CEO Network Centrality and Merger Performance

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Abstract

We study the effects on M&A outcomes of CEO network centrality, which measures the extent and strength of a CEO's personal connections. High network centrality can allow CEOs to efficiently gather and control private information, facilitating value-creating acquisition decisions. We show, however, that M&A deals initiated by high-centrality CEOs, in addition to being more frequent, carry greater value losses to both the acquirer and the combined entity than deals initiated by low-centrality CEOs. We also document that high-centrality CEOs are capable of avoiding the discipline of the markets for corporate control and the executive labor market, and that the mitigating effect of internal governance on CEO actions is limited. Our evidence suggests that corporate decisions can be influenced by a CEO's position in the social hierarchy, with high-centrality CEOs using their power and influence to increase entrenchment and reap private benefits.

JEL classifications: G34, D85
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Abstract

We study the effects on M&A outcomes of CEO network centrality, which measures the extent and strength of a CEO's personal connections. High network centrality can allow CEOs to efficiently gather and control private information, facilitating value-creating acquisition decisions. We show, however, that M&A deals initiated by high-centrality CEOs, in addition to being more frequent, carry greater value losses to both the acquirer and the combined entity than deals initiated by low-centrality CEOs. We also document that high-centrality CEOs are capable of avoiding the discipline of the markets for corporate control and the executive labor market, and that the mitigating effect of internal governance on CEO actions is limited. Our evidence suggests that corporate decisions can be influenced by a CEO's position in the social hierarchy, with high-centrality CEOs using their power and influence to increase entrenchment and reap private benefits.

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1. Introduction

Recent advances in finance research have documented significant financial consequences when there are personal connections among firm executives, board members, bankers, and other financial market participants. Formed through common education, work experience, or interconnecting board seats, these connections can facilitate certain value-creating financial transactions while altering behavior and even destroying value in other settings.

Personal connections provide an effective channel for information exchange, allowing transmission of knowledge, ideas, or private information. In the context of bank loan negotiations, Engelberg et al. (2012) show that informal ties between a borrower and a lender result in larger loan amounts, lower interest rates, and less restrictive covenants. Cohen et al. (2010) find that sell-side analysts perform better if they share an alma mater with key executives of covered firms. Larcker et al. (2013) show that firms with central boards earn superior risk-adjusted stock returns that can be attributed to greater information access.

On the other hand, pre-existing personal ties appear to interfere with effective corporate governance and director monitoring by weakening independent judgment and subverting rational decision-making, resulting in suboptimal behavior and inferior economic outcomes. Fracassi and Tate (2012) show that CEO–director connections weaken board monitoring and destroy corporate value. Hwang and Kim (2009) find that firms with board members who are personally connected to the CEO have higher CEO compensation, lower pay-performance sensitivity, and lower turnover-performance sensitivity. Chidambaran et al. (2012) show that the likelihood of fraud is higher in the presence of CEO–director connections that are formed outside the professional sphere.[1]

What remains puzzling is the order of the social hierarchy, or the direction of command and control. Social connections are mutual: person A knowing person B is equivalent to person B knowing person A.

[1] Information transfer and monitoring impediment effects of social networks can jointly affect firm activities. For example, Duchin and Sosyura (2013) document both the positive and negative impacts of increased capital spending managers with social ties to the CEO.

But a willingness to share valuable, private information in order to benefit others, thereby risking breaking the law and potentially getting caught, fined, or sanctioned, is difficult to explain. Why do directors display loyalty to a CEO, even to the point of abandoning their own judgment and becoming submissive to the CEO's demands, but not the other way around? Focusing on pairwise connections cannot give satisfactory answers.

In this paper, we assert that positions in a social network are unequal and that there exists a hierarchical order in social relations. Individuals residing higher in a hierarchy possess more information, greater resources, and thus more power in exercising their decision rights. CEOs with such advantageous positions can use their social status to influence corporate policies and dictate board decisions. On the other hand, these individuals might also come to believe in their own infallibility, which can lead to value destruction (e.g., Malmendier and Tate, 2008, 2009; Fogel, Ma, and Morck, 2014).

Following a long history of studies in graph theory (e.g., Proctor and Loomis, 1951; Sabidussi, 1966; Freeman, 1977; Bonacich, 1972), we argue that network centrality, which is a collection of measures that describe an individual's position in a social network, can capture a CEO's ability to access information, command others, and influence economic decision-making (Padgett and Ansell, 1993; Hanneman and Riddle, 2005; Banerjee et al., 2012; Jackson, 2010). We calculate CEO network centrality measures and evaluate the effect of CEO network centrality on merger and acquisition outcomes. Mergers and acquisitions provide fertile ground to test the impact of CEO network centrality because success, particularly on the bidder side, depends not only on a CEO's knowledge of the target and its future prospects but also on the CEO's ability to convince the board and close the deal. Well-networked CEOs could be in a better position to obtain low-cost private information (Burt, 1997; Nahapiet and Ghoshal, 1998) from their network contacts to aid in bidding and negotiation. On the other hand, these CEOs might use the power achieved through their network influence (Mizruchi and Potts, 1998) to secure board support and push for deal completion, regardless of the impact on shareholders (Bebchuk et al., 2011;

Masulis et al., 2007).[2]

Our paper is particularly timely because previous studies of social connections in M&A reach different conclusions. Cai and Sevilir (2012) find lower takeover premiums when the acquirer and the target share a common director, and greater value creation for the acquirer when one acquirer director and one target director serve on the same third board. On the other hand, Ishii and Xuan (2014) argue that acquirer–target social ties lead to poorer decision-making and value destruction: connected deals are more likely to occur, deals are more likely to be subsequently divested due to poor performance, bidder CEOs are more likely to receive bonuses and higher compensation for completing mergers, and there is a significant value loss for shareholders of both the acquirer and the combined entity. We argue that a CEO's position in the social network is at least as important as the connection to a particular transacting partner, and that focusing only on bilateral, non-directional ties can yield inconclusive results.

We use BoardEx data to construct a social network of CEOs of U.S. firms and calculate *closeness, degree, betweenness,* and *eigenvector* centrality measures for all individuals connected in this vast network. Our results show that higher-centrality acquirer CEOs are associated with more frequent acquisitions of U.S. public targets by S&P 1500 companies over the period January 2000 to December 2009. Increasing CEO centrality from the 25th to the 75th percentile of the sample increases the relative frequency of acquisitions by 28.0%, on average. In addition, abnormal returns to bidder shareholders, as well as total takeover synergies (measured by the weighted average of bidder and target abnormal shareholder returns), are negative in deals initiated by bidder CEOs with above-median network centrality. Increasing CEO centrality from the 25th to 75th percentile of the sample decreases acquirer CARs by 3.42 percentage points and total synergies by 3.06 percentage points, on average.

[2] There are many reasons why bidder CEOs might benefit from value-destroying M&A deals. Due to the separation of ownership and control, CEOs are likely to accrue the full value of private benefits, while bearing only partial value of the losses associated with the acquisitions. The examples of private benefits include: higher post-merger managerial compensation due to the increase in firm's size (Jensen and Murphy, 1990), post-merger compensation packages insensitive to negative stock performance (Harford and Li, 2007) smoother post-merger earnings, leading to the lower likelihood of financial distress (Berger and Ofek, 1995), and increase in the cost of CEO replacement if acquisitions involve manager-specific investments (Shleifer and Vishny, 1989).

We then investigate whether internal and external corporate governance mechanisms can reduce the frequency of deals and prevent value destruction for firms with high-centrality CEOs. We find that factors generally associated with stricter internal governance, such as the intensity of board monitoring and the presence of large blockholders, mitigate high takeover frequency but have only limited ability to mitigate value-destructive M&A.[3]

We also find that the disciplining roles of both the external market for corporate control and the managerial labor market are weaker for high-centrality CEOs. Whereas pursuing value-destroying deals typically increases the likelihood of the bidding firm being acquired within five years after the first value-destroying deal (Mitchell and Lehn, 1990), high bidder-CEO centrality diminishes the strength of this mechanism. Similarly, while the likelihood of CEO dismissal increases following the completion of acquisitions that destroy bidder shareholder value (Jenter and Kanaan, 2010; Lehn and Zhao, 2006), the magnitude of the value loss is unrelated to the likelihood of turnover for high-centrality CEOs.

We further investigate possible motives for the value-destructive behavior of bidder CEOs, such as whether high-centrality CEOs launch value-destroying M&A for their own pecuniary or non-pecuniary benefit. Studying changes in compensation around M&A deals, as well as non-monetary awards to CEOs following deal completion, we document positive evidence of such motives. We find that the compensation of higher-centrality CEOs is greater by approximately 8% in constant dollars, regardless of the typically significantly negative abnormal acquisition returns. On the other hand, lower-centrality CEOs do not receive any significant raises following M&A deals that destroy bidder value. In addition, high-centrality bidder CEOs have about a 25% greater chance of receiving a non-monetary award after the completion of the deal compared to their low-centrality counterparts.

We find no evidence that high-centrality CEOs use their information channels for the benefit of investors. While our results suggest that high-centrality CEOs might have easier access to information, because they tend to be associated with more reputable financial M&A advisors, the participation of

[3] Intense monitoring boards are defined as those where majority of independent board members have two or more membership in auditing, compensation, and nomination committees (Faleye et al. 2011).

reputable deal advisors is not associated with acquisition gains. Moreover, high-centrality CEOs can use their better access to information against the interest of their shareholders. We show that high-centrality CEOs tend to reduce their ownership stakes around the time of M&A deals. Furthermore, the personal stock sales of high-centrality CEOs throughout their tenure as CEO lead to subsequent three-month stock underperformance (by 7.25 percentage points) compared to inside sales by low-centrality CEOs.

Our results are robust under various alternative specifications and additional controls. Most important, our results hold after we control for possible links between centrality and CEO overconfidence or hubris (Roll, 1986; Malmendier and Tate, 2008; Campbell et al., 2011), bidder size (Moeller et al., 2004), and ties between bidder and target board members. In addition, our results are not due to ties between the CEO and board members—in fact, CEOs with both above- and below-median centrality are equally likely to have bilateral connections to their boards.

This paper makes several important contributions. First, we extend the existing literature on the economic value of social connections. Our evidence suggests that network position matters. Being at the center of the network, instead of the periphery, provides an individual with more access to information and more power to control information flows. It also grants the individual authority and dominance over others by virtue of an enhanced bargaining position, more numerous friends, more powerful friends, and more resources to fall back on. Studying network position and its behavioral and economic implications adds to prior literature that focuses on the presence of bilateral connections between pairs of transacting parties (e.g., Cai and Sevilir, 2012; Ishii and Xuan, 2014; Cohen et al., 2010; Engelberg et al., 2012).

Second, we extend the literature that investigates the reasons for and performance of M&A transactions. Acquisitions lead to substantial value changes (e.g., Andrade et al., 2001; Moeller et al., 2004, 2005). The tendency of high-centrality CEOs to initiate more value-destructive acquisitions suggests that deepened entrenchment offsets the benefits of informational advantage. Our results complement other papers (e.g., Malmendier and Tate, 2008; Masulis et al., 2007; Harford and Li, 2007; Lehn and Zhao, 2006) in showing that the bidder CEO's skills and attributes play a key role during the M&A process.

Third, we contribute to the growing literature in behavioral corporate finance on how the personal traits of corporate decision-makers affect the firm's financial outcomes (e.g., Baker et al., 2007; Cronqvist et al., 2012). Notable traits include hubris (Hayward and Hambrick, 1997), self-attribution bias (Billett and Qian, 2008), narcissism (Ham, Seybert, and Wang, 2012; Chatterjee and Hambrick, 2007), and overconfidence (Melmendier and Tate, 2008). Our measures of network position describe a CEO's relative position in a social network and thus represent a CEO trait undocumented in previous literature. In addition, contrary to variables derived from psychological studies, network-based centrality measures are quantitative in nature, as they result from intensive computations on systematically and objectively collected social-connection data. CEOs might be unaware of their precise rankings in the network, but our findings with regard to their M&A performance show remarkable explanatory power of centrality measures.

The paper proceeds as follows. Section 2 discusses social-network centrality measures and other data used in the paper. Section 3 presents the empirical results and various robustness checks. Section 4 investigates whether the strength of internal corporate governance metrics and the efficiency of the markets for external corporate control and executive labor can mitigate the effect of CEO centrality on M&A performance. Section 5 explores possible channels through which centrality is associated with merger outcomes. Section 6 concludes.

2. Network centrality

In social networks, individuals (nodes) form links to other individuals, and the nodes and links form the network (Jackson, 2010). The position of each node in the network is not random (Jackson and Rogers, 2007), and positions assume power when they (1) link to more individuals; (2) are close to all other individuals; (3) are on the shortest path connecting any other pairs of individuals; and (4) are more linked to other highly-linked-to individuals (Padgett and Ansell, 1993). "Power" in a network carries at least two different dimensions (Hanneman and Riddle, 2005, Chapter 10). First, a network-powerful individual might be better positioned for information access because such a position makes it possible to

reach other individuals more efficiently. Second, a network-powerful individual could have an advantage in bargaining and negotiation, as the network position allows more opportunities and reduces constraints. These two dimensions are not easily distinguishable conceptually, because we are not able to pinpoint the nature of relationships in each link. However, by observing how individuals exert power in major events, we can use the outcome of such events to distinguish these dimensions.

Four common measures of centrality are constructed: closeness, degree, betweenness, and eigenvector centrality (Proctor and Loomis, 1951; Sabidussi, 1966; Freeman, 1977; Bonacich, 1972). Closeness is the inverse of the sum of the (shortest) distances between an individual and all other individuals in a network. It indicates how efficiently an individual can obtain information from other individuals in the network. Degree is the number of direct ties an individual has with other individuals in the network. The more connections the individual holds, the more central this individual is in the network. Betweenness measures how often an individual lies on the shortest path between any other two members of the network. Hence, it indicates how much control an individual could have on the flow of information, because an individual located between two other individuals can either interrupt or facilitate the information flow between those two individuals. Finally, eigenvector centrality is a measure of the importance of an individual in the network. It takes into account the extent to which an individual is connected with other highly connected individuals. In Appendix A, we provide the mathematical formulas and a simple example to demonstrate the calculations and how we account for nodes that reside inside and outside the largest component in the network. [4,5]

2.1. CEO centrality data

Information about the educational background, prior employment, and social memberships of

[4] On average, 92% of all individuals have at least one connection to the largest, interconnected sub-network. They therefore form the largest component.

[5] The computation requires storing information for each and every possible pairs of nodes (nearly 250,000 for year 2005 and nearly 300,000 for year 2008 and later) in computer memory, and the Matlab program for closeness, for example, takes about 7 days to process the graph of 2010, on supercomputers with at least 84G of memory.

directors and executives of U.S. public companies is available from BoardEx. In our main analysis, we construct yearly networks based on employment history in listed firms only. This information is the most reliable, free of self-reporting bias, and can be cross-verified in other sources. In addition, we use the entire network built from overlaps in education, employment, and social activities to conduct robustness checks. We assume that once formed, social connections continue to exist until one party of the pair dies. Our network is therefore monotonically larger over time, ultimately including nearly 12 million links formed in publicly traded firms between 1938 and 2010, 21 million links if counting links formed in unlisted or non-profit organizations and academic institutions, and a maximum network of 384,489 individuals in 2010.[6]

To make our centrality measures comparable across time, we generate percentile values of the centrality measures annually, with 1 being the least central and 100 being the most central. These percentiles measure the position of the CEOs within the network of *all*—not just S&P 1500—executives and directors of U.S. public companies in the entire BoardEx database. This transformation preserves the rank order of the network importance of each individual, and permits a clear and simple interpretation of the variables. The centrality percentile values also make the size of the network irrelevant and thus are directly comparable across different years.

We identify 4,006 unique CEOs for all S&P 1500 firms and tabulate their network centrality annually from 1999 to 2008, for a total of 16,415 firm-year observations. Table 1 presents the summary statistics based on actual centrality values as well as on percentile rankings. The typical S&P 1500 CEO has higher centrality than the typical BoardEx executive.[7] The mean (median) centrality of an S&P 1500 CEO lies in

[6] We conduct robustness checks to alter the network by adding additional restrictions. One restriction is to ensure strength of connections, in which we only include links that last 3 years or longer. Another restriction is to drop inactive connections, in which any links that have not been active in the past 5 years out of the sample. Yet another robustness round combines the two restrictions. Our results are largely unaffected by these restrictions.

[7] Still, the sample CEOs display considerable variance in centrality. For example, degree centrality ranges from 2 to 1984. Change from 25th to 75th percentile is associated with having 129 extra connections, or being able to reach every individual in the network more than half-step faster, on average (as the inverse of closeness for the 25th percentile is 1/0.231 = 4.3 steps, while the inverse of closeness for the 75th percentile is 1/0.269 = 3.7 steps) Assuming average size of the network to be approximately 250,000 individuals (with 250,000*249,999/2 total connections), the CEO with the 25th percentile value resides on the shortest path between any two network members

the 75th (80th), 72nd (78th) , 77th (84th), and 74th (78th) percentile rank of the network of all executives and directors when using closeness, degree, betweenness, and eigenvector as measures of centrality, respectively.

[Table 1 about here]

In our sample, one of the most central CEOs is Steven Ballmer of Microsoft. His closeness, degree, betweenness, and eigenvector centrality rank in the 100th percentile, meaning that he is considered one of the most central players in the vast network of business professionals that includes corporate directors, bankers, hedge fund managers, etc. In 2006, he had 792 direct connections, and he could reach every individual in the network in an average of 3.2 steps (the inverse of his closeness, 0.31). He also resides on the shortest paths connecting pairs of all other individuals more than 15 million times, or 0.04% of all pairs of shortest paths. On the other end of the spectrum, Rodney C. Sacks, long-term CEO of Monster Beverage, ranked in the lowest 1% of BoardEx-tracked business professionals in 2006. He had only ten direct connections, required an average of 5.5 steps (the inverse of his closeness, 0.18) to reach other individuals in the network, and never resided on the shortest path between any two network members.

In Appendix B we use a top-down approach to graphically present the network of 2006. The sheer size of the network requires some aggregation, and we use Blondel et al. (2008) to group individuals into social communities (clusters).[8] We present three types of graphs. First, we start with an aerial view of the network, showing "core" clusters near the center, peripheral clusters loosely connected to the core like "leaflets," and unconnected "isolates" forming an outer ring of the network graph (Figs. B1 and B2). Second, we look further into the core to see clusters of well-connected executives, broken further to see smaller "subclusters" (Figs. B3 through B6). Third, we show an example of a "leaflet"—a cluster of

30,750 times, while CEO with the 75th percentile value resides on the shortest path between any two network members 2.5 million times, The minimum Betweenness centrality measures is zero, which suggests that there are some CEOs who have general relations with other executives and directors, but those relations are not exclusive, in the sense that no other pairs of relationship needs to go through these CEOs.

[8] The community structure of the network is discussed in Fogel and Zinoviev (2014). For further discussions on how CEOs and directors share social clusters, see Fogel, McBrayer, and Wu (2013).

executives with low connectivity to the rest of the network (Fig. B7).

In unreported analysis, we also examine the distribution of CEOs and their centralities by 12 industries as defined by Fama and French (1997). The largest industry group is business equipment, which represents 18.68% of the sample. We do not detect any industry clustering, or any significant clustering of high- or low-centrality CEOs in particular industries. These results, as well as all of our subsequent unreported analysis, are available upon request.

2.2. M&A data

Our M&A sample contains all completed mergers (reported in the Thomson Reuters SDC database) between S&P 1500 acquirers and U.S. public targets for the period spanning 2000 to 2009—a total of 464 acquirers in 776 deals. We choose deals with publicly listed targets and acquirers because our measures of takeover gains require the availability of stock returns. We obtain stock return data from CRSP and financial data from COMPUSTAT.

