



The small world of the American corporate elite, 1982–2001

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Abstract

This paper examines the degree of stability in the structure of the corporate elite network in the US during the 1980s and 1990s. Several studies have documented that board-to-board ties serve as a mechanism for the diffusion of corporate practices, strategies, and structures; thus, the overall structure of the network can shape the nature and rate of aggregate corporate change. But upheavals in the nature of corporate governance and nearly complete turnover in the firms and directors at the core of the network since 1980 prompt a reassessment of the network's topography. We find that the aggregate connectivity of the network is remarkably stable and appears to be an intrinsic property of the interlock network, resilient to major changes in corporate governance. After a brief review of elite studies in the US, we take advantage of the recent advances in the theoretical and methodological tools for analyzing network structures to examine the network properties of the directors and companies in 1982, 1990, and 1999. We use concepts from small-world analysis to explain our finding that the structure of the corporate elite is resilient to macro and micro changes affecting corporate governance.

Key words • business elites • complex systems • corporate governance • networks

The interlock network created by overlapping board memberships has proven to be a potent medium for the spread of corporate practices and structures, from how acquisitive a firm is (Haunschild, 1993) to how its board responds to takeover threats (Davis and Greve, 1997) to whether it creates an investor relations office (Rao and Sivakumar, 1999) to what stock market it lists on (Rao et al., 2000). A practice such as adopting a poison pill, or changing a firm's portfolio of industries, appears to spread through shared directors like a virus, cumulating in substantial changes in the character of the largest corporations. Indeed, 'If we want a biological metaphor for cultural change,' wrote Gould (1997), 'we should probably invoke infection rather than evolution.' The point-to-point contagion process among boards is straightforward: boards meet frequently (the board of J.P. Morgan Chase met ten times in 2001, for instance), and directors

bring the knowledge and insights gained on one board to bear on questions faced by their other boards. The architecture of social networks is important because it shapes the dynamics of contagion and information flow (Coleman, 1964: 495–514): networks in which nodes are separated by short paths are more conducive to the rapid spread of diseases and innovations than Balkanized networks. Moreover, if the structure of the interlock network affects information flow across organizations, changes in the structure of the network should have important consequences for the strategies adopted by organizations.

Yet while analysts have documented the circumstances under which dyadic ties are formed (e.g. Kono et al., 1998) and regularities in who is most central (Mintz and Schwartz, 1985), there has been little work on the global structure of the network over time. Mizruchi (1982) traced the early history of the US interlock network among 167 firms at seven points from 1904 to 1974, finding virtually all nodes to be reachable within four steps and banks to be perennially central. Using a larger sample of 797 firms in the 1969 and 1970 *Fortune* 800 lists, Levine (1977) showed that each of the 724 corporations forming the largest connected component could reach every other corporation in less than five steps. But we know little about how things have changed since the mid-1970s; moreover, the methodological tools for studying network structures have grown much more sophisticated in recent times (see Barabasi, 2002 for an interdisciplinary introduction).

Our study of interlock network structure over the period from 1982 to 2001 is timely for two reasons. First, changes in corporate governance and organizational structure since 1980 may have driven important changes in the interlock network. Mergers and acquisitions absorbed one-third of the 1980 *Fortune* 500 by the end of that decade (Useem, 1996). Commercial banks, the traditional center of the interlock network, substantially declined in economic significance and centrality during the 1980s and 1990s (Davis and Mizruchi, 1999). Institutional investor activists have promulgated best practices for boards and their composition, which could lead to the appointment of more experienced outsiders (creating more interlocks). At the same time, boards have received far more scrutiny and demand a greater time commitment than in the past, perhaps reducing directors' willingness to serve on multiple boards. Alongside these changes are the increasing internationalization of business and enhanced ease of travel and communication. The net result of all these transformations for the overall structure of the interlock network has yet to be determined. Second, the theoretical and methodological tools for analyzing network structures greatly improved during the late 1990s as complexity theorists turned their attention to social networks. Most important for our purposes, recent attention to the small-world phenomenon (the high probability that any two people are connected by short paths of acquaintances) has spurred the creation of new tools for analyzing overall network structures (e.g. Watts, 1999a, 1999b).

Our goal in this paper is to analyze the connective topography of the director and corporate board networks that connect the several hundred largest US

corporations through interlocks. Using data spanning two decades, we ask: 'How has the global network structure of US corporations changed as a response to political, economic, and social changes in the past 20 years?' We contrast two types of accounts, one following from the sociology of elites and focusing on the central role of institutions such as banks in sustaining connections among elites, and a second following from recent research on network topography in complex systems that emphasizes the relatively random nature of ties. Comparing cross-sections of several thousand directors serving on the boards of the several hundred largest US corporations in 1982, 1990, and 1999, we find that: first, the corporate elite is a small world – the average distance between directors and between firms is very short; and second, this property is highly resilient over time and evidently does not require any design or any particular type of firms (such as banks) – rather, it is an endemic property of social and other networks. We conclude with some implications for theory about social networks and the theory of elites.

Interlocks and corporate strategy

Shared directors on corporate boards have been a constant feature of American corporate capitalism since the turn of the 20th century (Mizruchi, 1982). There have been several explanations of their prevalence: firms might seek directors that are executives of important competitors, buyers or suppliers (including banks) in order to co-opt them (Pfeffer and Salancik, 1978); banks might force firms to appoint bankers to their boards as a condition for access to capital (Brandeis, 1914); CEOs might seek to appoint social acquaintances who are expected to be compliant, based on their prior board service (Zajac and Westphal, 1996), while boards prefer seasoned directors (ideally directors whom they have personally seen in action) over novices. Co-optation and bank control have clear relevance for corporate strategy, while social and career reasons for board interlocks are more problematic. But the weight of the evidence suggests that co-optation and bank control are responsible for very few board ties in recent years. Board ties among competitors have been illegal in the US since the Clayton Act of 1914 and are easily policed; prior findings of prevalent intra-industry board ties are attributable to highly aggregated data that, properly analyzed, show no such ties (Zajac, 1988). While nearly all large firms shared directors with other large firms, with nine ties being the average, fewer than 5% of large firms in the mid-1990s had any executives of firms in major buyer or supplier industries on their boards, and roughly one in 12 had a bank executive on the board (Davis, 1996). Chronic bank board centrality results from their large size and their predilection for recruiting well-connected CEOs, which serves the banks' strategies but may have little relevance to the CEO's own firm (Mintz and Schwartz, 1985). In short, the evidence suggests that directors are recruited (and accept board positions) for reasons other than interorganizational

strategies of co-optation or control (Zajac, 1988). The motivations of the directors themselves for serving on multiple boards are more straightforward: executives gain insights from seeing how things are done at other companies and feel an obligation to serve when colleagues ask (Lorsch and MacIver, 1989); professional service providers and non-profit executives gain access to decision-makers through board service; and the compensation directors receive can be considerable for the expected workload.

