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Director Histories and the Pattern of Acquisitions

Peter L. Rousseau and Caleb Stroup*

Abstract

We trace directors through time and across firms to study whether acquirers' access to nonpublic information about potential targets via their directors' past board service histories affects the market for corporate control. In a sample of publicly traded U.S. firms, we find acquirers about 4.5 times more likely to buy firms where their directors once served. Effects are stronger when the acquirer has better corporate governance, the interlocked director has a larger ownership stake at the acquirer, or the director played an important role during past service. The findings are robust to endogeneity of board composition and controls for contemporaneous interfirm interlocks.

I. Introduction

It is well known that managers possess private information about their firms' operations and fundamental values.[1] Information asymmetry in the market for corporate control makes it difficult for acquirers to evaluate gains associated with potential targets, thereby complicating the choice of which firms to buy. We focus on how corporate control patterns change when acquirers gain access to nonpublic information. Given that directors have access to nonpublic information, we specifically investigate whether the past board service of an acquiring firm's directors helps explain which targets are selected. By tracking the service histories of directors over time, we show that the answer is yes and offer evidence consistent with this occurring through the transfer of nonpublic information about specific targets from directors to managers. In so doing, we provide an example of how boards and the information available to them directly affect a major corporate decision.

*Rousseau (corresponding author), peter.l.rousseau@vanderbilt.edu, Vanderbilt University, Department of Economics, Nashville, TN 37235; Stroup, castroup@davidson.edu, Davidson College, Department of Economics, Davidson, NC 28035. We are grateful to Jarrad Harford (the editor), Boyan Jovanovic, Tong Li, Robert Schonlau (the referee), and participants at the 2011 European Finance Association meeting in Oslo, Norway, and the 2011 Midwest Macroeconomics Conference for comments that greatly improved our work. Much of this paper was written when Stroup was at Grinnell College.

[1] See, for example, Myers and Majluf (1984), Travlos (1987), Eckbo, Giammarino, and Heinkel (1990), Shleifer and Vishny (2003), and Rhodes-Kropf and Viswanathan (2004).

Our findings are consistent with managerial theories of corporate governance (Adams and Ferreira (2007), Harris and Raviv (2008), and Song and Thakor (2006)), and with survey evidence in Demb and Neubauer ((1992), pp. 43–44) indicating that most directors see themselves as active participants in setting corporate strategy.[2] It is therefore not surprising that U.S. Securities and Exchange Commission (SEC) merger filings offer numerous examples confirming that directors influence acquisition decisions.[3]

If a firm has a current director who formerly sat on the board of another firm, we say that there is a "historical interlock" from the current firm to the firm where the past service occurred.[4] We then test for whether the existence of a historical interlock increases the probability that the current firm initiates an acquisition of the past firm relative to a firm with which it is not historically interlocked, and find that a historical interlock makes this event about 4.5 times more likely.

To distinguish between information-based explanations of our results and other possibilities, we conduct a series of follow-up tests where we would expect the relation between historical interlocks and target selection to be stronger if indeed it is private information affecting the acquisition decision. We find broad support for the information-based explanation by documenting that the effects of historical interlocks are stronger when the acquirer has better corporate governance, which is consistent with recent theories of the labor market for directors (Levit (2012), Levit and Malenko (2012)).[5] They are also stronger when the interlocked director has a larger ownership stake at the acquirer and when the director had a more important role during past service at the potential target. The latter factor seems to increase the likelihood that the historically interlocked director was exposed to deal-relevant information. The effects of historical interlocks are also stronger when the acquirer cannot access nonpublic information about the target through contemporaneous social connections.

There are many studies that use board connections to proxy for agency issues, but most do not disentangle agency and information explanations of their results (Freeman (1979), Ishii and Xuan (2014)). Our approach allows for cleaner tests of the information explanation by distinguishing the effects of historical interlocks,

[2]Hermalin and Weisbach (2003), Adams, Hermalin, and Weisbach (2010), and Finkelstein, Hambrick, and Cannella ((2008), ch. 8) offer useful reviews of the literature. Mace (1986) emphasizes the general passivity of corporate boards, yet also reports that boards offer expertise to management when issues arise in which a member or members are expert.

[3]For example, the S-4 form submitted in 2003 by Plug Power (a fuel-cell-system manufacturer operating mainly in Illinois, Indiana, Michigan, and Ohio) in regard to its acquisition of H Power (a fuel-cell developer and manufacturer) reports that during the fall of 2001 and spring of 2002 the board established a special committee of three directors to consider potential acquisitions. This committee oversaw the process that eventually led to the Nov. 11, 2003, announcement that Plug Power intended to acquire H Power.

[4]For example, A. Clinton Allen served as a director at Psychemedics Corporation, Inc. from 1989 to 2002. After leaving Psychemedics, he joined Brooks Automation, Inc. in 2003 and has served on the board ever since. In this case, we would consider Brooks Automation to be historically interlocked with Psychemedics from 2004, but not before that. At the same time, given that no current director of Psychemedics ever served on the board of Brooks Automation, Psychemedics would not have a historical interlock with Brooks.

[5]Levit and Malenko (2012) illustrate how stronger corporate governance can lead to boards with more outside directors who in turn have more influence on strategic decisions.

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which are more likely to reflect information transmission, from those of standard contemporaneous linkages (where a director simultaneously sits on two firms' boards), which are more likely to also reflect agency issues.