2.3. Internal and external governance data

To obtain the governance data for the CEOs and the directors in our sample, we merge BoardEx and Risk Metrics data by algorithmic and manual matching of names of business executives in both databases. We rely on Risk Metrics to compute governance variables such as monitoring intensity, board size, CEO–chair duality, CEO age, block ownership, and CEO ownership, but we fill in any missing values using ExecuComp data. We use the entrenchment index (E-index) from Bebchuk et al. (2009).[9] We have complete governance data available for 3,283 CEOs in 13,398 firm-year observations.

[9] The entrenchment index data is available at www.law.harvard.edu/faculty/bebchuk/data.shtml. The entrenchment index is constructed by adding 1 for the following six provisions: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for mergers and charter amendments. In unreported analysis, in all the following tables that tested the role of governance, we also consider governance index (Gindex) developed by Gompers et al. (2003) and reported by Risk Metrics. Results remained virtually identical regardless whether we utilized E-index or Gindex.

3. CEO network centrality and acquisition outcomes

We study the effect of CEO network centrality on mergers and acquisitions because of the strategic importance of M&A in any organization (e.g., Andrade et al., 2001; Moeller et al., 2004, 2005). The size and importance of the bidder CEO's personal network should affect the course of acquisitions and the performance of the merged entity. On the one hand, Cai and Sevilir (2012) show that cross-firm social connections between the bidder and the target lead to better merger performance due to the reduction of information asymmetry.[10] Since personal networks can be considered an amalgamation of all bilateral ties that a person creates, well-connected CEOs might have better and easier access to valuable information about potential targets, leading to lower information asymmetry and more efficient acquisition decisions.

On the other hand, social science research has identified network centrality as a source of influence and power (e.g., Brass and Burkhardt, 1993; Mizruchi and Potts, 1998), with the implication that well-connected CEOs can utilize their social ties to entrench themselves and to neutralize monitoring of their activities. Fracassi and Tate (2012) and Hwang and Kim (2009) show that a CEO's social ties to board members reduce the effectiveness of board monitoring. Ishii and Xuan (2014) also claim that cross-firm bidder-target social ties lead to value losses due to weaker critical analysis, lower due diligence, and social conformity. Chikh and Filbien (2011) show that CEOs with extensive personal networks are less likely to cancel acquisitions even if the market reaction to the acquisition announcement is negative. Ultimately, increased entrenchment and insulation from monitoring can allow high-centrality bidder CEOs to pursue frequent acquisitions, even at the expense of bidder shareholders.

In sum, we expect that being well-connected lowers information asymmetry and increases entrenchment due to the CEO's influence or power—and should lead to a higher incidence of deal initiation and completed acquisitions by higher-centrality bidder CEOs.

[10] Similar information asymmetry-reducing benefits due to well-connected boards have also been documented by Schonlau and Singh (2009). The benefits of cross-connections have been argued even for mutually independent entities (e.g. Fracassi, 2009). Engelberg et al. (2013) further show that CEOs command higher salaries if they are able to connect to executives or directors of other firms.

3.1. ***Bidder CEO centrality and the likelihood of acquisitions***

Table 2 presents summary statistics of financial variables that are known in the literature to affect merger outcomes, including firm size (Moeller et al., 2004), Tobin's Q (Asquith et al., 1983), leverage (Palepu, 1986; Billet et al., 2004), profitability (Lang et al., 1991), and liquidity (Smith and Kim, 1994). We show the data for S&P 1500 companies (Panel A) and for bidders (Panel B)—both for the full sample and divided into below-median and above-median groups based on the four centrality measures of the firm's CEO: closeness, degree, betweenness, and eigenvector centrality. Firm size is measured by the log of total assets. Tobin's Q is the sum of short-term debt, long-term debt, preferred stock, and the market value of equity (year-end price per share multiplied by the number of shares outstanding at year-end), all divided by the total book value of assets. Leverage is the ratio of the book value of debt to total book value of assets. Profitability is the return on total assets (income before extraordinary items divided by total book value of assets). Liquidity is the ratio of operating cash flow to total assets. Using all measures of centrality, we find that firms with high-centrality CEOs are significantly larger and have higher Tobin's Q. We find less persistent differences (across centrality measures and between S&P 1500 and bidder subsamples) for profitability, leverage, and liquidity.

[Table 2 about here]

Table 3 shows tests of the differences in centrality measures between S&P 1500 acquirer and non-acquirer CEOs. We show that the means of CEO centrality are significantly higher for acquirer CEOs, exceeding the centrality of other S&P 1500 non-acquiring CEOs (who are nonetheless much more central than the median executives in the BoardEx sample). In terms of percentiles describing the whole BoardEx population, the centrality means for acquirer CEOs are 83, 84, 85, and 83 for closeness, degree, betweenness, and eigenvector centrality, respectively, while the centrality means for non-acquirers are 74, 71, 76, and 73. These differences are significant at the 1% level for all measures of centrality.[11]

[11] Since the non-acquirers' group is larger than the acquirers' group, we conduct a test of unequal variances. The F-value for the test of unequal variances is significant when using Degree and Betweenness centrality, thus we conduct

[Table 3 about here]

Panel B reports the numbers and relative proportions of acquisitions separately for acquirers with below- or above-median CEO centrality measures. For all sample years, acquirers with higher-centrality CEOs complete significantly more deals. In terms of annual numbers of mergers, we observe larger numbers of acquisitions in the peak years of business cycles—2000, 2001, and 2006—and smaller numbers in years of economic downturns, such as 2002, 2008, and 2009. However, none of the years significantly dominates.

In order to examine the effect of CEO centrality on the likelihood of acquisitions, we analyze a multivariate Probit model. We analyze S&P 1500 firms between 2000 and 2009, controlling for firm-level differences in financial characteristics identified in Table 2. We run the following model specification:

$$Prob(\text{Deal}=1|X_{i,t}) = \alpha_t + \beta_1 Centrality_{t-1} + \beta_2 Tobin'sQ_{t-1} + \beta_3 Liquidity_{t-1} + \beta_4 Profitability_{t-1} + \beta_5 FirmSize_{t-1} + \beta_6 Leverage_{t-1} + \varepsilon_t \quad (1)$$

where *Deal* is a dummy variable that equals one if a particular S&P 1500 firm announces an acquisition in year *t* that is successfully completed and zero otherwise, and *Centrality* is the percentile ranking of the acquirer CEO's centrality measured by closeness, degree, betweenness, and eigenvector centrality as previously defined. In addition, since the centrality variables are collinear, we create two additional centrality transformations: (a) the first principal component of all four centrality variables, designed to measure the main impact of all centrality factors, and (b) the "orthogonal" versions of the four centrality variables, designed to assess the marginal impact of each particular centrality dimension unrelated to the impacts of the other centrality characteristics.[12,13] All variables in the model are lagged one year relative

a Wilcoxon rank test and the Z-values of the test confirm the statistical significant difference between the high and low centrality groups.

[12] Principal component analysis (e.g. Hotelling, 1933) allows us to isolate the principal components of our four centrality variables – the linear combination of original centrality variables that has the largest possible variance (that is, accounts for as much of the variability in the data as possible). This process enables us to identify the effect of the most important "common element" shared by all centrality measures. The first component is a linear combination of all four centrality variables, with nearly equal weights, and captures 85 percent of the total variance.

to the acquisition announcement year.

Table 4, Panel A, presents the results of our analysis. Consistently with previous research, large firms with higher growth opportunities (as measured by Tobin's Q) and lower leverage are more likely to be the bidders in completed M&A deals. CEO centrality is measured by closeness in Model 1, degree in Model 2, betweenness in Model 3, eigenvector in Model 4, the first principal component in Model 5, and the orthogonal versions of the centrality measures in Model 6. Controlling for firm characteristics, CEO centrality is statistically significant and positive at the 1% level in the first four models. The significantly positive coefficient for the first principal component of centralities in Model 5 implies that the four centrality dimensions display a substantial joint common influence on the propensity to become a bidder. On the other hand, the process of orthogonalization allows us to transform the four centrality variables into a set of centralities that span the same four-dimensional subspace, but are uncorrelated with each other. Our Model 6 results, which show a statistically significant impact of all four orthogonally transformed centralities on the acquisition likelihood, suggest that despite the substantial joint common influence caused by high correlation among the centrality measures as represented by the first principal component, each of the four centrality variables still retains a unique feature of power or influence that is not captured by the other uncorrelated centrality dimensions. Our results, suggesting that firms with higher-centrality CEOs have a higher likelihood of conducting acquisitions than firms with lower-centrality CEOs, are also highly economically significant. On average, increasing CEO centrality from the 25th to the 75th percentile of the sample increases the frequency of acquisitions from 1.88% to 2.40%, or by 28% in relative terms.[14, 15]

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[13] Orthogonalization is achieved via the modified Gram-Schmidt process (Golub and Van Loan 1996) where our four independent centrality variables are transformed into a mutually orthogonal set of transformed centrality variables that span the same four-dimensional subspace as the original centrality factors. This process allows us to capture the unique impact of each particular centrality dimension, uncorrelated with the impacts of the remaining three centralities by creating a set of variables such that the effects of all the preceding variables have been removed from each subsequent variable added to the set. In our paper, we utilize the following orthogonalization order from first to last: betweenness-degree-eigenvector-closeness, though alternative ordering lead to similar results.

[14] Harford (1999) shows an unconditional likelihood of acquisitions of public targets in his sample equal to 2.06% (487 bids among 23,686 firm-years; p. 1977), while Comment and Schwert (1995) estimate the unconditional acquisition probability at 3.05% (669 bids among 21,887 firm-years).

[Table 4 about here]

In Panel B, we analyze the additional impact of bidder governance on the likelihood of an acquisition. We consider the following governance measures: board monitoring intensity, board size, CEO–chair duality, entrenchment, CEO age, block ownership, and CEO ownership. *Intense Monitors* is a dummy variable that equals one if more than 50% of the board's independent directors sit on at least two out of the three key board committees: audit, compensation, and nominating (Faleye et al., 2011). *Board Size* is the size of the board of directors. *Duality* is a dummy variable that equals one if the CEO is also the chair of the board. *E-index* is Bebchuk et al.'s (2009) entrenchment index. *CEO Age* is the CEO's age one year before the acquisition announcement. *Block Ownership* is a dummy variable that equals one if there is at least one block holder owning 5% or more of the common shares outstanding. *CEO Ownership* is the percentage of shares owned by the CEO. The sample size in Panel B is smaller due to data availability for the above variables. Our results suggest that several mechanisms that are typically linked to improved governance, namely the board's monitoring intensity, absence of CEO–chair duality, older CEO age, and higher CEO ownership, tend to be associated with a lower likelihood of acquisitions. However, even after controlling for the governance determinants, the coefficients on closeness, degree, betweenness, eigenvector, principal component, and three out of the four orthogonally transformed centralities remain positive and significant.

3.2. Bidder CEO centrality and acquisition gains/losses

Financial research has traditionally associated lower information asymmetry with value improvements and better managerial decisions, implying that acquisitions completed by well-connected bidder CEOs could lead to greater gains to bidder shareholders and to greater total takeover synergies (measured by the combined gains to the bidder and target shareholders). Sources of competitive advantage gained from

[15] In addition to the 776 completed sample takeovers from 2000 to 2009, a total of 58 extra bids were initiated, but later withdrawn. Our results are nearly identical if we consider bids initiated, regardless of completion, as our dependent variable. In unreported analysis, we find that higher-centrality CEOs, particularly those with high degree or betweenness, are more likely to be associated with completed, rather than withdrawn, takeovers.

higher-centrality acquirer CEOs include ease of access to private information about targets that results in better evaluation of deals.[16] Social science and management research documents the importance of central positions in a network in gaining access to better information and knowledge transfer (e.g. Freeman 1979; Tsai, 2001).

On the other hand, potential bidder CEO entrenchment due to strong CEO power and influence could lead to poor decision-making and value losses (e.g., Masulis et al., 2007; Bebchuk et al., 2011). High centrality could make others more likely to obey and less likely to challenge (Milgram, 1967, 1974). In boardrooms in particular, unless a majority of independent directors are also socially powerful, CEOs are likely to be unchallenged, resulting in poorer financial performance (Fogel, Ma, and Morck, 2014).

The ex-ante prediction of whether a high-centrality bidder CEO creates or destroys value is thus undetermined. We employ an event study to estimate daily cumulative abnormal returns (CARs) around the merger announcement using the standard market model.[17] Table 5 reports CARs over the (–3, +3) event-day window for the acquirer, the combined firm, and the target. We calculate CARs for the combined firm (the estimate of total synergies generated by the takeover) as the market-value-weighted average of CARs for the acquirer and the target. The returns are shown for the full sample first, then divided into three groups based on whether the acquirer CEO's centrality is low (below the sample 25th percentile), mid-range (between the 25th and 75th percentile), or high (above the sample 75th percentile).

[Table 5 about here]

The mean (median) CAR for the full sample is a significantly negative –1.87% (–1.41%) for the acquirers, a significantly positive 0.68% (0.33%) for the combined CARs, and a significantly positive 27.39% (21.28%) for the targets. Those figures are consistent with prior literature documenting positive

[16] Bruner (2004) documents that board networks lead to more efficient deals due to less costs of searching for and evaluating targets.

[17] Expected returns are estimated utilizing the standard market model: $R_{it} = a_i + b_i * R_{Mt} + e_t$ We use CRSP equally weighted index as the market portfolio to obtain R_{Mt}. The results utilizing CRSP value weighted index were virtually identical. A total of 255 days ending 46 days before the merger announcement date are used to estimate the model parameters for each company. In our subsequent analysis, we use abnormal returns over the (-3,+3) window around the merger announcement. Analyzing alternative windows such as (-1,+1) or (-5,+5) leads to very similar results.

abnormal returns to the target and combined firm and either negative or insignificant returns to the bidders (e.g., Andrade et al., 2001; Betton et al., 2008).

Even more important, measured as average differences in means across the four centrality measures, Table 5 shows that bidding companies whose CEOs have high centrality (compared to companies with low-centrality CEOs) generate approximately 1.5 percentage points lower CARs for the bidder shareholders, approximately 2.3 percentage points lower combined CARs, and about 8.0 percentage points higher CARs for the target shareholders. The vast majority of differences in CARs between low-centrality and high-centrality CEOs are highly statistically significant. In addition, average total takeover synergies (measured by the combined CARs) for the high-centrality CEOs are negative using all four measures of centrality. High centrality of bidder CEOs appears to be value reducing—especially for the bidder shareholders—and potentially consistent with CEO entrenchment.

So far, we have analyzed univariate differences in CARs for the subsamples of bidding firms with high versus low CEO centrality. Next, we will analyze CARs in the context of multivariate models to determine if the negative relation between acquirer CEO centrality and bidder or combined gains holds even after controlling for determinants of acquisition CARs identified by previous finance research.

3.2.1. Bidder CEO centrality and bidder acquisition gains

To investigate whether bidder CEO centrality affects bidder acquisition CARs, we estimate the following OLS model on acquirer CEO centrality, while controlling for firm and deal characteristics: [18]

$$CAR(-3,+3) = \alpha_t + \beta_1 Centrality_{t-1} + \beta_2 FirmSize_{t-1} + \beta_3 Profitability_{t-1} + \beta_4 Tobin'sQ_{t-1} + \beta_5 Leverage_{t-1} + \beta_6 Liquidity_{t-1} + \beta_7 Deal\ Value_t + \beta_8 Same\ Industry_t + \beta_9 Stock\ Deal_t + \varepsilon_t \quad (2)$$

where the dependent variable CAR (–3,+3) is the cumulative abnormal return for the acquirer over the (-3,+3) acquisition announcement event-day window. Acquirer CEO centrality is measured by closeness

[18] Controls for deal characteristics and fixed industry and year effects are included as previous literature document the impact of form of payment (e.g., Fuller et al. 2002), industry relatedness (e.g., Morck et al. 1990, and merger intensity of the industry (e.g., Schlingemann, 2002) on merger gains.

in Model 1, degree in Model 2, betweenness in Model 3, and eigenvector in Model 4. In addition, we include the first principal component of centralities in Model 5 and the orthogonally transformed centrality variables in Model 6. *Deal Value* is the value of the acquisition as reported by SDC, divided by the market value of the acquirer. *Same Industry* is a dummy variable that equals one if the acquirer and the target are in related industries as identified by two-digit SIC codes. *Stock Deal* is a dummy variable that equals one if the merger is entirely financed by stock. All other variables are as previously defined and are lagged one year. We also add fixed year effects and industry effects in all models.

The results of our analysis are presented in Table 6. Panel A shows that the coefficients on CEO centrality are negative and statistically significant at the 1% level in the first four models. Economic significance is also large. Increasing CEO centrality from the 25th to the 75th percentile of the sample increases the losses to acquirers by –3.42 percentage points, on average (across all four measures of centrality). The first principal component of centralities in Model 5, as well as three out of four orthogonally transformed centrality determinants in Model 6, also significantly negatively affect the bidder abnormal returns. The other determinants of bidder acquisition CARs have mostly the expected signs. More profitable acquirers are associated with gains to bidder shareholders, while stock deals and acquisitions of large targets lead to greater bidder shareholder losses.

[Table 6 about here]

Panel B includes additional control variables to take into account the effect of firm governance on CARs. Centrality remains a significantly negative determinant of bidder abnormal returns even when controlling for governance. Interestingly, none of the governance mechanisms, with the exception of CEO ownership (a negative determinant), are significantly related to bidder abnormal returns. To summarize, the findings in Table 6 provide evidence that bidder CEO centrality is negatively associated with the gains to bidder shareholders.

3.2.2. Bidder CEO centrality and total takeover synergies

If acquirers give up some of their gains to attract targets, bidder loss could be offset by the expectation of large synergy gains from the deals (Hietala et al., 2003). To test whether bidder CEO

centrality is associated with the total takeover combined CARs, we estimate the following OLS model on acquirer CEO centrality, together with other control variables identified by previous research as influencing total takeover synergies:

$$CAR(-3,+3) = \alpha_t + \beta_1 Centrality_{t-1} + \beta_2 Combined\ Size_{t-1} + \beta_3 Combined\ Profitability_{t-1} + \beta_4 Combined\ Tobin's\ Q_{t-1} + \beta_5 Combined\ Leverage_{t-1} + \beta_6 Combined\ Liquidity_{t-1} + \beta_7 Same\ Industry_t + \beta_8 Deal\ Value_t + \beta_9 Stock\ Deal_t + \varepsilon_t \quad (3)$$

The dependent variable CAR (–3,+3) is the cumulative abnormal return over the (–3,+3) acquisition announcement event-day window for the combined firm, calculated as the market-value-weighted average of CARs for the acquirer and the target. The acquirer CEO's centrality is measured by closeness in Model 1, degree in Model 2, betweenness in Model 3, and eigenvector in Model 4. In addition, we include the first principal component of centralities in Model 5 and the orthogonally transformed centrality variables in Model 6. *Combined Size* is the log of the number of employees for the combined entity. *Combined Profitability, Liquidity, Leverage,* and *Tobin's Q* are asset-weighted averages of the profitability, liquidity, leverage, and Tobin's Q of the acquirer and the target. All variables are lagged one year and are as previously defined. We also include industry and year fixed effects in all of our models.

The results of our analysis are reported in Table 7. Most important, the coefficients on the measures of CEO centrality in Panel A are negative and significant in all models at the 1% level. The first principal component of centralities in Model 5, as well as three out of four orthogonally transformed centrality determinants in Model 6, also significantly negatively affect the combined abnormal returns.[19] The results are highly economically significant. Increasing CEO centrality from the 25th to the 75th sample percentile increases the losses to the combined firm by –3.06 percentage points on average (across the four centrality measures). When we add governance controls in Panel B, our centrality variables remain negative and highly significant in all models. Similar to our univariate results, the findings in Table 7

[19] In unreported analysis for the sake of brevity, we analyze the impact of orthogonally-transformed centrality dimensions and their first principal component for all the subsequent tables. The coefficients of those variables are typically highly significant, with the signs equal to those for the four reported individual centrality characteristics (closeness, degree, betweenness, and eigenvector centrality).

suggest that bidder CEO centrality appears to be negatively associated with total takeover synergies.[20]

[Table 7 about here]

3.3. Robustness analysis

3.3.1. Bidder size effect

Moeller et al. (2004) show that bidder acquisition CARs are significantly related to bidder size. Table 2 in our study documents that bidder CEO centrality is also related to bidder size (higher-centrality CEOs are likely to manage larger firms). In unreported analysis, we control for the possibility that our centrality measures identify the potentially nonlinear size effect by three different methods: (a) addition of an additional dummy for large bidder sizes, (b) addition of a quadratic size variable, and (c) splitting the sample based on the size of the bidding firm. Regardless of the adjustment, the centrality variables in Tables 4, 6, and 7 remain significant, with unchanged coefficient signs. It is thus unlikely that our results regarding CEO centrality are due to the bidder size effect.