Consider the career of Vernon Jordan, the individual with the most *Fortune* 1000 board memberships in 1999. In that year, he was a senior partner in Akin Gump Strauss in Washington and, by all reports, President Clinton's closest friend, confidant, and regular golf partner. He served on nine corporate boards (with 106 other directors) across a wide range of industries and on the boards of several non-profits. In almost every instance over his career, when Jordan joined a new board, he already knew at least one of the directors personally from his service on other boards. Such prior acquaintanceship enables directors to vouch for prospective recruits and their qualities as directors (Khurana, 2000). Moreover, a recruitment process that relies on personal familiarity allows a handful of directors to become and remain highly central in the director network, thereby creating many ties among companies. In 1971, Jordan took over as chief of the National Urban League, and the next year he joined the board of Celanese, a diversified manufacturer of fibers, chemicals, and plastics, at the behest of Chairman John W. Brooks. Brooks nominated Jordan to the board of Bankers Trust New York, where he was an outside director, and Jordan accepted (Jordan, 2001: 252–4). At that time, William M. Ellinghaus served as outside director on the boards of both Bankers Trust and JC Penney. In 1973, Jordan joined the JC Penney board. In 1974, Jordan joined the Xerox board, where he served with Archie R. McCardell (president of Xerox) and Howard L. Clark (American Express CEO). Both McCardell and Clark were also directors of American Express, whose board Jordan joined in 1977. By late 1979, John D. Macomber (now CEO of Celanese) and J. Paul Sticht (CEO of RJ Reynolds) served as directors of both Celanese and RJ Reynolds, while Juanita Kreps was on the boards of JC Penney and RJ Reynolds. In 1980, Jordan also joined the RJ Reynolds board. In January 1982, Jordan left the Urban League for Akin Gump Strauss Hauer & Feld. He was recruited by one of the partners, Robert S. Strauss, a fellow Xerox director. At that point, he was responsible for creating 21 ties among American Express, Bankers Trust, Celanese, Dow Jones, JC Penney, RJ Reynolds, and Xerox (six from American Express to the others; five more from Bankers Trust to those other than American Express, and so on). Although some of these 21 dyadic ties may have had some strategic content, it is clear from the case history that the recruiting boards were seeking Jordan for his qualities as a director, not as a representative of a particular firm. The large majority of board ties are created by outside directors such as Jordan, who are not executives of either of the companies they connect.

Yet while the origins of ties among firms and directors may be primarily social rather than strategic, dozens of studies since the late 1980s have documented the influence of shared directorships on choices about corporate strategy and structure, from the ideological tone of political activism to basic choices about organization design. Examining the contribution patterns of candidates in the 1980 US congressional elections, Clawson and Neustadt (1989) found that corporations that were more highly interlocked with the 250 largest corporations were more likely to be ideologically moderate. Mizruchi (1992) found that firms sharing directors with each other, or with a common financial institution, were prone to contribute to the same political candidates and to give similar testimony before Congressional hearings during the 1980s. Haunschild (1993) showed through the analysis of firms in four industries that firms tied to acquisitive firms through interlocks were more likely to make horizontal, vertical, and conglomerate acquisitions themselves during the 1980s. Firms with bankers on the board subsequently increased their bank borrowing relative to other forms of financing from the 1950s to the early 1980s (Mizruchi and Stearns, 1994), while corporate ties to philanthropic leaders in Minneapolis and St Paul influenced both the size and direction of corporate charitable contributions during the 1970s and 1980s (Galaskiewicz, 1997). (See Mizruchi, 1996, for a review of the evidence on the influence of interlocks in the mid-1990s.)

More recent interlock studies have uncovered subtle factors influencing the impact of interlock relationships. Firms listed on Nasdaq in 1986 were more likely to re-list on the New York Stock Exchange during the subsequent eight years when their directors served on the boards of prior defectors, but this effect was dampened by board ties to non-defecting Nasdaq firms and enhanced by board ties to NYSE firms (Rao et al., 2000). The acquisitions of interlock partners had less impact on a firm's acquisitiveness when alternative information sources were available (e.g. when the CEO was a member of the Business Roundtable, an association of CEOs, Haunschild and Beckman, 1998). Directors' ties to prior adopters had a greater impact on a firm's propensity to adopt a poison pill during the 1980s when the prior adopter was of a similar status and in a similar industry (Davis and Greve, 1997). And firms were more prone to forming alliances with interlock partners in the mid-1990s when CEOs and boards had a cooperative relationship rather than a controlling one, suggesting that trust on the board enhanced the prospects for other business ties (Gulati and Westphal, 1999).

The upshot of these studies is that board interlocks may be a fortuitous by-product of board preferences for recruiting experienced directors, with little strategic intent (with the possible exception of bank ties), yet the result is the creation of a network that is highly consequential for board decision-making. The prior experience of directors is part of the raw material of board decision-making, and it is thus unsurprising that a director who has been involved in acquisitions, alliances, adopting takeover defenses, creating an investor relations

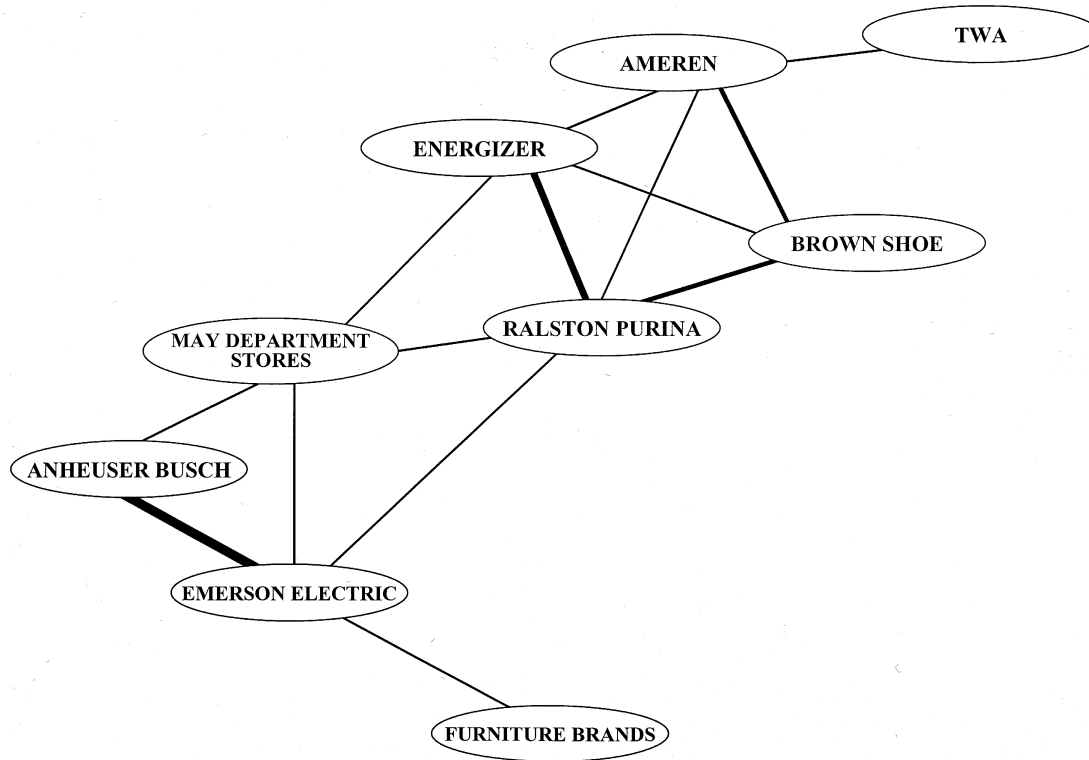


Figure 1 Board ties among St. Louis firms, 1999

Note: Line thickness represents the number of shared directors, which ranges from one (e.g. TWA and Ameren) to four (shared by Anheuser-Busch and Emerson Electric).