An additional advantage of historical interlocks over contemporaneous linkages is that the former are *directional*, whereas the latter are not. Because we propose that information transfers occur along with historical interlocks, this feature allows us to test the direction of information flow between potential acquirer–target pairs. Our finding of effects only from targets to acquirers suggests that decision makers in acquirers are more sensitive to information barriers than are those in targets, and is consistent with the view that overcoming such barriers is important when acquirers search for suitable targets.

Because directors are not randomly assigned to firms, persistent and unobserved network connectedness could undermine identification of a causal effect of information on acquisitions. Unobserved factors that might influence common director selection include governance structures, social connections, chief executive officer (CEO) entrenchment, board size, industry positioning, firm size, and organizational strategy, among others. We control for such unobserved and persistent factors with fixed effects for each firm and firm pair in our study and find even stronger effects of historical interlocks on the propensity to merge, which suggests that network effects specific to individual firm pairs are not driving the results. We also estimate the extent to which time-varying unobserved factors might influence director selection and find that they cannot account for our findings.

Cai and Sevilir (2012) examine how current linkages across boards tend to enhance return outcomes of completed transactions. To the extent that current links also allow for the transfer of information, albeit with more noise, we would expect to see such synergies. Our focus, however, is not on outcomes from completed deals but rather on how information influences the propensity for particular transactions to occur in the first place.[6] At the same time, we do show that historically interlocked acquisitions have less variable announcement returns, shorter and less variable times to completion, and higher completion rates, which are all consistent with an informational interpretation. Because we examine linkages among directors within broad industrial categories, our study also relates to Custodio and Metzger (2010), although they also examine performance outcomes associated with completed deals.

There are, of course, many other studies examining how experience in executing particular actions passes across firms through director linkages. These actions include the use of poison pills (Davis (1991)), option backdating (Bizjak, Lemmon, and Whitby (2009)), repeat acquisitions (Haunschild (1993)), cross-border mergers (Stroup (2012)), and taking firms private (Stuart and Yim (2010)). But the focus on isolating the passage of deal-relevant information about a specific target through past director service is what makes our contribution unique.

[6]Studies related to ours use contemporaneous director linkages to examine how cross-firm information may affect the decisions to initiate acquisitions or joint ventures (Gulati and Westphal (1999), Schonlau and Singh (2009)), but these linkages could also arise as part of a plan for acquisition, among many other possibilities, and therefore not reflect the transfer of information about the target to the acquirer.

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The rest of the study is organized as follows: Section II develops our hypotheses and discusses a firm's exposure to nonpublic information through the service histories of its directors. Section III describes the historical interlock, explains how our sample of firm pairs is constructed, and presents summary statistics from our data. Section IV lays out the primary estimation framework and identification strategy and presents our main results on merger probabilities. Section V considers a number of potential channels through which information can pass from a potential target to an acquirer and assesses the effects of historical interlocks on some performance outcomes from mergers. Section VI summarizes the results of robustness tests related to alternative hypotheses, potential endogeneity, functional forms, and key decisions made in building the data set. Section VII concludes.

II. Literature and Hypothesis Development

A. Theoretical Motivation and Main Testable Hypotheses

Information asymmetries are key to understanding the market for corporate control because they make it difficult for acquirers to evaluate gains associated with potential targets. Do control patterns change when acquirers have access to nonpublic information about a potential target? We formalize this question by taking the perspective of a particular acquirer whose management and board must choose a target j from among a set of potential targets $j \in \{1, 2, \ldots, J\}$.[7] For simplicity, all targets are assumed to be ex-ante identical from the acquirer's perspective and acquisition gains are normally distributed as $F(\pi_j)$ with mean μ_f.

We do not specify a particular interpretation for π, which could represent asset complementarities arising from scale economies (Coase (1937)), increases in market power (Salant, Switzer, and Reynolds (1983)), transfers of intangible technologies (Jovanovic and Rousseau (2002), (2008)), or liquidity constraints (Almeida, Campello, and Hackbarth (2011)), among other possibilities. The framework could also be extended to incorporate other acquisition motives such as empire building (Mueller (1969)) without altering the main prediction.[8] As the foregoing indicates, π_j is firm-pair specific and could depend on information about the target's technological capabilities, managerial know-how, or overall business strategy.

The acquirer has access to an information vector $H = \{h_1, h_2, \ldots, h_J\}$ with $h_j \in \{0, 1\}$. Here, $h_j = 1$ indicates that the acquirer has exposure to nonpublic

[7] In practice, not all acquisition attempts are successful and acquirers may have to compete for a single target. Allowing for these possibilities would make the analysis more complex but would not alter the main hypothesis that we develop.

[8] For example, Roll's (1986) framework focuses on an acquirer whose management overestimates its ability to value targets. Roll's hypothesis can be incorporated into our framework by including an acquirer-specific "hubris" term h_i that shifts the distribution of real acquisition gains. Similarly, we could incorporate empire building or diversification motives by conditioning $F(\cdot)$ on target industry-specific effects. If acquirers prefer to buy targets with stock and targets are uncertain about whether acquirers are overvalued, as in Shleifer and Vishny (2003) and Rhodes-Kropf and Viswanathan (2004), the acquisition price could involve an uncertainty premium, and acquirers who prefer to pay with stock will face an additional cost σ_i.

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information about potential target j, in which case the acquirer observes a signal $s_j = \pi_j + e_j$, where e_j is independent and identically distributed (IID) with 0 mean and $G(\cdot)$ is its Gaussian distribution function. For simplicity, assume $h_k = 1$ for a single potential target k. The acquirer chooses between target k and an unknown potential target $i \neq k$:

$$\max\{s_k, \max_{i \neq k} \mathrm{E}[\pi_i]\}. \tag{1}$$

Within the set of unknown potential targets, the acquirer can do no better than selecting a target at random.