3.3.2. CEO centrality and CEO connection to board members inside the firm

Existing finance research has already documented the detrimental effect of direct ties between CEOs and board members of their firms in the context of board monitoring (e.g., Fracassi and Tate, 2012; Hwang and Kim, 2009) and the quality of M&A decisions (Ishii and Xuan, 2014). If well-connected CEOs are simply managers who have ties to more people—including their own board members—then our results could be the effect of bilateral ties rather than centrality per se. To address this possibility, we performed several robustness checks. First, we studied the incidence of CEO–board connections for the subsamples of CEOs with high versus low centrality, where the existence of CEO–board connections was measured by prior joint work experience in listed companies, common board memberships, and common

[20] In the unreported analysis, we also study the link between bidder CEO centrality and target acquisition gains, utilizing regression models similar to those in Tables 6 and 7. We find the coefficients on acquirer's CEO centrality to be positive and significant in 3 out of 4 of our models. Increasing CEO centrality from the 25th to the 75th sample percentile increases the gains to the target by 5.56% on average. These findings suggest that target shareholders benefit from acquisitions initiated by well-connected bidder CEOs (possibly due to overpayment).

education experience. We found that the occurrence of CEO–board connections was nearly identical in the two subsamples—that is, whether or not CEOs are well-connected, they are roughly equally likely to have ties to their own board members. This result implies that the higher likelihood of acquisitions, combined with inferior bidder gains as documented in Tables 4 through 7, is indeed primarily due to CEO centrality, and not to CEO–board connections. Second, we added a variable measuring the incidence of CEO–board connections directly to our models of acquisition likelihood (Table 4) and abnormal returns (Tables 6 and 7). Addition of this variable left the significance of the centrality coefficients, as well as the coefficients for other variables, nearly identical to those presented in Tables 4, 6, and 7.

3.3.3. CEO centrality and bidder-target board connection

We follow Ishii and Xuan (2014) and construct bidder-target board connection measures, allowing for the possibility that higher-centrality CEOs can obtain more private information from their connections. The addition of this variable left the significances of the centrality coefficients, as well as the coefficients for other variables, nearly identical to those presented in Tables 4 through 7. Interestingly, bidder-target board connections had a negative and insignificant impact on abnormal returns.

3.3.4. Entrenchment versus overconfidence

Because highly confident people are more likely to form additional social ties, extensive and/or influential CEO personal networks could proxy for CEO overconfidence, optimism, or hubris. Since financial research has documented that overconfident (or overly optimistic) CEOs tend to pursue acquisitions more frequently (e.g., Malmendier and Tate, 2008; Roll, 1986), well-connected CEOs (who have extensive personal networks thanks to their confidence and/or optimism) might indeed bid more frequently. Previous finance research has also identified CEO overconfidence as a source of M&A losses (e.g., Malmendier and Tate, 2008; Roll, 1986). If large personal networks are built by overconfident, optimistic individuals, then we might indeed observe a negative relation between centrality and M&A gains.

In order to differentiate between entrenchment and overconfidence, in unreported analysis we add an overconfidence measure to our models in Tables 4, 6, and 7. *Overconfidence* is a dummy variable equal to one for highly confident CEOs as identified by Malmendier and Tate's (2008) and Otto's (2012) models.[21] The inclusion of overconfidence does not change the significance or the sign of the centrality coefficients. The overconfidence dummy, on the other hand, was not significant in any of the models. Consequently, it is unlikely that our results regarding CEO centrality are due to CEO overconfidence.

In addition, we also studied the direct link between the measures of centrality and overconfidence—in terms of both univariate tests and regression analysis of centrality determinants. Our unreported results suggest that centrality is actually negatively related to overconfidence, further strengthening our argument that the higher likelihood of acquisition and lower acquisition gains are mainly due to the connectedness of the CEOs, rather than to overconfidence.

3.3.5. Strength of ties forming CEO centrality

The strength of ties in the social network could affect the diffusion of information and influence (Granovetter, 1973). We therefore construct networks based on the length of connections and examine various alternative determinants of CEO centrality. For example, we consider the link between two people to be valid only if the relationship has existed for at least three (five) years.[22] With stronger ties, the network becomes more clustered, more modular, and more stable.[23] Using these alternative definitions leads to nearly identical results when compared to the results in Tables 4 through 7.

3.3.6. Determinants of CEO centrality and excess centrality

[21] Malmendier and Tate (2008) study CEO's personal portfolio choices. Confident CEOs tend to hold (rather than optimally sell) their highly in-the-money vested options. Otto (2012) determines "optimism" by the relation between voluntary earnings forecasts released by the firms and the actual realized earnings.

[22] Keeping ties lasting 10 years or longer results in too few ties and very fragmented networks, making centrality calculation irrelevant.

[23] For details on the definition and analysis of the network structure including clustering, modularity, and stability, see Fogel, McBrayer, and Wu (2013) and Fogel and Zinoviev (2014).

In unreported analysis, we study the impact of the following CEO characteristics on centrality: (a) attending an Ivy League university, (b) length of work experience, (c) sitting on boards of directors of public and private companies, (d) CEO salary, (e) CEO age, and (f) CEO overconfidence as measured by Malmendier and Tate (2008) and Otto (2012). Our results show that all four measures of centrality are positively associated with having graduated from an Ivy League school, being a director of a public company (especially if the company is in the S&P 1500), and having a high salary. Centrality measures are negatively related to overconfidence and to CEO age. The results suggest that, contrary to common belief, higher network centrality does not mirror an "overly confident" personality or a senior individual. For instance, Mr. G. Rubin of Flex Furniture, an 80-year-old executive, saw his centrality peak in the 1990s, but it has declined significantly in recent years due to the lack of new connections and/or the declines in network position of his existing connections.

We use the above centrality determinants to define "excess centrality," or the difference between actual centrality and predicted centrality. This allows us to distinguish whether our results are due to the extraordinary influence or power of the CEO (if excess centrality ends up having the same impact on all dependent variables as actual centrality), or whether they are simply caused by the CEO's personal characteristics as proxied by the centrality measures (if excess centrality does not affect our results). Our results on the higher likelihood of acquisitions and lower acquisition gains were very similar using "excess centrality" compared to the results with the centrality variables presented in Tables 4, 6 and 7, suggesting that our findings are primarily due to CEO influence or power.[24]

4. Corporate governance, corporate control, and CEO centrality

So far, our results regarding the links between bidder CEO centrality, the likelihood of acquisitions, and acquisition gains suggest that well-connected acquirer CEOs are associated with frequent acquisitions

[24] Additionally, we repeated our analysis of Tables 4, 6, and 7 defining excess centrality as residuals from the regressions of centrality on firm-specific (rather than CEO-specific) characteristics – size, growth opportunities (Tobin's Q), and profitability, Again, excess centrality had very silimar impacts on acquisition likelihood and bidder and combined acquisition gains to those presented in Tables 4, 6, and 7.

and value-destroying acquisitions (especially for bidder shareholders). However, our results do not preclude the possibility that the social networks of CEOs can be beneficial. What we have shown thus far suggests that the benefits from CEOs occupying very central positions in executive social networks do not appear to extend to shareholders, particularly in M&A deals. Instead, gains from higher network centrality could accrue to the CEOs personally—unless they face the constraining powers of internal governance and external markets. In this section, we study whether the negative effects on shareholder value can be mitigated by strong internal governance at the bidder firms and by efficient external markets for corporate control and executive labor.

4.1. Internal corporate governance, bidding likelihood, and acquisition gains

Financial research has documented the power of corporate governance to monitor CEO performance and to limit the potentially adverse impact of CEO actions. Faleye et al. (2011) show that boards on which the majority of independent board members qualify as "intense monitors" (the members serve on at least two of the three principal monitoring committees) display superior monitoring performance. Yermack (1996) suggests that bigger boards are generally considered to be poorer monitors. Bebchuk et al. (2011) and Masulis et al. (2007) document that entrenched managers pursue value-destroying acquisitions. Higher ownership concentration in the form of blockholdings or a greater CEO ownership share is generally associated with improved monitoring (Shleifer and Vishny, 1997), although high CEO ownership can also facilitate entrenchment (Morck et al., 1990). On the other hand, CEO–chair duality leads to greater extraction of rents from shareholders (Bebchuk and Cohen, 2005). CEO age can have both positive (Milbourn, 2003) and negative (Hermalin and Weisbach, 1998) effects on the quality of managerial decisions.

If higher bidder-CEO centrality is associated with losses to bidder shareholders and lower takeover synergies, then it is worth exploring whether the negative outcome from more acquisitions and worse merger performance in firms with high-centrality CEOs can be mitigated through better internal corporate governance.

Table 8 contains the results of Probit models of acquisition frequencies. Each model contains all determinants used in Table 4, including firm size, Tobin's Q, profitability, leverage, and liquidity. The corresponding regression coefficients are not reported in Table 8. We create a set of governance dummy variables that are equal to one if the bidder company is likely associated with stronger governance based on each of the following factors: presence of intense monitors, small board, absence of CEO–chair duality, low E-index, high CEO age, presence of block ownership, and high CEO ownership (high versus low values are based on the sample median). Then, we analyze the impact of the governance dummies, one at a time, and report the following three coefficients: (i) a *High Centrality* dummy, which equals one if CEO centrality is above the sample median; (ii) a governance dummy, and (iii) *High Centrality* interacted with the governance dummy. We expect the sum of those three coefficients, which together measure the joint impact of *High Centrality* of the bidder CEO in the environment of strong bidder governance, to be significantly smaller than the coefficient for *High Centrality*, which measures the effect of a high-centrality CEO operating in a bidder company with weak governance.

[Table 8 about here]

Table 8 confirms our previous results that CEO centrality is associated with takeover likelihood. In addition, we identify three governance mechanisms—intense board monitoring, CEO–chair separation, and older CEO age—that mitigate the high acquisition frequency of well-connected CEOs for at least one of the centrality definitions. On the other hand, we find that small boards and the existence of blockholders increase takeover likelihood for well-connected CEOs (these latter results are not consistent with strong internal governance having a mitigating effect on the likelihood of acquisitions).

Table 9 analyzes the impact of governance on acquirer CARs. Similar to Table 8, we analyze regression models explaining bidder gains and report only coefficients on *High Centrality,* the governance dummies*,* and the interaction between *High Centrality* and the governance dummies. The financial and deal variables of firm size, profitability, leverage, liquidity, growth opportunities, deal size, stock deal dummy, and same industry dummy are controlled for but not reported for brevity. We expect that if strong governance mitigates the opportunistic behavior of higher-centrality CEOs, the sum of the three

coefficients measuring the joint effect of high centrality and strong governance should exceed the coefficient on *High Centrality* alone. We find that just one variable—the existence of blockholders—improves (but only weakly) the bidder CARs for high-centrality CEOs.

[Table 9 about here]

In summary, the results in Table 8 and Table 9 suggest that strong governance has at best only limited power to mitigate the potentially value-destructive M&A activities of well-connected CEOs.

4.2. Bidder CEO centrality and the market for corporate control

In this section, we examine whether high-centrality CEOs can be disciplined by the external market for corporate control, or whether they are able to retain immunity. Mitchell and Lehn (1990) show that the market for corporate control can discipline bidder CEOs because bidder companies involved in value-destroying acquisitions (as proxied by negative bidder abnormal acquisition returns) are more likely to be acquired during the five years following the completed M&A deal. We hypothesize that well-connected bidder CEOs are able to use their influence and power to insulate themselves from the market for corporate control. Thus, we expect that for well-connected bidder CEOs, bidder abnormal acquisition returns will have less explanatory power with regard to the likelihood that the bidder firm is subsequently acquired.

We follow Mitchell and Lehn's (1990) methodology to test whether higher-centrality acquirer CEOs are insulated from the market for corporate control. We use a subsample of acquisitions announced from January 1, 2000 through December 31, 2005 in order to form a five-year window following the acquisition announcement to determine if the firm was subsequently acquired. Moreover, we follow Mitchell and Lehn's (1990) restriction in limiting the sample to targets whose market value is at least 5% of that of the acquirer in order to analyze acquisitions that are material for the bidder. Finally, if the acquirer has more than one acquisition, we use the sum of the abnormal cumulative returns associated with those deals. The final sample includes 222 observations.

To test the likelihood that an acquirer subsequently becomes a target, we run the following Probit

model, similar to the one used by Mitchell and Lehn (1990):

$$\text{Prob}(\text{Targeted}=1|X_{i,t}) = \alpha + \beta_1 \textit{Centrality} + \beta_2 \textit{CAR} + \beta_3 \textit{Centrality*CAR} + \beta_4 \textit{FirmSize} + \beta_5 \textit{Profitability} + \beta_6 \textit{Tobin'sQ} + \beta_7 \textit{Leverage} + \beta_8 \textit{Relative Target Size} + \varepsilon_t \quad (4)$$

The dependent variable is a dummy variable that equals one if the acquirer was successfully acquired within five years of its first acquisition, and zero otherwise. *Centrality* is CEO centrality as defined previously, *CAR* is the acquirer shareholder cumulative abnormal returns computed at the (–3, +3) event-day window around the merger announcement, and *Centrality*CAR* is an interaction term between *Centrality* and *CAR*. All other variables are as previously defined. All independent and control variables are calculated at the end of 1999. Similarly to Mitchell and Lehn (1990), we expect negative CARs to bidder shareholders to significantly increase the likelihood of the subsequent acquisition of the bidder. However, if higher-centrality CEOs are likely to be insulated from the market for corporate control, we expect the bidder CAR of companies run by high-centrality CEOs to be a less significant determinant of the likelihood that the bidder will be subsequently acquired.

Table 10 presents our Probit regression estimates. *Centrality* is measured using closeness in Model 1, degree in Model 2, betweenness in Model 3, and eigenvector in Model 4. Consistent with Mitchell and Lehn (1990), CARs are significantly negative in three out of the four models—that is, bad bidders indeed have a higher probability of becoming targets. Most important, the interaction between *Centrality* and *CAR* is positive and statistically significant in three out of the four models. The size of the coefficient on *Centrality*CAR* outweighs the negative coefficient on CAR, rendering insignificant the impact of CAR on the likelihood of being acquired for companies run by well-connected CEOs. The results indicate a failure of the corporate control market in the face of a well-connected bidder CEO.

[Table 10 about here]

4.3. Bidder CEO centrality and the managerial labor market

The executive labor market is another mechanism that disciplines managers and forces them not to deviate from value-enhancing policies. Well-governed firms optimally fire poorly performing CEOs. Jenter and Kanaan (2010), Warner et al. (1988), and Weisbach (1988) find that the likelihood of top

executive turnover is negatively associated with a firm's stock returns. Dismissal is a serious threat for a CEO, whose reputation, future employment opportunities, and lifetime income stream are significantly adversely affected (Jensen and Murphy, 1990). Lehn and Zhao (2006) examine the disciplining effect of the managerial labor market on bidder CEOs. The bidder acquisition abnormal return is negatively correlated with bidder CEO turnover during the five years following the merger. However, for high-centrality CEOs, the threat of turnover might not be effective if they are able to use their influence and power to reduce the likelihood of dismissal following value-destructive deals.

To determine whether high-centrality bidder CEOs who undertake value-destroying acquisitions tend to be insulated from the managerial labor market, we follow Jenter and Kanaan (2010) and Lehn and Zhao (2006) in modeling the determinants of CEO turnover in a five-year window following the first merger announcement by the firm's CEO during the sample period. We perform our analysis on a subsample of acquisitions announced from January 1, 2000 to December 31, 2005 to see whether the CEO is replaced within five years from the date of the first merger announcement. If a firm has more than one acquisition in the sample, we keep only the first acquisition if all acquisitions are conducted by the same CEO. If they are conducted by different CEOs, then we keep the first acquisition for each different CEO. Again, we restrict the sample to include only acquisitions in which the target's market value constitutes at least 5% of that of the acquirer in order to focus on mergers that are material for the bidder. Our final sample includes 222 observations.

To obtain data about CEO turnover, we download CEO data from ExecuComp and use the annual CEO flag (CEOANN) to identify the firm's CEO just before the first merger announcement during the sample period and compare the CEO's name and ID number (EXEID) to that of the firm's CEO five years later. If they are not the same then we consider the firm to have experienced CEO turnover. Since our initial sample is restricted to M&A activity by S&P 1500 firms, we retain observations pertaining to all

(not just disciplinary) turnovers. Our sample contains 128 instances of CEO turnover.[25]

We estimate the Cox Hazard model, similar to the one used by Jenter and Kanaan (2010):

$$(\text{CEO Turnover}=1|X_{i,t}) = \alpha + \beta_1\ \textit{Centrality} + \beta_2\ \text{Post-Merger}\ \textit{CAR} + \beta_3\ \textit{Centrality}*\ \text{Post-Merger}\ \textit{CAR} + \beta_4 \textit{Pre-ROA} + \beta_5 \textit{Age} + \beta_6 \textit{High CEO Ownership} + \beta_7\ \textit{Tenure} + \varepsilon_t \quad (5)$$

where the dependent variable is a hazard rate for CEO turnover within a five-year window of the first merger announcement. *Centrality* is CEO centrality as defined previously. *Post-Merger CAR* is the acquirer's cumulative abnormal returns over a three-year window starting from one month after the first merger announcement. *Pre_ROA(3)* is the firm's average return on assets over the three years prior to the merger announcement. *Age* is the age of the CEO, and *Tenure* is the tenure of the CEO. *High CEO Ownership* is a dummy variable that equals one if the CEO's percentage ownership of the firm's common stock is higher than the sample median.

The results for this model are presented in Table 11. The likelihood of bidder CEO turnover is inversely related to the firm's pre-acquisition accounting performance. Even more important, the negative coefficients on *Post-Merger CAR* in all four models are consistent with Jenter and Kanaan (2010), and suggest that bidder stock underperformance following the completion of an acquisition increases the likelihood of CEO turnover. While CEO turnover is not related to centrality per se (the centrality coefficients are insignificant in all models that analyze the four centrality specifications), our results show that the coefficients on *Centrality*Post-Merger CAR* are positive and significant. In all four models, the interactive coefficient reverses the negative coefficient on *Post-Merger CAR*. Ultimately, the sum of the coefficients for *Post-Merger CAR* and *Centrality*Post-Merger CAR* is insignificantly different from zero, suggesting that the likelihood of turnover for well-connected CEOs is unaffected by their previous post-

[25] Out of these turnovers, only 55 can be considered "disciplinary". Defined by e.g. Parrino (1997), "disciplinary" turnovers are CEO replacements performed not due to retirements or reassignments of the CEO inside the company (e.g. to the Chairman of the Board position). Our results are qualitatively similar, but less significant, if we repeat our analysis for the subsample of disciplinary turnovers.

merger performance.[26] Well-connected CEOs are thus less likely to be replaced, and less likely to be affected by the managerial labor market.

[Table 11 about here]

5. Interpreting the effects of CEO centrality on M&A performance

The previous sections show that superior social positions, as measured by high network centrality, are associated with not only a higher tendency to pursue acquisitions but also inferior merger performance among CEOs of S&P 1500 firms. This section attempts to dissect the channels through which centrality affects merger outcomes. The first possibility is that CEOs harvest pecuniary or non-pecuniary benefits from their superior social positions, because such positions bring power, influence, and the ability to attract followers and inspire allegiance. If so, then we should observe that high-centrality CEOs personally benefit from deals that otherwise destroys shareholder value. The second possibility is that high-centrality CEOs use their advantageous network positions to obtain private information. If so, then they could be benefitting from these channels elsewhere, such as in their personal trading of company stock. A third channel could be reverse causality, whereby CEOs gain connections (and thus network centrality) through deals; or a latent factor story, where some unknown factors drive both observations. We present some evidence on each of these possible channels.

