yet unlike many affiliation networks, interlocks are strong ties. As Grannis (2010) points out, the network among sociology departments created through faculty hiring (or the network among actors who appeared in the same film at some point in their careers) lacks plausible mechanisms for two-way communication. Board meetings, in contrast, effectively ensure regular face-to-face contact between directors and two-way communications between connected companies. Day-long board meetings every month or two create a powerful substrate for diffusion.

Finally, interlocks are a network both of people and of corporations (Breiger, 1974). The agenda for work on both aspects of the network was set in the 1980s. As a network of *people*, researchers focused on the careers of directors and how the inner circle was comprised and operated. Useem (1984) found members of the inner circle to be a distinct social type who were prone to being involved both in the business world and in public service. Over the course of two

decades, Westphal and co-authors have analyzed in detail the career paths of directors and the factors that led some types to gather many board appointments in the U.S. (Westphal and Zajac, 2013). Perhaps the central question here is, What distinguishes those directors who become super-connectors serving on a large number of boards? Super-connectors are few in number but disproportionately consequential in their effect on the structure of the network. A director serving on two boards creates one tie (between companies A and B), and a director serving on three boards creates three ties (between A and B, B and C, and A and C). But a director serving on nine boards, as Vernon Jordan did for much of the 1980s and 1990s, creates 36 dyadic ties among companies (and over 4,000 two-step ties between directors).

As a network of *corporations*, research focused largely on the status ordering among companies—which kinds of companies became central, and why. Mintz and Schwartz (1985) found that money center banks comprised a stable core for the U.S. interlock network due to their position in the flow of capital in the economy. Early in the century, bank centrality stemmed from ties created through the appointment of bankers to corporate boards. By the 1960s, banks instead gained their centrality by appointing to their own board well-connected outside directors, such as the CEOs of prominent companies. Subsequently, Davis and Mizruchi (1999) found that bank boards had shrunk in size and in their recruiting of well-connected directors, and no single type of company monopolized the most central positions. Centrality no longer reliably mapped onto capital flows. Despite these shifts in the identity of the most central companies, the network as a whole remained highly-connected, with short path lengths connecting almost all directors and companies, as a result of the continued existence of a highly-connected core of directors (Davis et al., 2003).

Corporate governance and challenges to the interlock network since 2000

For almost the whole of the 20th century, the distribution of board memberships was highly skewed. While thousands of directors served on only one board, and hundreds on two or three, a few dozen sat on five or more, and a handful on eight or more. A highly skewed distribution held at the dawn of the corporate age at the beginning of the 20th century (Mizruchi, 1982), in the 1930s and1940s (Mills, 1956: p. 383, footnote 12), and at the end of the century (Davis et al., 2003). The existence of an inner circle was an enduring feature of the U.S. corporate landscape, even as particular directors and companies came and went and as the kinds of people occupying central positions shifted from bankers to corporate executives to prominent figures from the non-profit and academic worlds.

The two key properties of the network – the presence of an inner circle and short path lengths (geodesics) connecting directors and companies – are mathematically related. Super-connectors have a vastly disproportionate impact on the network's macrostructure, increasing its density (percentage of potential ties realized) and shrinking its average geodesic. One super-connector serving on ten boards creates 45 unique ties among corporations, as much as 15 directors who serve on three boards each, or 45 directors serving on two boards each. Thus, the presence of an inner circle of super-connectors is critical for creating a densely-connected network.

The existence of an inner circle reflects the recruiting practices of boards: some directors are attractive to many kinds of boards and have the opportunity to become super-connectors. Previous studies of the corporate interlock network suggested different bases for preferential recruitment. One basis is broadly demographic: directors are attractive due to their background, education, race, or gender. A second basis is network dynamics: certain directors are advantaged either because of the processes that boards used when searching for new directors or because of the criteria that boards used to evaluate director candidates. First, a director who served on many

boards had many co-directors who could provide personal recommendations for new board appointments[1]. Second, sitting on many boards in itself increased the value of a director for new board appointments. Useem (1984) argued that directors sitting on many boards gained broad-based business intelligence, social connections, and legitimacy within the corporate and political worlds, thus making them attractive as co-directors. Companies encouraged their best executives to serve on outside boards to gain access to these network benefits. Moreover, there is reason to expect that directors convey status to their boards via the other boards on which they serve. Among the few pieces of information that shareholders learn about directors during their annual election is what other boards they serve on. For instance, a bank whose directors serve on many other well-known corporate boards gains the implicit endorsement of these firms (Davis and Robbins, 2005).

Any of these rules of attachment—widely-shared preferences based on demography or network positions—could yield a distribution of board memberships in which a few directors end up on many boards. This is in most cases sufficient to yield a small world network (Barabási and Albert, 1999; Watts, 1999). Thus, the disappearance of the inner circle suggests that the rules of attachment changed around the turn of the 21st century.

We examine changes in the rules of attachment, that is, the characteristics that made directors more or less likely to join new boards, to ascertain the causes of the demise of the inner circle. We focus on demography and network dynamics. For most of the 20th century, boards were comprised almost exclusively of white men, typically executives with elite pedigrees. This changed somewhat during the 1980s and 1990s, and boards came to contain more non-executives

[1] In almost all the instances where Vernon Jordan gained another board seat, he had previously served on another board with at least one director on the new board (Davis at al., 2003: 304).

and became modestly more diverse. Given that boards prefer to recruit those with whom at least one director is acquainted, one of the results of this new-found preference for diversity was that a small handful of women and minority directors each joined a large number of boards: once such a director joined one board, he or she was in a position to be invited onto several more. By 2002, Forbes[2] magazine reported that four of the five best-connected directors on S&P 500 boards were African-American.

Studies also showed that boards preferred to recruit sought-after directors who already served on many other boards, especially if the companies on whose boards they served were successful (Davis and Robbins, 2005). A board's status is transmitted in part by its affiliations (Bothner, Smith, and White, 2010), which suggests that directors of prominent and successful firms would be preferred.

This process can work in reverse, however: directors (and, by association, their firms) can be tainted by their affiliations (Sullivan,Haunschild, and Page, 2007). In the wake of corporate scandals at Enron, WorldCom, and elsewhere in the early 2000s, directors' other affiliations—even with firms lauded for their performance and innovation—could be hazardous to a firm's prestige. Directors became subject to increased scrutiny through the publication of "report cards" by outside evaluators, where directors serving on multiple boards faced greater hazards of downgrades (e.g., due to earnings restatements). Moreover, simply serving on several boards in itself came to be seen as prima facie evidence of inattention. Rather than being a sign of status and talent, service on multiple boards was classified by many as a sign of being stretched too thin, or "overboarded." Institutional Shareholder Services, an influential firm that advises institutional investors on how to vote their shares at the annual meetings where directors

[2] Forbes. 2002. America's most overworked directors. (http://www.forbes.com/2002/08/06/0806directors.html)

are elected, codified this diagnosis. Beginning with the 2004 proxy season, ISS began recommending that votes be withheld for directors who served on more than six public company boards. For CEOs, the recommended limit on number of boards was reduced to three (including their own firm). As of this writing, the policy stands at a maximum of six boards[3]. What is perhaps remarkable is that at the time the policy was enacted, it applied to fewer than ten individuals (of whom at least five were African-American), none sitting on more than seven boards. A six-board maximum would have only limited influence on the existence of an inner circle.

But the new policy's real significance is that it indicated a reversal of the valuation of being well-connected. As we have noted, for decades well-connected directors were highly sought after for their experience, connections, and legitimating potential. Our discussions with veteran directors and corporate counsel suggest that this preference for well-connected directors has reversed.

In some cases the new standards are codified in corporate policies that limit the number of boards on which directors can serve. Bank of America's current corporate governance guidelines state:

> "To ensure that directors have sufficient time to properly discharge their duties, directors are expected to seek Corporate Governance Committee approval prior to joining the board of any other public company. **No director shall serve on the boards of more than six public companies, including the Company's Board.**" (emphasis added, here and in quotes below)

General Motors' standards say:

[3] The current policy is available at http://www.issgovernance.com/file/policy/1_2015-us-summary-voting-guidelines-updated.pdf on page 15.

> "It is the expectation of the Board that every member have sufficient time to commit to preparation for and attendance at Board and committee meetings. Therefore, it is the sense of the Board that **non-employee directors should not serve on more than four other boards of publicly traded companies** (excluding non-profits and subsidiaries) unless the Board determines that such service will not impair the ability of such director to effectively perform his or her obligations as a director of the Company."

And Altria's standards state:

> "Each director is expected to ensure that other commitments do not interfere with the discharge of his or her duties as a director of the Company. Consequently, **directors should not serve on more than three other public company boards**. Directors are expected to inform the Chairman and the Chair of Nominating, Corporate Governance and Social Responsibility Committee upon becoming a director of any other public company or becoming a member of the audit committee of any other public company."

The number of allowable board memberships varies – six for Bank of America directors, five for GM directors (with the option for a waiver), four for Altria directors – but what is significant is that firms have *any* stated policies limiting the number of directorships, something that was almost unheard-of before 2001.

Data sources

In the following sections, we begin by describing changes in the macro-structure of the U.S. board interlock network from 1997 to 2010. We then determine whether these structural changes can be explained by changes in the preference for well-boarded, well-connected directors, by first identifying shifts in board hiring patterns, and then using Monte Carlo simulations to ascertain whether these shifts were sufficient to cause the interlock network's observed macro-structural changes.

For these investigations, we created a dataset covering S&P 1500 boards from 1997 to 2010 inclusive, using data from Institutional Shareholder Services (ISS; formerly RiskMetrics), Boardex, and CRSP/Compustat. Annual board composition data were created using board data

from ISS/RiskMetrics and interlock data from Boardex. While the ISS/RiskMetrics dataset is the one most commonly used in studies of board interlocks, it suffers from issues of data quality. Names are listed inconsistently, different people with the same name or similar names are sometimes indicated as being the same person, and the same person is often listed using several "unique" identifiers. The Boardex dataset uses company and director unique identifiers consistently. (During data processing, we found only one instance of an identifier being used inconsistently in Boardex, compared to thousands of inconsistencies in ISS/RiskMetrics.) Boardex has its own weaknesses, however. The data coverage is incomplete for firms and individuals that were not active into the late 2000s and Boardex sometimes splits one company into two entries.

We corrected ISS/RiskMetrics company and director identifiers by matching them to Boardex identifiers, using text similarity matching for company and director names, director board lists and company director lists, and pattern-matching for interlocks. We created algorithms to automatically generate suggested corrections to ISS/RiskMetrics data based on linked Boardex data. Suggested corrections were manually checked before being reflected in the final dataset.

Using this corrected data set, we created the list of companies that were on the S&P 1500 as of their annual meeting date according to ISS/RiskMetrics, and generated the corresponding lists of board members. We added annual performance data from CRSP/Compustat, matching entries on CUSIPs and ticker symbols. For supplemental analyses of the effect of shareholder proposals on director hiring, we used the ISS/RiskMetrics Shareholder Proposals dataset, matching on company name.

The S&P 1500 sample includes 2,454 distinct companies and 17,065 company-years, and 27,192

directors and 151,135 director-years. From these lists of companies and boards, we created lists of annual board interlocks (companies sharing a director) and director interlocks (directors serving together on the same board). The sample consisted of 54,220 corporate interlock-years for an average of slightly under 3,900 interlocks per year, and 882,120 director interlock-years for an average of slightly over 63,000 interlocks per year.

The collapse of connectedness in the interlock network

Figure 1 shows mean geodesics in the main component of the corporate interlock network connecting the largest U.S. public companies. Average network distances stayed near constant between 1982 and 1999 (Davis et al., 2003), but increased sharply from 2000 to 2010 (this study). The average distance between two companies in the main component of the S&P 500 corporate interlock network increased from 3.21 in 2000 to 4.23 in 2010, while the S&P 1500 mean geodesic increased from 4.16 to 4.97 during the same period. Table 1 lists the sizes of the maximal three-step networks in the large U.S. public company network for selected years from 1904 to 2010. Like the most-central companies over the previous 100 years, the company with the largest three-step network in 2000 (Sara Lee) had board ties linking it to over 80% of S&P 500 boards in three steps, and none of the 425 S&P 500 main component companies were more than five steps away from Sara Lee on the corporate interlock network. By contrast, in 2010 United Technologies Company had the largest three-step network, but had barely more than 60% of S&P 500 boards linked within three steps, and it required eight steps to reach all companies in the main component from United Technologies.

Insert figure 1 about here

Insert table 1 about here

The decreased connectedness in the interlock network (figure 2) was caused by 1) decreased numbers of direct ties from companies to companies, and 2) changes in the distribution of number of ties from companies to companies and directors to directors. The average degree for companies in the S&P 1500 corporate interlock network decreased from 7.14 in 2000 to 4.98 in 2010. There were 62 companies with more than 20 direct board ties (shared directors) to other companies in 2000 with Sara Lee and Allstate having 37 direct ties each. By 2010, only one company with more than 20 direct ties remained—Marathon Oil with only 21. (See table 2 for a list of the most-connected companies and their number of shared-director ties to other companies in 2000 and 2010.) The average degree for directors (number of directors sharing boards with the focal director) declined from 12.32 to 10.95, a smaller drop as the modal director continued to serve on one board with eight to ten other directors. The connectedness of the most-connected directors decreased dramatically, however. In 2000, Vernon Jordan served on boards with 101 different S&P 1500 directors. By 2010, the most-connected director (Sam Nunn) had only 53 direct ties. (See figure 2 for company and director degree distributions. See table 3 for a list of the most-connected directors and their number of same-board ties to other directors in 2000 and 2010.) In 2000, 71 directors had more than 50 direct ties; by 2010 only five directors had more than 50 ties.

Insert table 2 about here

Insert table 3 about here

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Insert figure 2 about here

Insert figure 3 about here

These decreases in average connectedness were driven by the disappearance of super-connectors—directors who sat on many boards simultaneously. In 2000, 17 directors each sat on six or more S&P 1500 boards (Vernon Jordan was on nine) and 44 sat on five. By 2010, no directors sat on six or more boards and only 11 sat on five (see figure 4). The median age for super-connectors in 2000 was five years higher (64) than the median age for all directors, suggesting that super-connector attrition due to age and retirement could explain one part of the decline in network connectivity. Figure 5 plots the age of directors with six or more board seats in 2001 versus the net number of board seats each of these directors lost over the next eight years, and shows a strong linear relationship ($t = 4.76$, $p = 0.001$).