Our primary empirical question is whether a known potential target is more likely to be acquired than an unknown one, that is, whether reductions in information frictions promote acquisitions. Let $A_j = 1$ if the acquirer buys target j and 0 otherwise, so that we can pose the question as whether B is greater than, less than, or equal to 1, where

$$B = \frac{p(A_j = 1 | h_j = 1)}{p(A_j = 1 | h_j = 0)}. \tag{2}$$

This formulation is useful because the relative probability of acquisition will not be affected by extraneous factors influencing the overall probability that firms are acquired, such as acquirer characteristics or industry-wide merger waves, at least to the extent that such factors equally influence known and unknown targets.

It is not obvious that $B > 1$, because acquirers may have private information revealing a potential target to be a poor acquisition candidate. To examine this, first consider the case where the signal reveals favorable information about firm k; that is, $s_k - \mu_f \geq 0$. Equation (1) implies that the known target will always be selected in this case: $p(A_k = 1 | h_k = 1, s_k - \mu_f > 0) = 1$. Let K be the cumulative distribution function (CDF) of s, which by unbiasedness of e_j has mean μ_f. Symmetry of K implies that $p(s_k - \mu_f \leq 0) = K(\mu_f) = ½$. Bayes' theorem implies $p(A_k = 1 | h_k = 1) = p(A_k = 1 \cap s_k - \mu_f > 0) = ½$. When unfavorable information is revealed about the potential target ($s_k - \mu_f \leq 0$), the acquirer will draw an unknown target (i.e., $p(A_i = 1 | s_k - \mu_f < 0) = 1/(J-1)$). Using this result along with $K(\mu_f) = ½$ and Bayes' theorem yields $p(A_i = 1 | h_i = 0) = p(A_i = 1 \cap s_k - \mu_f \leq 0) = 1/(2(J-1))$.

Applying these findings to an arbitrary firm j gives $B = J - 1 > 0$, which is just the relative probability that the known target will be acquired. The mechanism is simple: Known targets are more likely to be acquired relative to unknown targets because positive information allows a potential acquirer to avoid negative outcomes in the distribution of unknown synergies. This leads to our main hypothesis:

Hypothesis 1. Acquirers are more likely to buy firms about which they have access to nonpublic information, relative to others.

To put this result in perspective, suppose $J = 11$, in which case $p(A_i = 1 \cap s_i - \mu_f > 0) = ½$ and $p(A_j = 1 \cap s_i - \mu_f \leq 0) = ⅒$, so known targets would be 10 times more likely to be acquired than unknown targets. Our setup is clearly stylized, yet its main prediction can hold even when known potential targets are

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worse on average relative to other acquisition candidates (e_t is centered below 0) if acquirers have information about multiple targets or if selection of unknown targets is nonrandom.

There are two other paths, in addition to the mechanism just described, through which information about acquisition synergies could lead acquirers to buy known targets. First, given that acquisitions typically involve large capital outlays, risk-averse managers or boards may prefer to avoid bad outcomes by bidding for a target about which information is known. This could occur even if the expected gain is worse than that associated with the acquisition of an average unknown firm.

The second possibility is motivated by Rhodes-Kropf and Robinson (2008), who model mergers as the outcome of a costly search process. This interpretation is supported by Bruner ((2004), p. 183), who views acquisition search as an information-gathering process focused on obtaining "deal-rich" information, a key component of which is nonpublic. In this case, access to nonpublic information about a potential target reduces search costs associated with that particular firm and leads acquirers to prioritize known targets in their search queues. When risk aversion or search costs are present, the degree of information asymmetry between known and unknown targets will affect the difference in the acquirer's likelihood of bidding on a known target relative to an unknown target.

Thus far we have focused on the perspective of a potential acquirer. Yet potential targets may also value information about firms that attempt to acquire them. This can occur if targets are concerned about being bought with overvalued stock, so that information about the acquirer is relevant in deciding whether or not to accept an exchange offer. A second possibility is that targets facing a hostile takeover may find nonpublic information useful in selecting a white knight (i.e., alternative acquirer). Because white knight outcomes are far more rare than acquisitions themselves, it may be that this "reverse information flow" is weak in practice. Under the assumption that targets receive deal-relevant information from current directors through their prior service at potential acquirers, our framework is easily modified to formulate a testable alternative hypothesis using our directed pairs:

Hypothesis 2. Targets are more likely to merge with acquirers about which they have access to nonpublic information, relative to others.

To test these hypotheses, we now turn to motivating and constructing a measure of a firm's exposure to nonpublic information about potential targets.

B. Measuring Cross-Firm Information Asymmetries

An ideal measure of an acquiring firm's access to information about a potential target would perfectly isolate this effect from other factors affecting mergers. Although no ideal measure exists, our "historical interlocks" are more likely than the common alternatives to meet this criterion. To guide the analysis, we briefly review the literature on cross-firm information asymmetries to motivate our use of the historical interlock as a measure of information exposure.

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A well-developed literature examines the degree of information asymmetry between a given firm and other market participants. Some authors propose that asymmetries are largest when analysts disagree about a firm's prospects (Krishnaswami and Subramaniam (1999), Moeller, Schlingemann, and Stulz (2007)), whereas others relate valuation difficulties to the idiosyncratic component of stock prices (Dierkens (1991)), the quality of a firm's accounting information (McNichols and Stubben (2009)), or the existence and size of a defined-benefit pension plan (Cocco and Volpin (2009)).