5.1. Do high-centrality CEOs initiate M&As because they personally benefit from acquisitions?

The analysis of bidder and combined acquisition abnormal returns in Section 3 suggests that the increased acquisition intensity among high-centrality CEOs comes at the expense of bidder shareholders (especially because we find that the negative impacts of acquisitions are not mitigated by strong governance at the bidding firms). Financial research has argued that managers have a tendency to pursue

[26] We get similar results when we analyze Post-Merger CARs as one- or two-year acquirer returns or when we replace Post-Merger CARs by the bidder abnormal returns around the acquisition attempts that were analyzed by Lehn and Zhao (2006).

activities that allow them to increase their pecuniary and/or non-pecuniary perquisite consumption at the expense of investors (e.g., Jensen and Meckling, 1976; Demsetz and Lehn, 1985; Jensen, 1986). In this section, we examine the possibility that high-centrality managers are able to derive personal benefits from pursuing acquisitions.

Table 12 contains the results of the analysis of the evolution of CEOs' total direct compensation (the sum of salary, bonus, and restricted stock grants as reported by ExecuComp, in constant 1998 dollars) from two years before to two years after an acquisition for the subsample of 405 CEOs with available data. Even controlling for the size of the company, we find that the compensation of high-centrality CEOs is larger, as the *High Centrality* dummy (denoting CEOs with above-median centrality) is significantly positive in all four models. We further show that CEO compensation significantly increases after the completion of an acquisition. Most important, whereas post-acquisition compensation is significantly positively related to the change in bidder shareholder value during acquisition (as measured by acquirer CARs) for low-centrality CEOs, high-centrality CEOs receive compensation packages unrelated to shareholder acquisition returns. Ultimately, the results in Table 12 are consistent with the ability of high-centrality CEOs to consume more pecuniary benefits as a consequence of their acquisition activities. Moreover, high-centrality CEOs (who initiate more acquisitions and are associated with greater shareholder losses) appear not to be significantly penalized for their generally poor acquisition performance. Holding other variables constant, we find that CEOs with high centrality receive approximately 8% higher constant-dollar compensation after acquisitions, with very little variation in terms of bidder acquisition CARs. On the other hand, low-centrality CEOs initiating acquisitions with bidder CARs in the lowest quartile do not receive any significant compensation increases.[27]

[Table 12 about here]

[27] The salary increases captured by high centrality bidder CEOs, together with their successful entrenchment (as represented by the lower likelihood of being taken over or being replaced documented earlier) could explain why those CEOs initiate acquisitions generally *known* to destroy value. In unreported analysis, we found that the CEO centrality is positively related to the likelihood of initiating a conglomerate (using the classification of Aggarwal and Baxamusa, 2013) and unrelated (different bidder and target SIC codes) deals, as well as to the increased likelihood of acquisition of targets involving multiple bidders.

Table 13 examines the ability of bidding CEOs to increase their consumption of non-pecuniary perquisites following an acquisition. We were able to collect data on non-monetary awards given to CEOs during the three years following an acquisition for 502 bidding CEOs, as well as non-bidding CEOs matched by year, industry, and firm size. Panel A shows the distribution of the typical non-monetary awards, with the most frequent honors related to being named a "top executive" and to receiving honorary doctorates or alumni awards. Panel B documents the results of a Probit analysis of the likelihood of receiving a non-monetary award. Our results show that while bidding CEOs are slightly less likely to receive such awards (as measured by negative coefficients on *Bidder* CEOs), the marginal impact of bidder CEO centrality on non-monetary award consumption is significantly positive in three out of four models. Other determinants held equal, an increase from the 25th to the 75th percentile of centrality is associated with a rise in the probability of receiving an award from 44% to 69% for the bidder CEOs, as contrasted with an increase from 50% to 54% for non-bidder CEOs.

[Table 13 about here]

Overall, the findings in Table 12 and Table 13 suggest that the prospects of increased consumption of pecuniary and non-pecuniary perquisites could be an important motivation for the higher frequency of value-losing takeover bids among high-centrality CEOs.

5.2. Network centrality and information flows

5.2.1. Are high-centrality CEOs more involved in informed insider trading?

Sales by insiders have been shown to carry significantly negative signals about the future performance of the firm (e.g., Seyhun, 1992; Clarke et al., 2001). We documented in previous sections that acquirers with high-centrality CEOs are generally associated with negative abnormal acquisition returns. Those CEOs might thus want to limit their personal stock losses and get involved in more intense insider selling around the time of takeovers. In addition, the insider sales of high-centrality CEOs might carry more adverse signals about future firm prospects.

In unreported analysis using the Thomson Reuters Insider Filing Data Feed, we found that high-

centrality CEOs were associated with a greater incidence of inside sale orders from the period 12 months prior to an acquisition announcement until an acquisition completion date for all four measures of centrality, even though the differences with respect to low-centrality CEOs were not statistically significant. Further, we found evidence of a higher decline in share ownership among high-centrality bidder firm CEOs compared to low-centrality CEOs from one year prior to the acquisition announcement to one year after completion (the decline was significant for three out of four centrality measures). This result suggests that high-centrality CEOs can limit the negative impact of value-reducing deals on their personal wealth by lowering their inside ownership in the firm.

Finally, we analyze the stock performance following inside sale orders of 509 bidding CEOs throughout their careers.[28] In unreported analysis, we find that the career average and median three-month stock returns after bidder CEO equity sales were significantly negative. In addition, Table 14 shows that high-centrality CEOs are associated with significantly more negative average stock performance (compared to low-centrality CEOs) following CEO insider sales. A change from the 25th to the 75th percentile of centrality reduces three-month stock returns by 7.24 percentage points, on average. Because CEOs associated with stock underperformance after their stock sales are likely to repeatedly unload their shares before the market recognizes the expected negative firm performance (e.g., Seyhun, 1992), our findings of more negative stock returns for high-centrality CEOs are consistent with those executives being more engaged in self-serving behavior at the expense of shareholders.[29]

[Table 14 about here]

5.2.2. Do high-centrality CEOs work with better-informed deal advisors?

[28] *Thomson Reuters Insider Filing Data Feed* generates the average career three-month stock performance following all CEO insider sells for each executive in their database by tracking the stock performance of the company following each incidence of inside sell by the particular executive.

[29] In unreported analysis, we added the dummy variable identifying the quartile of the CEOs with the worst average stock performance following inside sells (i.e. the executives who are more likely to exploit the negative information about the company for their personal benefits) into our regression models analyzing bidders and combined CARs (Tables 6 and 7). Not surprisingly, the impact of the dummy on acquisition abnormal returns was negative, even though insignificantly. Importantly, all centrality coefficients were still associated with negative coefficients and the same high significance as that reported in Tables 6 and 7.

According to Golubov et al. (2012), financial advisors are expected to improve access to information for bidders, and over 85% of recent M&A transactions involve advisor services. However, financial research has presented conflicting evidence on the benefits of financial advisors. While Golubov et al. (2012) and Bao and Edmans (2011) document a positive relation between financial advisor reputation and bidder acquisition gains, Rau (2000), Servaes and Zenner (1996), and others find an insignificant or even negative impact of financial advisors on acquirer value.

In unreported analysis, we find that bidders with higher-centrality CEOs tend to be associated with more reputable financial advisors (measured by advisor rank based on annual deal volumes as reported by the SDC M&A database) for the subsample of 571 acquirers with available data. Whereas high-centrality CEOs have more opportunities to gather information from their connections, and thus might not need to use the services of more reputable—and, according to Golubov et al. (2012), more costly—advisors, our results are consistent with financial advisors and CEOs recognizing the mutual benefits of enhancing their respective networks (Engelberg et al., 2013). On the other hand, we find that advisor reputation—either alone or interacted with CEO centrality—is unrelated to bidder and combined acquisition gains, and also that the presence of the advisor reputation variable does not affect the significantly negative impact of centrality on takeover gains documented in Tables 6 and 7. These results (especially the lack of benefits of advisor reputation for mergers involving high-centrality CEOs) are consistent with the "passive executor" role of financial advisors in the M&A process (Bao and Edmans, 2011), and suggest that merger decisions are primarily driven by powerful CEOs, likely without much opposition from the advisors.

5.3. Precluding reverse causality

Our results thus far show that high-centrality CEOs tend to initiate and complete more acquisitions but also are associated with value-destroying deals. However, this behavior could potentially be explained by the desire to make additional connections. The process of deal identification, initiation, negotiation, and completion could bring new contacts from among industry peers, consultants, financial advisors,

investment bankers, etc., thus increasing the number of personal connections of a CEO and directly or indirectly increasing the CEO's centrality. In addition, though not necessary, it is plausible that a CEO who understands the importance of social networking overpays for targets in order to form friendly connections with the target's CEO and board members, while sacrificing some of the acquiring firm's shareholder value (Ishii and Xuan, 2014). This section therefore conducts a series of tests to identify the direction of the causal relation.

First, we examine changes in centrality from one or two years before an acquisition to the year when the deal happens, both for the full sample as well as for the subsample of bidders associated with below-median acquisition CARs. In all cases, the median centrality change is zero and the mean change is a one percentile increase for the [t–2, t] and [t–1, t] windows—economically insignificant, and statistically insignificantly different from zero. The results are nearly identical if we look at changes in centrality between deals by repeated bidders. Taken together, this evidence does not support the reverse causality story that CEOs bid to increase network centrality, or that CEOs purposely conduct value-destroying deals in order to increase network centrality.

Second, we rerun the models in Tables 4, 6, and 7 with centrality measures estimated two to five years prior (as opposed to immediately before) the takeover announcement. At that time, CEO centrality should be unrelated to future M&A decisions. We find that the lagged centrality measures are still significantly positive determinants of takeover likelihood, and significantly negative determinants of both bidder and combined acquisition CARs.

Third, we rerun the models in Tables 4, 6, and 7 with centrality measures calculated using only connections that the CEO has had for at least five years. Average bidder CEO centrality percentiles are now lower compared to those presented in Table 1 (by approximately 8 percentage points), but centrality measures based on these long-lasting connections are still significantly positive determinants of takeover likelihood, and significantly negative determinants of both bidder and combined acquisition CARs, again suggesting the detrimental effect of CEO centrality even if we disregard connections formed shortly before the acquisition attempt.

Lastly, we find that the means and medians of bidder and combined CARs are significantly negative for subsamples of both first-time acquirers (510 acquisitions) and repeated acquirers (the remaining 266 sample acquisitions). In addition, when we rerun the models in Table 6 and Table 7 separately for both subsamples, we find that all centrality measures are negative determinants of bidder and combined CARs for both first-time and repeat acquirers (significantly negative in all four models analyzing bidder or combined CARs for the subsample of first-time acquirers, and in two out of four models analyzing bidder or combined CARs for the subsample of repeat acquirers).[30,31] These results once again fail to support the hypothesis that the CEO's motivation for pursuing acquisitions is a desire to acquire connections or higher centrality: whatever the frequency of pursued acquisitions (and thus the number of new connections gained), the deals tend to be value-destroying and are negatively affected by centrality.

6. Conclusion

CEOs who are centrally positioned in a network of business professionals enjoy better access to private information, greater bargaining power, and more loyalty and conformity in the boardroom. Adding to prior studies of the role of social ties between business participants, we employ network centrality measures to test the power of one party over another when the higher-centrality person commands the information flow and the ability to achieve consensus and conformity.

In the context of M&A transactions, we show that CEOs with higher network centrality are more likely to pursue acquisitions, and that these deals are more likely to destroy value. The evidence suggests that the benefits from better access to information are offset by increased entrenchment and greater power over board members.

We further confirm that high-centrality CEOs' greater tendency to make acquisitions and to generate lower returns from M&A deals does not come solely from other known factors such as the existence of

[30] When we put a dummy of first-time vs. repeated acquisition in Table 6 and Table 7 regressions, the dummy itself is insignificant, while the centrality coefficients remain highly significantly negative.
[31] We get very similar results when we split the sample into subsamples CEOs with only one acquisition vs. CEOs associated with multiple acquisitions.

ties between the CEO and board members (Hwang and Kim, 2009), the presence of social ties between bidder and target boards (Cai and Sevilir, 2012; Ishii and Xuan, 2014), the deal size effect (Moeller et al., 2004), or overconfidence (Melmendier and Tate, 2008). Further supporting the association between high centrality and managerial entrenchment, we find that bidding companies run by well-connected CEOs are less likely to be taken over following a value-destroying acquisition. In addition, high-centrality bidder CEOs are less likely to be dismissed when an acquisition generates shareholder losses. Bidder CEOs are able to reap extra pecuniary and non-pecuniary benefits, while internal corporate governance, such as board monitoring intensity (Faleye et al., 2011) and blockholder ownership, has limited power in reducing bidding propensity or improving bidder returns.

We contribute to the literature on social networks in finance by introducing the concept of high and low centrality. Our results extend the existing literature on the benefits and costs of social connections and show that social network positioning, beyond bilateral connections, matters in corporate governance. With regard to CEOs, our findings suggest a corporate governance challenge unidentified in prior literature: high-centrality CEOs can become powerful enough to pursue acquisitions regardless of the potentially negative impact on shareholders. Further studies can help to shed light on social pressure, behavior modification, or new governance designs that create appropriate incentives or otherwise constrain powerful CEOs.

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Appendix A

Social network centrality: definitions and a simple example

The following table presents the mathematical formulas for the network centrality measures used in the paper. The example demonstrates a network of eight individuals belonging to two separate "components," with six (nodes A through F) having at least one connection to the larger component, and two (nodes X and Y) having no connection to the larger component. We denote $\boldsymbol{N}$ as the size of the network, and $\boldsymbol{n}$ as the size of a component.

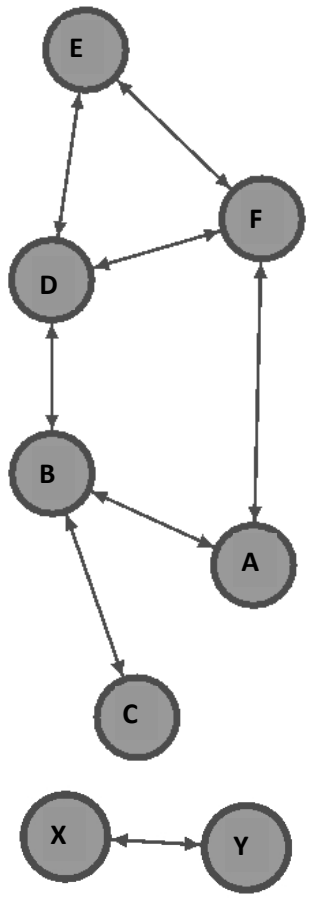
Next, we illustrate the calculation of centrality using persons A and X as examples. Person A is directly linked to persons B and F, and thus has a degree of 2. Person X is linked only to Y, and thus has a degree of 1.

Person A's shortest distances to persons B, C, D, E, and F are 1, 2, 2, 2, and 1, respectively. Person A has no connections to X or Y. The size of the component is 6. Person A's closeness is therefore $\frac{6-1}{1+2+2+2+1} \times \frac{6}{8} = 0.469$. Person X's closeness is $\frac{2-1}{1} \times \frac{2}{8} = 0.25$.

Person A is on the geodesic between two pairs of individuals: the first pair is persons B and F and the second pair is persons C and F. Note that the geodesic is not unique in either case, as the shortest path can take B–D–F or B–A–F between B and F, and C–B–D–F or C–B–A–F between C and F. Therefore, person A's betweenness is $\frac{1/2}{(6-1)\times(6-2)/2} + \frac{1/2}{(6-1)\times(6-2)/2} = 0.100$. Person X connects no pairs of individuals, so betweenness is 0.

Lastly, eigenvector centrality is calculated by finding the principal eigenvalue of the adjacency matrix that represents this network.

The following table summarizes the definitions and the centrality values based on the graphic example.

Centrality	Formula	Graphic Example	Results
Degree	$D_i = \sum_{j \neq i} x_{ij}$ where x_{ij} is 1 for the presence of a social connection between *i* and *j*.		D_A=2 D_B=3 D_C=1 D_D=3 D_E=2 D_F=3 D_X=1 D_Y=1
Closeness	$C_i = \frac{n-1}{\sum_{i \neq j \in N} d_{ij}} \times \frac{n}{N}$ where d_{ij} is the shortest distance between nodes *i* and *j*, *n* is the size of the component *i* belongs to, and *N* is the size of the yearly network.		C_A=0.469 C_B=0.536 C_C=0.341 C_D=0.536 C_E=0.417 C_F=0.469 C_X=0.250 C_Y=0.250
Betweenness	$B_k = \sum_{i<j \neq k \in N} \frac{g_{ij(k)}/g_{ij}}{(n-1)(n-2)/2}$ where g_{ij} is 1 for any geodesic connecting *i* and *j*, and $g_{ij(k)}$ is assigned a value of 1 if the geodesic between *i* and *j* also passes through *k*.		B_A=0.100 B_B=0.450 B_C=0.000 B_D=0.300 B_E=0.000 B_F=0.150 B_X=0 B_Y=0
Eigenvector	E_i is solved by satisfying λE′ E = E′ AE, where ***E*** is an eigenvector of the matrix of connections **A**, and λ is its associated eigenvalue. E_i is taken as the elements of the *eigenvector* $\mathbf{E}^*$ associated with **A**'s *principal eigenvalue*, λ^*.		E_A=0.358 E_B=0.408 E_C=0.161 E_D=0.516 E_E=0.401 E_F=0.502 E_X=0 E_Y=0

Appendix B

Graphing the network

We take a top-down approach to provide a graphic illustration of the actual business network. In 2006, the network of business professionals consists of 275,080 individuals interlinked by nearly 9.8 million unique connections. Figure B1 shows an aerial view of the network, represented by 1,474 clusters using the Louvian method (Blondel et al., 2008). The outer ring is made up by 1,252 "isolates," groups of individuals in very small clusters unconnected to the main components. The "star" shape inside the ring is the giant main component of the network, containing 222 clusters that collect 264,915 individuals, or 96.3% of the network.