office, or any other board-level decision (including recruiting other directors) would bring that expertise to bear; indeed, it would be bizarre if things were otherwise. The situation is analogous to the famous study of social networks in MIT student housing by Festinger et al. (1950): the network of social relationships formed by students was overwhelmingly influenced by the random fact of the physical proximity of their apartments, yet once these ties were in place they influenced the students' attitudes and shaped the spread of rumors and other information. Similar forces are at work in the creation of board ties. Figure 1 shows the interlocks connecting firms headquartered in St Louis, Missouri in 1999. Geographic proximity is a frequent source of invitations to join boards, and thus firms in the same area often share directors among themselves (Friedland and Palmer, 1994). Among *Fortune* 1000 firms, 27% of ties were between companies headquartered in the same state, and multiple overlaps were common: 8% of connected companies shared two or more directors.

If interlocks are largely unplanned and without strategic intent, then what is the structure of the network created through interlocks? We consider two approaches to this question, one rooted in the sociology of the corporate elite and one in the study of small-world networks.

The sociology of the corporate elite

An undercurrent of concern about concentrated economic power has characterized American public opinion since the founding of the Republic. After Louis Brandeis published *Other Peoples' Money* in 1914, the network of interlocking boards of directors has been a prominent piece of evidence for oligarchy, although the presumed nature of the underlying power relations has changed over time. Brandeis argued that a 'money trust', centered on an inner circle composed of J.P. Morgan, National City Bank, and First National Bank of New York, acted as a financial oligarchy 'to control the business of the country and "divide the spoils"' (Brandeis, 1914: 27). Although the primary source of their power was control of credit, the bankers exercised their influence through an 'endless chain' of interlocking directorates that was 'the most potent instrument of the Money Trust' (p. 51). For example, J.P. Morgan directors held 72 directorships in 47 large corporations; National City directors served on 48 outside boards; and First National directors served on 49 other boards. All this was considered to be *prima facie* evidence of concentrated economic power. Lenin (1916) argued that the situation described by Brandeis, of increasingly concentrated finance capital controlled by a network of financial oligarchs, characterized not just the US but all advanced capitalist nations on the verge of the first world war. At the center of the typical industrial nation was a 'bank trust', tied to the commanding heights of the economy via shared directorships. In Berlin, for instance, six banks had directors on 344 industrial corporations, as the banks offered directorships to 'persons of title . . . ex-civil servants

. . . [and] experts in industrial affairs, such as manufacturers' (Lenin, 1916: 42–3).

Forty years later, C. Wright Mills published *The Power Elite*, his account of how the power structure of the US had changed in the years since Brandeis wrote. Mills described three structural trends creating the conditions for the emergence of a single national power elite: the increasing dominance of national corporations (as opposed to local or regional businesses), the expansion of a centralized federal government during the 1930s; and the creation of a large standing military coming out of the second world war. In contrast to Brandeis and Lenin, Mills argued 'Not "Wall Street financiers" or bankers, but large owners and executives in their self-financing corporations hold the keys to economic power' (p. 125). Those occupying the strategic command posts of the two or three hundred largest corporations 'often seem to know one another, seem quite naturally to work together, and share many organizations in common' (p. 294), and they take each other into account in their decision-making. A key insight of Mills's work is that the existence of this mutually acquainted power elite did not require a conspiracy among bankers or anyone else, but emerged out of the structural tendency toward concentration of powerful institutions at the national level. Through frequent contact on boards and elsewhere, the corporate rich come to share a worldview and standards of appropriate action for people in their position. 'The question is not: are these honorable men? The question is: what are their codes of honor? The answer to that question is that they are the codes of their circles, of those to whose opinions they defer' (p. 284). The elite thus becomes a compact social and psychological entity with common frames of reference guiding the decisions its members make.

With the advent of network analysis tools, Mills's intellectual heirs brought quantitative rigor to the study of the corporate elite network and its politics. For example, Useem (1984) combined expansive archival data on the directors of the largest British and American corporations with interviews of 129 directors and executives to provide a systematic assessment of the political role of the corporate elite in each country. 'Both America's and Britain's economies are increasingly dominated by a relatively small number of large companies linked through inclusive and diffusely structured networks' formed by shared directorships (p. 26). The configurations of the aggregate networks are not formed by conscious design but by the efforts of individual businesses seeking to recruit well-connected directors that enhance the firm's business scan. A relatively small number of these directors comes to serve on several disparate boards and thus to form a cosmopolitan inner circle of the corporate elite. Through their experiences on multiple boards, members of the inner circle are able to understand and represent the interests of big business in general rather than merely the parochial interests of particular companies or regions. Moreover, these individuals end up being disproportionately represented in policy organizations, in the governance of non-profits, and in government service. They become, in a sense, the political vanguard of the corporate community.

While Useem's argument highlighted the social psychology of individual directors, Mintz and Schwartz (1985) focused less on the directors themselves and more on the network of power relations among corporations. In an updated version of the Brandeis thesis, they found that during the 1960s commercial banks continued to form a stable core of the interlock network. But banks did not and could not use interlocks as a means to dominate business. Rather, most bank interlocks were created not by bank executives but by the top managers of large nonfinancial firms that were themselves heavily interlocked. Major banks had a greater need for business than other corporations because they had loan capital at risk across the economy, and thus they sought to recruit corporate diplomats from major companies to serve on their boards. Bank interlocks 'give lenders access to the expertise of corporate diplomats who are knowledgeable about the viability of investment in their home sectors. These leaders, in turn, obtain vital information about capital flows, influence lending decisions, and obtain a variety of personal rewards' (Mintz and Schwartz, 1985: 160). Bank boards thus served a crucial function in creating the inner circle described by Useem, although once again the outcome is fortuitous rather than planned. These works supported Mills's impression that a relatively small number of mutually acquainted people serving on the same boards of directors had the potential to form a unified and powerful class, influencing the actions of each other's affiliated corporations.

From this discussion, we can derive two main conjectures regarding the underpinnings of the elite network. On the one hand, several authors point to the central importance of banks in ordering – or even creating – the network. In this view, the fact that the corporate elite is well-connected results from the presence of particular institutions at the core, acting as a switchboard connecting disparate directors. In contrast, others emphasize the unplanned nature of the network: members of the corporate elite all seem to know one another simply as an unintended consequence of increasing economic concentration (Mills, 1956). Both conjectures suggest that the connectedness of the corporate elite is fragile. If banks lost their central position, or if corporate resources became less concentrated, or if boards substantially changed what they did and how they were composed, then we might expect an end to the connectivity described by Brandeis, Mills, and their heirs.