In contrast, we focus on a firm's decision to acquire a specific target. This requires a measure of information friction that varies across potential acquirers for each potential target and vice versa. By supposing that directors at an acquirer retain information about a potential target from their past service histories on the target's board of directors, we define a "historical interlock" for a potential acquirer as a binary indicator that varies at the *firm-pair* level. We then build a comprehensive set of ordered annual firm pairs, where some involve an acquisition of the second firm in the pair by the first and many others do not, and assess how historical interlocks and other measures of target desirability affect the probability of such acquisitions.[9]

Historical interlocks by construction isolate instances where a current director at a given firm served on the board of a prospective target more than 2 years ago, but has not since served there. An alternative would be to measure interfirm information transfers with contemporaneous interlocks. Indeed, although it is natural to suppose that information about corporate practices can be transmitted through current linkages, such linkages are more likely than historical interlocks to also reflect agency conflicts or strategic effects unrelated to the transfer of private information. Among other possibilities, these factors could include knowledge about a firm's current negotiating position or a tendency to "stack" the target's board with directors from the acquirer shortly before announcing a merger.[10] The existence of such agency conflicts, even if only in the minds of investors, may alter acquisition decisions in ways that are unrelated to the transfer of information. Because contemporaneous interlocks may simultaneously confer information and involve strategic effects, their interpretation in this context is not clear.

An additional advantage of historical interlocks is that, unlike contemporaneous interlocks, they are "directed" in the sense that if firm i is historically interlocked with firm j in year t through a director k, it follows that director k has a fiduciary responsibility to firm i and not to firm j in year t. It is also less likely that director k would have obtained nonpublic information about firm i while serving on the board of firm j unless he or she had served on both boards simultaneously in the past but had stepped down from only firm j. This directedness allows us to test whether private information matters more for an acquirer seeking a target or for a target seeking an acquirer.

[9]Section III.B provides a detailed description of how we create the data set used in the empirical analysis.

[10]These practices under certain circumstances could be seen as a breach of the director's fiduciary responsibility. For example, the S-4 form submitted by Capitol Bancorp in connection with its 2001 acquisition of Sun Community Bancorp Ltd. reports that concerns were raised during the preannouncement negotiations about conflicts of interest because the two firms had a common director.

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The directedness of historical interlocks also allows us to test for a broad alternative hypothesis that we refer to as "director–firm matching" or "spurious correlation," which could arise because similar firms are more likely to hire the same directors.[11] Because similar firms are also more likely to merge, an observed correlation between director connections and acquisitions could reflect these unobserved common characteristics. For example, directors with experience in a particular industry are likely to be hired by firms in that industry.[12] This hypothesis predicts that either firm will be as likely as the other to become the acquirer, which we can assess by looking at the effect of reverse historical interlocks on acquisition patterns.

A potential concern associated with all forms of interfirm connections is that linked directors' decision-making is dominated by psychological biases (Asch (1951), Freeman (1979), and Gulati and Westphal (1999)). For example, directors influenced by familiarity bias (i.e., social connections) might attempt to pressure their boards to bid on firms where they once served. We will refer to variants of the bias hypothesis collectively as "psychological biases" even though they could reflect agency concerns as well, and test for whether these channels are also at play.

III. Data and Experience Measures

A. Directors and Historical Interlocks

Our main measure of interfirm director connections is the historical interlock, which takes a value of unity for a potential acquirer in year t if at least one of its current directors served on the potential target's board in the past, but not in the most recent 2 years. In other words, for each firm in our sample there are potential matches with a universe of possible targets, each of which is characterized by the presence or absence of a historical interlock. Historical interlocks are thus meant to isolate situations where information about a target is all that likely remains with the potential acquirer and where the reverse (i.e., information transfer from acquirer to target) is much less likely.

Figure 1 illustrates the historical interlock. The three horizontal time lines reflect board service at different firms by a single director. In the figure, our hypothetical director served on the board of firm A prior to 2000, at which point he left firm A and joined the board of firm B. He also served from 1997 to 2003 at firm C. The definitions given earlier imply that firm B has a historical interlock with firm A from 2002 onward and that firm C has a historical interlock with firm A from 2002 to 2003. Further, firm B would have a historical interlock with firm C from 2006 onward.

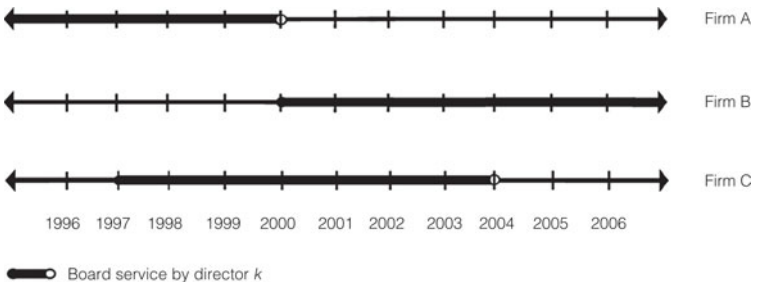
[11]The theoretical literature rationalizes this observation by noting that optimal board structure should depend on firm characteristics (Hermalin and Weisbach (2003), Adams et al. (2010)).

[12]Even outside the context of directors, an observed relationship between firm actions and mergers could reflect such unobserved firm-pair similarity. For example, Higgins and Rodriguez (2006) study the wealth effects of mergers among firms that have prior business alliances. Gompers and Xuan (2009) measure the extent to which problems of asymmetric information are smaller among common pools of venture capital investors relative to independent venture capitalists, and find that having common venture capital investors increases the probability of a merger.