Figure B1
Giant main component and outer ring of isolates

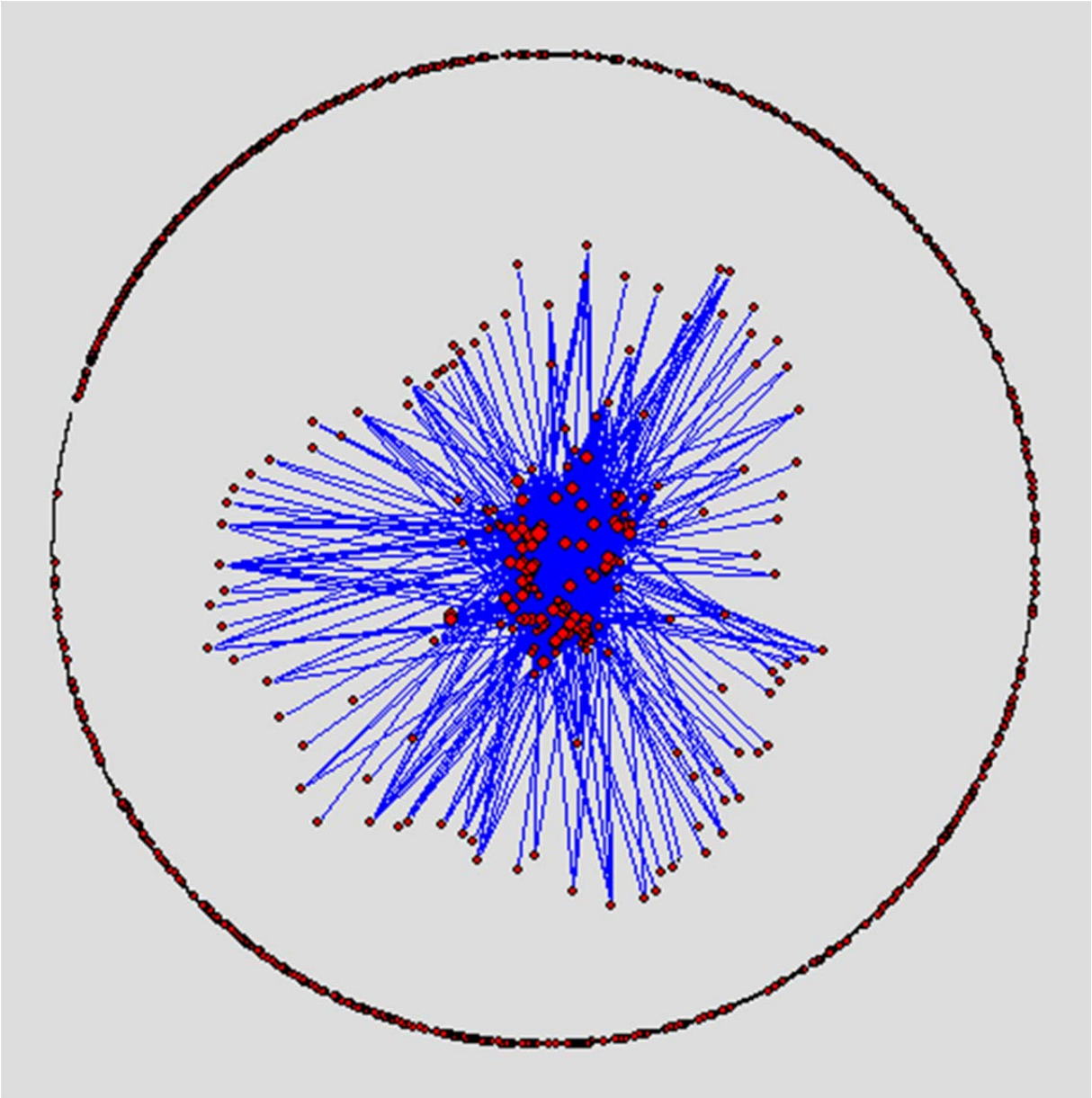


Figure B2
Core and leaflets

Figure B2 presents a larger view of the 222 clusters in the giant main component. Note that the ID of each cluster is assigned by the algorithm and does not represent a particular ordering. The size of the circle representing each cluster is proportional to the natural logarithm of the number of individuals in that cluster. The graph shows large clusters forming a densely connected "core" and smaller clusters loosely connected to the core, called "leaflets."

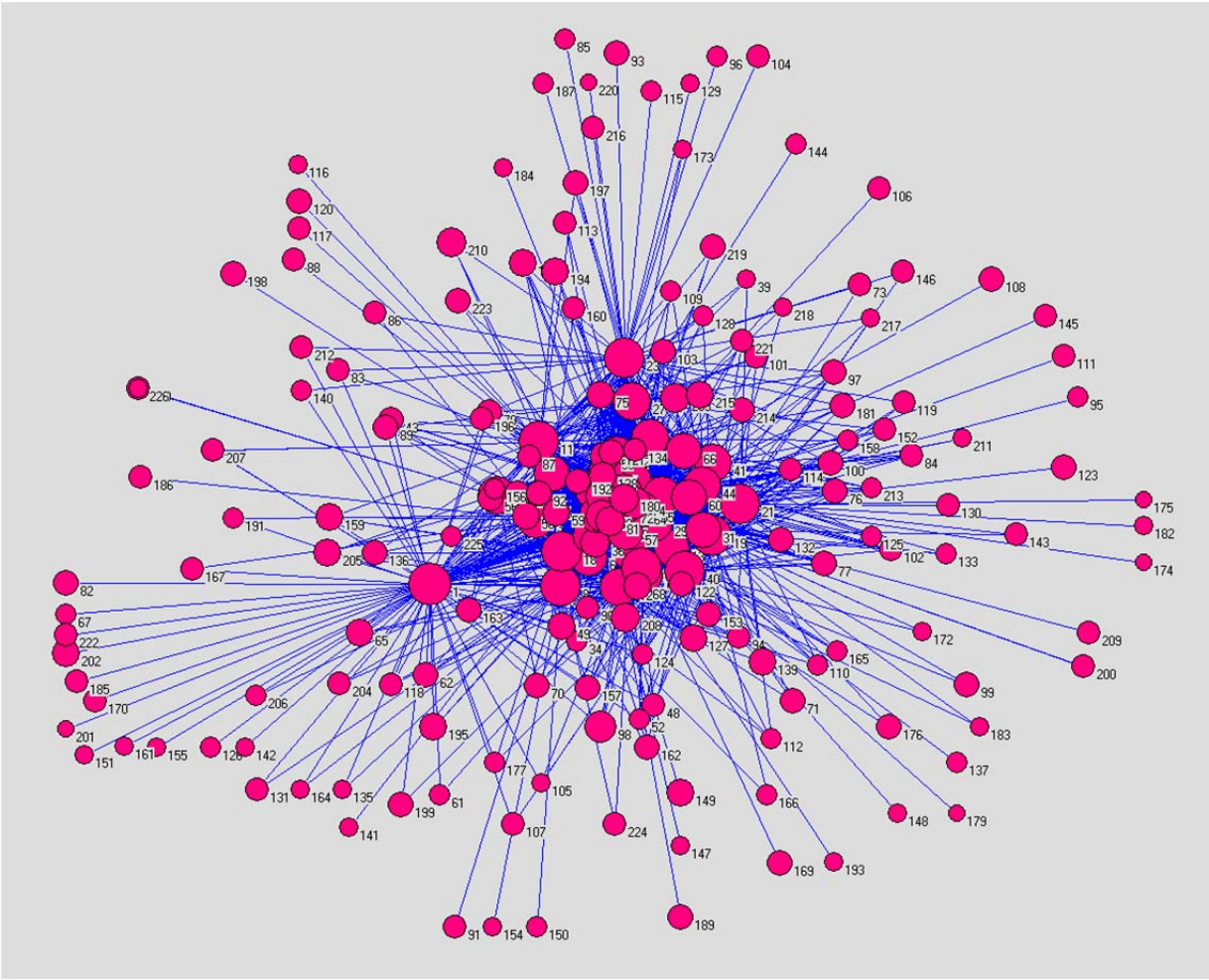


Figure B3
Selecting two examples

This figure shows the selection of two examples for further illustration. The white rectangle marks one area of the core that is magnified in Figure B4, and the black circle indicates one cluster (#73) in the periphery, which is magnified in Figure B7.

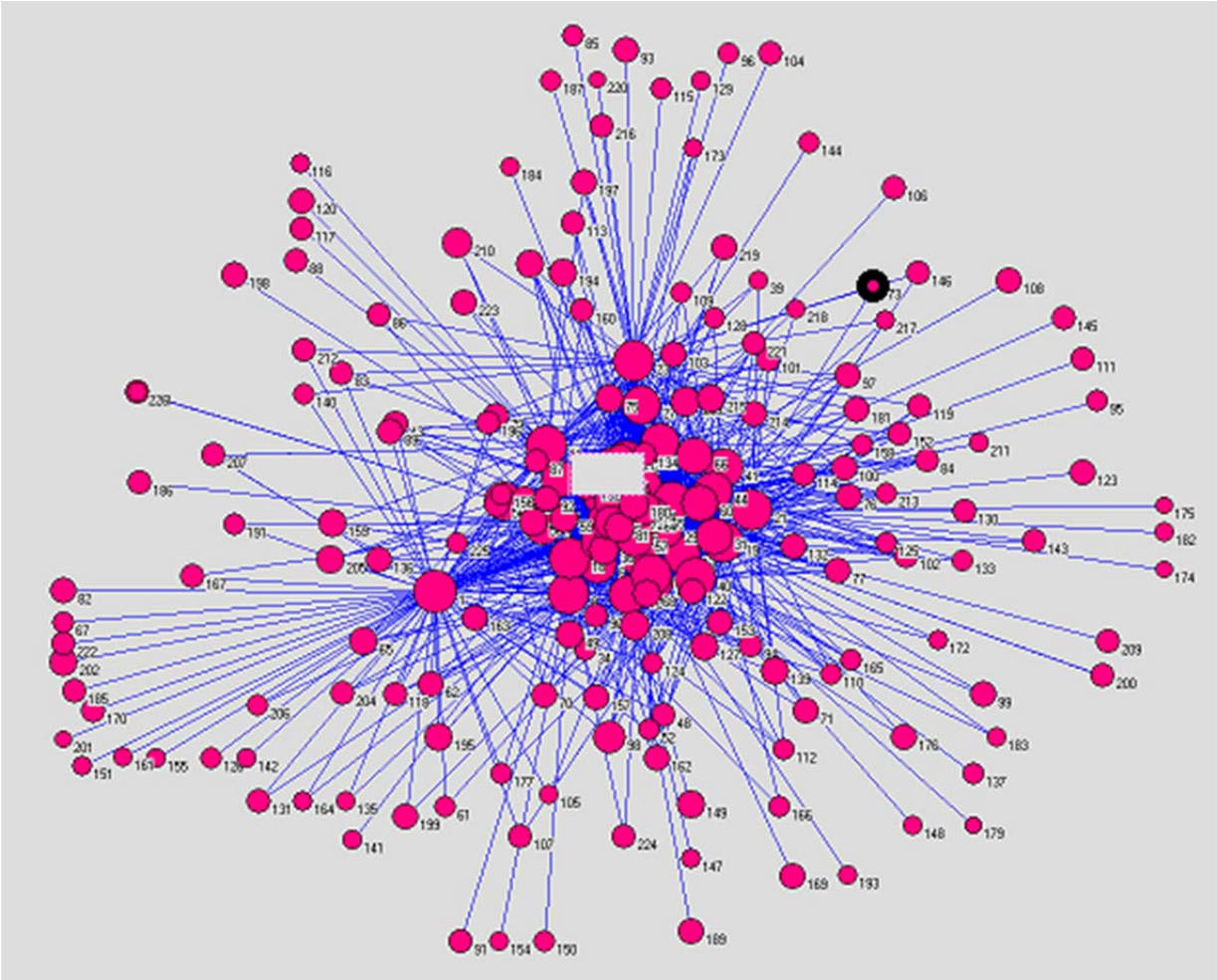


Figure B4
Close-up look at the core

This figure zeroes in on the rectangular area of the core near the center (indicated in Figure B3) to show more details. Here we see, from top to bottom, clusters #121 (49), #22 (2,748), #50 (152), #30 (1,678), #138 (109), and #192 (48), where the numbers in parentheses indicate the number of individuals in each cluster. The size of the circle is proportional to the square root of the number of people in each cluster. The graph shows interconnections between clusters, at different level of density. Not shown here are individuals inside the clusters are even more densely connected. Figure B5 shows the structure of Cluster 30, circled in black.

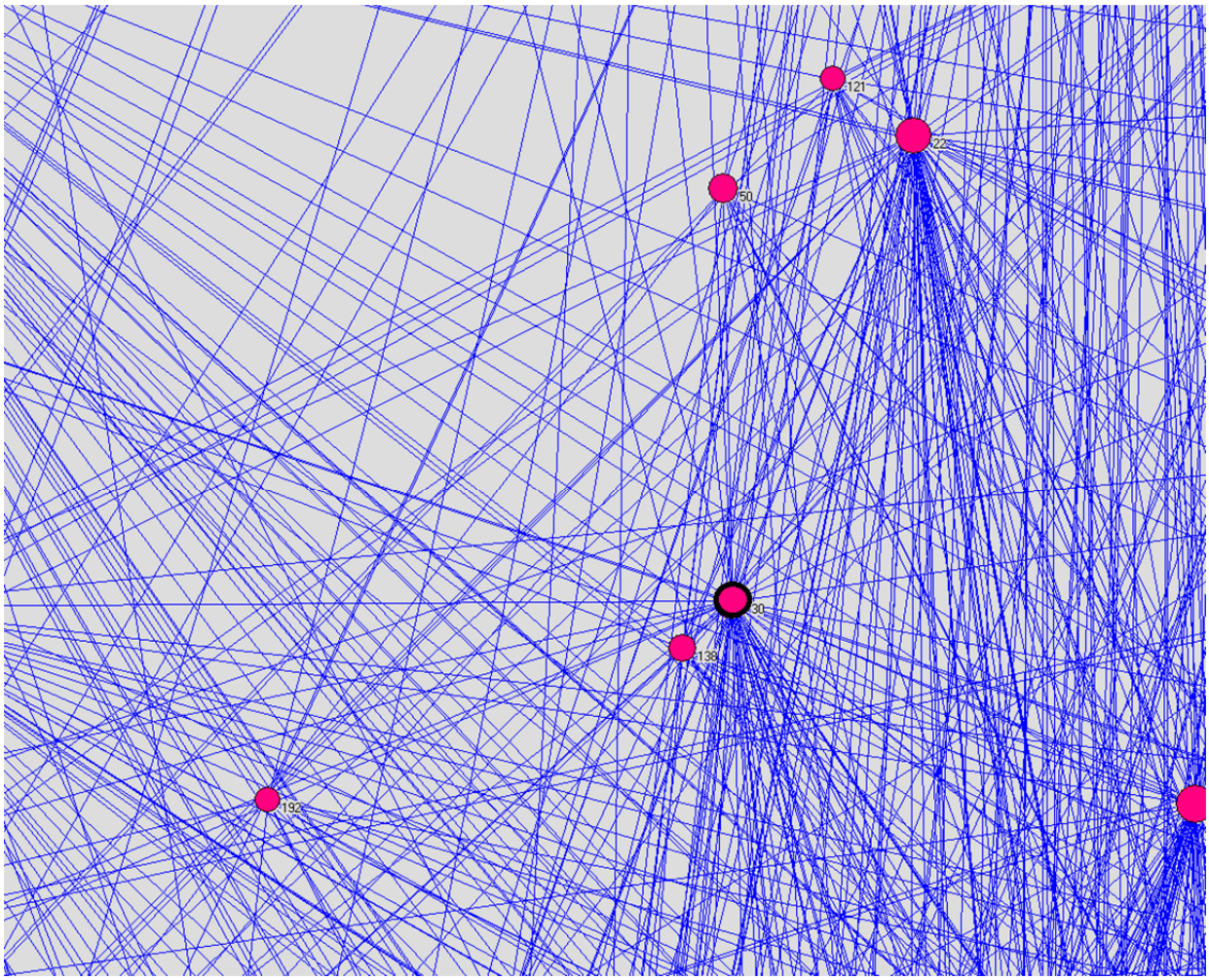


Figure B5
Cluster #30 (1,678) in sub-clusters

This figure shows 27 sub-clusters inside Cluster #30, once again applying the Louvian community detection algorithm of Blondel et al. (2008). The largest subclusters are #1, representing 498 individuals, and #2, representing 442 individuals. The size of the circle representing each subcluster is proportional to the number of people in the subcluster. Most of the smaller subclusters are connected to either subcluster #1 or subcluster #2, but not all are connected to both. The next figure shows more details of subcluster #1.

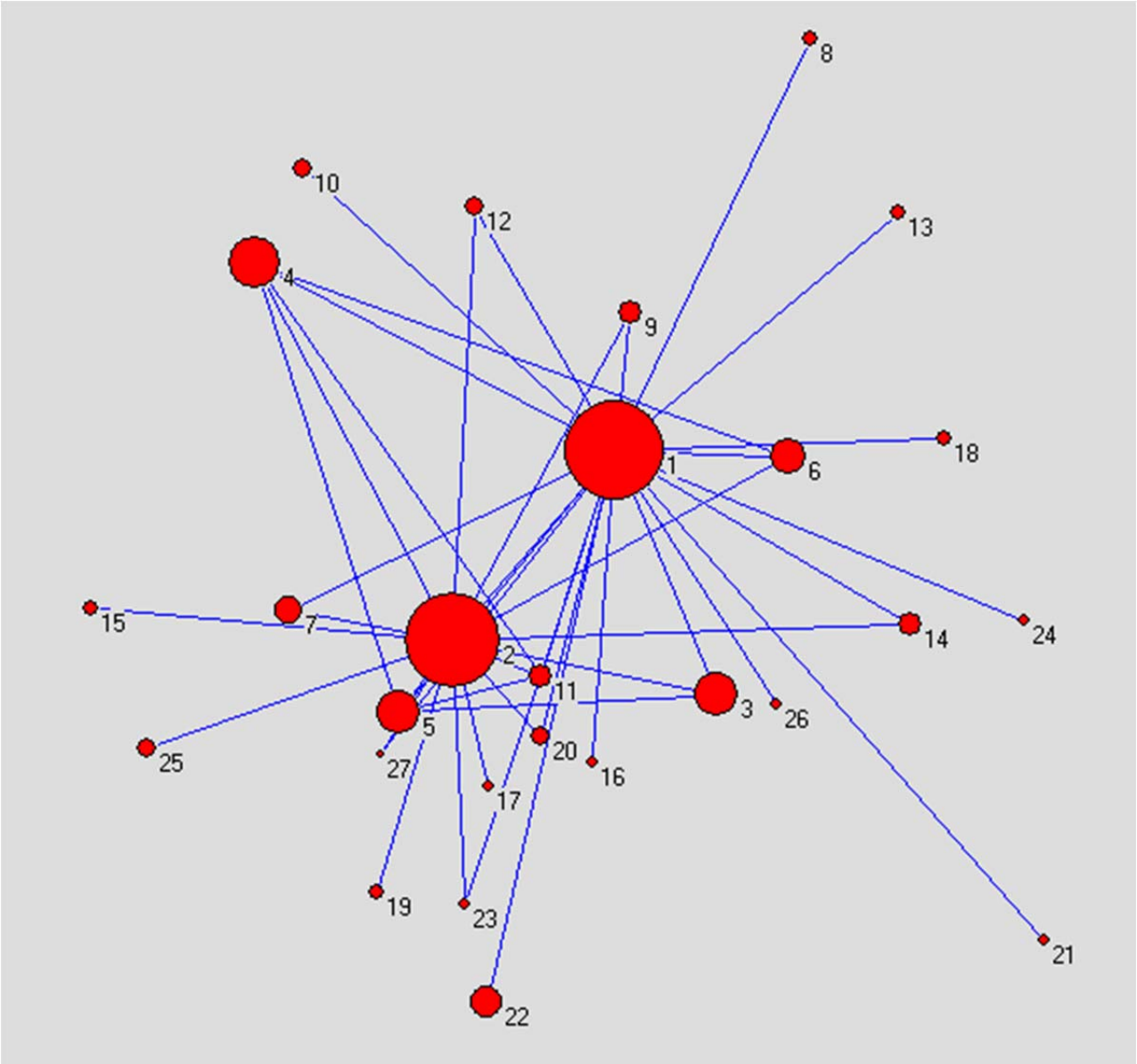


Figure B6
Sub-cluster #1 of Cluster #30

Figure B5 shows each individual in Cluster #30, subcluster #1. These 498 individuals once again appear to form closer and tighter connections within their color-coded region, but those with the highest centrality appear to be closer to the other regions ("connectors") than their peers in the same colored region. Node 1 is Mr. Nardelli, CEO of Home Depot from December 2000 to January 2007. Node 2 is Mr. McNerney (CEO of Boeing since July 2005). Both carry a score of 100 for all four centrality measures in percentiles.