Insert figure 4 about here

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Insert figure 5 about here

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Declining preference for well-boarded, well-connected directors

The question still remained as to what precluded the appearance of new super-connectors to replace those who retired. To answer this question we examined over-time changes in what kinds of directors were more likely to gain another board seat in the subsequent year. Our first measure was the number of board seats held by the focal director—how well-boarded the director was. We also used a measure of network reach for each director—the logged[4] number of boards that each director could be introduced to by his peer directors. To construct this director-year measure, we calculated the number of boards that were directly linked to the focal director's current boards and on which the focal director did not currently serve.

We examined the effect of several different director characteristics beyond being well-boarded and well-connected. Demographically, we tagged directors who were female, members of an ethnic minority, or members of the social elite (which we defined as non-minority men educated at Harvard, Yale, Princeton, or Stanford). We also tracked whether each director was a corporate executive for each year of our study period. We also controlled for directors' age and age-squared in our regressions.

Fama and Jensen (1983) argued that skilled directors were good stewards of shareholder value, and that such directors would be rewarded with more remunerative, high-profile board seats. While it is impossible to directly measure director skill, several studies (e.g., Yermack, 2004) found that directors of firms with good performance tended to join more boards, as did directors

[4] We added 1 to the number before logging to allow inclusion of directors whose peers did not sit on any other boards.

serving on the boards of large companies (e.g., Davis and Robbins, 2005)[5]. We used these indirect measures of director skill: the size (logged number of employees) and performance (total annual returns) of companies where the focal director currently served. For each director, we used the maximal value of each size and performance measure in our regressions[6].

We included two additional network measures. A director's degree centrality (how many different directors serve on boards with the focal director) measures the number of peer directors for the focal director without regard to these peers' other board appointments. We used logged degree centrality in our regressions. Eigenvector centrality is a recursive indicator of the focal director's status in the overall director-director network. Directors who are linked to many well-linked directors rank higher in eigenvector centrality.

Regressions also controlled for years since the first year in our dataset and included individual year effects. Table 4 contains details of how we constructed each measure from our data sources. Table 5 shows descriptive statistics and correlations[7].

Insert table 4 about here

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Insert table 5 about here

[5] On the other hand, Westphal and colleagues (Westphal and Stern, 2007; Zajac and Westphal, 1996) have shown that being skilled at ingratiation and having a reputation for not actively monitoring CEO actions could lead to more board appointments. We cannot control for this in the current study.

[6] Exploratory regressions showed that the maximal values of these measures explained more of the variance in subsequent director hiring than means or medians. Using means or medians instead yields the same significant regression results. Alternate specifications used logged market value for size and return on assets or return on equity for performance. The empirical conclusions below were unaffected by these substitutions.

[7] For obvious reasons, director degree centrality was highly correlated with both the number of board seats held by the director and the number of distinct boards served by peer directors. Removing director degree centrality from the analysis did not change the pattern of results for the remaining variables.

Models 1-3 in table 6 show the regression results from a random-effects unbalanced panel logistic regression calculating the effects of each independent variable on the probability of a director gaining a new board seat in the subsequent year. To capture monotonous changes in the effect of each independent variable over the years, we included the interaction terms of each independent variable with the number of years since 1997 (the first year in our data). Model 1 shows results from the full model. We find that directors associated with larger companies were more likely to gain new board seats, but no effect for directors on the boards of higher performance companies, when controlling for demographic and network characteristics. Note the comparison with models 2 and 3, which show regression results without network measure regressors. Directors from more successful companies were not preferred per se, but may have been popular with board selection committees only because they had good network connections.

Minority directors and social elite directors were preferentially hired onto additional boards throughout the period of the study. Minority directors were 1.47 times more likely than non-minority directors, and social elite directors 1.33 times more likely than non-elite directors, to gain an additional board seat in the next year. There was no significant preference for female directors, however. Corporate executives were initially less likely than non-executives to gain additional board seats, but this comparative propensity increased over time.

Insert table 6 about here

Well-connected directors—those whose peer directors served on many other boards—were more likely to gain additional board seats throughout the period of the study. But this advantage

decreased over time. In 1997, each ten-fold increase in the number of distinct boards served by peer directors more than quadrupled the likelihood of the focal director gaining a new board seat in the next year. By 2010, the effect size was almost halved[8].

There was strong evidence of preferential attachment, by which the rich (in board seats) get richer, at the beginning of the study period. This preference for directors on many boards disappeared during the period of the study, however. In 1997, directors who served on two boards were approximately twice as likely to gain additional board seats as those who served on only one board, and the same held true for directors on three or more boards. By 2010 neither directors on two boards nor those on three or more boards were preferred compared to those on one board.

To examine the changes in preferential hiring of well-boarded, well-connected, and corporate executive directors in more detail, we repeated the regression above, but substituted interactions with year dummies instead of with years since 1997 for the measures of number of boards, number of peer boards, and corporate executive status. This allowed us to estimate coefficients for these variables' effects on hiring for each year in the study period, by taking the coefficient vector from the regression results and adding the coefficient of the interaction term of the independent variable with the year to the base year (1997) coefficient for the independent variable. We also calculated variances for each of these coefficients by using the covariance matrix with the sum formula for variances:

$$\text{VARIANCE}(a1 + a2) = \text{VARIANCE}(a1) + \text{VARIANCE}(a2) + 2 * \text{COV}(a1, a2)$$

[8] Note that when controlling for peer board reach and other network characteristics, increasing the number of peer directors negatively impacted the propensity to gain additional board seats. This is in line with social network research finding that the range and content of connections trumps sheer number of connections in determining outcomes for the focal actor (e.g., Burt, 1992; Cotton-Nessler, 2013).

Four separate variance-weighted least-squares (VWLS) regressions confirm the overall shift in the values of these coefficients over the period of the study. Directors on multiple boards became comparatively less likely to gain additional board seats over time (directors on two boards: $t = -4.40$, $p < 0.0005$; on three or more boards: $t = -5.74$, $p < 0.0005$), as did directors with peers on many distinct boards ($t = -3.05$, $p = 0.002$). Corporate executives became comparatively more likely to gain new board appointments ($t = 2.43$, $p = 0.015$).

Using the yearly coefficients obtained above, figure 6 plots the odds-ratios of joining a new board in the subsequent year for directors with multiple board seats compared to those with one board seat for each year from 1997 to 2009. The VWLS models predict that a director with two board seats in 1997 was 1.82 times more likely than a director with only one board seat to join a new board within the next year, but no more likely than the single-board director in 2009. The predicted change in log-odds for directors on three or more boards was even more drastic. A director on three or more boards in 1997 was 2.20 times more likely than a director on one board to join a new board within the next year, but became only 0.66 times as likely as a one-board director in 2009. This shift in preference for three or more board directors appears to have occurred abruptly between 2002 and 2003 (see figure 6 right graph).

The effects of having peers on many boards are shown in figure 7. In 1997, a director with ten times the one-step board reach of an otherwise similar director was predicted to have a 4.31 times higher chance of gaining a new board seat in the subsequent year. By 2009, this difference in propensities was reduced to 2.40. Having well-placed peers still helped, but much less so.

Insert figure 6 about here

Insert figure 7 about here

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The preference shifts described above were not driven by new types of companies joining the S&P 1500, such as Internet companies around the turn of the century. Model 4 in table 6 shows the results of regressions with a dependent variable that was coded as 1 only if the director joined the board of a company in the survivor panel, which consisted of companies present in the S&P 1500 in all years from 1997 to 2010. A similar pattern of results is obtained.

The decline in comparative propensity to be hired onto additional boards for well-boarded and well-connected directors compared to their less-boarded and less-connected peers is congruent with a shift in companies' preference for certain types of directors. But another explanation for these results is that director preferences changed while company hiring preferences remained constant. Instead of companies eschewing multiple board directors and placing less weight on personal introductions, well-boarded directors may have become loath to take on more board appointments and well-connected directors less likely to rely on personal contacts to find new board seats.

An examination of the effects of shareholder proposals on board hiring propensities provides support for a shift in boards' hiring preferences rather than a shift in directors' preferences. Figure 8 shows results from two separate logistic regressions with fixed company effects, where the dependent variables are the propensity to hire certain types of directors. The left panel graphs the effect of being targeted by a shareholder proposal on a company's propensity to hire directors on three or more boards. The right panel displays the same effect for the propensity to hire directors who are well-connected (linked to 10 or more boards they do not already serve on

through board peers). Boards targeted by shareholder proposals in 1997 tended to respond by hiring well-boarded and well-connected directors. By 2009, being targeted by shareholder proposals had the opposite effect. Targeted boards eschewed well-boarded, well-connected directors.

Insert figure 8 about here

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An examination of how often board seats were filled by directors with no previous S&P 1500 board experience also provides support for changed corporate preferences, suggesting that corporations came to place less emphasis on directors' connections to other boards. Figure 9 plots the observed probability that a board appointment was filled by a director with no existing board appointments from 1998 to 2010. A linear regression predicts an approximately 5% increase between 1998 and 2010 in the percentage of board appointments filled by directors not already serving on another board.

Insert figure 9 about here

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Who killed the inner circle?

Did the decreased preferences for well-connected directors lead to the collapse of cohesion in the interlock network? We adopt a two-prong approach to answering this question. First, we consider possible alternative causes of the decline in interlock network connectedness, and check to see if these possible causes are observed. Second, we use Monte Carlo simulations to test whether the observed changes in preference for well-boarded and well-connected directors were

sufficient to explain the magnitude of change in the interlock network's macro-structure.

The regression results in table 6 show that preferences for directors on large company or high-performing company boards, for female, minority, and social elite directors, and for network degree- or eigenvector-central directors did not significantly change during the period of the study. A similar regression for directors' propensity to leave an existing board appointment in the next year showed that directors on two or more boards and directors with high eigenvector centrality became *less* likely to leave a board over the period of the study.

We also checked for the occurrence of several other shifts that could potentially explain the decrease in interlock network connectedness. Company entries and exits into the S&P 1500 did not become more frequent over time. More central companies and companies with more well-boarded directors did not become more likely to leave the S&P 1500 during the period under study; we found no significant changes in propensity to leave the S&P 1500 based on company degree centrality, eigenvector centrality, closeness centrality, betweenness centrality, number of directors, mean degree of directors, mean eigenvector centrality of directors, mean closeness centrality of directors, or mean number of board seats held by directors, nor on the percentile rank (by year) of each of these variables. The characteristics of new entrants to the S&P 1500 did not change significantly. Examining companies in their first year of listing on the S&P 1500, we found no temporal trend in their percentile rankings on degree centrality, eigenvector centrality, closeness centrality, betweenness centrality, number of directors, mean director degree centrality, mean director eigenvector centrality, mean director closeness centrality, and mean number of board seats. In a further test of whether newer companies' director hiring was driving the decrease in interlock network connectedness, we calculated network statistics for a survivor panel consisting of the 403 companies that were in the S&P

1500 throughout the 14 years of our study. The mean geodesic increased steadily for this panel as well (figure 10).

Insert figure 10 about here

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Changes in board size also cannot explain the observed decrease in interlock network connectedness. The average board size decreased slightly from 9.67 directors in 2000 to 9.35 directors in 2010. This small drop cannot explain the reduction in the average degree of companies from 7.14 to 4.98 during the same period. Over the period of the study, companies with more direct board ties to other companies became more likely to increase their board size and less likely to decrease board size compared to those with less degree. The companies with more connected directors (higher director mean degree) also became less likely to decrease board size compared to companies with directors with lower average degree. On the other hand, companies with more directors became more likely to decrease the size of their boards compared to companies with fewer directors.

After ruling out alternatives, we are left with four confirmed shifts in director hiring patterns: increased preferences for corporate executives and for individuals with no current board appointments, and decreased preferences for individuals with many current board appointments and with peers on many other boards. While the effects of the preference shift in favor of corporate executives on the connectedness of the interlock network are uncertain, the latter three shifts in preference all militate for decreased interlock network connectedness. The presence of more directors with only a single board appointment leads to a decrease in the number of links between companies. The non-appearance of super-connectors—directors on many boards who

connect directors on many other boards—leads to a network with higher average number of steps between companies.

To test whether these observed shifts in hiring patterns were sufficient to explain the macro-structural changes in the interlock network, we coded a simulation. The simulation allowed us to model counterfactual scenarios where the four shifts in preference were not present. In the baseline *Reality* scenario, we calculated relative odds of gaining a new board seat for each director present in a year *y* using annual log-odds coefficients from the variance-weighted least squares regressions for whether the director was a corporate executive, whether the director was on two boards, whether the director was on three or more boards, and the logged number of distinct boards served by the focal director's peers. The model ignored the effect of all other director characteristics.

Starting from 1997 and iterating over the years, we simulated each board appointment where a director who already had an S&P 1500 board appointment was hired in the historical record in the next year (y+1). For each of the simulated board appointments, a director was randomly selected to take the board seat, with each director's odds of being selected determined by his or her calculated log-odds based on corporate executive status, number of current boards, and number of peer-linked boards. From 1998 on, previous year simulation results provided the choice set of available directors and their relative odds of gaining a new board seat in the next year.

We modeled a series of counterfactual scenarios. In the full *Counterfactual* scenario, we did not use varying log-odds coefficients for the four factors above. Instead, the log-odds coefficients were held constant at the average log-odds coefficient for each independent variable for the first

six years of historical data (1997 to 2002). This corresponds to an alternative universe where the shifts in preference for corporate executives, directors on two or three-plus boards, and directors with higher board reach did not occur. The full Counterfactual scenario also eliminated the observed increase in propensity to hire directors with no existing board appointments. The rate of zero-board director hiring was held constant by randomly-selecting zero-board director hires in the historical data and simulating the hiring of an existing director into the position.