All three of these changes indeed occurred in the last two decades of the 20th century. First, commercial banks, the most central corporations in the interlock network from the turn of the century to the early 1980s, had lost their position of prominence by the mid-1990s. Davis and Mizruchi (1999) found that as commercial banks moved away from domestic corporate lending, which had previously encouraged them to staff their boards with executives of highly central corporations, they shrunk the size and centrality of their boards. Table 1 shows the ten most central public corporations in 1962, 1982, and 2001.¹ The stability of the list between 1962 and 1982 is striking: of the ten most central firms in 1962, seven were still on the list in 1982, and six of these were

commercial banks headquartered in New York, thus continuing a tendency that dated back to the beginning of the century (Mizruchi, 1982; Mintz and Schwartz, 1985). In contrast, by 2001 only one member from the 1982 list still remained: J.P. Morgan Chase (the entity remaining after the mergers of Manufacturers Hanover, Chemical, Chase Manhattan, and J.P. Morgan). This table also highlights the fact that the typical board at the center of the network became far less connected than it had been in previous years, even after the dramatic consolidation among money-center banks. J.P. Morgan Chase, for instance, shared directors with far fewer companies in 2001 than did any of its four predecessor institutions in 1982.

Aggregate corporate concentration also declined after 1980, in spite of two massive merger waves in the US. Whether one considers the proportion of the labor force employed or the assets controlled by the largest firms, the trend toward increasing corporate concentration was reversed in the 1980s and 1990s by widespread vertical dis-integration and the growth of technology companies. White (2001: 24) finds that 'Aggregate concentration in the U.S. – the fraction of private-sector economic activity accounted for by the largest X [sic] companies in the U.S. – declined during the 1980s, and declined further in the early 1990s and then increased by the late 1990s only to the levels of the late 1980s or early 1990s. Overall, aggregate concentration . . . has declined since the early 1980s, despite the substantial merger wave of the 1980s and the far greater merger wave of the 1990s.' Even as banks and other corporations merged, new firms were founded that more than offset the effect of these mergers. Indeed, the

Table 1 Ten most central firms in the interlock network, 1962–2001^a

| 1962 | 1982 | 2001 |
|-------------------------------|----------------------------|------------------------|
| J.P. Morgan [56] | AT&T [43] | J.P. Morgan Chase [28] |
| Chemical Bank [51] | J.P. Morgan [48] | Pfizer [26] |
| Chase Manhattan [50] | Chase Manhattan [43] | Sara Lee [28] |
| First National City Bank [47] | Citicorp [43] | Georgia Pacific [29] |
| Manufacturers Hanover [43] | IBM [38] | AMR [25] |
| Southern Pacific RR [38] | General Foods [31] | Dell Computer [19] |
| Ford Motor Co [34] | Chemical NY [38] | Verizon [28] |
| AT&T [31] | Bankers Trust [39] | 3M [25] |
| Chrysler [28] | Manufacturers Hanover [36] | Allstate [24] |
| Bankers Trust [41] | Mobil [28] | Bellsouth [22] |

^aRankings are based on Bonacich's (1972a, 1972b) eigenvector measure of point centrality, in which a node is more central if the nodes it is connected to are also central. Numbers in parentheses are counts of interlock ties. Interlock data for 1962 came from the MACNET project (see Mintz and Schwartz, 1985, for a description of the sample) and were graciously provided by Don Palmer. For comparability with subsequent years, non-public insurance companies were excluded. Data for 1982 were derived from board compositions listed in Standard & Poor's *Directory of Corporations, Executives, and Directors* (see text for description of sample). Board data for 2001 came from Global Access and the SEC's EDGAR system and cover the 930 members of the 2001 *Fortune* 1000 that filed with the SEC as of November 2001.

number of US corporations more than doubled from 1980 to 2000 (from 2.7 million to 5.5 million – White, 2001: 14).

Finally, boards of directors began to receive far more scrutiny from shareholders and the press during the 1980s and 1990s than they had previously, resulting in changed recruitment and compensation practices designed to increase directors' company-specific parochial interests (Useem, 1996). Activist institutional investors such as the California Public Employees Retirement System (CalPERS) and Teachers Insurance and Annuity Association College Retirement Equities Fund (TIAA-CREF) promulgated best practices and targeted egregious violators with campaigns to demand change, moving the entire field of corporate governance in the direction of shareholder capitalism. Compared with 1980, boards in 2000 were smaller, had fewer inside directors, fewer interlocks, and were far more likely to be compensated in company stock rather than cash (see Davis and Useem, 2002 for a review of recent changes). The time demands of board membership increased, as did the visibility and potential liability of particular directors. Veteran directors themselves reported that the job of a board member had changed significantly during this period, with greater demands on their time, greater pressures from forces outside the boardroom (particularly from institutional investors), and greater scrutiny from the media (Neiva, 1996). And the very act of serving on multiple boards had been implicated as a sign of neglect: how could anyone serve attentively on more than a small number of boards? To the extent that a directorship was once seen as a sinecure, it was no longer the case by the end of the 1990s. All these changes militated against casual membership on a large number of boards, which was previously hypothesized to promote cosmopolitan directors (Useem, 1984).

The implication of this perspective from the sociology of the corporate elite is clear: if the corporate elite requires well-connected banks, corporate concentration, or cosmopolitan boards, then the connectivity of the corporate elite may be a thing of the past. Moreover, most of what we know about the influence of interlocks on corporate strategy comes from research on the 1980s, when the network was demonstrably dense. If events have disrupted the connective topology of the network, then it is quite possible that acquisitions, Political Action Committee (PAC) contributions, or takeover defenses would no longer follow the same patterns of contagion today.

The small-world phenomenon

Mills's observation that members of the corporate elite 'often seem to know one another, seem quite naturally to work together, and share many organizations in common' (1956: 294) suggests another perspective on the corporate elite. Using field experiments to trace acquaintance chains, Stanley Milgram first analyzed the small-world problem (Milgram, 1967; Travers and Milgram, 1969): the average number of links between any two individuals selected randomly from

the population. This line of research popularized the notion that any two people could be connected through a chain of six links (on average): the famous 'six degrees of separation'. As Watts (1999b: 4) puts it:

The small-world phenomenon formalises the anecdotal notion that 'you are only ever "six degrees of separation" away from anyone else on the planet.' Almost everyone is familiar with the sensation of running into a complete stranger at a party or in some public arena and, after a short conversation, discovering that they know somebody unexpected in common. 'Well, it's a small world!' they exclaim. The small-world phenomenon is a generalised version of this experience. The claim being that even when two people do not have a friend in common, they are separated by only a short chain of intermediaries.

Milgram's finding that any two people could be connected by short chains was surprising because the architecture of the overall network seems to suggest that chains should be long, that the world is big, not small. For example, the population is very large (during the time of Milgram's experiments, the American population was about 200 million). And the network is very sparse. Each person node has relatively few acquaintances, compared with the size of the population itself. Moreover, most of one's acquaintances already know one other (i.e. local clustering). Under these conditions, intuition suggests that the average shortest path length (geodesic) between any two people selected randomly from the population should be long; yet the evidence shows that, on average, path lengths are short.