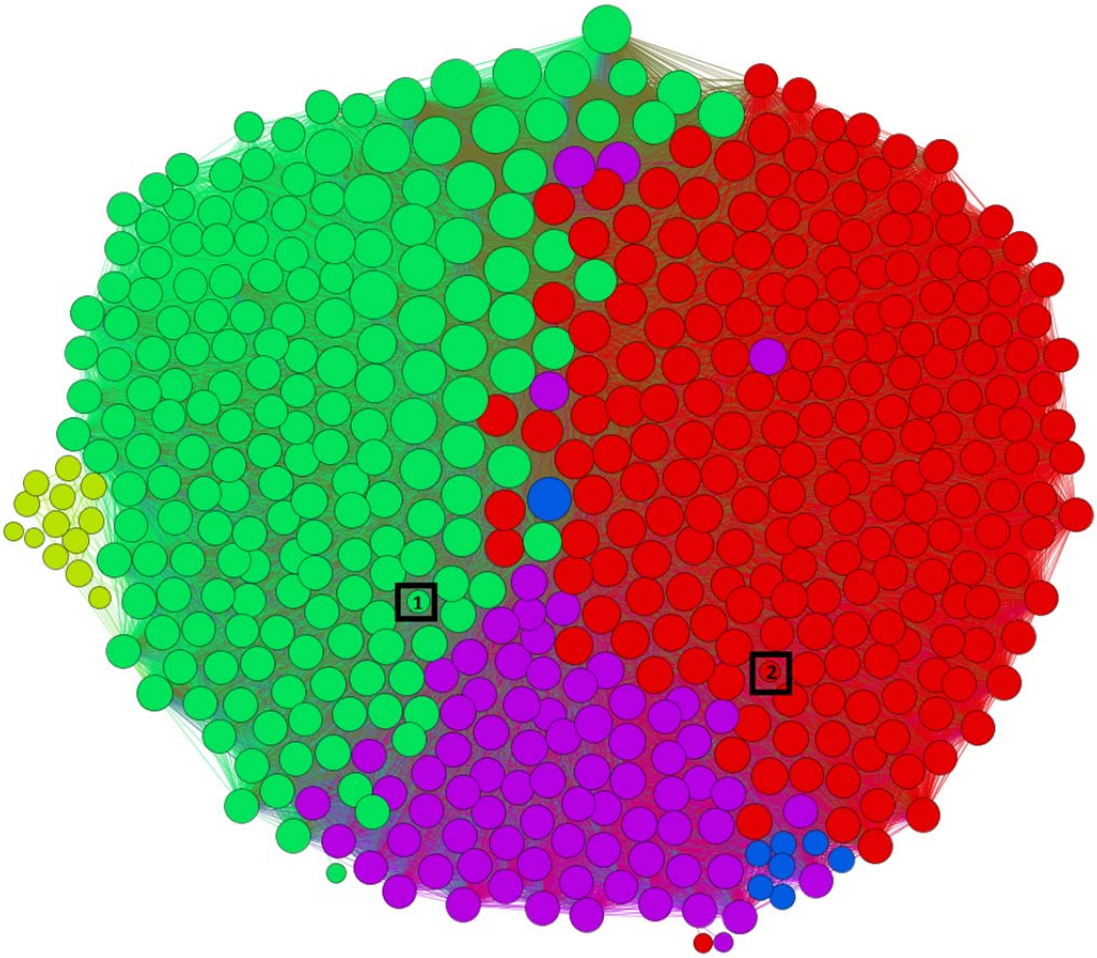


Figure B7: Cluster #73.

Cluster #73 is the "leaflet" identified in Fig. B3. It is an extremely symmetric cluster where everyone is connected to everyone else inside the cluster. The large dot is Ronald Hermance Jr. (CEO of Hudson City). In this cluster, everyone assumes the same level of importance because we cut out the information on the connections to the outside. Once we add connections to the outside, certain people (those with connections) become more important than others in the cluster. For example, Mr. Hermance becomes more important than others in the cluster, with a percentile centrality ranking of 1 in betweenness (compared to zero for those who have no outside connection), 35 in closeness, and 35 in eigenvector centrality. The low number of connections to the outside, on the other hand, keep Cluster 73 in the periphery, and thus adversely affects the centrality of each individual in this cluster.

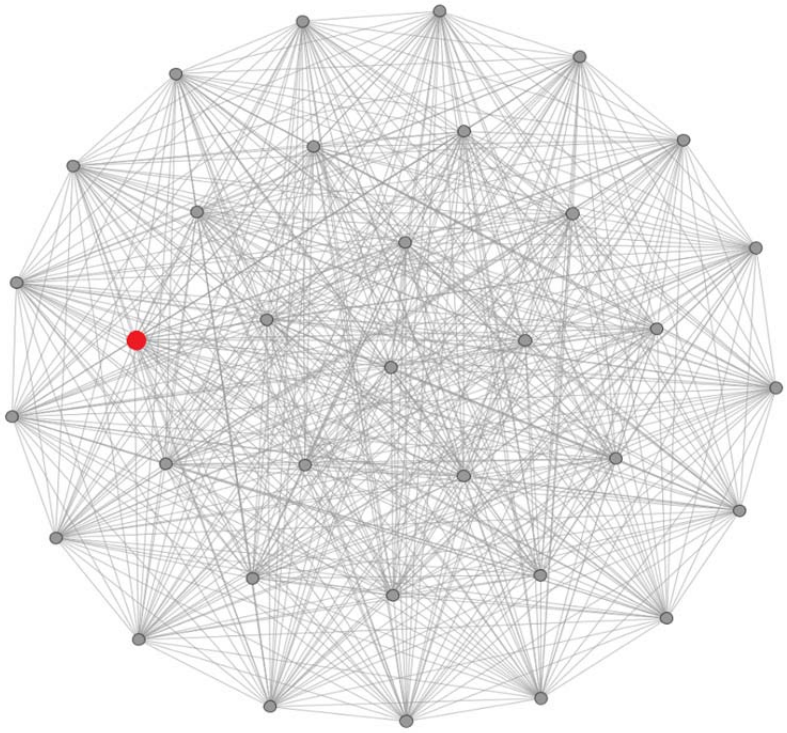


Table 1
Summary statistics for centrality measures

This table presents summary statistics on the four centrality measures for the sample of 4,005 S&P 1500 CEOs over the period January 1, 1999 to December 31, 2008, or a total of 16,415 firm-year observations. Centrality measures are as defined in Section 2.1. and 2.2. Panel A shows the centrality measures and Panel B shows the percentile ranks based on the social network of all directors and executives of U.S. public companies.

Panel A: Centrality measures

	N	Mean	Std. Dev.	P25	Median	P75	Min.	Max.
Closeness	16,415	0.250	0.029	0.231	0.250	0.269	0.183	0.313
Degree	16,415	153.07	205.040	35	76	174	2	1984
Betweenness	16,415	0.0000455	0.0001	0.000000984	0.00001	0.0000818	0	0.0036
Eigenvector	16,415	0.0006	0.0037	0.000000962	0.000001	0.0000849	0	0.041

Panel B: Percentiles

Closeness	16,415	74.644th	21.513	61st	80th	93rd	1st	100th
Degree	16,415	71.617th	24.258	54th	78th	93rd	1st	100th
Betweenness	16,415	76.591th	23.756	67th	84th	94th	1st	100th
Eigenvector	16,415	73.827th	21.256	61st	78th	92nd	1st	100th

Table 2
Summary statistics of firm characteristics

This table presents the summary statistics of firm characteristics for the S&P 1500 universe and the bidder sample. In Panel A, the mean, median, and standard deviation of financial variables are calculated for the full sample and for two subsamples divided by the median value of one of the four CEO network centrality measures: closeness, degree, betweenness, and eigenvector. *Firm Size* is the log of total assets. *Tobin's Q* is calculated as the sum of the market value of equity (end-of-year price per share multiplied by the number of shares outstanding at year-end), short-term and long-term debt, and the liquidating value of preferred stock, all divided by the total book value of assets. *Profitability* is the return on total assets. *Leverage* is the ratio of the book value of short-term and long-term debt to total assets. *Liquidity* is the ratio of operating cash flow to total assets. *** and ** denote a statistically significant difference between the means of below- and above-Median CEO centrality groups at the 1% and 5% levels, respectively. Panel B repeats the analysis using the bidder sample that includes only firms that successfully completed an acquisition of another publicly traded entity between 2000 and 2009. Means, medians, and standard deviations are reported for the subsamples based on closeness centrality values. Only means are reported for the subsamples based on degree, betweenness, and eigenvector values.

Panel A: S&P 1500 sample

	Closeness										
	Full Sample				Below Median			Above Median			
	N	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Below – Above
Size	16,415	7.607	7.469	1.709	7.080	6.953	1.476	8.160	8.063	1.761	-1.080***
Tobin's Q	16,415	1.667	1.168	2.086	1.609	1.150	1.909	1.728	1.189	2.256	-0.119***
Profitability	16,415	0.034	0.041	0.109	0.037	0.042	0.106	0.030	0.041	0.111	0.007***
Leverage	16,415	0.229	0.211	0.191	0.212	0.194	0.195	0.239	0.227	0.188	-0.020***
Liquidity	16,415	0.090	0.086	0.101	0.090	0.085	0.104	0.090	0.088	0.099	-0.000

	Degree			Betweenness			Eigenvector		
	Below	Above	Diff	Below	Above	Diff	Below	Above	Diff
Size	7.024	8.205	-1.180***	7.198	8.040	-0.842***	7.267	7.966	-0.700***
Tobin's Q	1.634	1.700	-0.066**	1.685	1.647	0.038	1.549	1.791	-0.242***
Profitability	0.037	0.030	0.007***	0.036	0.031	0.005***	0.039	0.029	0.010***
Leverage	0.217	0.242	-0.025***	0.216	0.243	-0.027***	0.231	0.227	0.003
Liquidity	0.091	0.089	0.001	0.090	0.090	-0.000	0.090	0.090	0.001

Panel B: Bidder sample

	Closeness										
	Full Sample				Below Median			Above Median			
	N	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Below – Above
Size	776	8.839	8.855	1.615	8.348	8.499	1.503	9.047	8.855	1.617	-0.699***
Tobin's Q	776	1.922	1.342	2.311	1.372	0.929	1.833	2.156	1.500	2.451	-0.784***
Profitability	776	0.052	0.050	0.079	0.042	0.023	0.060	0.057	0.059	0.085	-0.015**
Leverage	776	0.202	0.193	0.152	0.233	0.245	0.159	0.189	0.178	0.147	0.044***
Liquidity	776	0.102	0.099	0.082	0.083	0.057	0.080	0.109	0.116	0.081	-0.026***

	Degree			Betweenness			Eigenvector		
	Below	Above	Diff	Below	Above	Diff	Below	Above	Diff
Size	7.955	9.163	-1.208***	8.453	9.047	-0.594***	8.577	8.956	-0.379***
Tobin's Q	1.605	2.038	-0.433**	1.662	2.062	-0.400**	1.369	2.169	-0.800***
Profitability	0.040	0.057	-0.017***	0.048	0.055	-0.007	0.044	0.056	-0.012**
Leverage	0.234	0.191	0.043***	0.221	0.192	0.029**	0.243	0.184	0.059***
Liquidity	0.084	0.108	-0.024***	0.087	0.110	-0.023***	0.082	0.110	-0.028***

Table 3
Univariate statistics on CEO centrality and acquisition likelihood

Panel A: Comparisons of CEO centrality measures between acquirers and non-acquirers

This panel presents T-test and Wilcoxon rank test statistics on the null hypotheses of equal mean and median of network centrality measures between groups of acquirer CEOs and non-acquirer CEOs. Acquirers are S&P 1500 firms that successfully completed one or more acquisitions of public targets. The results of the tests are presented using centrality percentiles. *** Denotes statistical significance at the 1% level.

	Acquirers				Non-Acquirers				T-test	Wilcoxon Rank Test
Centrality	**N**	**Mean**	**Median**	**Std.**	**N**	**Mean**	**Median**	**Std.**	**T-Value**	**Z-Value**
Closeness	776	83.22	90.00	19.47	15639	74.26	79.00	21.52	-11.94***	-12.94***
Degree	776	83.65	91.00	18.45	15639	71.06	78.00	24.35	-17.51***	-15.04***
Betweenness	776	84.9	92.00	19.76	15639	76.22	84.00	23.85	-11.34***	-12.49***
Eigenvector	776	82.61	89.00	18.98	15639	73.43	78.00	21.27	-12.54***	-13.17***

Panel B: Number of acquisitions by CEOs with below- or above-median measures of closeness, degree, betweenness, and eigenvector

This panel presents the number of acquisitions by year of merger announcement as reported by SDC. The acquirers are S&P 1500 firms and the targets are U.S. public companies, and the deals are all successfully completed. The numbers in parentheses are the number of deals by the below- or above-median group (on the basis of CEO centrality) divided by the total number of deals in the year.

Year		**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**Total**
Full Sample		114	108	62	69	77	79	82	78	50	57	776
Closeness	**Below median**	34	28	22	23	28	21	26	22	12	15	231
		(.30)	(.26)	(.35)	(.33)	(.36)	(.27)	(.32)	(.28)	(.24)	(.26)	(.30)
	Above median	80	80	40	46	49	58	56	57	38	42	545
		(.70)	(.74)	(.65)	(.67)	(.64)	(.73)	(.68)	(.72)	(.76)	(.74)	(.70)
Degree	**Below median**	28	24	19	22	25	18	23	21	12	16	208
		(.25)	(.22)	(.31)	(.32)	(.32)	(.23)	(.28)	(.27)	(.24)	(.28)	(.27)
	Above median	86	84	43	47	52	61	59	57	38	41	568
		(.75)	(.78)	(.69)	(.68)	(.68)	(.77)	(.72)	(.73)	(.76)	(.72)	(.73)
Betweenness	**Below median**	45	40	18	29	23	30	29	25	18	15	272
		(.39)	(.37)	(.29)	(.42)	(.30)	(.38)	(.35)	(.32)	(.36)	(.26)	(.35)
	Above median	69	68	44	40	54	49	53	53	32	42	504
		(.61)	(.63)	(.71)	(.58)	(.70)	(.62)	(.65)	(.68)	(.64)	(.74)	(.65)
Eigenvector	**Below median**	36	35	22	23	29	27	21	23	10	13	239
		(.32)	(.32)	(.35)	(.33)	(.38)	(.34)	(.26)	(.29)	(.20)	(.23)	(.31)
	Above median	78	73	40	46	48	52	61	55	40	44	537
		(.68)	(.68)	(.65)	(.67)	(.62)	(.66)	(.74)	(.71)	(.80)	(.77)	(.69)

Table 4
Probit model of acquisitions

This table presents the results of Probit models of acquisitions using a sample of S&P 1500 firms from 2000 to 2009. The dependent variable is the probability that the firm announced a successfully completed acquisition of a U.S. public target. The CEO's centrality is measured by closeness in column (1), degree in (2), betweenness in (3), eigenvector in (4), the first principal component score in (5), and the orthogonal versions of the centrality measures in (6). Panel A includes firm financial measures as control variables. *Tobin's Q* is calculated as the sum of the market value of equity (end-of-year price per share multiplied by the number of shares outstanding at year-end), short-term and long-term debt, and the liquidating value of preferred stock, all divided by the total book value of assets. *Liquidity* is the ratio of operating cash flow to total assets. *Profitability* is the return on total assets. *Firm Size* is the log of total assets. *Leverage* is the ratio of the book value of short-term and long-term debt to total assets. Panel B adds additional controls for corporate governance. *Intense Monitors* is a dummy variable that equals one if more than 50% of the board directors sit on two or more of the auditing, nominating, and compensation committees (Faleye et al., 2011). *Board Size* is the total number of directors on the board. *Duality* is a dummy variable that equals one if the CEO is also the chair of the board and zero otherwise. *E-index* is Bebchuk, Cohen, and Ferrell's (2009) entrenchment index. *Age* is the CEO's age. *Block Ownership* is a dummy variable that equals one if there is at least one block holder that owns 5% or more of the common shares outstanding and zero otherwise. *CEO Ownership* is the percentage of shares owned by the CEO. All independent variables and controls are lagged one year. Heteroskedastic-consistent probability values rejecting the null hypotheses of zero coefficients are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4 Panel A: CEO centrality and the probability of acquisition controlling for firm characteristics

Dep. Variable = Prob(Deal)	(1)	(2)	(3)	(4)	(5)	(6)
Centrality	Closeness	Degree	Betweenness	Eigenvector	Principal component	Ortho
Closeness	0.4553*** 0.000					0.1131*** (0.000)
Degree		0.6754*** (0.000)				0.0367* (0.080)
Betweenness			0.4967*** (0.000)			0.1340*** (0.000)
Eigenvector				0.6161*** (0.000)		0.1176*** (0.000)
Principal component					0.0744*** (0.000)	
Tobin's Q	0.0344*** 0.000	0.0325*** (0.000)	0.0357*** (0.000)	0.0323*** (0.000)	0.0329*** (0.000)	0.0304*** (0.000)
Liquidity	0.2231 (0.444)	0.1499 (0.609)	0.2455 (0.400)	0.1900 (0.515)	0.1692 (0.561)	0.1965 (0.511)
Profitability	0.3862 (0.162)	0.4493 (0.106)	0.3630 (0.193)	0.4523* (0.100)	0.4368 (0.114)	0.5303* (0.061)
Firm size	0.1943*** (0.000)	0.1776*** (0.000)	0.1977*** (0.000)	0.1929*** (0.000)	0.1867*** (0.000)	0.1835*** (0.000)
Leverage	-0.7692*** (0.000)	-0.7635*** (0.000)	-0.7837*** (0.000)	-0.7360*** (0.000)	-0.7632*** (0.000)	-0.6771*** (0.000)
Constant	-3.5685*** (0.000)	-3.5908*** (0.000)	-3.6378*** (0.000)	-3.6820*** (0.000)	-3.1733*** (0.000)	-3.1924*** (0.000)
N	16,415	16,415	16,415	16,415	16,415	16,415
Pseudo R^2	7.86%	8.33%	7.99%	8.16%	8.17%	9.06%

Table 4 Panel B: CEO centrality and the probability of acquisition controlling for firm characteristics and corporate governance

Dep. Variable=Prob(Deal)	(1)	(2)	(3)	(4)	(5)	(6)
Centrality	**Closeness**	**Degree**	**Betweenness**	**Eigenvector**	**Principal component**	**Ortho**
Closeness	0.3557***					0.1027***
	(0.004)					(0.000)
Degree		0.5900***				0.0169
		(0.000)				(0.470)
Betweenness			0.4542***			0.1247***
			(0.000)			(0.000)
Eigenvector				0.5004***		0.1035***
				(0.000)		(0.000)
Principal component					0.0631***	
					(0.000)	
Tobin's Q	0.0322***	0.0300***	0.0326***	0.0305***	0.0307***	0.0282***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Liquidity	0.3061	0.2205	0.3073	0.2710	0.2455	0.2720
	(0.363)	(0.512)	(0.359)	(0.420)	(0.464)	(0.426)
Profitability	0.4518	0.5108	0.4545	0.5027	0.4961	0.5943*
	(0.161)	(0.115)	(0.162)	(0.118)	(0.124)	(0.073)
Size	0.1783***	0.1637***	0.1793***	0.1760***	0.1710***	0.1704***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	-0.8228***	-0.8155***	-0.8299***	-0.7957***	-0.8153***	-0.7383***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intense monitors	-0.1923***	-0.1902***	-0.1973***	-0.1883***	-0.1905***	-0.1913***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Board size	0.0111	0.0101	0.0107	0.0120	0.0115	0.0086
	(0.225)	(0.267)	(0.240)	(0.188)	(0.210)	(0.342)
Duality	0.0828*	0.0757*	0.0781*	0.0830*	0.0776*	0.0852*
	(0.064)	(0.092)	(0.082)	(0.063)	(0.083)	(0.059)
E-index	-0.0113	-0.0121	-0.0117	-0.0094	-0.0109	-0.0092
	(0.442)	(0.412)	(0.429)	(0.526)	(0.461)	(0.530)
Age	-0.0119***	-0.0121***	-0.0127***	-0.0115***	-0.0119***	-0.0125***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Block ownership	0.0349	0.0432	0.0397	0.0397	0.0406	0.0564
	(0.546)	(0.457)	(0.494)	(0.493)	(0.483)	(0.335)
CEO ownership	-0.9966*	-0.8712*	-1.0192*	-0.9597*	-.91382*	-1.0245*
	(0.059)	(0.096)	(0.054)	(0.067)	(0.081)	(0.060)
Constant	-2.7216***	-2.7516***	-2.7607***	-2.8540***	-2.4057***	-2.3958***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	13,398	13,398	13,398	13,398	13,398	13,398
Pseudo R^2	8.55%	8.93%	8.62%	8.75%	8.79%	9.53%

Table 5
Cumulative abnormal returns around merger announcements

This table presents the cumulative abnormal returns (CARs) around the merger announcements over the three-day event windows (–3, +3) for the acquirer, the target, and the combined new firm. In each panel, numbers are presented first for the full sample and then divided into three groups based on the centrality of the acquirer's CEO. *LOW* contains the acquirers whose CEO centrality is below the 25th percentile of the sample, *MID* between the 25th and 75th percentiles, and *HIGH* above the 75th percentile of the sample. Each of the four measures of centrality—closeness, degree, betweenness, and eigenvector—are used to classify the sample into those groups. The CAR for the combined firm is calculated as the market-value-weighted average of CARs for the acquirer and the target. ***, **, and * denote statistical significance from zero at the 1%, 5%, and 10% levels, respectively. (a), (b), and (c) denote the statistical difference of means between *LOW* and *HIGH* at the 1%, 5%, and 10% levels, respectively. (x), (y), and (z) denote the statistical difference of medians between *LOW* and *HIGH* at the 1%, 5%, and 10% levels, respectively. Numbers in this table are percentages.