The effect of each preference shift was also tested separately. Four partial-counterfactual scenarios each held log-odds coefficients for one independent variable constant, while using time-varying log-odds coefficients for the other independent variables. Another partial-counterfactual scenario held the log-odds coefficients for both whether a director was on two boards and whether a director was on three or more boards constant, corresponding to a counterfactual where there was no shift in preference for well-boarded directors. A final partial-counterfactual scenario modeled only the effect of maintaining a constant rate of zero-board director hiring.

Figure 11 displays simulation results for the 2010 mean geodesic for the S&P 1500. The distribution of mean geodesics over 100 runs of the Reality scenario is centered close to the 2010 mean geodesic observed in the historical data of 4.96. The distribution for the full Counterfactual scenario is centered close to the observed 1996 mean geodesic of 4.16. An examination of the partial-counterfactual scenario results shows that the change in propensity for corporate executives to gain new board seats was inconsequential in its effect, but the other propensity changes all mattered.

These results indicate that the observed shifts in preferences for zero-board, well-boarded, and

well-connected directors were sufficient to explain the magnitude of the change in the interlock network's mean step distance between companies. Conversely, if these preference shifts had not occurred, we would expect the interlock network mean geodesic in 2010 to be little changed from its value in 1996.

Insert figure 11 about here

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While figure 11 shows an uncanny quantitative agreement with the historical data, this was not expected. The model omits many factors that could affect the shape of the interlock network, such as assortative matching (e.g., larger companies may be more likely to hire directors on more boards) and the aforementioned effects of being targeted by shareholder proposals. We expect that these omissions should cause the simulation to overestimate the geodesic-lengthening in the center of the network (e.g., the S&P 500) and underestimate it outside the center of the network. Nevertheless, the change in overall mean geodesic can be explained by our simple simulation model without needing to resort to a more complicated model.

Figure 12 shows distributions of the number of board appointments for directors for representative Reality and Counterfactual scenario runs (respectively one of the two Reality or Counterfactual scenario runs wherein the run's mean geodesic was closest to the median mean geodesic for all runs in the respective scenario). Figure 13 shows degree distributions of the number of ties to other companies for companies from these simulation runs. Comparing these distributions to the observed historical distributions in figures 3 and 4 shows that the identified shifts in preference for certain types of directors are sufficient to explain the decrease in directors

with many board appointments and companies with many directly-linked companies.[9]

Insert figure 12 about here

Insert figure 13 about here

Revisiting prior scholarship on the effects of board ties

To illustrate the impact of the interlock network changes described above, we revisit three classic studies of the effects of interlock ties, and examine whether and how their findings still apply in the less connected interlock network. Among other functions (Mizruchi, 1996), shared board memberships have been identified as a central mechanism for socializing new elites (Useem, 1984), fostering political unity (Mizruchi, 1992), and diffusing corporate practices (Davis, 1991). We find that the interlock network is no longer connected enough to act as an effective mechanism for these processes.

In his groundbreaking study of American and British boards of the late 1970s and early 1980s, Useem (1984) described the interlock network as a broadly-connected, elite socialization device. An individual newly-appointed to his (and it was almost always his, not her) first board seat could catch the eye of an established member of the inner circle, someone who already served on many corporate boards and was connected to others who did also. If the new board appointee passed muster and proved amenable to mentoring, this mentor would sponsor him for

[9] Here, the effects of ignoring assortative matching are more easily identified. We see a shorter right-hand tail for the Reality simulated data than observed in the historical data.

membership in more corporate boards, suggest government and civic affiliations, and nudge him towards the appropriate political views for a member of the inner circle.

This narrative is predicated on the existence of a group of mutually-connected, frequently-interacting individuals, each on many boards, and collectively connected to the majority of the interlock network. Our data show that no such group existed by 2010. In 1997, 363 of the 432 S&P 500 companies with any interlocks were linked by a single network of directors with three or more board seats serving on boards with each other. The mean geodesic between companies on this network of well-boarded directors was 3.24; on average, any company's board could reach any other company board through a director's friend or friend of a friend. By 2010, only 244 of 440 companies were connected in the main component of directors with three or more board seats linked to similarly well-boarded directors, and there were four smaller components of three to six companies each connected in this way. The mean geodesic in the (much smaller compared to that in 1997) main component lengthened to 4.85[10].

The disappearance of a cohesive inner circle is even more apparent when considering the network between companies created by shared directors each on four or more boards. A 258-company component existed in 1997 with a single smaller component of four companies. There was no longer a predominant component by 2010. The largest component comprised 17 companies, alongside ten more components with between four and ten companies apiece. The broader S&P 1500 network underwent similar de-cohesion. There were four components each linked by directors on four or more boards in 1997, with the main component creating a connected core of 510 companies, but in 2010, there were 28 components with the largest

[10] To put this number—a mean geodesic of 4.85 between 244 companies—in perspective, the average Twitter follower network geodesic in 2010 was estimated to be between 3.43 and 4.12 for a network size of approximately 200 million users (Bakhshandeh, Samadi, Azimifar, and Schaeffer, 2011). The acquaintance network in the U.S. population of 200 million in the late 1960s was estimated to have a geodesic between 3 and 5.2 (Milgram, 1967).

consisting of 62 companies and most with only four companies each.

Against this changed backdrop, a director joining his first corporate board became unlikely to meet another director who could introduce him to many other boards. Even if the newly-minted director was lucky enough to serve on a board with such a well-boarded, well-connected director, the senior director's board connections would span only a small part of the corporate milieu. The new director could not climb into the corporate interlock network inner circle through introductions from his well-connected board peers. Indeed, there was no inner circle left to join.

Mizruchi's (1992) classic study of large firms' political action provided evidence for the unifying effects of interlock ties, finding that director interlocks increase political cohesion. Commercial banks figure prominently in his analysis; in 1980, the focal year of Mizruchi's analysis, commercial bank boards formed the hubs of the interlock network. By 1997, commercial banks were no longer at the center of the network, however, so examining how his findings would be changed by the de-cohesion of the interlock network from 1997 onwards is not instructive.

A better study to revisit for our current purposes is Burris's (2005) study of the effect of shared board memberships on political contributions by top executives. Using data from 1980 (the same year studied by Mizruchi [1992]), Burris found that serving on the same board caused executives to adopt similar patterns of political donation. The average dissimilarity in giving—the difference in percentage of total political contributions allocated to the Republican Party between a pair of executives—was 24% for pairs of executives who served on the same board, compared to 34% for pairs of executives in general[11]. Sharing a board affiliation was consequential in

[11] Even a 24% average dissimilarity is indicative of a bimodal distribution of political giving, albeit significantly less-polarized than a donation distribution with 34% average dissimilarity.

increasing political consensus. The effects of serving on the same board were much stronger than the effects of being employed by companies in the same industry or state.

We modeled the consensus-generating effect of interlock ties using our S&P 500 data for 1997 and 2010, restricting the data to include only corporate executives and the ties between them. Our data covers 1,134 executives in 1997 and 768 in 2010, with 69.8% of executives in 1997 and 58.1% in 2010 with at least one interlock tie to another executive. (Burris's [2005] sample consisted of 761 executives, with 62% having at least one interlock tie.) Interlock ties between executives with the same employer were excluded from the analysis.

Each director's percentage of total political contributions allocated to the Republican Party was calculated in a two-step process. Each executive's latent *baseline*—unaffected by ties to other executives—percentage of political giving allocated to the Republican Party was drawn randomly from a strongly bimodal probability distribution. The distribution was created by summing two normal distributions, one with mean 0.41667 and standard deviation 0.08333, and the other with mean -0.41667 and the same standard deviation. The summed distribution was truncated at ±0.5 (-0.5 corresponded to making 100% of political donations to the Democratic Party, +0.5 to making 100% of donations to the Republican Party), and normalized so the area under the probability distribution curve summed to one. Next, each director's percentage of contributions going to the Republican Party was adjusted to be closer to his or her board peers' donations. Each director's giving was shifted towards their peers' mean; a director's Republican contribution percentage was calculated as the weighted average of the focal director's baseline Republican percentage and that of his or her peers, with the focal director's baseline percentage

weighted ten times higher than his or her peers'[12].

We find a weakened political unifying and moderating effect for the interlock network. Using the 1997 network, the simulation predicts that a pair of executives who serve on the same board will have on average a 24% difference in political contribution percentage to the Republican Party, compared to a 37% difference between two executives randomly selected without regard to interlock ties. Even though the effects of each individual board tie are held constant across the 1997 and 2010 network scenarios, the decrease in overall network density leads to increased differences in political contribution percentage allocated to Republicans for board peers—an average 30% difference between linked directors in 2010. The similarity boost from serving on the same board is halved, purely because of the decrease in the connectedness of the overall interlock network.

A weakened unifying effect leads to more polarized political action. Comparing the simulated distributions of executives' percentage of contributions to the Republican Party for the 1997 and 2010 interlock networks (figure 14) shows a shift away from giving similar amounts to both political parties towards allocating almost all one's contributions to one party. While both distributions are bimodal, the 2010 distribution has many more extremely polarized donors on both sides of the political spectrum, while more balanced, centrist contributors have all but disappeared.

Insert figure 14 about here

[12] The shape of the baseline bimodal distribution and the ten-fold weight for a focal director's baseline percentage versus his or her peers were chosen through trial and error to give distributions similar to Burris's for 1997. This allows us to relate our simulation results to his empirical findings. Using different shapes for the bimodal distribution and values for the peer influence weight yielded similar results.

Studying the spread of poison pill anti-takeover defenses in the Fortune 500, Davis (1991) found that innovations diffused across the board interlock network. The number of interlock ties to prior adopters was the best predictor of whether a company opted to adopt poison pill provisions. Being connected by shared board members to companies that had already adopted poison pills increased the probability that a company would also adopt the takeover defense. The more prior adopters (up to an optimal, for adoption, value of six) a company was connected to on the interlock network, the higher the probability the company also chose to adopt a poison pill provision. While a tie to one prior adopter increased the rate of adoption by about 60% compared to when a company had no ties to prior adopters, possessing ties to three prior adopters more than doubled the adoption rate. A firm with ties to six prior adopters had the highest rate of poison pill adoption, about 2.5 times the rate for a company with no ties to prior adopters.

We simulated poison pill adoption using the interlock networks for 593 large companies in 1982 and this study's 2010 S&P 500[13] companies. The simulation was run 1,000 times for each condition (1982 and 2010 interlock networks), with the interlock network held constant throughout each simulation. Each simulation run consisted of 20 sequential quarters. In each quarter, a company's propensity to adopt a poison pill was set proportional to

$$e^{0.2094\times\ln(\text{INTERLOCKS}+1) + 0.643\times\ln(\text{TIES TO ADOPTERS}+1) - 0.1689\times\ln(\text{TIES}^2+1)}$$

where INTERLOCKS is the number of directly interlocked boards of the focal company, TIES TO ADOPTERS is the number of directly interlocked boards which have adopted a poison pill in a prior quarter, and TIES^2 is the square of this number. The coefficients were taken from model 6

[13] The 1982 dataset is the one used in Davis et al., (2003). Using the current study's 1997 S&P 500 interlock network instead of the 1982 data yields similar results. We present results using the 1982 data since the interlock structure then is more likely to be similar to the structure during 1984 to 1989, the period of Davis's (1991) study.

in table 2 of Davis's (1991) study. We multiplied this propensity by a normalizing factor to derive the probability that a given company would adopt a poison pill in the quarter. The normalizing factor was calibrated to reproduce the observed adoption pattern by quarter (Davis [1991], figure 3) for the 1982 network.

Calibrating the normalization factor in this way constrains the shape of the simulated adoption curves. Both the curves for the 1982 network and the 2010 network are similar to Davis's observed adoption curve (1991, figure 1). The 2010 adoption curve is less steep relative to the 1982 curve, and, on average, only 50% of the companies adopt poison pills by the end of the simulation, compared to 62% in the 1982 simulation runs.

A much more striking difference is observed in the mechanisms of poison pill adoption. Examining the ratio of adopters with links to three or more prior adopters versus those with links to two or fewer prior adopters (figure 15) shows that most of the poison pill adoptions on the 1982 network after quarter 7 could conceivably be attributed to diffusion through board links to multiple prior adopters. This mechanism cannot account for the majority of adoptions in the 2010 network at any time during the simulation period, however, as the less connected network structure provided fewer links to prior adopters. In the middle of the simulation period, at quarter 10 where the adoption curve was steepest, 2/3 of companies adopting poison pills in the 1982 network were connected to three or more prior adopters. Contagion from exposure to multiple prior adopters could be a significant driver of adoption as half of at risk companies (those which had not yet adopted poison pill provisions) were linked to three or more prior adopters. In contrast, only 1/5 of at risk companies were linked to three or more prior adopters in quarter 10 of simulations using the 2010 network, and only 1/4 of poison pill adoptions occurred in companies connected to three or more prior adopters.

By 2010, it was logically impossible for an innovation to spread rapidly via interlock links to multiple prior adopters. The typical company shared too few directors with prior adopters to allow for multiple exposures to a new innovation, until the innovation was already widespread. Different, most probably non-interlock-based, mechanisms now underlie the spread of new management practices. If such mechanisms are less effective than interlock ties in the 1980s, then there will be less isomorphism in corporate policies today.

Insert figure 15 about here

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The United States without a cohesive corporate elite

Our findings show that the U.S. board interlock network has changed in fundamental ways. Much that was true of the interlock network for 100 years became untrue within ten subsequent years. The U.S. corporate interlock network suffered a striking decline in connectedness. This decline was driven by a radical shift in the characteristics of directors invited onto additional boards. The preference for directors on many boards disappeared. Directors serving on three or more boards may now be *less* likely than those serving on one board to gain a new board seat. The value of being well-connected through peers serving on other boards also declined.