FIGURE 1

Director Movements and the Historical Interlock

Figure 1 presents a hypothetical example to illustrate how the historical interlock is constructed. Each of the three horizontal time lines reflects potential years of board service by a particular director *k*. A bolded segment of the line indicates board service by director *k* at the firm indicated on the right side of the horizontal line. The table below the figure indicates, for each pair of firms, the time period when the two firms were historically or contemporaneously interlocked.



Ordered Pair	Historical Interlock	Contemporaneous Interlock
A to B	None	None
A to C	None	1998-2000
B to A	2002–	None
B to C	2006–	2002–2004
C to A	2002–2003	1998–2000
C to B	None	2002–2004

As discussed in Section I, the historical interlock stands in contrast with standard (i.e., contemporaneous) interlocks, which are defined for an acquirer *i* in year *t* as the presence of a current board member sitting, at period *t*, on a potential target's board. This implies that one of the potential target's current directors also sits on the acquirer's board, so that, unlike in historical interlocks, every contemporaneous linkage reflects *two* interlocks, with one in each direction. Figure 1 also illustrates the contemporaneous interlock. Here, firm B is contemporaneously interlocked with firm C (and vice versa) from 2002–2004 and firm A is contemporaneously interlocked with firm C (and vice versa) from 1998–2000.[13]

B. Sample Creation and Descriptive Statistics

We use information on the service histories of individual directors from the Investor Responsibility Research Center, Inc. (IRRC) Directors Database to identify historical and contemporaneous interlocks.[14] Along with board service records, the Directors Database also characterizes directors in each year as corporate executives, insiders, former employees, and/or professional directors, among other roles.

[13]The annual data reported in the IRRC data set obscures the fact that annual meetings and thus director appointments occur throughout the year. This complicates the decision of how to classify directors, given that in some instances no cross-firm overlap occurs within years, whereas in others there are varying degrees of overlap. We take a conservative approach and count firms as contemporaneously interlocked only in those cases where the director served on both boards in the prior year, as illustrated in Figure 1.

[14]These data are primarily from company proxy statements but also include some director information from company annual reports and Web sites. They include directors who served at firms listed in the Standard & Poor's (S&P) 1500, which covers approximately 90% of U.S. stock market capitalization.

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Table 1 shows summary statistics on cross-firm seatings obtained by tracking the 26,797 directors in the IRRC data set across firms and over time. The left-hand side of Panel A, which shows the distribution of the total number of firms at which each director served, indicates that 22.4% of directors served at only one firm over the 1996–2006 period, thus generating no interlocks. At the same time, 69% of directors served on five boards or fewer. To understand whether the multiple board seatings resulted primarily from simultaneous appointments or from director movements from firm to firm, the right-hand side of Panel A shows the distribution of simultaneous seatings at the director-year level. The majority (81.1%) of annual seatings involve directors who serve on the board of a single firm, 12.8% involve directors who sit simultaneously on the boards of two firms, and 5.9% involve directors serving with three to five firms. This indicates that most cross-firm director connections occur through movements across firms over time, and are thus historical in nature rather than contemporaneous.

TABLE 1

Interfirm Director Connections

Panel A of Table 1 shows the distribution of the total number of firms where directors served from 1996 to 2006 (left-hand side) and, at the director-year level, the distribution of the number of simultaneous board seatings held by a given director at a point in time (right-hand side). Panel B shows the numbers of historically and contemporaneously interlocked directors at the potential acquirer or target that, during their tenure, served as executives, were "insiders," were ever a former employee, or were identified as a "professional director" in the IRRC data set.

Panel A. Director Seating Patterns

Director Firm Count			Annual Seat Count		
No. of Firms	Frequency	Percent	No. of Simultaneous Board Seatings	Frequency	Percent
1	6,005	22.4%	1	104,860	81.1%
2	4,862	18.1%	2	16,573	12.8%
3 to 5	7,635	28.5%	3 to 5	7,644	5.9%
6 to 10	5,940	22.2%	6 to 10	254	0.2%
10+	2,355	8.8%			
All	26,797	100.0%	All	129,331	100.0%

Panel B. Role of Interlocked Directors

	Frequency		
	Historically Interlocked		
Role	Potential Acquirers	Potential Targets	Contemporaneously Interlocked
Executive	6,525	5,775	9,984
Insider	9,323	11,757	13,051
Former employee	742	1,095	1,259
Professional director	1,079	1,253	962
Other	4,283	2,554	4,213

Panel B of Table 1 indicates the roles played by historically and contemporaneously interlocked directors at the potential acquirer and target. For example, insider directors are highly represented, whereas professional directors are less commonly represented. The distribution of director roles is broadly comparable across both historically interlocked and contemporaneously interlocked directors, as well as across the roles of historically interlocked directors at their current and previous firms. At the same time, contemporaneously interlocked directors

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are more likely to be executives and less likely to be professional (i.e., "career") directors than are historically interlocked directors.[15]

Our main data set, an unbalanced panel of ordered (i,j) firm pairs, combines the information on historical and contemporaneous interlocks with data from S&P's Compustat and Thomson's SDC Platinum databases. Our approach requires three fundamental items: an ordered firm pair (i,j), an indicator for whether firm i is historically interlocked with firm j, and an indicator for whether firm i acquires firm j. This is conceptually similar to Rhodes-Kropf and Robinson (2008), who study the effect of similarity in the market-to-book ratios of firm pairs on the probability that the two firms will merge.