CAR (–3,+3)		**Full sample**		***LOW***		***MID***		***HIGH***		**Diff**	
	N	**Mean**	**Med.**	**Mean**	**Med.**	**Mean**	**Med.**	**Mean**	**Med.**	**Mean**	**Med.**
					Acquirer CARs						
Closeness	776	-1.87***	-1.41***	-0.775	-0.845**	-2.49***	-2.01***	-2.38***	-1.44***	1.60**(b)**	1.16**(y)**
Degree	776			-0.837	-1.200**	-2.76***	-1.88***	-2.02***	-1.15***	1.19**(c)**	0.046
Betweenness	776			-1.31**	-1.19***	-1.91***	-1.41***	-2.44***	-1.49***	1.13	0.303**(z)**
Eigenvector	776			-0.689	-0.677**	-2.29***	-1.83***	-2.69***	-1.61***	2.00**(a)**	0.93**(x)**
					Combined CARs						
Closeness	776	0.682**	0.330**	2.28***	1.535***	0.145	-0.106	-0.479	-0.248	2.76**(a)**	1.78**(x)**
Degree	776			2.32***	1.508***	-0.319	-0.212	-0.034	0.084	2.36**(a)**	1.42**(x)**
Betweenness	776			1.68***	1.218***	0.651	0.217	-0.418	-0.203	2.11**(a)**	1.42**(x)**
Eigenvector	776			1.95***	1.561***	0.194	0.028	-0.169	-0.283	2.12**(a)**	1.84**(x)**
					Target CARs						
Closeness	776	27.39***	21.28***	23.61***	19.33***	28.45***	23.24***	30.40***	23.32***	-6.78**(a)**	-3.99**(y)**
Degree	776			24.28***	19.89***	25.19***	21.48***	33.34***	24.18***	-9.06**(a)**	-4.29**(x)**
Betweenness	776			23.64***	19.97***	28.93***	20.85***	30.07***	23.88***	-6.43**(a)**	-3.90**(y)**
Eigenvector	776			22.14***	19.06***	28.62***	22.48***	31.81***	24.01***	-9.67**(a)**	-4.95**(x)**

Table 6
Acquirer CEO centrality and acquirer cumulative abnormal returns

This table presents OLS regression estimates of acquirer cumulative abnormal returns on measures of acquirer CEO centrality and other control variables. The dependent variable is the acquirer CAR over the three days before and after merger announcements. Acquirer CEO centrality is closeness in column (1), degree in (2), betweenness in (3), eigenvector in (4), the principal component score in (5), and the orthogonally transformed centrality variables in (6). Panel A includes firm financials and deal measures as control variables. *Firm Size* is the log of total assets. *Profitability* is the return on total assets. *Tobin's Q* is calculated as the sum of the market value of equity (end-of-year price per share multiplied by the number of shares outstanding at year-end), short-term and long-term debt, and the liquidating value of preferred stock, all divided by the total book value of assets. *Leverage* is the ratio of the book value of short-term and long-term debt to total assets. *Liquidity* is the ratio of operating cash flow to total assets. *Deal Value* is the total deal value as reported by SDC divided by the market value of the acquirer. *Same Industry* is a dummy variable that equals one if the acquirer and target have the same two-digit SIC code and zero otherwise. *Stock Deal* is a dummy variable that equals one if the transaction is financed entirely by stock and zero otherwise. Panel B adds additional controls for corporate governance. *Intense Monitors* is a dummy variable that equals one if more than 50% of the board directors sit on two or more of the auditing, nominating, and compensation committees (Faleye et al., 2011). *Board Size* is the total number of directors on the board. *Duality* is a dummy variable that equals one if the CEO is also the chair of the board and zero otherwise. *E-index* is Bebchuk, Cohen, and Ferrell's (2009) entrenchment index. *Age* is the CEO's age. *Block Ownership* is a dummy variable that equals one if there is at least one block holder that owns 5% or more of the common shares outstanding and zero otherwise. *CEO Ownership* is the percentage of shares owned by the CEO. All independent variables and controls are lagged one year. All models include industry and fixed year effects. Heteroskedastic-consistent probability values rejecting the null hypotheses of zero coefficients are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6
Panel A: Acquirer CEO centrality and acquirer CAR controlling for firm and deal characteristics

Dep. Variable=Bidder CAR	(1)	(2)	(3)	(4)	(5)	(6)
Centrality	**Closeness**	**Degree**	**Betweenness**	**Eigenvector**	**Principal component**	**Ortho**
Closeness	-0.0745***					-0.0080**
	(0.000)					(0.011)
Degree		-0.0688***				-0.0067*
		(0.001)				(0.079)
Betweenness			-0.0502***			-0.0118***
			(0.003)			(0.000)
Eigenvector				-0.0798***		-0.0001
				(0.000)		(0.957)
Principal component					-0.0079***	
					(0.000)	
Firm size	0.0034	0.0037	0.0015	0.0029	0.0036	0.0037
	(0.185)	(0.179)	(0.526)	(0.230)	(0.157)	(0.186)
Profitability	0.1481**	0.1498**	0.1547**	0.1494**	0.1479**	0.1476**
	(0.027)	(0.026)	(0.022)	(0.025)	(0.027)	(0.028)
Tobin's Q	-0.0026	-0.0029	-0.0032	-0.0025	-0.0028	-0.0025
	(0.252)	(0.198)	(0.148)	(0.276)	(0.213)	(0.269)
Leverage	0.0628**	0.0582**	0.0629**	0.0620**	0.0599**	0.0600**
	(0.023)	(0.033)	(0.023)	(0.024)	(0.029)	(0.028)
Liquidity	0.0499	0.0479	0.0451	0.0471	0.0510	0.0493
	(0.469)	(0.489)	(0.515)	(0.492)	(0.461)	(0.478)
Deal value	-0.0339***	-0.0345***	-0.0346***	-0.0339***	-0.0346***	-0.0341***
	(0.010)	(0.009)	(0.009)	(0.010)	(0.009)	(0.010)
Same industry	-0.0003	0.0013	0.0024	-0.0001	0.0004	-0.0002
	(0.956)	(0.834)	(0.691)	(0.981)	(0.952)	(0.969)
Stock deal	-0.0191**	-0.0174**	-0.0166**	-0.0182**	-0.0178**	-0.0182**
	(0.017)	(0.030)	(0.038)	(0.022)	(0.026)	(0.023)
Industry effects	YES	YES	YES	YES	YES	YES
Year effects	YES	YES	YES	YES	YES	YES
N	776	776	776	776	776	776
Adjusted R^2	9.34%	8.82%	8.40%	9.50%	7.811%	12.97%

Table 6
Panel B: Acquirer CEO centrality and acquirer CAR controlling for firm and deal characteristics and corporate governance

Dep. Variable=Bidder CAR	(1)	(2)	(3)	(4)	(5)	(6)
Centrality	Closeness	Degree	Betweenness	Eigenvector	Principal component	Ortho
Closeness	-0.0800***					-0.0081**
	(0.000)					(0.016)
Degree		-0.0774***				-0.0069*
		(0.000)				(0.072)
Betweenness			-0.0589***			-0.0131***
			(0.001)			(0.000)
Eigenvector				-0.0857***		0.0005
				(0.000)		(0.854)
Principal component					-0.0087***	
					(0.000)	
Firm size	0.0029	0.0031	0.0010	0.0023	0.0032	0.0031
	(0.334)	(0.322)	(0.733)	(0.444)	(0.295)	(0.322)
Profitability	0.1435**	0.1441**	0.1480**	0.1445**	0.1433**	0.1432**
	(0.029)	(0.029)	(0.027)	(0.028)	(0.029)	(0.029)
Tobin's Q	-0.0035	-0.0036*	-0.0041*	-0.0033	-0.0036*	-0.0033
	(0.111)	(0.097)	(0.057)	(0.121)	(0.094)	(0.121)
Leverage	0.0653**	0.0619**	0.0663**	0.0649**	0.0631**	0.0628**
	(0.021)	(0.027)	(0.020)	(0.022)	(0.025)	(0.024)
Liquidity	0.0176	0.0189	0.0161	0.0155	0.0198	0.0183
	(0.813)	(0.800)	(0.830)	(0.834)	(0.790)	(0.807)
Deal value	-0.0392***	-0.0392***	-0.0397***	-0.0391***	-0.0397***	-0.0394***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Same industry	-0.0009	0.0007	0.0018	-0.0010	-0.0001	-0.0007
	(0.890)	(0.911)	(0.787)	(0.883)	(0.983)	(0.915)
Stock deal	-0.0139	-0.0124	-0.0115	-0.0132	-0.0128	-0.0129
	(0.101)	(0.144)	(0.173)	(0.116)	(0.130)	(0.124)
Intense monitors	-0.0057	-0.0044	-0.0045	-0.0058	-0.0046	-0.0051
	(0.433)	(0.553)	(0.542)	(0.420)	(0.526)	(0.483)
Board size	0.0004	0.0009	0.0007	0.0005	0.0006	0.0006
	(0.753)	(0.462)	(0.572)	(0.666)	(0.621)	(0.601)
Duality	0.0077	0.0082	0.0074	0.0077	0.0080	0.0080
	(0.233)	(0.204)	(0.256)	(0.237)	(0.214)	(0.214)
E-index	0.0016	0.0022	0.0022	0.0015	0.0019	0.0018
	(0.485)	(0.325)	(0.344)	(0.506)	(0.396)	(0.434)
Age	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001
	(0.845)	(0.844)	(0.700)	(0.863)	(0.821)	(0.872)
Block ownership	0.0147	0.0148	0.0152	0.0144	0.0147	0.0144
	(0.119)	(0.124)	(0.113)	(0.128)	(0.124)	(0.131)
CEO ownership	-0.1780**	-0.1802**	-0.1597**	-0.1698**	-0.1740**	-0.1739**
	(0.014)	(0.016)	(0.030)	(0.020)	(0.018)	(0.018)
Industry effects	YES	YES	YES	YES	YES	YES
Year effects	YES	YES	YES	YES	YES	YES

N	685	685	685	685	685	685
Adjusted R^2	10.25%	9.74%	9.32%	10.50%	15.13%	15.35%

Table 7
Acquirer CEO centrality and combined cumulative abnormal returns

This table presents OLS regression estimates of the combined cumulative abnormal returns on measures of acquirer CEO centrality and other control variables. The dependent variable is the combined CAR, calculated as the weighted market value of the acquirer CAR and the target CAR, measured over the three days before and after the merger announcement. Acquirer CEO centrality is measured by closeness in column (1), degree in (2), betweenness in (3), eigenvector in (4), the principal component score in (5), and the orthogonally transformed centrality variables in (6). Panel A includes firm financials and deal measures as control variables. *Combined Size* is the total number of employees of both the target and the acquirer. *Combined Profitability* is the asset-weighted average of the acquirer and target return on assets. *Combined Tobin's Q* is the asset-weighted average of the acquirer and target Tobin's Q. *Combined Leverage* is the asset-weighted average of the acquirer and target debt-to-assets ratio. *Combined Liquidity* is the asset-weighted average of the ratio of operating cash flow to assets of the acquirer and target. *Same Industry* is a dummy variable that equals one if the acquirer and target have the same two-digit SIC code and zero otherwise. *Deal Value* is the total deal value as reported by SDC divided by the market value of the acquirer. *Stock Deal* is a dummy variable that equals one if the transaction is financed entirely by stock and zero otherwise. Panel B adds additional controls for corporate governance. *Intense Monitors* is a dummy variable that equals one if more than 50% of the board directors sit on two or more of the auditing, nominating, and compensation committees (Faleye et al., 2011). *Board Size* is the total number of directors on the board. *Duality* is a dummy variable that equals one if the CEO is also the chair of the board and zero otherwise. *E-index* is Bebchuk, Cohen, and Ferrell's (2009) entrenchment index. *Age* is the CEO's age. *Block Ownership* is a dummy variable that equals one if there is at least one block holder that owns 5% or more of the common shares outstanding and zero otherwise. *CEO Ownership* is the percentage of shares owned by the CEO. All independent variables and controls are lagged one year. All models include industry and fixed year effects. Heteroskedastic-consistent probability values rejecting the null hypotheses of zero coefficients are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7
Panel A: Acquirer CEO centrality and combined CAR controlling for firm and deal characteristics

Dep. Variable=Combined CAR	(1)	(2)	(3)	(4)	(5)	(6)
Centrality	**Closeness**	**Degree**	**Betweenness**	**Eigenvector**	**Principal component**	**Ortho**
Closeness	-0.0670***					-0.0062**
	(0.000)					(0.035)
Degree		-0.0641***				-0.0071**
		(0.000)				(0.026)
Betweenness			-0.0444***			-0.0104***
			(0.004)			(0.001)
Eigenvector				-0.0696***		-0.0006
				(0.000)		(0.808)
Principal component					-0.0071***	
					(0.000)	
Combined size	0.0021	0.0019	0.0005	0.0018	0.0021	0.0024
	(0.364)	(0.401)	(0.823)	(0.439)	(0.347)	(0.290)
Combined profitability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(0.394)	(0.417)	(0.364)	(0.332)	(0.361)	(0.373)
Combined Tobin's Q	-0.0021	-0.0025	-0.0029	-0.0020	-0.0023	-0.0020
	(0.353)	(0.265)	(0.197)	(0.370)	(0.298)	(0.368)
Combined leverage	0.0457*	0.0418*	0.0454*	0.0440*	0.0428*	0.0423*
	(0.070)	(0.096)	(0.076)	(0.080)	(0.089)	(0.089)
Combined liquidity	0.1175*	0.1175*	0.1211*	0.1159*	0.1181*	0.1155*
	(0.076)	(0.076)	(0.067)	(0.079)	(0.074)	(0.081)
Same industry	0.0043	0.0059	0.0065	0.0045	0.0050	0.0045
	(0.471)	(0.310)	(0.262)	(0.449)	(0.395)	(0.451)
Deal value	0.0345**	0.0314*	0.0342**	0.0349**	0.0329**	0.0329**
	(0.031)	(0.055)	(0.036)	(0.031)	(0.043)	(0.044)
Stock deal	-0.0181**	-0.0160**	-0.0158**	-0.0173**	-0.0168**	-0.0172**
	(0.020)	(0.039)	(0.042)	(0.025)	(0.030)	(0.029)
Industry effects	YES	YES	YES	YES	YES	YES
Year effects	YES	YES	YES	YES	YES	YES
N	776	776	776	776	776	776
Adjusted R^2	6.54%	6.26%	5.65%	6.54%	9.95%	10.13%

Table 7
Panel B: Acquirer's CEO centrality and combined CAR controlling for firm and deal characteristics and corporate governance

Dep. Variable=Combined CAR	(1)	(2)	(3)	(4)	(5)	(6)
Centrality	**Closeness**	**Degree**	**Betweenness**	**Eigenvector**	**Principal component**	**Ortho**
Closeness	-0.0669***					-0.0062**
	(0.000)					(0.048)
Degree		-0.0668***				-0.0068*
		(0.001)				(0.055)
Betweenness			-0.0488***			-0.0109***
			(0.005)			(0.002)
Eigenvector				-0.0707***		0.0004
				(0.000)		(0.902)
Principal component					-0.0072***	
					(0.000)	
Combined size	0.0011	0.0008	-0.0003	0.0007	0.0012	0.0012
	(0.672)	(0.771)	(0.920)	(0.790)	(0.655)	(0.660)
Combined profitability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(0.280)	(0.297)	(0.273)	(0.253)	(0.261)	(0.262)
Combined Tobin's Q	-0.0033*	-0.0034*	-0.0040**	-0.0032*	-0.0034*	-0.0032
	(0.095)	(0.079)	(0.037)	(0.096)	(0.075)	(0.104)
Combined leverage	0.0548*	0.0513*	0.0547*	0.0532*	0.0524*	0.0511*
	(0.052)	(0.066)	(0.055)	(0.059)	(0.063)	(0.064)
Combined liquidity	0.1226	0.1252*	0.1260*	0.1214	0.1241	0.1226
	(0.108)	(0.100)	(0.099)	(0.110)	(0.103)	(0.109)
Same industry	0.0026	0.0040	0.0047	0.0026	0.0033	0.0028
	(0.690)	(0.542)	(0.471)	(0.698)	(0.613)	(0.670)
Deal value	0.0243	0.0232	0.0250	0.0247	0.0231	0.0232
	(0.1240)	(0.154)	(0.121)	(0.118)	(0.147)	(0.149)
Stock deal	-0.0156*	-0.0143*	-0.0137*	-0.0151*	-0.0147*	-0.0149*
	(0.056)	(0.081)	(0.095)	(0.063)	(0.071)	(0.069)
Intense monitors	0.0001	0.0011	0.0010	0.0000	0.0009	0.0006
	(0.991)	(0.885)	(0.895)	(0.995)	(0.901)	(0.936)
Board size	0.0004	0.0010	0.0006	0.0004	0.0006	0.0007
	(0.730)	(0.368)	(0.616)	(0.686)	(0.583)	(0.540)
Duality	0.0060	0.0067	0.0057	0.0059	0.0063	0.0065
	(0.360)	(0.308)	(0.389)	(0.369)	(0.339)	(0.327)
E-index	0.0021	0.0026	0.0027	0.0021	0.0024	0.0023
	(0.307)	(0.219)	(0.199)	(0.311)	(0.253)	(0.278)
Age	-0.0002	-0.0002	-0.0001	-0.0002	-0.0002	-0.0002
	(0.702)	(0.717)	(0.822)	(0.688)	(0.719)	(0.672)
Block ownership	0.0046	0.0043	0.0051	0.0044	0.0044	0.0041
	(0.631)	(0.657)	(0.597)	(0.645)	(0.643)	(0.668)
CEO ownership	-0.1561**	-0.1588**	-0.1383*	-0.1481*	-0.1529*	-0.1557*
	(0.047)	(0.050)	(0.086)	(0.060)	(0.055)	(0.052)
Industry effects	YES	YES	YES	YES	YES	YES
Year effects	YES	YES	YES	YES	YES	YES
N	685	685	685	685	685	685

Adjusted R^2	7.35%	7.15%	6.64%	7.45%	12.37%	12.22%

Table 8
Board constraints and CEO characteristics on the likelihood of acquisitions