It is important to point out that the interlock network had faced momentous challenges before. Brandeis's exposé in 1914 led many bankers to resign their directorships en masse later that year. Wars, market crashes, the Depression, and multiple merger waves shuffled the players but did little to alter the existence of an inner circle. The interlock network remained densely-connected and consistent in its properties throughout these changes. Seven firms that were among the ten most central in 1962 were also in the top ten in 1982—six of them banks. In the subsequent two

decades, however, banks shrunk their boards and stopped recruiting well-connected directors, and the banking industry consolidated (Davis and Mizruchi, 1999); hundreds of large corporations were taken over and their boards disbanded; and demands from corporate constituents for greater diversity led to a demographic shift in directors, mostly benefiting a small handful of directors (such as Vernon Jordan). Yet the average geodesic stayed nearly constant, and the inner circle endured (Davis et al., 2003). It appeared that the inner circle and the network's cohesion were durably resilient, perhaps even inevitable "emergent properties of networks qua networks" (Davis et al., 2003: 322).

The crucial difference between the changes described in this paper and previous interlock network transformations was the breakdown of the preference for well-connected directors. Whereas directors were previously sought after because of their legitimating connections, the financial scandals of the early 2000s and the attendant public outcry reversed this social construction (cf. Zhu & Westphal, 2011) and turned "corporate diplomats" (Useem, 1984) into "busy" (e.g., Ferris, Jagannathan, and Pritchard, 2003; Fich and Shivdasani, 2006) or "overworked" directors. Companies became leery of hiring multi-board directors lest they be chastised by analysts and investors. This rapid social de-construction of prestige occurred when multiple-board membership had become decoupled from social elite membership and corporate power. In the 1970s, over 90 directors, almost all corporate executives and all but one white, served on five or more boards each. By the late 1990s, directors with the most board appointments were often African-Americans with experience outside the traditional corporate sphere. The increasing number of minority directors in U.S. boardrooms was and is a testament to the progress towards racial equality made in the United States over the latter half of the 20th century. This silver lining has a cloud, however. When scandals, such as the Penn Central

bankruptcy, erupted in the 1970s, the status of well-boarded directors was not threatened. After the corporate scandals of the early 2000s, on the other hand, directors serving on many boards were vilified.

Studies of U.S. board interlocks have proliferated over the past thirty years. For the board researcher of today, our results are both exciting and damning. On one hand, everything old is new again. The foundational laws of the network have changed. Directors sitting on multiple boards are no longer sought out. The interlock network is no longer a reliable map of elite power. Social distances are no longer reliably shortened by board ties. The findings of classic studies—on elite socialization and class consciousness, on political unity and pragmatism, and on corporate learning and isomorphism—no longer hold. Previously discovered "facts" need reconfirmation. On the other hand, the network is now less interesting in some senses. The interlock network no longer tells us much about who holds power in U.S. society. Nor does it provide a substrate for rapid isomorphism. Future studies will have to establish new reasons for studying the changed interlock network.

More broadly, the findings presented here call into question whether a broad-based, cohesive social elite still exist in the United States. Mizruchi (2013) makes this argument, asserting that a moderate, highly-connected and influential core of business leaders—the corporate elite—continually existed from the early 20th century, but disappeared in the 1990s. In his view, an "active state, powerful labor, and a financial community whose interests transcended those of particular firms or sectors" forced the corporate elite to unite and defend the corporate system. In the 1980s, the moderating influences of the state, labor and commercial banks were weakened, and instead "shareholder value" became the dominant logic (Zajac and Westphal, 2004). Institutional investors (Useem, 1996), financial analysts (Dobbin and Zorn, 2005) and the capital

market itself (Davis, 2009) came to exert control on CEOs and directors. On one hand, the corporate elite had won the war, and the U.S. corporate system had become a taken-for-granted institution. Attempts by labor or government to place restrictions on corporations were now deemed ill-advised, even unpatriotic. On the other hand, the new shareholder value master proved a tyrant. Public company CEOs lost job security, and found themselves scrambling to survive individually by capturing more market value for their individual firms. The corporate elite no longer had the motivation nor the ability to band together to defend their interests as a class. With the corporate elite fragmented, U.S. society lost a powerful consensus-building, politically-moderate interest group.

Another possibility is that the social elite still coheres, but has found new, more hospitable enclaves, protected from non-elite entry and hidden from public scrutiny. Davis (2013) suggests that public corporations are losing their central place in the American economy, noting that the number of listed companies in the U.S. dropped by more than half between 1997 and 2012, as the number of de-listings consistently outpaced the number of companies going public.[14] Moreover, companies going public most recently have adopted market-hostile governance structures, giving their founders super-voting rights that ensure their control. (The three founders of Groupon, for instance, hold stakes giving them 150 votes per share; Mark Zuckerberg personally controls an absolute majority of Facebook's voting rights.) It is possible that the public corporation as we know it is an artifact of the 20th century, and thus those who direct public corporations are no longer society's elites. The study of social elites in the 21st century will have to follow a different path than that of the study of 20th century elites.

[14] On the other hand, the number of private equity-owned companies increased dramatically during this period. Members of the boards of these companies are not subject to the same public scrutiny.

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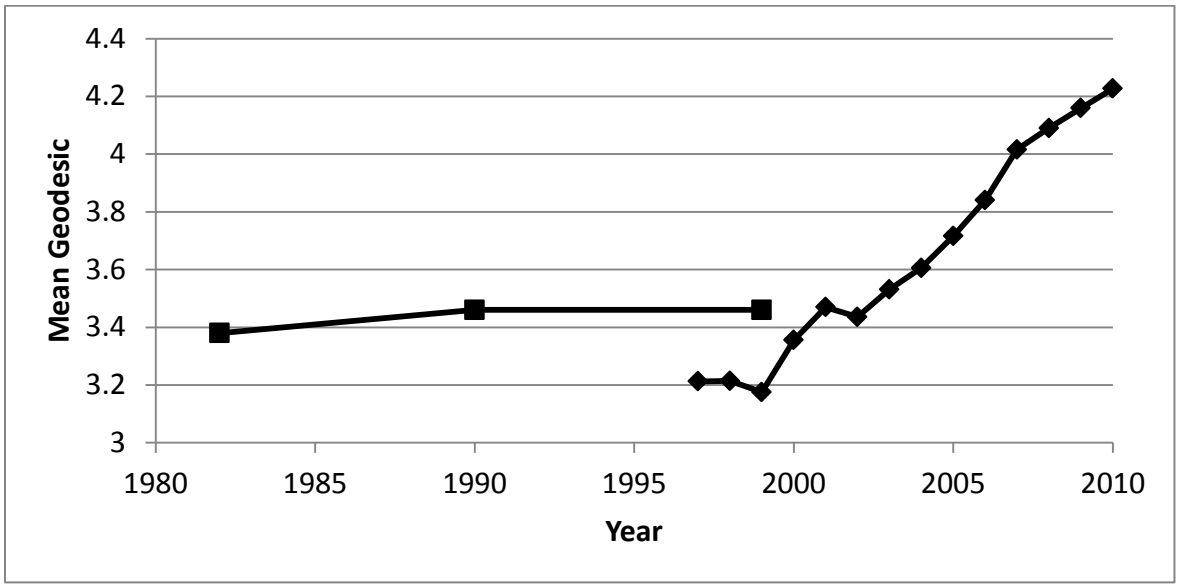
FIGURE 1

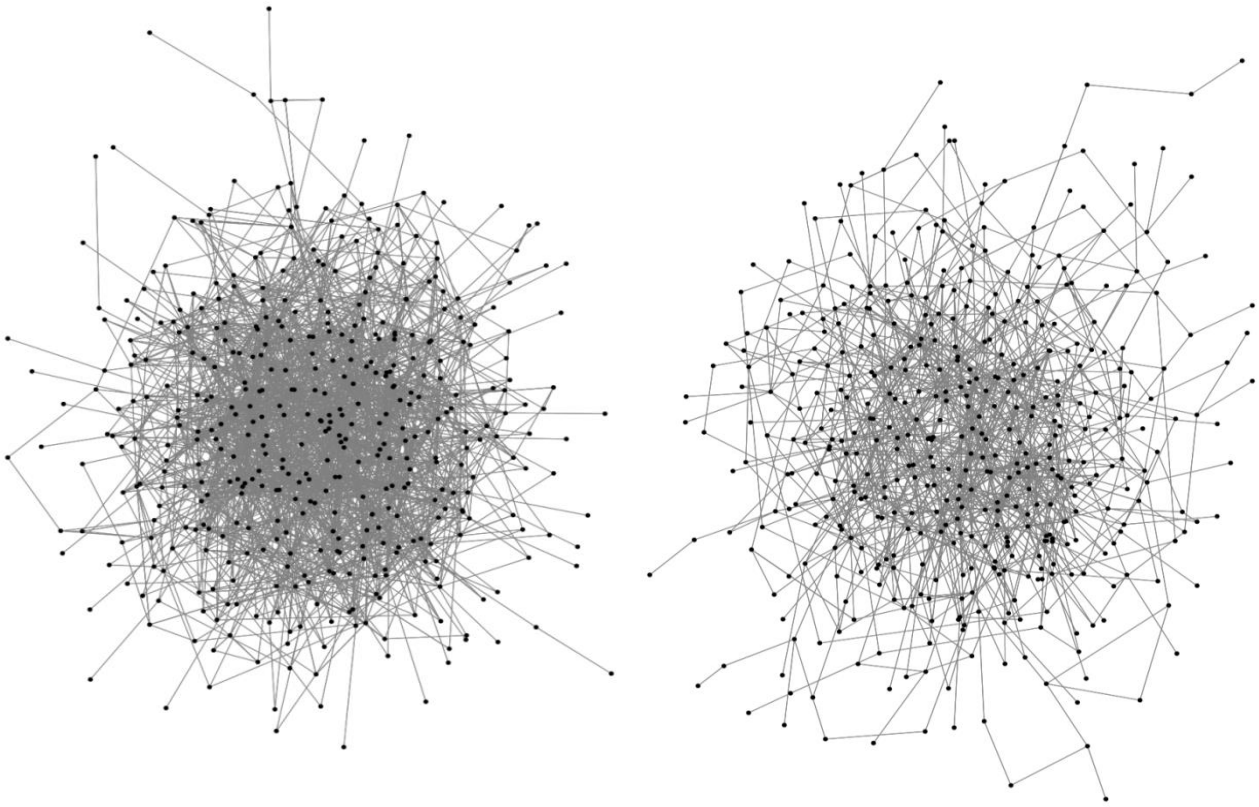
Mean geodesic in main component of board interlock networks, 1982-2010



NOTE—1982-1999 data from Davis et al. (2003); 1997-2010 this study; study population differs across the sources.

FIGURE 2

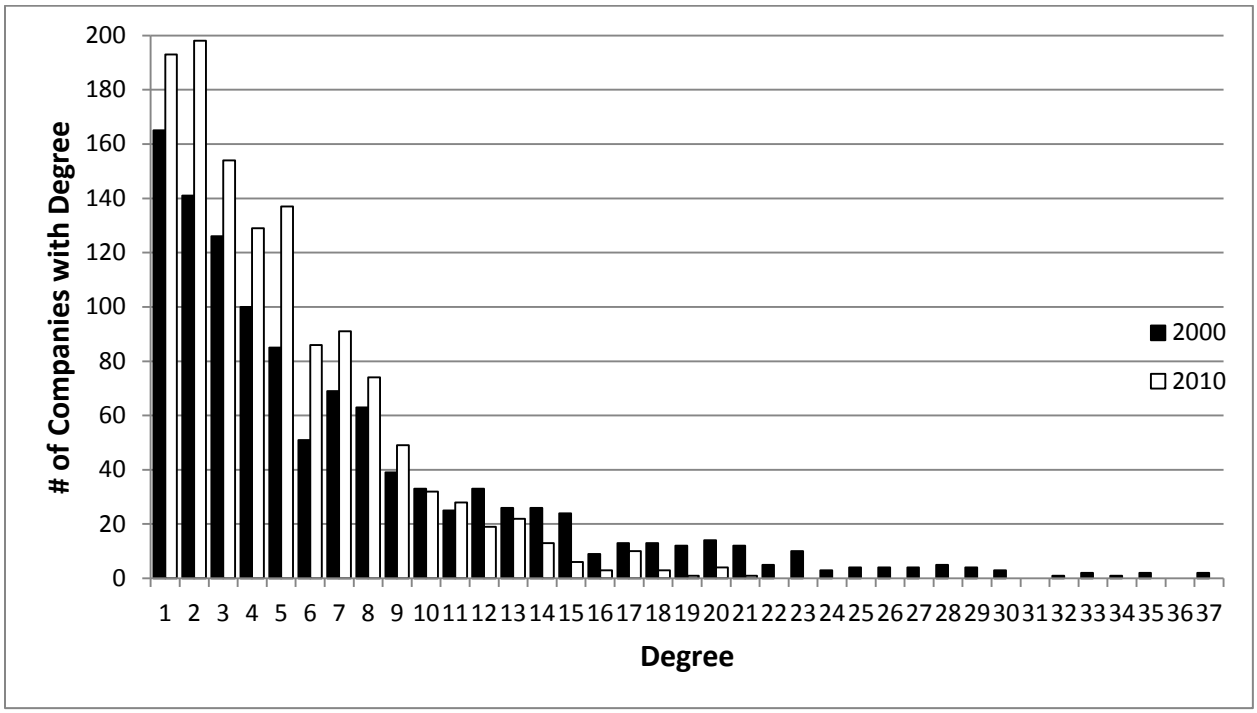
S&P 500 interlock network, 1996 and 2010



NOTE—Left figure is main component in 1996, right in 2010.