At the time of their original studies, not long after Mills wrote about the power elite, Milgram and his associates noted that '[t]he theoretical machinery needed to deal with social networks is still in its infancy' (Travers and Milgram, 1969: 441). Yet most of the subsequent work on the small-world problem continued to emphasize empirical studies (Korte and Milgram, 1970; Lundberg, 1975; Bochner et al., 1976; Stevenson and Gilly, 1991). With few exceptions (e.g. White, 1970; Hunter and Shotland, 1974), the theoretical machinery did not evolve until the recent work by Duncan Watts and his co-authors (Watts, 1999a, 1999b; Watts and Strogatz, 1998).

Watts (1999a, 1999b) analyzed the small-world problem in detail, providing a powerful model for studying the corporate elite network. He defined four preconditions for a small world. First, the network is very large, containing many nodes. Second, the network is sparse, that is, each node has few ties relative to the size of the population. Third, the network is decentralized: no single node is connected to most other nodes (i.e. the largest degree of centrality is small relative to population size). Fourth, the network is locally clustered. Local clustering occurs, for example, if networks are transitive: a friend of a friend is a friend. These preconditions should produce a big world, a network in which the average path length between any two people selected randomly from the population is quite long. (By contrast, when clustering approaches zero – that is, ties among nodes are selected at random – average path lengths approach being as

short as possible.) Yet Watts showed that the presence of a few linchpins whose personal (egocentric) networks have ‘random’ ties that cut across local clusters are enough to make the world small. These linchpins are short cuts in the overall network. One surprise from Watts’s work is that as few as 1% of all ties have to be short cuts to create the small-world effect. Even a single shortcut can have ‘a highly nonlinear impact’ on the average path length in the network (Watts, 1999a: 511). Just a few linchpins can turn a giant, sparse, locally clustered network into a small world.

Watts and his co-authors formalized their model as follows. A network consists of n nodes (e.g. boards) with a mean of k ties (interlocks) per node. Let L_{actual} equal the average shortest path length between nodes in the largest connected component.² This is the average of all geodesics (shortest path lengths) between nodes. Let L_{random} equal the average geodesic of the same network in which the ties between nodes are random (approximated by $\ln(n)/\ln(k)$). Let C_{actual} equal the average degree of local clustering in the largest connected component. Local clustering represents the extent to which alters in an egocentric network are connected to one another (i.e. to what extent do firms that share directors with a focal firm also share directors with each other).³ C_{actual} is the average local clustering of all egocentric networks. Finally, let C_{random} equal the average degree of local clustering in the randomized network (approximated by k/n). Then, a network is a ‘small world’ when $[C_{\text{actual}}/L_{\text{actual}}] * [L_{\text{random}}/C_{\text{random}}]$ (the ‘small-world quotient’) is substantially greater than one. The small-world quotient provides a null model to compare observed networks with a hypothetical random network. Networks with small-world properties range from relatively small (the brain of the worm *C. elegans*, in which nodes are neurons and ties are synapses and gap junctions – Watts and Strogatz, 1998); to the German corporate ownership network (in which nodes are firms and ties are common owners – Kogut and Walker, 2001); to the enormous (the World Wide Web, in which nodes are web pages and ties are hot-links – see Barabasi, 2002, for this and related work).

In contrast to the sociology of corporate elites, this perspective suggests that the connectivity of the corporate elite may not require banks, corporate concentration, or cosmopolitan boards: an elite connected by short paths may be endemic to networks *qua* networks, with no particular need for conscious design or institutions for facilitating cohesion. Moreover, this perspective suggests that such a network would be highly resilient to change, in contrast to the sociology of corporate elites. We next turn to data that will allow us to contrast the plausibility of these two accounts.

Method

Macro changes in economic concentration and the role of commercial banks in the economy, as well as micro changes in the attraction of service on multiple

boards, indicate that the global structure of the network may have shifted. To the extent that banks and multiple directors served as short cuts, knitting together the larger network, we can expect that the network among the corporate elite has grown sparser and less connected. But the small-world perspective implies that some aspects of network structure, such as connectivity, are relatively easy to achieve and hard to disperse. To investigate this question, we analyzed the boards of directors for three panels of the several hundred largest American firms in 1982, 1990, and 1999.

Sample and data

We define the American corporate elite to be the directors of the several hundred largest US corporations at a given time. This definition raises two issues: what count as the 'largest US corporations', and how do we deal with turnover? We follow popular and academic convention by defining largest as the *Fortune* 500 largest industrials and largest service firms. Our 1982 and 1990 sampling frame thus included publicly-traded members of the 500 largest industrials, 50 largest commercial banks, 25 diversified financials, 25 retailers, and 25 transportation companies. This included 648 corporations with 8623 directorships in 1982 and 592 corporations with 7109 directorships in 1990. The 1999 sample is different in some ways from the earlier years. Reflecting the blurring boundaries among manufacturing and service industries and firms, *Fortune* changed the definition of the *Fortune* 500 in 1995 to include firms in all industries, not just manufacturing. (Thus, the retailer Wal-Mart made the list that year at #4.) To maximize comparability over time, we therefore selected the largest 600 public firms that reported the compositions of their boards to the SEC from among the *Fortune* 1000 for 1999. This included firms ranked 1 through 625, a sample that covered firms in all the previously represented industry groups (industrial, banking, finance, retail, transportation). The network consisted of ties among this set of firms. Although other ways of bounding the network are possible (e.g. all publicly traded US firms, a number well in excess of 10,000), we believe sampling large firms best represents the population to which the sociology of the corporate elite is most applicable.

As one might expect, given the enormous changes in the US corporate economy during the 1980s and 1990s, the master samples do not consist of the same firms at each time point. Three demographic changes – mergers, divergent growth rates, and spinoffs – account for most of the difference. First, roughly one-third of the 1980 *Fortune* 500 had been acquired or merged by 1990, and the subsequent decade saw an even larger merger wave. Second, a large proportion of the *Fortune* 500 in 1999 consisted of firms that were small or non-existent in 1982, including high-tech giants such as Microsoft, Oracle, Cisco, and Dell; the retailers AutoNation and Costco; and health-care service providers such as Humana. Third, several firms were born large, as spinoffs of other major firms: AT&T spun off Lucent; Monsanto spun off Solutia; and Pepsico spun off

Tricon Global Restaurants. There was also a handful of firms that were large but not public before the 1999 sample. Our three sets of firms thus do not consist of a single panel followed over time, but rather the firms that fit the contemporaneous definition of largest US corporations in 1982, 1990, and 1999. For comparison, we also analyzed a sub-set of these three groups that consisted of a panel of 195 firms that survived the entire period (although not all of the 195 had board ties to the largest component in each year).

The turnover among directors during the 17 years of our sample period was of course even larger than the turnover among firms. Less than 5% of directorships were held by the same person in the same firm (or a successor) from 1982 to 1999, unsurprising given that the vast majority of directors were over 50 in 1982. These long-lived directorships created a very small number of long-lived interlock ties among firms, in which the same director served on the same two boards at the beginning and end of our sample period: roughly 1.3% of ties survived the entire sample period. The upshot of this discussion is that the phrase 'the American corporate elite' may connote more coherence than is warranted, at least during the period of our study. The identities of the firms and directors that compose the elite, and the particular ties that create the network among firms, are subject to substantial turnover over time.