The data set is constructed as follows. We first identify a computationally feasible sample of ordered firm pairs from Compustat by retaining all possible ordered firm pairs over the 1996–2006 period, where firm i and firm j lie in the same major 10-category Standard Industrial Classification (SIC) division.[16] We next identify and retain those firm pairs for which we have director data and at least 2 years of Compustat data for both firms. This leaves a sample of 1,401,955 ordered firm pairs, or 12,703,425 firm-pair-year observations. For each firm pair, we then set indicator variables for whether, in each year, firm i was historically or contemporaneously interlocked with firm j. It turns out that 4,488 annual firm pairs have a historical interlock. Finally, we use the SDC Platinum database to set an indicator variable for whether, in each year, firm i acquired firm j, with acquisitions defined as deals with value greater than \$1 million that involve acquisition of at least 20% of the target's shares and would result in a controlling interest in the target.[17] This results in 612 cases where firm i acquires firm j.

Our procedure generates a reasonably representative sample of Compustat firms, but, as well known in the literature on rare events, also leads to downward biases in the estimated effects of historical interlocks on merger pairings. To mitigate this, we impose the additional restriction that the potential acquirer be no smaller than 75% of the potential target, with size measured as a firm's total assets. This restriction creates a sample in which mergers are more likely because in practice it is much more common for larger acquirers to buy smaller targets. This eliminates about 45% of nonmerging and 8% of merging pairs from the sample, leaving us with 6,984,098 firm-pair observations.[18]

[15]The right-hand side of Panel B in Table 1 counts each simultaneous directorship in the sample separately because a director may have different roles at the firms where contemporaneous service occurs.

[16]The 10 major SIC divisions are: i) agriculture, forestry, and fishing; ii) mining; iii) construction; iv) manufacturing; v) transportation, communications, electric, gas, and sanitary services; vi) wholesale trade; vii) retail trade; viii) finance, insurance, and real estate; ix) services; and x) public administration. Using more disaggregated industries is infeasible computationally because the probability models that we estimate in Section IV and Section V would require a separate industry effect for every possible combination of industry codes.

[17]These restrictions focus attention on situations where the deal is more likely to represent a major capital investment by the acquirer, that is, be classified as a merger rather than a portfolio investment.

[18]We also experimented with no relative size restriction and with cutoffs set at 1 and 1.33, and found that the effects of historical interlocks on acquisitions increased with the aggressiveness of the cutoff.

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Panel A of Table 2 compares acquirer and target characteristics of firms in our sample with average characteristics of S&P 1500 firms. Consistent with previous studies, acquirers are larger, have higher free cash flow, are less leveraged, and have lower sales-to-asset ratios but higher market-to-book ratios, whereas targets are more similar to the average S&P 1500 firm. Panel B shows that 9.1% of merging firm pairs were historically interlocked and that 6.3% of merging firm pairs were contemporaneously interlocked.[19]

TABLE 2

Firm-Level Characteristics

Panel A of Table 2 compares characteristics of all in-sample acquirers and targets with the mean for all S&P 1500 firms over the period 1996–2006. Assets is total book value of assets and market capitalization is the total market value of equity computed as common shares outstanding multiplied by the fiscal year closing price, both in thousands. The cash-to-assets ratio is the ratio of cash to total book assets, the debt-to-assets ratio is the ratio of short- and long-term debt to total assets, and the sales-to-assets ratio is total sales revenue divided by total assets. The construction of the market-to-book ratio is described in Section IV. All amounts are in millions of U.S. dollars. Panel B shows the frequency of historical and contemporaneous interlocks alone and based on whether the two firms are headquartered in the same county. Historical and contemporaneous interlocks are defined in Section III.A.

Panel A. Firm-Level Descriptive Statistics

	Acquirers		Targets		S&P 1500	
Variable	Mean	Median	Mean	Median	Mean	Median
Total assets	47,515	8,935	5,617	1,300	5,037	231.6
Market capitalization	43,082	8,302	5,355	1,714	3,988	250.5
Cash-to-assets ratio	0.07	0.04	0.09	0.04	0.12	0.05
Debt-to-assets ratio	0.23	0.21	0.25	0.23	0.27	0.17
Sales-to-assets ratio	0.82	0.69	0.90	0.72	0.91	0.73
Market-to-book ratio	3.36	2.04	2.36	1.71	2.90	1.55

Panel B. Cross-Firm Connections for Firm Pairs That Merge (N = 809)

Connection Type	%	Same County
Historical interlock	9.1%	3.9%
Contemporaneous interlock	6.3%	1.7%
No interfirm connection	84.6%	94.4%

IV. Baseline Findings

In this section we present our baseline findings, describing the estimation approach as we proceed. Our aim is to estimate the effect of a historical interlock between firm i and potential target j on the probability that firm i acquires j. Consider the following algebraic reformulation of equation (2):

$$\Pr(\mathrm{ACQ}_{ijt} = 1 | H_{ijt} = 1) - \Pr(\mathrm{ACQ}_{ijt} = 1 | H_{ijt} = 0), \tag{3}$$

where ACQ_{ijt} takes a value of unity if firm i announces an acquisition of target j in year t, and 0 otherwise, and H_{ijt} is an indicator set to unity if firm i has a current director with a historical interlock to firm j in year t, and 0 otherwise.