FIGURE 3

Degree distributions for S&P 1500 companies and directors, 2000 and 2010



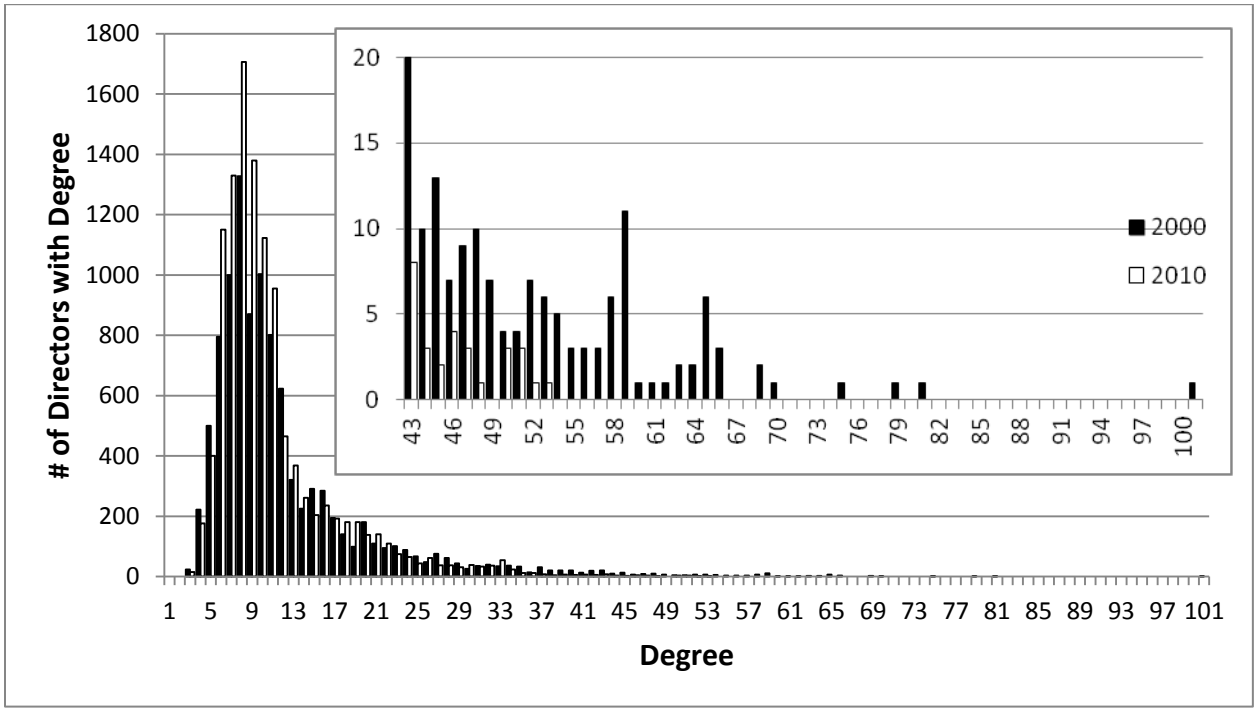


FIGURE 4

Distribution of directors by number of S&P 1500 board seats, 2000 and 2010

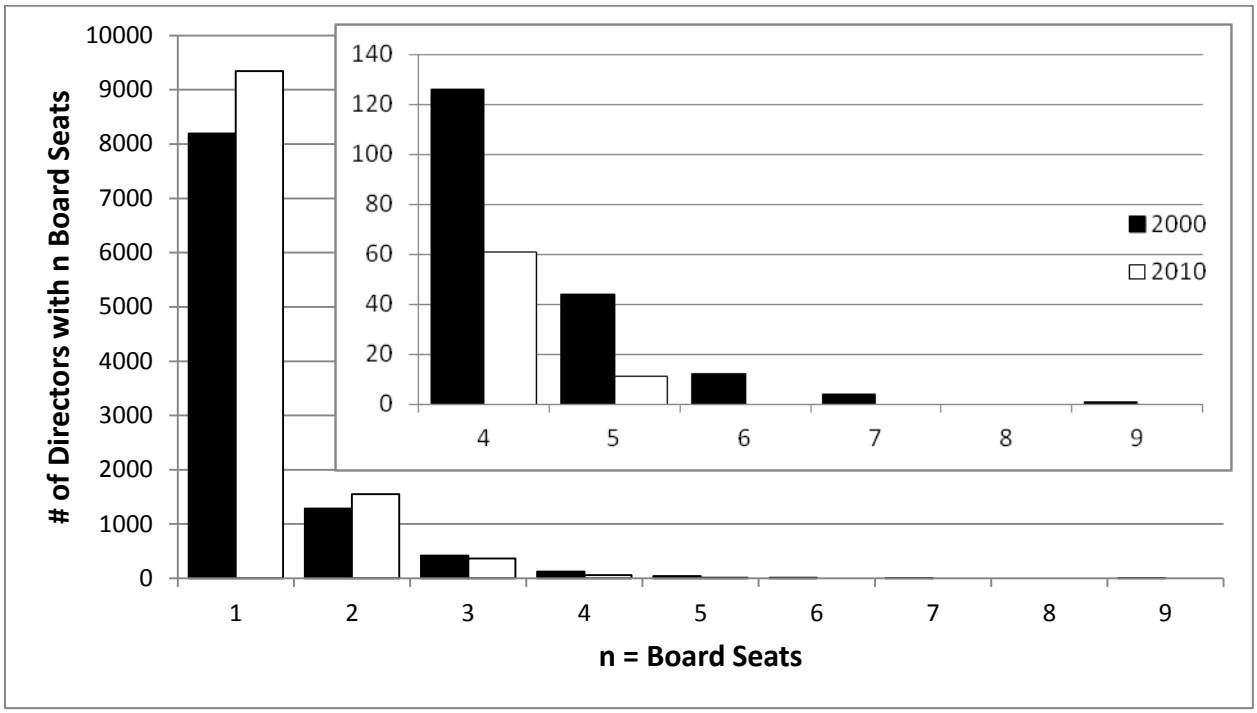


FIGURE 5

Net loss of board seats by 2009 versus age for directors with 6 or more board seats in 2001

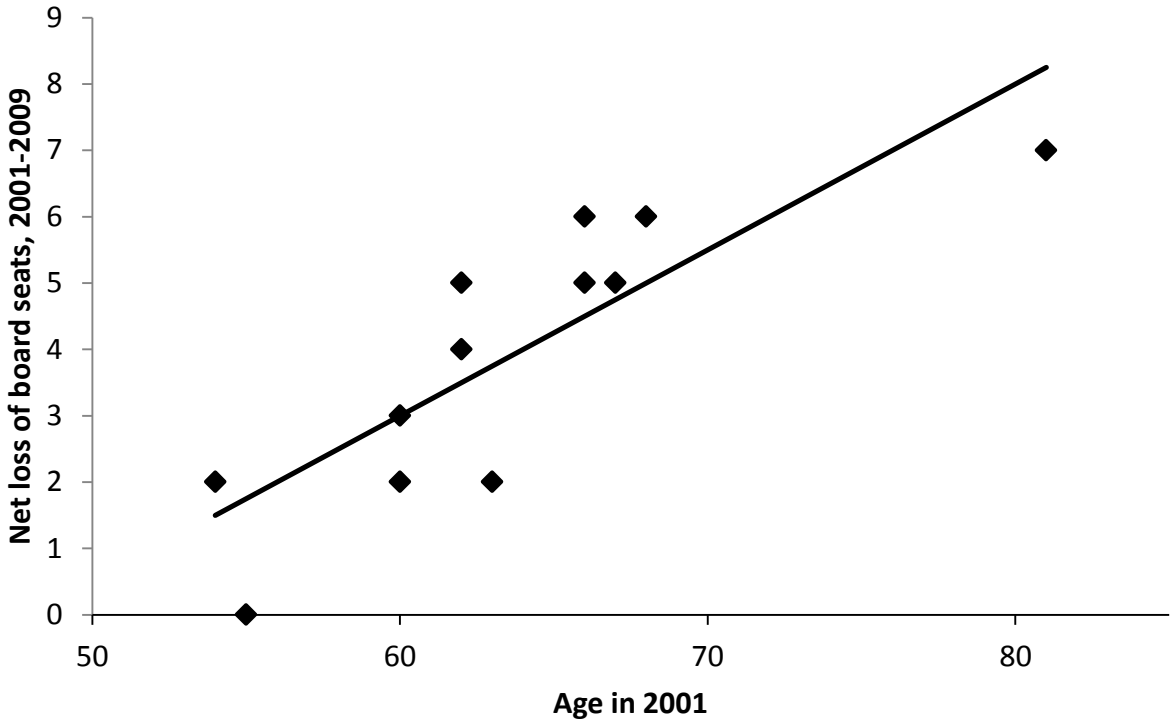
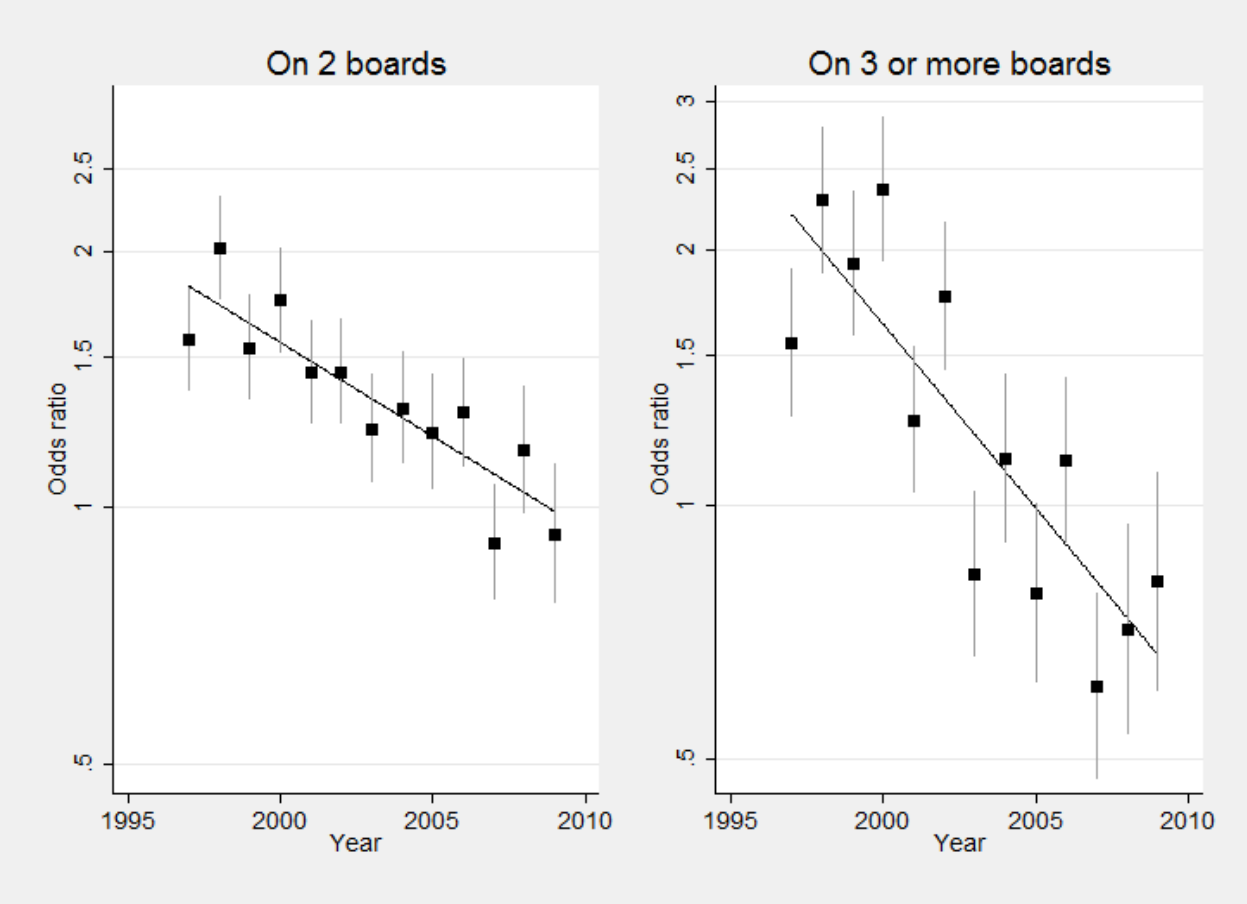


FIGURE 6

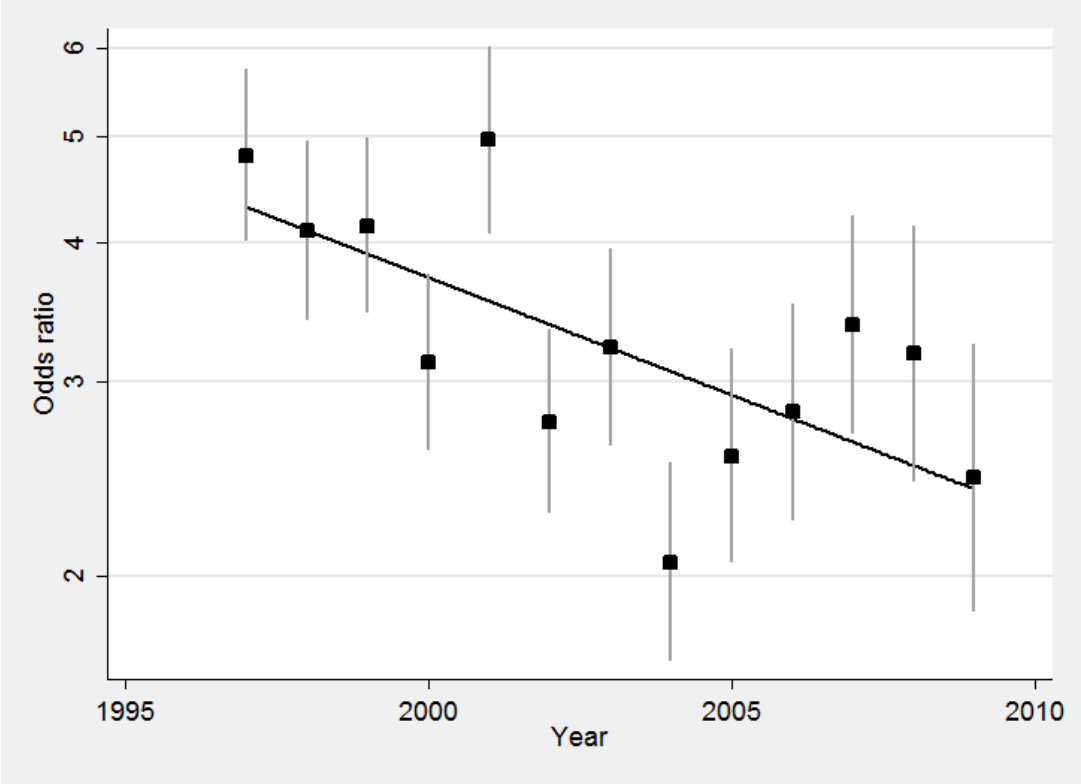
Odds ratios for directors on multiple boards compared to directors on one board of gaining a new board appointment in next year (log scale)



NOTE—The points are the observed odds-ratios for each year, the error bars are standard errors in these odds-ratios, and the lines are predictions of a variance-weighted least squares regression. Separate VWLS regressions on the first six years (1997 to 2002) and the remaining seven years for directors on three or more boards do not yield a linear trend with a slope significantly different from 0 (z = -0.60 and -0.91 respectively).