Our data on the board compositions of sampled firms came from three sources. The 1982 data on boards of directors came from Standard & Poor's *Directory of Corporations, Executives, and Directors* for 1982, which compiled data on boards from proxy statements and other filings. The 1990 data on board compositions came from Compact Disclosure, a CD-ROM dataset produced by the SEC's primary contractor for distributing information from securities filings. The 1999 data came from Global Access (the Web-based successor to Compact Disclosure), supplemented by proxy statements filed electronically with the SEC via EDGAR (see <http://www.sec.gov/edgar.shtml>). Subsidiaries of foreign parents, private companies, agricultural and other cooperatives, and joint ventures that do not issue public securities are excluded from the samples as they do not file board information with the SEC.

We used extensive computerized and manual data cleaning procedures to ensure the quality of the data on boards and to make certain that we had accurately identified interlocks. This included reading each name, standardizing individual directors' designations across boards (e.g. Andrew Lewis, Jr and Andrew Lewis II), and disambiguating common names (e.g. if we had a John Smith listed as 45 years old and one listed as 60 years old).

Analyses

Overlapping groups such as boards of directors form a two-mode membership network in which one can conceive of directors as nodes connected by a tie of common board membership, or boards as nodes connected by a tie of one or more shared directors (Breiger, 1974). Thus, when we say that the corporate

elite is more or less well-connected, we may mean that large companies are well-connected (Mintz and Schwartz, 1985), or that individual directors are well-connected (e.g., Useem, 1984). Hence, upon collecting and cleaning board membership data, we created for each year two matrices: a director-by-director matrix and a company-by-company matrix. We refer to the first network as the director network and the second as the board network.

For the largest connected component of each network (that is, the sub-set of the network consisting of all mutually reachable nodes), we calculated several small-world measures. (Our most critical measure, distance, is only calculable within the connected component; isolated nodes have no ties to the network and their distance from other nodes is therefore undefined. Thus, all reported measures are for firms and directors in their respective largest component.) Our measure of k is the average degree, that is, the number of other nodes to which an actor is connected. For boards, this is the number of other boards with which one or more directors is shared; for directors, it is the number of other directors with whom one serves on the same board(s). In the director network, distance (L_{actual}) is measured by the shortest path (geodesic) between directors created through shared board memberships. If Smith and Jones serve on board A and Jones and Brown serve on board B, then the distance from Smith to Jones is one and from Smith to Brown is two. In the board network, distance is the shortest path between boards created by shared directors. Thus, if Jones serves on boards A and B and Brown serves on boards B and C, then the distance from A to B is one and from A to C is two. The clustering coefficient is the proportion of possible ties among one's alters that are realized. Note that this measure is undefined for nodes with only one alter; thus, the reported average is defined over nodes with two or more alters. Mean degree, mean geodesic, and mean clustering coefficient were computed in UCINET V for the largest connected component of each network.

Results

Table 2 shows the results of our small-world analyses for 1982, 1990, and 1999. The first panel shows the results for firms in the full sample, while the second panel includes only firms that appeared in all three years. The mean degree declined over time for boards (from 10 to 8.6) and directors (from 19 to 16), reflecting the modest decline in the size of boards over time and the substantial decline in number of ties of the most connected firms (see Table 1). The maximum degree observed among firms (not reported in the table) declined from 48 in 1982 to 41 in 1990, and then to 32 in 1999. The standard deviation in degree (a measure of centralization in the network – Wasserman and Faust, 1997: Chapter 5) also declined accordingly. But what is most striking is that the small-world statistics in the first panel are so close as to be nearly indistinguishable over time. The average geodesic for firms was 3.38, 3.46, and 3.46 at the

three time points, while the clustering coefficient was .24, .24, and .22. In each case there was a relatively high degree of clustering (as expected, given the tendency for directors to be selected based in part on geographic proximity) and a short average path length. All three count as 'small worlds' according to the small-world coefficient. Directors naturally had a much higher clustering coefficient because all directors on the same board by definition are tied to every other director on that board, but again the average geodesic is quite small, and the networks are clearly small worlds.

The second panel examines interlocks among only those firms that appeared in all three panels. Although the firms are the same, however, we would hesitate to refer to this as the same network over time, given the almost complete turnover in directors (and therefore ties) over our time period. What we find within this sub-set is a modest increase in degree among firms and a slight decline in average geodesics, but the network is still a small world in each period. Relative to the other firms appearing at the end of the sample period, of course, this set was both older and more established within the population of large firms, which may have increased their attractiveness to multiple directors and consequently reduced slightly their average distance.

Collectively, the results show that, in spite of major changes in the place of commercial banks in the interlock network, the average path length between nodes in the largest connected component is remarkably stable over time. And despite a major overhaul in corporate governance and the practices of corporate boards, the average path length in the director network was consistent over time. These structures are robust even in the face of large shifts in the identities of the key players and the characteristics of ties.

Table 2 Changes in the elite network, 1982–1999

| | N | N (component) | K (avg degree) | L (avg geodesic) | C | L (random) | C (random) | SW quotient |
|---|------|------------------|-------------------|---------------------|------|---------------|---------------|----------------|
| All 'large' firms | | | | | | | | |
| 1982 boards | 648 | 581 | 10.0 | 3.38 | 0.24 | 2.76 | 0.017 | 11.34 |
| 1990 boards | 591 | 524 | 8.8 | 3.46 | 0.24 | 2.88 | 0.017 | 11.87 |
| 1999 boards | 600 | 516 | 8.6 | 3.46 | 0.22 | 2.93 | 0.016 | 11.84 |
| 1982 directors | 6505 | 5853 | 19.0 | 4.27 | 0.88 | 2.94 | 0.003 | 186.82 |
| 1990 directors | 5393 | 4768 | 17.0 | 4.30 | 0.87 | 2.99 | 0.004 | 169.21 |
| 1999 directors | 5311 | 4538 | 16.0 | 4.33 | 0.87 | 3.06 | 0.003 | 183.03 |
| Single panel of firms at three points in time | | | | | | | | |
| 1982 boards | 195 | 177 | 6.8 | 3.15 | 0.24 | 2.70 | 0.039 | 5.33 |
| 1990 boards | 195 | 185 | 7.6 | 3.06 | 0.23 | 2.58 | 0.041 | 4.73 |
| 1999 boards | 195 | 186 | 7.2 | 2.98 | 0.20 | 2.64 | 0.039 | 4.55 |
| 1982 directors | 2366 | 2179 | 19.1 | 4.03 | 0.91 | 2.61 | 0.009 | 67.23 |
| 1990 directors | 2078 | 1976 | 17.4 | 3.98 | 0.89 | 2.65 | 0.009 | 67.26 |
| 1999 directors | 1916 | 1819 | 16.3 | 3.86 | 0.88 | 2.69 | 0.009 | 68.35 |

One possible explanation for this stability is that while firms in the network may come and go, a handful of linchpins remain constant, creating short cuts among whatever the important firms happen to be at a given time. The account of Mintz and Schwartz (1985) implies that banks recruit directors from among the ranks of executives in economically important industries, and that as some sectors decline (e.g. railroads) and others rise to take their place (e.g. telecommunications), banks would shift their board recruiting strategy to reflect this, and their boards would therefore retain their linchpin status over time. Conceptually, a linchpin is a node that creates short cuts; thus, a fair approximation of being a linchpin is 'betweenness' centrality (defined by the number of times a node is on the shortest path between all possible pairs of nodes in a network – see Wasserman and Faust, 1997). Table 3 lists in order the ten firms with the highest betweenness scores in 1982, 1990, and 1999. As one might expect, nine of the ten top linchpin firms in 1982 were commercial banks. Yet by 1990 the number had dropped to three, where it still was in 1999. By the end of our sample period, the top ten included firms in telecommunications (Bell Atlantic), transportation (CSX), branded foods and clothing (Sara Lee), military hardware (TRW), diversified industrial products (Textron), financial services (American Express), and car and truck engines (Cummins). Arguably, these firms were linchpins because their boards were staffed, fortuitously, with one or more linchpin directors.