[19]Computational feasibility is not a concern when we analyze deal outcomes in Section V.E because we do not need information on nonmerging firm pairs. In these cases we relax the restriction that the acquirer and target lie in the same major 10-category SIC division and use the full sample of 809 announced acquisitions shown in Panel B of Table 2.

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We estimate the partial effect in expression (3) with the baseline logit equation:

$$\Pr(\mathrm{ACQ}_{ijt} = 1) = G(\beta_1 H_{ijt} + \beta_2 I_{ijt} + \gamma X_{ijt} + \tau_t + w_k + \varepsilon_{ijt}), \tag{4}$$

where β_1 is the coefficient of interest, I_{ijt} is an indicator set to unity if firm i has a contemporaneous interlock with potential target j in year t, and 0 otherwise, and X_{ijt} represents a vector of firm-pair-specific control variables that may affect the probability that the two firms merge. Intuitively, equation (4) asks whether a historical interlock from firm i to firm j associates with a higher probability that i acquires j.[20] We include year (τ_t) and industry (w_k) fixed effects because merger waves tend to cluster along these dimensions (Harford (2005)), and we account for arbitrary correlations in acquisition probabilities between individual firm pairs by clustering standard errors at the ordered-pair level. We estimate equation (4) using the set of ordered firm pairs described in Section III.B.

Table 3 presents the results. Column 1 shows that the coefficient for a historical interlock is positive and statistically significant, which is consistent with Hypothesis 1, namely, that acquirers are more likely to buy firms about which

TABLE 3

Effects of a Historical Interlock on Merger Likelihood

Table 3 reports estimates from logit regressions for the likelihood of a merger where the dependent variable is unity if firm *i* announced an acquisition of potential target *j* in period *t*. The variable of interest is the historical interlock (defined in Section III.A). Column 2 adds an indicator for whether there is a contemporaneous interlock between the two firms. Column 3 adds controls for relative size, relative sales-to-assets ratio, and relative market-to-book ratio. Column 4 includes binary indicators set to unity when the potential pair are in the same 4-digit SIC industry or are headquartered in the same county. Column 5 adds industry fixed effects defined at the major 10-category SIC division. All regressions include year fixed effects. Robust standard errors clustered at the firm-pair level appear in parentheses beneath the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	1	2	3	4	5
Historical interlock	4.440***	4.316***	4.339***	3.888***	3.839***
	(0.162)	(0.176)	(0.176)	(0.185)	(0.189)
Contemporaneous interlock		1.264***	1.282***	1.205***	1.175***
		(0.261)	(0.262)	(0.256)	(0.260)
Relative size			0.003***	0.003***	0.004***
			(0.001)	(0.001)	(0.001)
Relative sales-to-assets ratio			0.002	0.004	0.005
			(0.010)	(0.008)	(0.007)
Relative market-to-book ratio			0.020	0.026***	0.032***
			(0.013)	(0.007)	(0.006)
Same 4-digit SIC				3.133***	3.067***
				(0.088)	(0.113)
Same county dummy				1.071***	1.141***
				(0.148)	(0.158)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No	Yes
No. obs. (thousands)	6,952	6,952	6,952	6,952	6,951
Pseudo R^2	0.037	0.039	0.040	0.136	0.142

[20] Shumway (2001) demonstrates the equivalence between the multiperiod binary response model that we use and hazard models, implying that the marginal effect associated with β_1 can be interpreted as that of a historical interlock on the probability that firm i acquires target j in year t.

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they have access to nonpublic information, and in this case through directors' service histories. Column 2 adds contemporaneous interlocks, which also enter positively and are statistically significant. We add several controls in column 3. These include measures of relative size (i.e., the ratio of acquirer-to-target total assets), relative sales productivity (sales-to-assets ratios), and relative market valuation (market-to-book ratios), all of which could reflect increased investment opportunities or overvaluation and lead to a greater probability of an acquisition (Jovanovic and Rousseau (2002), (2008), Harford (2005), and Dong, Hirshleifer, Richardson, and Teoh (2006)).[21] We add two measures of network connectedness among firm pairs in column 4, which are dummy variables set to unity when the acquirer and potential target are in the same 4-digit SIC industry or are headquartered in the same county (Hoberg and Phillips (2010)).[22] The main specification in column 5 includes fixed effects for the major (10-category) SIC division of each firm pair.

The key finding is that these controls do not affect the sign or statistical significance of the estimated coefficient on historical interlocks, although it is slightly smaller in columns 4 and 5 of Table 3, which suggests that historical interlocks are positively correlated with measures of network connectedness. Turning to the other controls, a potential acquirer is more likely to buy a given potential target when the former is relatively larger and more highly valued than the latter. The relative sales-to-assets ratio is unrelated to the likelihood of a merger.

We assess the economic magnitudes of the estimated effects by computing marginal effects using the odds ratio evaluated at the covariate means.[23] The marginal effects indicate that acquirers are 4.5 times more likely to initiate purchases of potential targets with which they are historically interlocked.