FIGURE 7

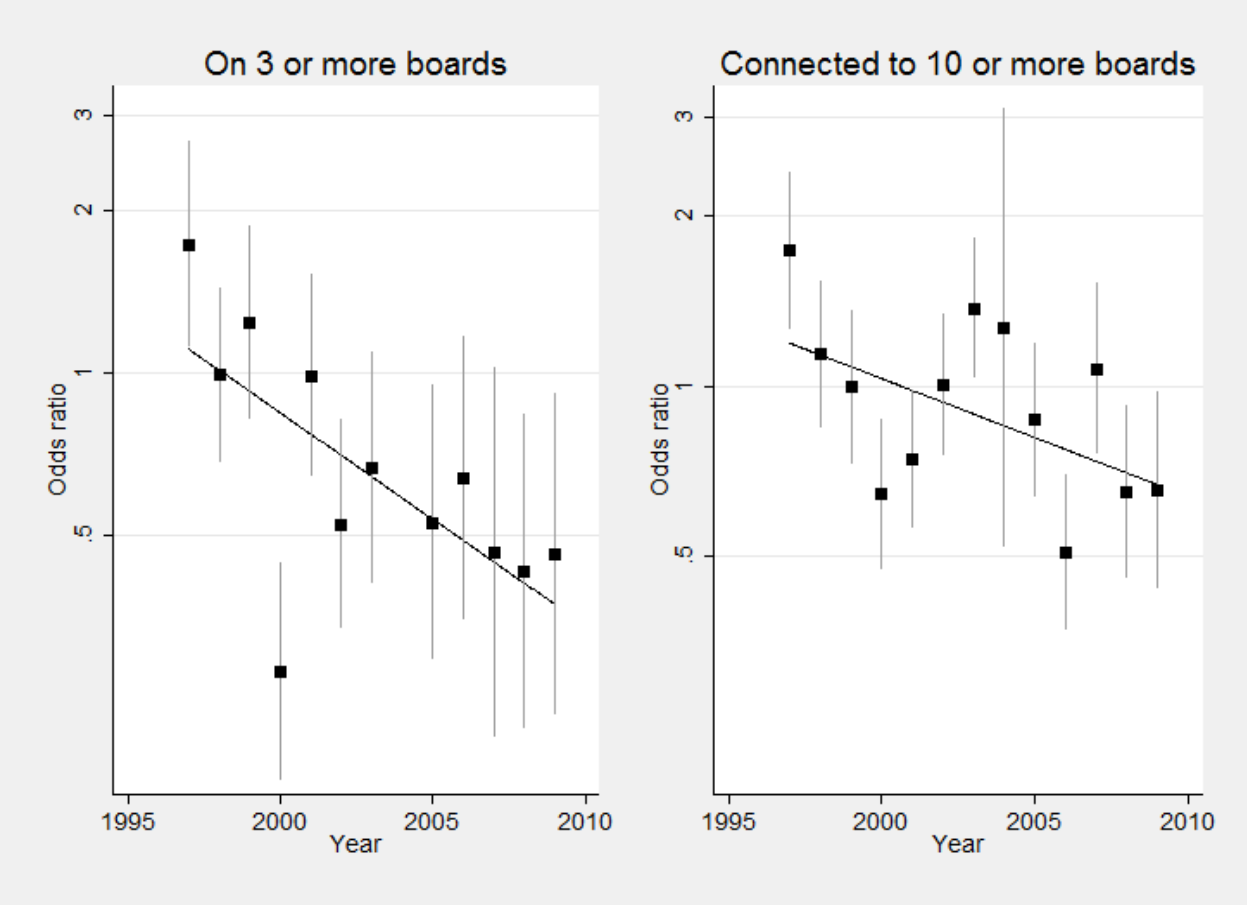
Effect of being well-connected on odds ratios of gaining a new board appointment in the next year



NOTE—Effect of ten-fold increase in number of linked boards. The points are the observed odds-ratios for each year, the error bars are standard errors in these odds-ratios, and the lines are predictions of a variance-weighted least squares regression.

FIGURE 8

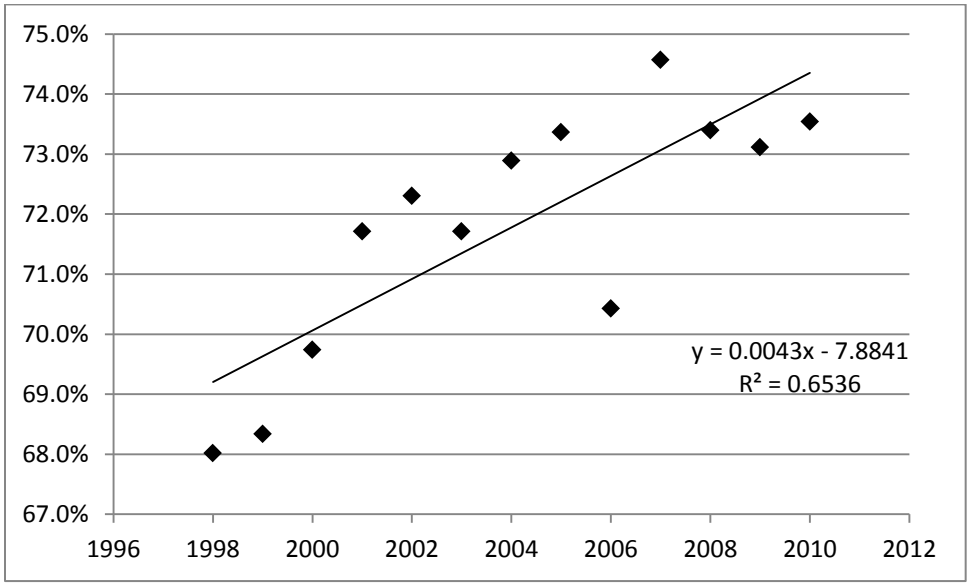
Effect of being targeted by shareholder proposal



NOTE—The points are the observed odds-ratios for each year, the error bars are standard errors in these odds-ratios, and the lines are predictions of a variance-weighted least squares regression.

FIGURE 9

Percentage of board appointments filled by director with no existing board appointments



NOTE—The points are observed values for each year. The line is a linear least-squares regression.

FIGURE 10

Mean geodesic in main component of board interlock networks, 1997-2010

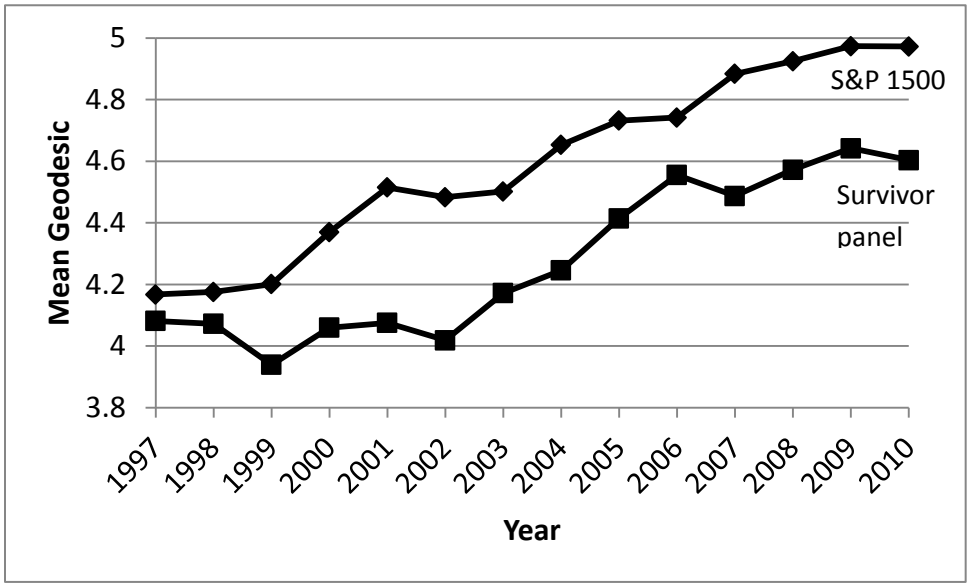
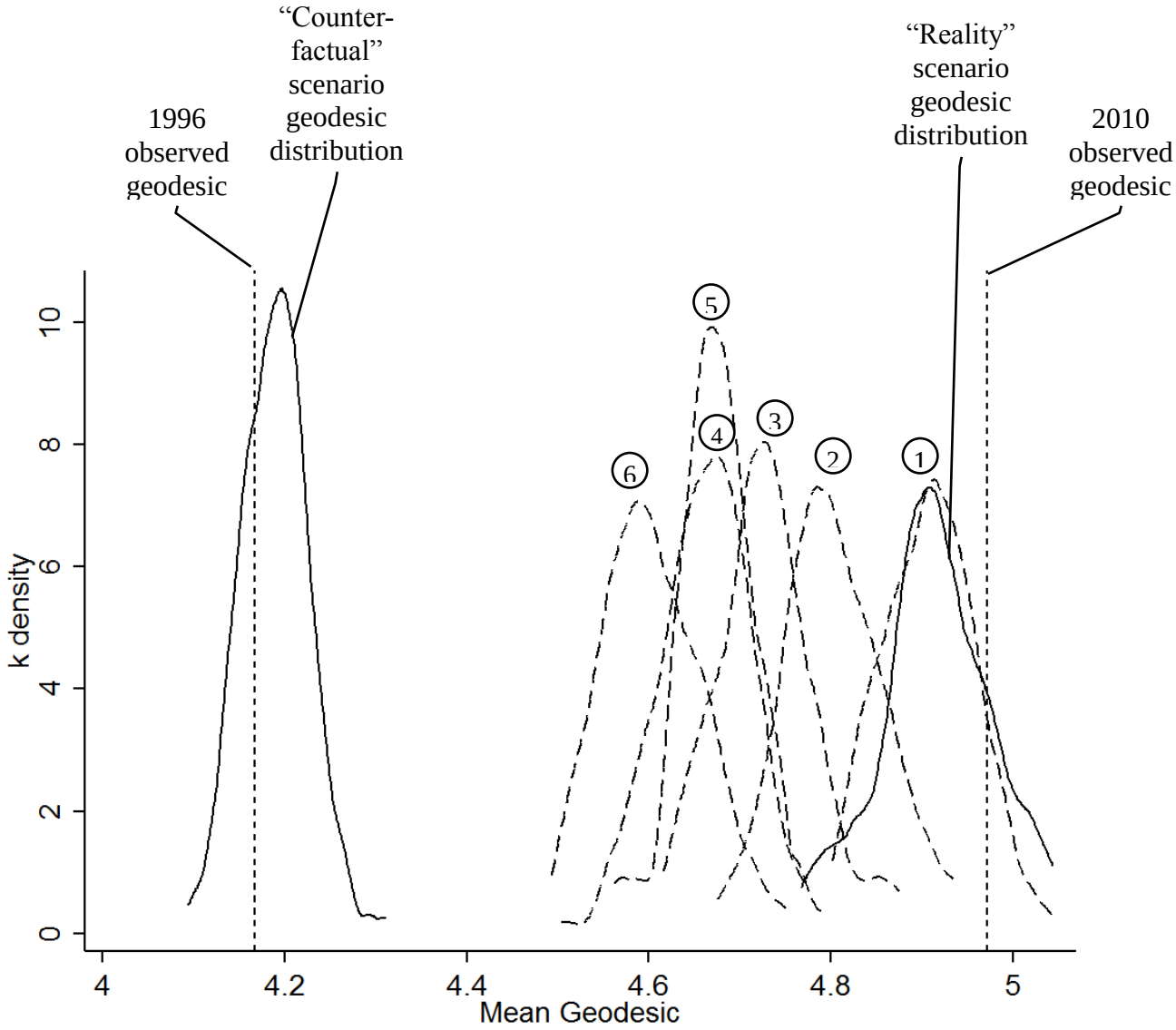


FIGURE 11

K-densities of simulated 2010 mean geodesics



NOTE— Eight scenarios of 100 runs each. Vertical dashed lines indicate observed historical mean geodesic in S&P 1500 for 1996 and 2010. Solid curves show distributions for "Counterfactual" and "Reality" simulation scenarios. Dashed curves show distributions for scenarios where one or more independent variables' effect has been held steady (as in the Counterfactual scenario), while the remaining independent variables' effects have been allowed to change (as in the Reality scenario). The held-constant variables for each dashed scenario are:

① Director is a corporate executive

② Director is on two boards

③ Number of non-overlapping boards where peer directors served

④ Proportion of board seats taken by new versus existing directors

⑤ Director is on three or more boards

⑥ Director is on two boards, and Director is on three or more boards

FIGURE 12

Distribution of number of directors with n boards from simulations

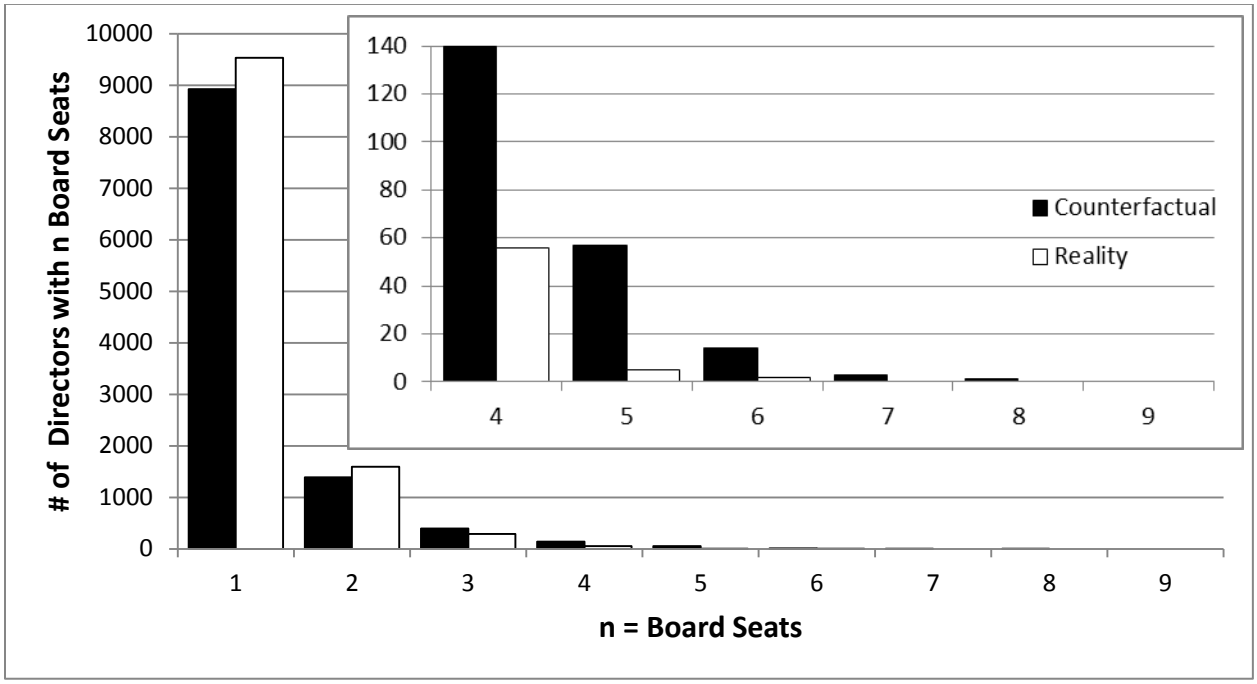


FIGURE 13

Distribution of number of companies with n linked companies from simulations

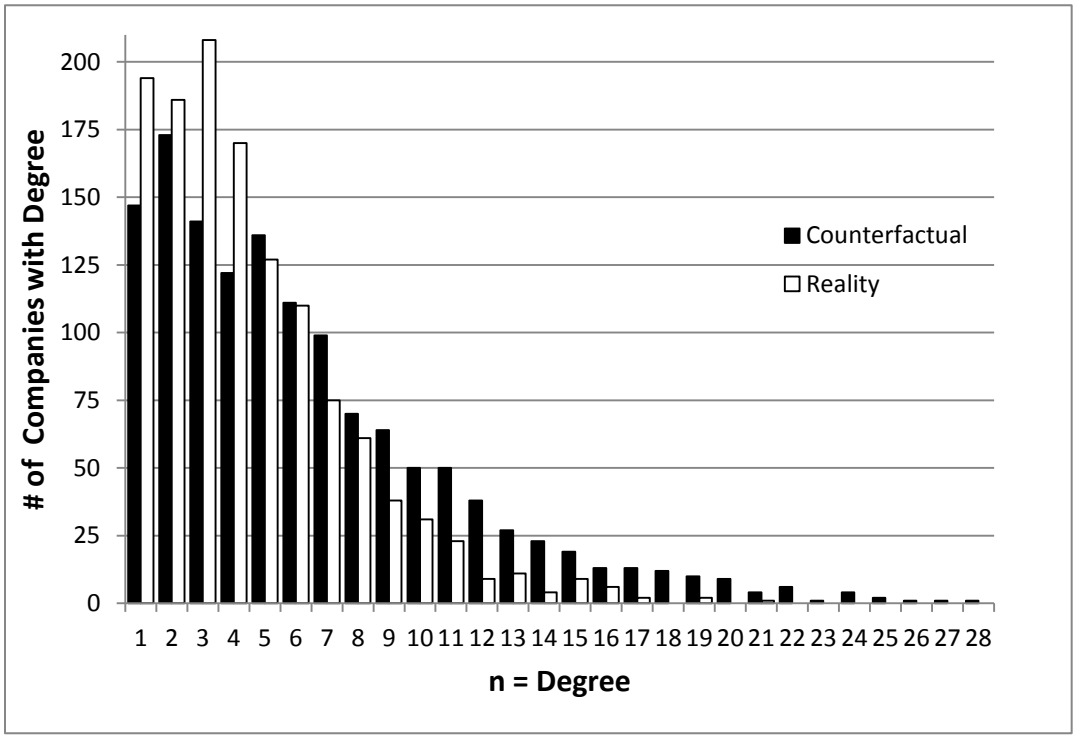


FIGURE 14

Normalized distribution of the proportion of political contributions allocated to the Republican Party

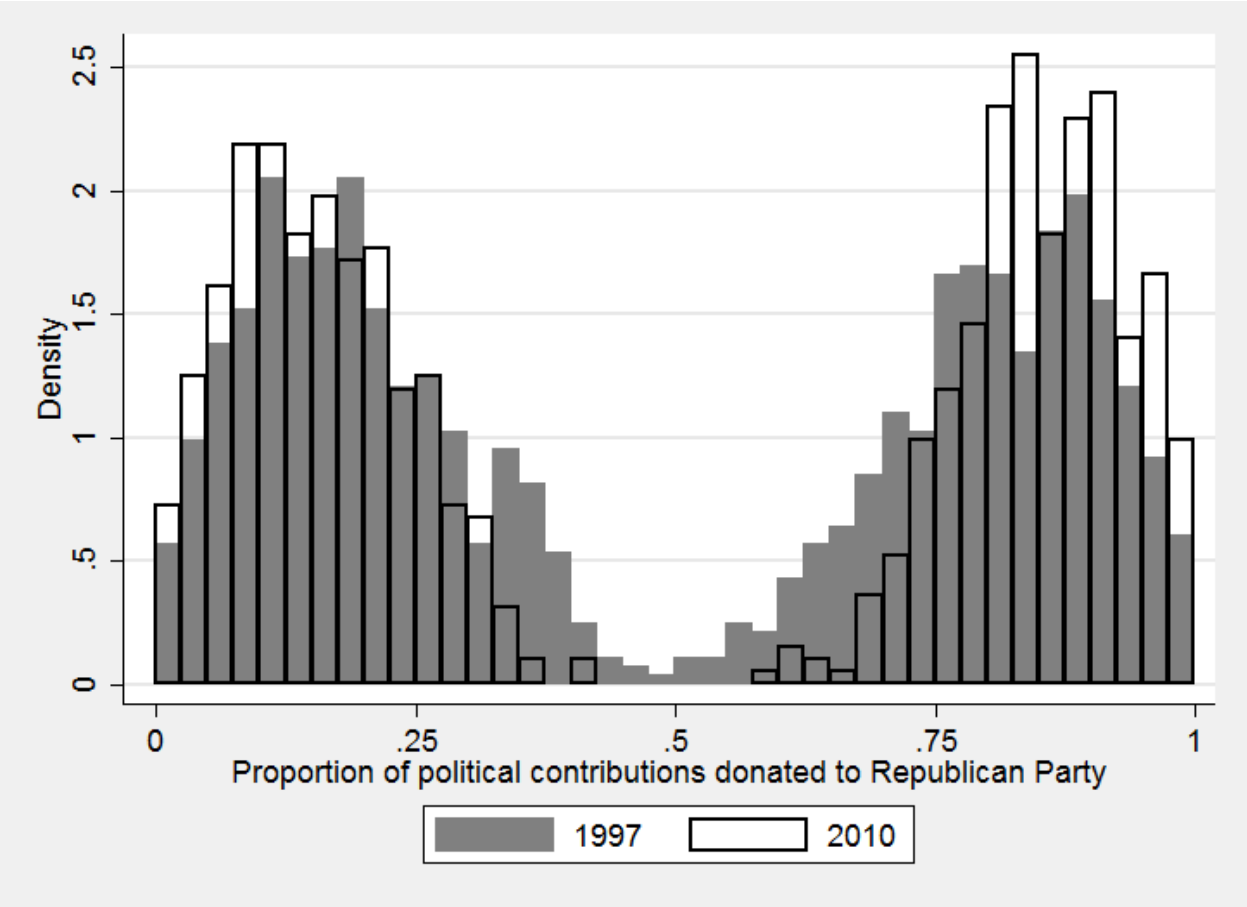


FIGURE 15

Number of new adopters with ties to three or more prior adopters compared to number of new adopters without ties to three or more prior adopters

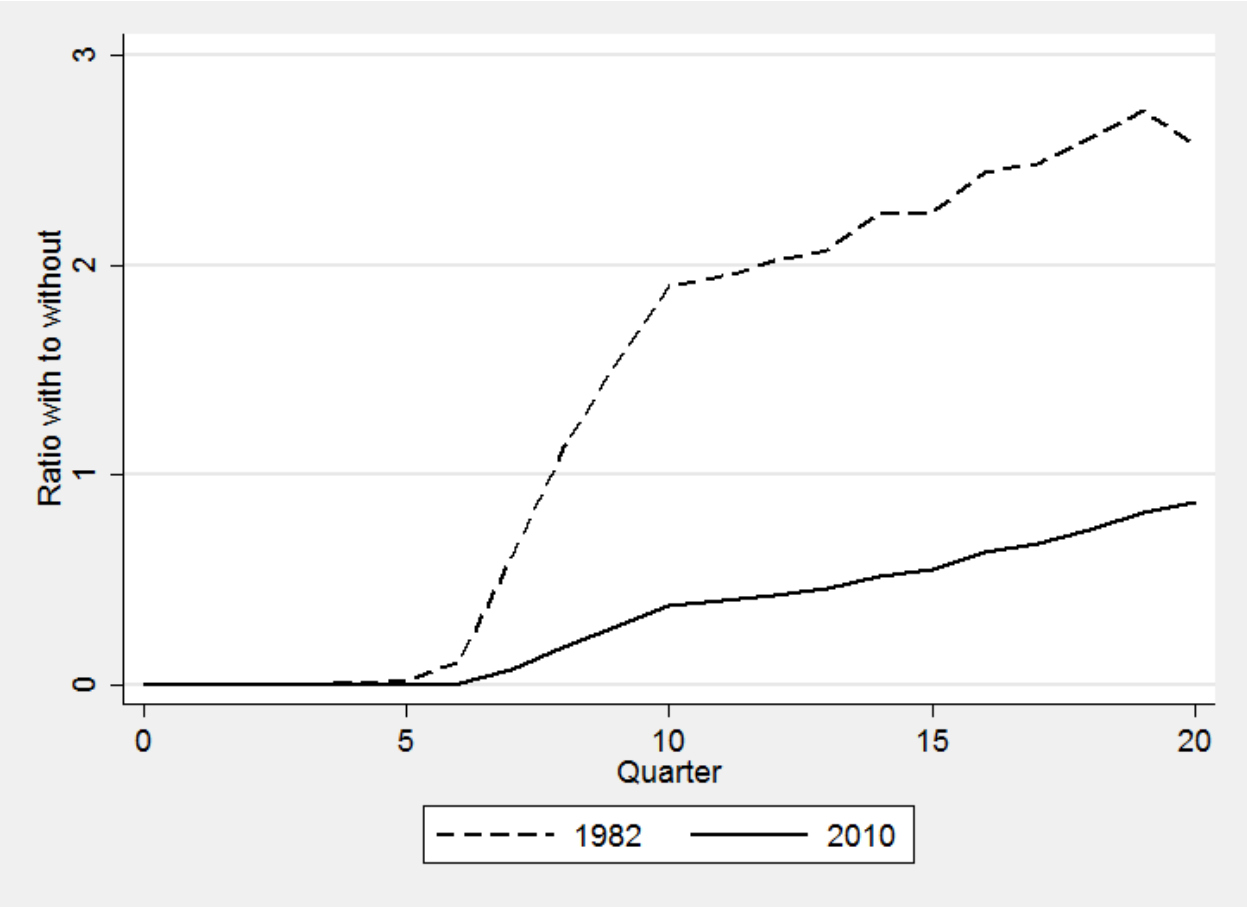


TABLE 1

Characteristics of the board interlock network, 1912-2010

Characteristic	1904	1912	1919	1935	1964	1969	1974	1999	2000	2010
Number of connected firms	154	140	143	145	153	153	145	811	425	440
3-step reach of most central corporation (%)	90.9	81.9	85.5	80.7	90.4	91.0	84.9	82.4	84.2	60.9
Directors on 6 or more boards	24	27	14	3	4	2	0	*	8	0

† 1904-1974 data from Mizruchi (1982: 105-108); 1999 from Davis et al. (2003: 320); 2000-2010 this study; study population differs across the three sources.

* Data not available in source article.