While the role of directors as individuals is implicitly taken into account in interlock studies, no study, to our knowledge, has specifically distinguished between director and board networks. There may be both theoretical and practical ramifications of this neglect. Mills hinted at the duality of individuals and their memberships in collectivities, arguing that those who moved among corporate, military, and governmental institutions were particularly critical for knitting together the power elite: 'By their very careers and activities, they lace the three types of milieux together. They are, accordingly, the core members of

Table 3 Top ten linchpin boards

| Rank | 1982 | 1990 | 1999 |
|------|---------------------------|-------------------------|----------------------|
| 1 | Mellon Bank* | Allied Signal | Bell Atlantic |
| 2 | J P Morgan Co* | Textron | Bank Of America* |
| 3 | First Interstate Bancorp* | AT&T | CSX |
| 4 | Bank America* | American Express Co | Chase Manhattan* |
| 5 | Continental Illinois* | Westinghouse Electric | Sara Lee |
| 6 | Nabisco Brands | Chrysler | TRW |
| 7 | Bankers Trust New York * | International Paper Co. | Textron |
| 8 | Manufacturers Hanover* | Bankers Trust New York* | American Express Co. |
| 9 | Chase Manhattan* | First Chicago* | Cummins Engine Co. |
| 10 | Citicorp* | Citicorp* | Bank One* |

Note: Boards are ranked by 'betweenness' centrality.

* Starred names are commercial banks.

the power elite . . . it is they who are most active in organizing the several top milieux into a structure of power and maintaining it' (Mills, 1956: 289). More recently, when Palmer and Barber (2001) examined the role of individual and organizational action in the adoption of a practice, they noted the tendency of organizational theory to treat managers and directors as instruments for achieving organizational ambitions. The converse is also possible, however, and the structure of the corporate network may be the result of self-interested directors occupying board seats to fulfill individual ambitions (Zajac, 1988).

Who, then, are the linchpin directors? Table 4 lists the top ten in each time period, again using the betweenness measure. Directors that were active (i.e. not retired) executives of one of the firms in the network are starred. Only one director, Vernon Jordan, is among the top ten in all three periods. None of the others in the early period were still on any boards in 1999, which is largely attributable to the fact that nearly all were either at or past retirement age in 1982. The 1990 list also included only four directors younger than age 65 (Jordan; Stafford, who was commander of Apollo 10; Brimmer, an economist; and Morrow, chairman of Amoco). The 1999 list included the CEOs of plastics firm MA Hanna (Walker) and auto suppliers Eaton (Hardis) and Lear (Way); the former CEOs of Union Pacific (Lewis) and Goodrich (Ong); a former US senator (Mitchell); two attorneys (Arnelle and Jordan); a consultant (Malone), and a physician (Royal). Demographically, the linchpins are unlike other directors in that four of the top ten are African-American (compared with perhaps 2% of all directors in this sample).

Discussion

Our findings suggest that neither particular types of firms (such as banks) nor particular directors (CEOs or bankers) are essential for maintaining the

Table 4 Top ten linchpin directors

| Rank | 1982 | 1990 | 1999 |
|------|-----------------------|-----------------------|-------------------|
| 1 | Richard T Baker | Rawleigh Warner, Jr | Jesse H Arnelle |
| 2 | Gene K Beare | William M Ellinghaus | Martin D Walker* |
| 3 | Samuel A Casey | Juanita M Kreps | Vernon Jordan, Jr |
| 4 | Kenneth C Foster | Vernon Jordan, Jr | Claudine B Malone |
| 5 | C Jackson Grayson, Jr | Thomas P Stafford | Drew Lewis |
| 6 | J Paul Lyet* | Andrew F Brimmer | George J Mitchell |
| 7 | Vernon Jordan, Jr | C Jackson Grayson, Jr | Stephen R Hardis* |
| 8 | David C Scott* | Richard M Morrow* | Kenneth L Way* |
| 9 | Richard A Lenon* | Norma T Pace | Frank S Royal |
| 10 | W H Krome George* | Richard A Lenon | John D Ong |

Note: Directors are ranked by 'betweenness' centrality.

* Starred names are executives in sample firms at the time of ranking.

small-world property of the corporate elite network. Indeed, if we pulled out the top ten linchpin firms, the impact on the mean geodesic was relatively modest: it increased from 3.38 to 3.48 in 1982 and from 3.46 to 3.6 in 1999. It is worth emphasizing again that the short social distances among directors and boards do not require planning by some central authority. Quite the opposite is true: it is the existence of a relatively small proportion of random ties that makes the world small, i.e. connections that are random with respect to the process generating clustering.⁴ For instance, even if the large majority of ties among St Louis companies were local, as suggested by Figure 1, a few ties outside the region (say, from Anheuser Busch in St Louis to J.P. Morgan in New York) can act as short cuts, dramatically shrinking the average distance between St Louis companies and other nodes, 'The introduction of a single shortcut is likely to connect vertices that were previously widely separated. This shortcut then contracts the distance not only between the pair of vertices, but also between their immediate neighborhoods, their neighborhoods' neighborhoods, and so on. Thus, one single shortcut can potentially have a highly "nonlinear impact" on the average path length' (Watts, 1999a: 511). Moreover, if the tie were not from Anheuser Busch to J.P. Morgan, then a tie from Emerson Electric to Sara Lee in Chicago would have a similar impact. No particular node or tie is critical for maintaining the small world of the corporate elite, in the same sense that no particular router is essential to the operations of the internet.