This table summarizes the coefficients on CEO centrality, board constraints, and CEO characteristics, and their interactions, in the Probit model of acquisitions. The dependent variable is the probability that the firm announced a successfully completed acquisition of a U.S. public target. *High Centrality* is a dummy variable that equals one if CEO centrality is above the sample median and zero otherwise. CEO centrality is measured by closeness, degree, betweenness, and eigenvector in columns 1, 2, 3, and 4, respectively. *Intense Monitors* is a dummy variable that equals one if more than 50% of the board directors sit on two or more of the auditing, nominating, and compensation committees (Faleye et al., 2011). *Small Board* is a dummy variable that equals one if the board has less than eight members and zero otherwise. *Non-Duality* is a dummy variable that equals one if the CEO is not the chair of the board and zero otherwise. *E-index* is Bebchuk, Cohen, and Ferrell's (2009) entrenchment index. *Low E-index* is a dummy variable that equals one if the E-index is lower than the sample median and zero otherwise. *Older CEO* is a dummy variable that equals one if the CEO's age is above the sample median and zero otherwise. *Block Ownership* is a dummy variable that equals one if there is at least one block holder that owns 5% or more of the common shares outstanding and zero otherwise. *High CEO Ownership* is a dummy variable that equals one if the CEO's percentage ownership of firm's common stock is higher than the sample median and zero otherwise. The models include controls for size, profitability, Tobin's Q, leverage, and liquidity, but their coefficients are suppressed for brevity. All independent variables and controls are lagged one year. Heteroskedastic-consistent probability values rejecting the null hypotheses of zero coefficients are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variable=Prob(Deal) Centrality	(1) Closeness	(2) Degree	(3) Betweenness	(4) Eigenvector
High centrality	0.1691*** (0.000)	0.1889*** (0.000)	0.0839* (0.078)	0.1892*** (0.000)
Intense monitors	-0.2816*** (0.000)	-0.2469*** (0.000)	-0.3135*** (0.000)	-0.2675*** (0.000)
High centrality * Intense monitors	0.1321 (0.114)	0.0770 (0.356)	0.1859** (0.024)	0.1123 (0.176)
High centrality	0.0966* (0.054)	0.1368*** (0.008)	0.0760 (0.109)	0.1440*** (0.003)
Small board	-0.1395** (0.038)	-0.0655 (0.324)	-0.0371 (0.558)	-0.1142* (0.093)
High centrality * Small board	0.3490*** (0.000)	0.2175*** (0.008)	0.1811** (0.023)	0.2886*** (0.001)
High centrality	0.2364*** (0.000)	0.2860*** (0.000)	0.1659*** (0.001)	0.2653*** (0.000)
Non-duality	0.0311 (0.604)	0.1002 (0.135)	-0.0280 (0.621)	-0.0201 (0.737)
High Centrality * Non-duality	-0.0585 (0.447)	-0.1666** (0.032)	0.0566 (0.455)	0.0482 (0.530)
High centrality	0.1452** (0.043)	0.1960*** (0.007)	0.0760 (0.280)	0.1436** (0.042)
Low E-index	0.0121 (0.855)	0.0609 (0.375)	-0.0322 (0.609)	-0.0101 (0.876)
High centrality * Low E-index	0.1079 (0.206)	0.0299 (0.729)	0.0840 (0.315)	0.1384 (0.101)
High centrality	0.1512*** (0.003)	0.1678*** (0.001)	0.0907* (0.066)	0.2050*** (0.000)
Older CEO	-0.2295*** (0.000)	-0.2213*** (0.001)	-0.2408*** (0.000)	-0.1860*** (0.002)
High centrality * Older CEO	0.1507* (0.053)	0.1270 (0.106)	0.1545** (0.045)	0.0883 (0.252)
High centrality	0.1859*** (0.000)	0.1832*** (0.000)	0.0854* (0.052)	0.1739*** (0.000)
Block ownership	-0.1186* (0.082)	-0.1102 (0.105)	-0.1644** (0.013)	-0.1947*** (0.005)
High centrality * Block ownership	0.1369 (0.126)	0.1248 (0.164)	0.2106** (0.017)	0.2785*** (0.002)
High centrality	0.2017*** (0.000)	0.2172*** (0.000)	0.1380*** (0.009)	0.2047*** (0.000)
High CEO ownership	-0.0556 (0.382)	-0.0408 (0.526)	-0.0484 (0.421)	-0.0717 (0.253)
High centrality * High CEO ownership	0.0583 (0.473)	0.0258 (0.752)	0.0184 (0.815)	0.0865 (0.281)

Table 9
Board constraints and CEO characteristics on acquirer cumulative abnormal returns

This table summarizes the coefficients on CEO centrality, board constraints, and CEO characteristics, and their interactions, in the OLS regressions of acquirer cumulative abnormal returns. The dependent variable is the acquirer CAR over the three days before and after the merger announcements. *High Centrality* is a dummy variable that equals one if CEO centrality is above the sample median and zero otherwise. CEO centrality is measured by closeness, degree, betweenness, and eigenvector in columns 1, 2, 3, and 4, respectively. *Intense Monitors* is a dummy variable that equals one if more than 50% of the board directors sit on two or more of the auditing, nominating, and compensation committees (Faleye et al., 2011). *Small Board* is a dummy variable that equals one if the board has less than eight members and zero otherwise. *Non-Duality* is a dummy variable that equals one if the CEO is not the chair of the board and zero otherwise. *E-index* is Bebchuk, Cohen, and Ferrell's (2009) entrenchment index. *Low E-index* is a dummy variable that equals one if the E-index is lower than the sample median and zero otherwise. *Older CEO* is a dummy variable that equals one if the CEO's age is above the sample median and zero otherwise. *Block Ownership* is a dummy variable that equals one if there is at least one block holder that owns 5% or more of the common shares outstanding and zero otherwise. *High CEO Ownership* is a dummy variable that equals one if the CEO's percentage ownership of firm's common stock is higher than the sample median and zero otherwise. The models include controls for size, profitability, Tobin's Q, leverage, liquidity, and industry and year fixed effects, but their coefficients are suppressed for brevity. All independent variables and controls are lagged one year. Heteroskedastic-consistent probability values rejecting the null hypotheses of zero coefficients are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep. Variable=Bidder CAR Centrality	(1) Closeness	(2) Degree	(3) Betweenness	(4) Eigenvector
High centrality	-0.0258*** (0.001)	-0.0280*** (0.001)	-0.0170** (0.019)	-0.0253*** (0.001)
Intense monitors	-0.0109 (0.364)	-0.0139 (0.251)	-0.0185 (0.101)	-0.0057 (0.622)
High centrality * Intense monitors	0.0060 (0.667)	-0.0096 (0.498)	0.0176 (0.194)	-0.0023 (0.869)
High centrality	-0.0217*** (0.010)	-0.0188** (0.033)	-0.0158** (0.035)	-0.0236*** (0.003)
Small board	0.0037 (0.763)	0.0093 (0.440)	-0.0163 (0.149)	0.0025 (0.833)
High centrality * Small board	-0.0120 (0.387)	-0.0208 (0.130)	0.0145 (0.269)	-0.0123 (0.386)
High centrality	-0.0250*** (0.005)	-0.0374*** (0.000)	-0.0060 (0.460)	-0.0232*** (0.006)
Non-duality	0.0026 (0.804)	-0.0144 (0.192)	0.0077 (0.440)	0.0046 (0.665)
High centrality * Non-duality	-0.0088 (0.493)	0.0144 (0.278)	-0.0159 (0.199)	-0.0109 (0.393)
High centrality	-0.0282*** (0.002)	-0.0226** (0.015)	-0.0124 (0.138)	-0.0236*** (0.006)
Low E-index	-0.0056 (0.613)	0.0069 (0.546)	-0.0068 (0.502)	-0.0020 (0.855)
High centrality * Low E-index	0.0007 (0.959)	-0.0190 (0.146)	0.0012 (0.922)	-0.0083 (0.532)
High centrality	-0.0308*** (0.000)	-0.0279*** (0.001)	-0.0061 (0.429)	-0.0260*** (0.002)
Older CEO	0.0023 (0.808)	0.0094 (0.329)	0.0170* (0.066)	0.0077 (0.407)
High centrality * Older CEO	-0.0054 (0.636)	-0.0063 (0.572)	-0.0180 (0.110)	-0.0032 (0.773)
High centrality	-0.0284*** (0.000)	-0.0332*** (0.000)	-0.0123* (0.077)	-0.0314*** (0.000)
Block ownership	-0.0065 (0.594)	-0.0183 (0.133)	-0.0004 (0.972)	-0.0129 (0.307)
High centrality * Block ownership	0.0101 (0.496)	0.0276* (0.063)	0.0027 (0.851)	0.0202 (0.179)
High centrality	-0.0299*** (0.001)	-0.0272*** (0.003)	-0.0149* (0.054)	-0.0293*** (0.000)
High CEO ownership	0.0002 (0.978)	0.0010 (0.907)	-0.0024 (0.759)	-0.0011 (0.890)
High centrality * High CEO ownership	-0.0016 (0.877)	-0.0047 (0.648)	0.0059 (0.562)	-0.0009 (0.929)

Table 10
Acquirer CEO centrality on the probability that the bidder is subsequently targeted and successfully acquired

This table estimates the Probit model of the bidder subsequently becoming a successfully acquired target. For the first six years of the sample period (2000 to 2005, inclusive), we identify a list of firms that successfully completed acquisitions of U.S. public targets. Deals are restricted to include acquisitions whose targets represent at least 5% of the market value of the bidders. We then estimate a Probit model with the dependent variable being a dummy that equals one if the bidder becomes a successfully acquired target within a five-year window following the date of the first merger announcement, and zero otherwise. The centrality of the acquirer's CEO is measured by closeness, degree, betweenness, and eigenvector in columns 1, 2, 3, and 4, respectively. *CAR* is the cumulative abnormal return for the acquirer over the three days before and after the merger announcement. If the bidder has more than one deal during this subsample, then CAR represents the sum of the CARs of those deals. Centrality * CAR is an interaction term between acquirer CEO centrality and CAR. *Relative Target Size* is the market value of the target divided by the market value of the bidder. All independent variables and controls are calculated at one year before the beginning of the sample. Heteroskedastic-consistent probability values rejecting the null hypotheses of zero coefficients are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep. Var.=Prob(Bidder acquired)	**(1)**	**(2)**	**(3)**	**(4)**
Centrality	**Closeness**	**Degree**	**Betweenness**	**Eigenvector**
Centrality	0.6430	0.3171	0.4372	0.3484
	(0.194)	(0.520)	(0.275)	(0.485)
CAR	-8.0746**	-7.3620*	-6.6153	-7.4122*
	(0.041)	(0.068)	(0.141)	(0.059)
Centrality * CAR	10.5378**	9.9212**	8.2813	9.6941**
	(0.033)	(0.050)	(0.112)	(0.048)
Size	-0.1486***	-0.1389**	-0.1380**	-0.1419**
	(0.010)	(0.021)	(0.016)	(0.013)
Profitability	-2.7815**	-2.5607**	-2.6168**	-2.9474**
	(0.020)	(0.030)	(0.028)	(0.015)
Tobin's Q	-0.0105	-0.0088	-0.0095	-0.0086
	(0.575)	(0.634)	(0.605)	(0.636)
Leverage	0.0738	0.0870	0.1015	0.0426
	(0.901)	(0.883)	(0.863)	(0.943)
Relative target size	-1.2997**	-1.4125***	-1.2284**	-1.2281**
	(0.014)	(0.009)	(0.019)	(0.018)
Constant	0.6382	0.8275	0.6600	0.8135
	(0.270)	(0.129)	(0.245)	(0.179)
N	222	222	222	222
Pseudo R^2	7.54%	7.56%	7.29%	7.06%

Table 11
CEO turnover analysis

This table presents the estimation results of the Cox hazard model used to predict CEO turnover subsequent to first merger announcements between 2000 and 2005. This sample is also restricted to include targets that represent at least 5% of the market value of acquirer. CEO turnover is measured within a five-year window from the date of the first merger announcement. Centrality is measured by closeness, degree, betweenness, and eigenvector in columns 1, 2, 3, and 4, respectively. *Post-Merger CAR* is the company's cumulative abnormal return over a three-year window starting one month after the first merger announcement. The cumulative abnormal returns are estimated using the market model. *Centrality * Post-Merger CAR* is an interaction term between centrality and Post-Merger CAR. *Pre-Merger ROA* is the three-year average return on assets prior to the merger announcement. *Age* is the age of the CEO. *High CEO Ownership* is a dummy variable that equals one if the CEO's percentage ownership of firm's common stock is higher than the sample median and zero otherwise. *Tenure* is the tenure of the CEO. Model coefficients (i.e., not hazard ratios) are reported. Robust standard errors are used. P values are included in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep. Var.=Prob(CEO turnover)	**(1)**	**(2)**	**(3)**	**(4)**
Centrality	**Closeness**	**Degree**	**Betweenness**	**Eigenvector**
Centrality	0.6856	0.1549	-0.0201	0.6836
	(0.171)	(0.778)	(0.959)	(0.211)
Post-merger CAR	-39.4244	-49.1463**	-41.0873	-45.4370*
	(0.113)	(0.048)	(0.106)	(0.079)
Centrality *Post-merger CAR	51.9236*	63.2398**	50.2520*	58.9824*
	(0.075)	(0.030)	(0.079)	(0.054)
Pre-merger ROA	-3.4229***	-3.4062***	-3.3637***	-3.3289***
	(0.000)	(0.000)	(0.000)	(0.000)
Age	0.0520***	0.0511***	0.0529***	0.0516***
	(0.000)	(0.001)	(0.000)	(0.000)
High CEO ownership	0.0888	0.0564	0.0427	0.0458
	(0.665)	(0.789)	(0.836)	(0.822)
Tenure	-0.0148	-0.0156	-0.0159	-0.0124
	(0.206)	(0.170)	(0.162)	(0.285)
N	222	222	222	222
Prob > chi2	0.0001	0.0001	0.0002	0.0001

Table 12
Centrality and bidder CEO compensation

This table presents the estimation results of the OLS regression model that is used to predict the effect of CEO centrality on CEO compensation for the sample of bidders. Each bidder CEO must have available CEO compensation data two years prior and two years after the merger announcement date to be included in this analysis. This results in 405 bidder CEOs with 810 observations. The dependent variable is *log (TDC_1998)* which is the log of the sum of salary, bonus, and restricted stock grants as reported by Execucomp calculated using 1998 constant dollars (1998 is the first year used in this analysis). *High Centrality* is an indicator that is set to one if centrality is above sample median and zero otherwise. Centrality is measured by closeness, degree, betweenness, and eigenvector in columns 1, 2, 3, and 4, respectively. *Post* is an indicator that is set to one if the compensation is from two years after the merger announcement and zero if the compensation is from two years prior to the merger announcement. *CAR*Post*Low Centrality* and *CAR*Post*High Centrality* are interaction terms. *CAR* is the bidder cumulative abnormal return for the three days before and after the merger announcement. *Low Centrality* is an indicator that is set to one if centrality is below the sample median and zero otherwise. *Size* is the total book value of assets calculated in 1998 constant dollars. All models include industry controls. Robust standard errors are used. P values are included in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep.Var. = log(TDC_1998)	(1)	(2)	(3)	(4)
Centrality is :	Closeness	Degree	Betweenness	Eigenvector
High centrality	0.6652***	0.6836***	0.4208***	0.4951***
	(0.000)	(0.000)	(0.000)	(0.000)
Post	0.1348*	0.1300*	0.1314*	0.1363*
	(0.075)	(0.085)	(0.089)	(0.077)
CAR * Post * Low centrality	1.3906**	1.2100*	1.1055*	1.5376**
	(0.037)	(0.053)	(0.076)	(0.020)
CAR * Post * High centrality	0.8395	1.1055	0.4560	0.7206
	(0.489)	(0.888)	(0.468)	(0.306)
Size	1.5026***	1.4022***	1.6210***	1.6768***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	7.4737***	7.4733***	7.6472***	7.5643***
	(0.000)	(0.000)	(0.000)	(0.000)
Industry controls	YES	YES	YES	YES
N	810	810	810	810
Adjusted R^2	17.55%	17.46%	13.66%	14.71%

Table 13
CEO centrality and CEO awards

Panel A shows the distribution of CEO awards in the bidder sample within a three-year window after the merger announcement date, and Panel B shows the results of the Probit model of the likelihood of receiving an award within a three-year window after the merger announcement date.
This analysis is conducted on 502 bidders in 541 deals that have available data regarding awards. Those bidders are matched to 391 match firms in 541 firm-year observations. The matching is based on year, industry (two-digit SIC industry), and size (best match based on 50% to 200% of total assets) from the S&P 1500 firms that did not have any acquisitions in a window of three years before and after the merger date. The dependent variable in Panel B is an indicator that is set to one if the CEO received an award within a three-year window from the merger announcement date and zero otherwise. Centrality is measured using closeness, degree, betweenness, and eigenvector in columns 1, 2, 3, and,4, respectively). *Bidder* is an indicator that is set to one if the firm is a bidder and zero if it is a control match firm. *Centrality * Bidder* is an interaction term. *Firm Size* is the total book value of assets. All models include industry controls. Robust standard errors are used. Heteroskedastic-consistent probability values rejecting the null hypotheses of zero coefficients are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Distribution of CEO awards

Type of award	Frequency
Best executive award	31
Honorary doctorate degrees	27
Alumni awards	27
Listed as one of the top CEOs	26
Distinguished leadership award	25
Entrepreneur award	23
Outstanding achievement award	23
Listed as one of the most influential people	21
Listed among the most powerful people	20
Inducted to hall of fame	20
Distinguished service award	18
CEO of the year	13
Director of the year	5
Other	158
Total	**437**

Panel B: Probit model of the likelihood of receiving an award

Dep. Var. = Prob(Award= 1)	(1)	(2)	(3)	(4)
Centrality	Closeness	Degree	Betweenness	Eigenvector
Centrality	0.3247	0.1731	-0.3498	0.6996*
	(0.374)	(0.588)	(0.284)	(0.068)
Bidder	-0.8768**	-1.1769***	- 0.7575*	-0.5133
	(0.041)	(0.004)	(0.063)	(0.224)
Centrality * Bidder	1.1636**	1.5122***	1.0056**	0.7399
	(0.019)	(0.001)	(0.031)	(0.134)
Size	0.0037**	0.0038**	0.0058***	0.0036**
	(0.024)	(0.018)	(0.000)	(0.028)
Constant	-0.7974**	-0.6594**	-0.2825	-1.0890***
	(0.019)	(0.027)	(0.355)	(0.002)
Industry controls	YES	YES	YES	YES
N	1,082	1,082	1,082	1,082
Pseudo R^2	4.20%	4.54%	3.33%	4.11%

Table 14
Bidder CEO centrality and Insider Sales

This table presents the results of Tobit models estimating the effect of bidder CEO centrality on insider stock sales and subsequent returns. Of the 509 firms in the bidder sample, 40 did not have data in Thomson Reuters on insider transactions. Thus we run Tobit models treating those 40 bidder observations as censored. The dependent variable is the average three-month stock return after an insider sale by the CEO. Centrality is measured by closeness, degree, betweenness, and eigenvector in columns 1, 2, 3, and 4, respectively. All variables are as previously defined and are measured in the first year of the sample. Heteroskedastic-consistent probability values rejecting the null hypotheses of zero coefficients are reported in parentheses. ** and * denote statistical significance at the 5% and 10% levels, respectively.

Dependent Variable: Average post-sale three-month returns

	(1)	(2)	(3)	(4)
Centrality	**Closeness**	**Degree**	**Betweenness**	**Eigenvector**
Centrality	-0.1551**	-0.1653**	-0.1159**	-0.1428**
	(0.03)	(0.023)	(0.048)	(0.048)
Size	-0.0128	-0.0108	-0.0152*	-0.0144*
	(0.111)	(0.192)	(0.053)	(0.068)
Profitability	0.1215	0.1076	0.1051	0.1178
	(0.428)	(0.483)	(0.494)	(0.443)
Tobin's Q	0.0024	0.002	0.0018	0.0025
	(0.402)	(0.425)	(0.543)	(0.394)
Constant	0.1447*	0.1359*	0.1362*	0.1476*
	(0.062)	(0.070)	(0.079)	(0.067)
N	509	509	509	509
Pseudo R^2	3.12%	3.25%	2.89%	2.89%