TABLE 2

Top-25 (including ties) degree centrality companies in S&P 1500 interlock network

Year 2000

Rank	Degree	Company
1	37	SARA LEE
1	37	ALLSTATE
3	35	BANK OF AMERICA
3	35	SBC COMMUNICATIONS
5	34	BELL ATLANTIC
6	33	CHASE MANHATTAN
6	33	SCHERING-PLOUGH
8	32	EXXONMOBIL
9	30	XEROX
9	30	EQUIFAX
9	30	HONEYWELL INTERNATIONAL
12	29	AMR
12	29	BANK ONE
12	29	SUNTRUST BANKS
12	29	KROGER
16	28	PROTECTIVE LIFE
16	28	KMART
16	28	VULCAN MATERIALS
16	28	BELLSOUTH
16	28	MINNESOTA MINING & MANUFACTURING (3M)
21	27	PROCTER & GAMBLE
21	27	AT&T
21	27	UNION CARBIDE
21	27	FLEET BOSTON
25	26	PEPSICO
25	26	AON
25	26	SPRINGS INDUSTRIES
25	26	SUNOCO

Year 2010

Rank	Degree	Company
1	21	MARATHON OIL CORPORATION
2	20	NORTHERN TRUST CORPORATION
2	20	STANLEY BLACK & DECKER, INC.
2	20	H. J. HEINZ COMPANY
2	20	LOWE'S COMPANIES, INC.
6	19	THE PROGRESSIVE CORPORATION
7	18	CATERPILLAR INC.
7	18	AON CORPORATION
7	18	SUNTRUST BANKS, INC.
10	17	PRUDENTIAL FINANCIAL, INC.
10	17	THE PNC FINANCIAL SERVICES GROUP, INC.
10	17	INTERNATIONAL BUSINESS MACHINES CORP
10	17	KEYCORP
10	17	UNITED TECHNOLOGIES CORPORATION
10	17	CHEVRON CORPORATION
10	17	WELLS FARGO & COMPANY
10	17	MCDONALD'S CORPORATION
10	17	FMC TECHNOLOGIES, INC.
10	17	PFIZER INC.
20	16	SPRINT NEXTEL CORPORATION
20	16	THE BANK OF NEW YORK MELLON CORP
20	16	ENPRO INDUSTRIES, INC.
23	15	ELI LILLY AND COMPANY
23	15	MEADWESTVACO CORPORATION
23	15	NORTHROP GRUMMAN CORPORATION
23	15	DEERE & COMPANY
23	15	3M COMPANY
23	15	QWEST COMMUNICATIONS INTERNATIONAL

TABLE 3

Top-25 (including ties) degree centrality directors in S&P 1500 interlock network

Year 2000

Rank	Degree	Director	Age	Gender	Ethnicity
1	101	VERNON E JORDAN JR	65	Male	Black
2	81	RONALD L KUEHN JR	64	Male	White
3	79	JOHN L CLENDENIN	65	Male	White
4	75	EDWARD E WHITACRE JR	58	Male	White
5	70	WILLIE D DAVIS	66	Male	Black
6	69	ELAINE L CHAO	46	Female	Asian
6	69	CHARLES F KNIGHT	64	Male	White
8	66	LOUIS W SULLIVAN	66	Male	Black
8	66	CHARLES W COKER	67	Male	White
8	66	SAM NUNN	62	Male	White
11	65	JOHN W SNOW	60	Male	White
11	65	STEPHEN R HARDIS	64	Male	White
11	65	GEORGE J MITCHELL	66	Male	White
11	65	LYNN M MARTIN	60	Female	White
11	65	FRANK S ROYAL	60	Male	Black
11	65	JACQUELYN M WARD	62	Female	White
17	64	HANS W BECHERER	64	Male	White
17	64	ANN M KOROLOGOS	58	Female	White
19	63	IVAN G SEIDENBERG	53	Male	White
19	63	JAMES F HARDYMON	65	Male	White
21	62	MARY JOHNSTON EVANS	70	Female	White
22	61	ALAN T DICKSON	68	Male	White
23	60	BRIAN H ROWE	69	Male	White
24	59	ROBERT P LUCIANO	66	Male	White
24	59	JOHN R STAFFORD	62	Male	White
24	59	JOHN G BREEN	66	Male	White
24	59	DONALD F MCHENRY	63	Male	Black
24	59	DONALD V FITES	66	Male	White
24	59	BOBBY R INMAN	69	Male	White
24	59	PAUL FULTON	65	Male	White
24	59	LEONARD S COLEMAN	50	Male	White
24	59	FRANKLIN A THOMAS	65	Male	Black
24	59	RAY J GROVES	64	Male	White
24	59	ROZANNE L RIDGWAY	65	Female	White

Year 2010

Rank	Degree	Director	Age	Gender	Ethnicity
1	53	SAM NUNN	72	Male	White
2	52	EDUARDO MENASCE	66	Male	White
3	51	FREDERIC V SALERNO	67	Male	White
3	51	ROBERT L RYAN	66	Male	Black
3	51	SHIRLEY A JACKSON	63	Female	Black
6	50	DENNIS H CHOOKASZIAN	66	Male	White
6	50	ARTHUR C MARTINEZ	70	Male	White
6	50	ENRIQUE HERNANDEZ JR	54	Male	Hispanic
9	48	RICHARD J SWIFT	65	Male	White
10	47	EDWARD J MOONEY	69	Male	White
10	47	THOMAS J USHER	67	Male	White
10	47	JAMES H HANCE JR.	66	Male	White
13	46	KENNETH M DUBERSTEIN	65	Male	White
13	46	BARRY DILLER	68	Male	White
13	46	RICHARD B MYERS	68	Male	White
13	46	WILLIAM H. GRAY III	69	Male	Black
17	45	STEVEN S REINEMUND	61	Male	White
17	45	MANUEL A FERNANDEZ	63	Male	Hispanic
19	44	J MICHAEL LOSH	64	Male	White
19	44	HANSEL E TOOKES II	63	Male	Black
19	44	LAURA D'ANDREA TYSON	63	Female	White
22	43	CHARLES R LEE	70	Male	White
22	43	JAMES H BLANCHARD	68	Male	White
22	43	ROBERT T BRADY	70	Male	White
22	43	R DAVID HOOVER	64	Male	White
22	43	KRISS CLONINGER III	62	Male	White
22	43	CHARLENE BARSHEFSKY	60	Female	White
22	43	JOHN C. MALONE	70	Male	White
22	43	VIRGIS W. COLBERT	71	Male	Black

TABLE 4

Data descriptions

Variable	Description
Years since 1997	The data year minus 1997
Age & *age*^{2}	ISS/RiskMetrics lists age as of the date of the proxy statement while Boardex lists age as of the data of data access. ISS/RiskMetrics often has conflicting age information for the same director. We converted each ISS/RiskMetrics age entry into age as of end of 2010, and then took the modal age if the ages listed for a director differed by less than two years for all pairs of entries. For those entries where there was no modal age or the difference between a pair of ages listed was greater than two years, we examined and corrected the entries manually, often using web searches to check birthdates and ages. Boardex data is as of late 2010. For cases where Boardex and corrected ISS/RiskMetrics ages differed by more than two years, we again corrected entries manually. Where Boardex and ISS/RiskMetrics ages differed but by no more than two years, Boardex-listed ages were used in the final dataset.
Maximum number of employees (logged)	For each director, we selected the largest company (by number of employees) whose board the director sat on during the focal year, and took the log of the number of employees. Preliminary analyses showed that using the largest company value instead of a median or average value has better predictive power. These analyses also showed that number of employees is a better predictor of additional board seats than company market value.
Maximum annual return	For each director, we selected the best performing company (by total annual market return) whose board the director sat on during the focal year. Preliminary analyses showed that using the largest company value instead of a median or average value has better predictive power. These analyses also showed that company market return is a better predictor of additional board seats than industry-standardized ROA or ROE.
Female director	Coded 1 for female directors. Data on gender came from both ISS/RiskMetrics and Boardex. First, in cases where ISS/RiskMetrics had conflicting listings of a director's gender, we examined and corrected ISS/RiskMetrics data manually, using web searches to confirm the gender of the director in question. Second, after we had created a lookup of director database identifiers between ISS/RiskMetrics and Boardex, we cross-checked gender between the two databases. Where there were discrepancies, we again manually corrected the entries.
Minority director	Coded 1 for non-white directors. Ethnicity data came from ISS/RiskMetrics. ISS/RiskMetrics often lists conflicting ethnicity information for the same director in different years or on different boards. If one ethnicity was listed

	more than 75% of the time for a director, we used that ethnicity for the director. For each director for whom there was no such dominant ethnicity identification, we examined and determined the ethnicity manually, often using web searches to confirm the ethnicity of the director in question.
Social elite director	Directors were coded as a member of the social elite if they were white, male and had an educational affiliation with Harvard, Yale, Princeton or Stanford listed in Boardex. Ethnicity, gender and elite education credentials have been shown to correspond with social elite membership (e.g., Useem and Karabel, 1986). The correlation between these demographic markers and elite membership is far from perfect, but is reasonable for directors during the period under study.
Corporate executive	Directors were identified as corporate executives in a given year if they were listed in ISS/RiskMetrics as being an employee director for a firm. Occasionally, directors may not be on the board of their employer, but sit only on an outside board or boards. These cases are not captured in the data.
Director degree centrality (logged)	Degree centrality measures for directors were calculated by flattening the bimodal data to create director-director networks for each year. Two directors are linked if they serve on the same board. We added 1 to the degree before logging.
Director eigenvector centrality	Eigenvector centrality measures for directors were calculated by flattening the bimodal data to create director-director networks for each year. Two directors are linked if they serve on the same board.
# of non-overlapping boards served on by peer directors (logged)	For the measure of peer director reach, we calculated the number of non-overlapping boards each director's peer directors sat on for each year, excluding any boards the focal director also sat on. We added 1 to this value before logging.
Number of board seats held by director	The number of board seats held by the director in the given year.
Joined board next year?	Coded 1 if a director joined a new S&P 1500 board in the following calendar year.

TABLE 5

Descriptive statistics and correlation coefficients

Variable	Mean	S.D.	1	2	3	4	5
1. Years since 1997	6.10	3.75					
2. Age	59.82	8.62	0.09				
3. Age^2/100	36.53	10.31	0.09	1.00			
4. Maximum number of employees (logged)	3.97	0.69	-0.01	0.03	0.02		
5. Maximum annual return	0.13	0.56	0.01	0.01	0.00	0.05	
6. Female director? (1 = yes)	0.11	0.31	0.05	-0.18	-0.18	0.07	0.00
7. Minority director? (1 = yes)	0.08	0.27	0.05	-0.11	-0.11	0.09	0.01
8. Social elite director? (1 = yes)	0.13	0.34	0.02	0.04	0.04	0.04	0.02
9. Corporate executive? (1 = yes)	0.23	0.42	-0.08	-0.26	-0.26	0.02	0.01
10. Director degree centrality (logged)	1.08	0.20	-0.07	0.08	0.06	0.49	0.14
11. Director eigenvector centrality × 100	0.23	1.05	-0.07	0.01	0.01	0.19	0.03
12. # of boards with peer directors (logged)	0.80	0.35	-0.11	0.03	0.02	0.60	0.10
13. Number of board seats held by director*	1.29	0.58	-0.03	0.05	0.04	0.38	0.18
14. Joined new board next year? (1 = yes)	0.06	0.24	-0.05	-0.07	-0.07	0.08	0.02

Variable	6	7	8	9	10	11	12	13
7. Minority director? (1 = yes)	0.08							
8. Social elite director? (1 = yes)	-0.17	-0.14						
9. Corporate executive? (1 = yes)	-0.16	-0.10	0.01					
10. Director degree centrality	0.05	0.08	0.05	0.03				
11. Director eigenvector centrality	0.01	0.03	0.01	0.02	0.33			
12. # of boards with peer directors (logged)	0.06	0.09	0.08	0.04	0.72	0.28		
13. Number of board seats held by director*	0.03	0.06	0.07	0.07	0.84	0.21	0.62	
14. Joined new board next year? (1 = yes)	0.02	0.03	0.02	0.03	0.09	0.04	0.12	0.09

NOTE—* Number of board seats coded as 3 for three or more boards.

TABLE 6

Logistic regression coefficients for log-odds of director gaining a new board appointment in next year

	DV = join board next year			DV = join survivor panel board
	Model 1	**Model 2**	**Model 3**	**Model 4**
Years since 1997	-0.190	0.188	0.167	-1.141**
	(-0.92)	(1.01)	(0.83)	(-2.94)
Age	0.341***	0.428***	0.405***	0.466***
	(7.37)	(9.95)	(8.79)	(5.49)
$Age^2/100$	-0.328***	-0.396***	-0.376***	-0.462***
	(-8.15)	(-10.62)	(-9.39)	(-6.14)
Maximum number of employees (logged)	0.112*	0.683***	0.594***	-0.027
	(2.01)	(16.73)	(13.54)	(-0.31)
Maximum annual return	0.069	0.187***	0.171***	0.035
	(1.30)	(3.97)	(3.35)	(0.39)
Female director	-0.024		0.075	0.140
	(-0.26)		(0.81)	(1.05)
Minority director	0.382***		0.500***	0.645***
	(3.86)		(5.05)	(4.90)
Social elite director	0.284***		0.412***	0.128
	(4.01)		(5.84)	(1.16)
Corporate executive	-0.177**		-0.071	0.156
	(-2.75)		(-1.11)	(1.63)
Director degree centrality (logged)	-1.470***			-1.175*
	(-5.09)			(-2.54)
Director eigenvector centrality	0.281			-3.870
	(0.12)			(-0.93)
# of boards served by peer directors (logged)	1.466***			2.217***
	(11.67)			(10.59)
Number of board seats held by director (n=2)	0.586***			0.368*
	(6.16)			(2.46)
Number of board seats held by director (n=3 or more)	0.765***			0.468*
	(5.15)			(2.02)
(Years since 1997) x				
Age	0.005	-0.004	-0.002	0.035**
	(0.77)	(-0.60)	(-0.22)	(2.58)
$Age^2/100$	-0.005	0.003	0.000	-0.029*
	(-0.75)	(0.48)	(0.07)	(-2.45)
Maximum number of employees (logged)	0.006	-0.030***	-0.037***	0.036**
	(0.82)	(-5.29)	(-5.90)	(2.92)
Maximum annual return	-0.002	-0.013*	-0.013*	-0.004

	(-0.28)	(-2.25)	(-2.11)	(-0.34)
Female director	0.012		0.001	-0.008
	(0.94)		(0.07)	(-0.44)
Minority director	-0.022		-0.034*	-0.035
	(-1.63)		(-2.54)	(-1.87)
Social elite director	-0.013		-0.023*	-0.009
	(-1.24)		(-2.23)	(-0.55)
Corporate executive	0.021*		0.010	0.026
	(2.16)		(1.03)	(1.83)
Director degree centrality (logged)	0.012			0.043
	(0.25)			(0.58)
Director eigenvector centrality	-0.383			-0.529
	(-0.86)			(-0.65)
# of boards served by peer directors (logged)	-0.049*			-0.075*
	(-2.54)			(-2.36)
Number of board seats held by director (n=2)	-0.048**			-0.042
	(-3.23)			(-1.80)
Number of board seats held by director (n=3 or more)	-0.097***			-0.107**
	(-4.02)			(-2.83)

NOTE—Year coefficients not shown.

* p<0.05, ** p<0.01, *** p<0.001. All tests two-tailed.