It is useful to have a concrete example of what this small world property implies. Consider Chase Manhattan Bank's distribution of degrees of separation in Table 5. The table indicates that 97% of the largest firms in the US interlock network are within four degrees of Chase, and only one firm is as far away as seven degrees. According to Chase's 2000 proxy statement, 'Chase is governed by a Board of Directors and various committees of the Board which meet throughout the year. Directors discharge their responsibilities throughout the year at Board and committee meetings, and also through considerable telephone contact and other communications with the Chairman and others regarding matters of concern and interest to Chase. During 1999, there were 13 meetings

Table 5 Chase Manhattan Bank's Distribution of 'Degrees of Separation' in 1999

| Number of 'Degrees' | Frequency | % | Cumulative % |
|---------------------|-----------|-------|--------------|
| 0 | 1 | 0.1 | 0.1 |
| 1 | 34 | 4.2 | 4.3 |
| 2 | 244 | 0.1 | 34.4 |
| 3 | 389 | 48.0 | 82.4 |
| 4 | 122 | 15.0 | 97.4 |
| 5 | 17 | 2.1 | 99.5 |
| 6 | 3 | 0.4 | 99.9 |
| 7 | 1 | 0.1 | 100.0 |
| Total | 811 | 100.0 | |

of the Board.' Discount the degree of continuous communication implied by the proxy and assume that the directors meet monthly. If other boards likewise met monthly, then a corporate governance reform (or a rumor) discussed at a Chase board meeting in January could make its way via face-to-face contact to the boards of 97% of the largest corporations by May. Imagine a virus spread by handshake: in under half a year, such a disease could infect almost the entire corporate elite. As Watts (1999a: 523) notes, 'shorter characteristic path length [i.e. average geodesics] implies faster spreading of the disease'. Monthly meetings and a small-world network provide an ideal medium for the rapid spread of practices, strategies, structures, rumors, diseases, or anything else spread by face-to-face contact. It is this small-world property that can turn a geographically dispersed population of nearly 5000 directors into the compact social and psychological entity described by Mills. It also renders the population especially susceptible to outbreaks of managerial contagion, just as international travel has much enhanced the career prospects of flu viruses and the internet has greatly facilitated the spread of computer viruses.

Conclusion

The level of connectivity among the several hundred largest US corporations and their several thousand directors is remarkably consistent over time. This is surprising for several reasons. The 1980s and 1990s witnessed an upheaval in corporate governance and in the commercial banking industry, changing the staffing and practices of boards of directors and the identities of the most central firms. Mergers, growth, and ordinary demographic processes meant that the population of the largest firms and their directors were rather different at the end of the 1990s from the beginning of the 1980s. Less than one-third of the largest firms in 1999 were among the largest in 1982, and less than 5% of the directorships were constant across this time. Moreover, less than 2% of the ties among firms that were created by particular shared directors in 1999 could be traced back to the beginning of the 1980s. Yet in spite of the rampant turnover among boards and directors, and nearly complete turnover in ties, distances among the corporate elite remained virtually constant. Mills's observation that members of the corporate elite 'often seem to know one another . . . and share many organizations in common' turns out to be strikingly robust against even nearly complete changes in who the members and organizations are. We argue that this is most parsimoniously attributed to the small-world property of networks.

Outside observers from Brandeis and Lenin to Mills and his intellectual heirs have taken the endless chain of the corporate interlock network as evidence of economic oligarchy in the US. As our results show, corporate America is overseen by a network of individuals who to a great extent know each other or have acquaintances in common. On average, any two of the 4538 directors of the 516

largest US firms in the largest component in 1999 could be connected by 4.3 links, and any two of the boards are 3.5 degrees distant. Mills (1956) saw a small set of private schools, such as Groton and Exeter, providing an essential agency for socializing and organizing members of the upper class, and Mintz and Schwartz (1985) argued for a special role for money-center banks in knitting together corporate directors. But our results suggest that the small-world organization of the corporate elite is an emergent property of networks *qua* networks and requires no coordinating mechanism whatsoever, for the same reasons that brains, power grids, and the World Wide Web are also small worlds. It appears that nearly any collection of firms that share directors with a few random ties will end up appearing like a well-connected elite, without intentional design. Such design is, of course, possible; our results simply indicate that it is not necessary.

Barabasi's (2002) recent model of network evolution suggests that networks following a pair of simple rules – that the network grows over time (nodes are added), and that the propensity of new nodes to form ties with existing nodes is proportional to the old nodes' existing ties – will generate such features. If we assume (plausibly, based on prior research) that boards preferentially recruit directors with experience on well-connected boards, and that directors have reason to prefer well-connected boards to peripheral ones, then sufficient conditions are in place for generating a small world. Put another way, it is difficult to imagine a public policy that would eliminate the small-world property of the interlock network, short of banning shared directorships outright.

The corporate elite network is distinguished by the fact that its constituents (board members) have face-to-face contact several times per year and in some cases as often as monthly. This is in stark contrast to other social networks studied as small worlds. Analyses of film actors shows that any two of the 225,226 actors in the Internet Movie Database could be linked on average by 3.65 steps, where steps are defined by 'appearing in the same movie' (Watts and Strogatz, 1998). But many of the nodes are long dead, and their linkage came from a film shot decades ago – hardly a strong tie. Indeed, the original studies of the small-world phenomenon by Milgram contemplated a world in which many of the ties that knit together the social world were weak or dormant (say, among long-ago friends from college). But board ties entail active, frequent, face-to-face social interactions. One could hardly design a setting more conducive to contagion than this: it is literally true that an especially contagious airborne virus would spread quite rapidly through the corporate elite. We cannot argue that monthly meetings are sufficient to forge a common worldview among directors, or to generate substantial homogeneity in corporate practices, but it is highly conducive to the spread of information and ideas, strategies and structures, as our review of prior work suggests. In this sense, finding a short diameter of the network that is resilient to large changes in corporate governance is significant.

Theory on strategic conformity has often focused on population-level processes such as selection or imitation-based isomorphism. Recent empirical work has elaborated a more nuanced view of the strategic decision process in firms and linked it to social influences. Baum et al. (2000), for instance, find that nursing-home chains learn vicariously about appropriate locations for acquisitions by observing what their competitors have done, echoing Haveman's (1993) studies of the changing strategies of California thrift institutions. The view implied is not that firms are selected by environmental forces for conformity, or that decision-makers mindlessly emulate dominant tactics in their industry; rather, boundedly rational decision-makers in firms respond to uncertainty by assessing what relevant local peers have done. Information can come through observation at a distance (e.g. seeing what competitors have done) or more directly (e.g. via shared directors). Board ties have the advantage of providing thick, hands-on, high-level intelligence, which accounts for the pervasive influence of board ties on issues of corporate governance. To the extent that decision-makers in firms look to peers to inform their choices, our results suggest that there will inevitably be overlap in peer groups: firms will be looking to the same set of alters to reduce their uncertainty. By understanding the resilient structure and dynamics of the interlock network, we can anticipate both local practice clusters (say, a St Louis approach to corporate governance) and aggregate mechanisms for producing conformity, without the need for any central planning authority. Thus, just as ants following localized information produce a well-articulated division of labor and social structure in ant colonies without a need for central direction, we can anticipate enduring patterns in corporate governance to emerge out of interactions structured by the interlock network.

Notes

We thank Duncan Warts for his generous assistance with small world analysis. Mark Mizruchi and seminar participants at the University of Michigan and the University of Toronto Rotman School provided helpful comments on previous versions.

- 1 Centrality is here measured using Bonacich's eigenvector measure, calculated using UCINET V. For comparability, only publicly-traded corporations are included; thus, the insurance companies prominent in Mintz and Schwartz's (1985) tables are excluded.
- 2 The largest connected component is the largest sub-set of nodes that are connected to each other. In our study, as our goal is to examine the characteristics and changes of a single network structure over time, we exclude isolated companies (those that are not connected to other corporations via board interlocks) and isolated networks (smaller networks that are not connected to the largest component).
- 3 In network terms, local clustering is the ego network density, and C_{actual} is the average of the density of all ego networks.
- 4 Newman et al. (2001) find that it is possible to generate the basic small world character of the *Fortune* 1000 interlock network by assuming a process that is literally random.

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