[21]Total assets is Compustat item 6, sales is item 12, and cash is item 1. The leverage ratio is the sum of short- and long-term debt (items 34 and 9) divided by item 6. We measure the numerator of the market-to-book ratio as the value of a firm's common equity at current share prices (the product of items 24 and 25), to which we add the book values of preferred stock (item 130) and short- and long-term debt (items 34 and 9). We use book values of preferred stock and debt in the numerator because prices of preferred stock are not available on Compustat and we do not have information on issue dates for debt from which we might better estimate market value. We note that book values of these components are reasonable approximations of market values in stable interest rate environments such as the United States during our sample period. We compute the denominator in the same way except that we use the book value of common equity (item 60) rather than its market value. We eliminate firms with negative values for net common equity from the sample because they imply negative market-to-book ratios, as well as observations with market-to-book ratios in the top 0.5% of the distribution, which yields a cutoff market-to-book value of 34.1, because these are likely to reflect data errors. Robustness tests (not reported) indicate that our main results are robust to alternative upper cutoffs at the top 5% and 1% of the distribution, which corresponds to market-to-book ratios of 10.1 and 20.0, respectively. The sales-to-asset ratio (Compustat item 12 divided by item 6) is our proxy for total factor productivity (TFP) because individual firm output is not available on Compustat. Leverage is given by the ratio of short- and long-term debt to total assets (the sum of Compustat items 34 and 9 divided by item 6).

[22]Although the sample is already restricted to firm pairs that reside in the same major (10-category) SIC division, including an indicator in the logit model for whether the paired firms are also in the same 4-digit SIC category controls for the possibility of much stronger network connectedness due to the closeness of the two firms' core functions.

[23]Marginal effects of covariates on the dependent variable are obtained in the usual manner given coefficient estimates for a dx_i change in covariate i: $\partial \Pr(\text{ACQ}_{it} = 1)/\partial x_{it} = G'(\text{ODDS}(X))\gamma_i$ where $\text{ODDS}(X)$ is the odds ratio constructed using the estimated coefficients and is evaluated at the mean value of covariates: $\text{ODDS}(X) = \exp(\alpha_1 H_{it}^C + \gamma X_{i,t} + \tau_t + w_k)$.

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The probability of an acquisition also rises by 6.8% in response to a 1-standard-deviation increase in relative firm size and by 3.4% for a 1-standard-deviation increase in relative market-to-book ratios. The same-county effect is also strong, with two firms from the same county being 9.3% more likely to merge relative to an average firm pair. Firms within the same 4-digit SIC industry are 80% more likely to merge relative to those across 4-digit industries.

V. Potential Channels

We now examine the extent to which historical interlocks reflect information transmission and conduct tests to see whether there is evidence in favor of an alternative interpretation. These tests strengthen the argument made later that director selection is not driving our results.

A. Does the Direction of Information Flow Matter?

Our prior is that information available to acquirers through a current board member's earlier service can be useful in selecting targets, and our illustrative model suggests how this may occur. An alternative explanation is that the relevant flow of information runs in the opposite direction. For example, if a target believes that acquirers are generally overvalued and a proposed merger involves an exchange of shares, information gained by one of the target's current directors during past service at the acquirer could reduce uncertainty about the value of the shares being offered relative to an unknown acquirer, making the target more likely to accept this particular offer. Alternatively, the target of a hostile takeover may be more likely to recruit as white knights those acquirers with which they have a historical interlock.

We test for the direction of information flow by constructing "reverse historical interlocks," which are simply historical interlocks from targets to potential acquirers. Formally, we define a reverse historical interlock for an acquirer when, in year t, one of the potential *target*'s current directors once served on the acquirer's board but has not in the past 2 years. Here, we reestimate equation (4) and include the reverse historical interlock in the equation to examine if it, like the historical interlock, has any predictive power. Note that the sample includes both actual and potential acquirers, so there is no a priori distinction made between direct and reverse historical interlocks in terms of acquirer or target characteristics. Including reverse historical interlocks in our regressions also tests indirectly for whether our historical interlocks reflect network connectivity or spurious director–firm matching, because both of these alternative interpretations predict a positive and equivalent effect of either type of interlock.

Table 4 presents the results. The first row shows that historical interlocks remain associated with a higher probability that, for firm pair ij in year t, firm i will announce an acquisition of j. The second row, on the other hand, shows that reverse historical interlocks are not statistically significant whether or not historical interlocks are included in the regression, except possibly with a negative effect at the 10% level when we omit control variables. Comparing Table 3 with Table 4, there is no evidence that the inclusion of reverse historical interlocks

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TABLE 4

Effects of Interlocks on Mergers: Reverse Historical Interlocks

Table 4 reports estimates from logit regressions for the likelihood of a merger where the dependent variable equals unity if an acquisition is announced by potential acquirer *i* for potential target *j* in period *t*. The variables of interest are historical interlocks in the first row and reverse historical interlocks from the potential target to an acquirer (defined in Section V.A) in the second row. Column 1 includes reverse historical interlocks only and column 2 adds historical interlocks, whereas column 3 adds contemporaneous interlocks. Column 4 adds controls for relative size, sales-to-assets ratio, and market-to-book ratio, and binary indicators for the firm pair being in the same 4-digit SIC industry and for being headquartered in the same county. Column 5 adds fixed effects for industries at the major 10-category SIC division. All estimating equations include fixed effects for years. Robust standard errors clustered at the firm-pair level appear in parentheses beneath the estimated coefficients. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	1	2	3	4	5
Historical interlock		4.437***	4.305***	3.877***	3.829***
		(0.163)	(0.177)	(0.186)	(0.190)
Reverse historical interlock	0.550	0.285	−1.068*	−0.926	−0.904
	(0.620)	(0.605)	(0.632)	(0.645)	(0.646)
Contemporaneous interlock			1.475***	1.381***	1.348***
			(0.268)	(0.268)	(0.273)
Relative size				0.003***	0.004***
				(0.001)	(0.001)
Relative sales-to-assets ratio				0.004	0.005
				(0.008)	(0.007)
Relative market-to-book ratio				0.026***	0.032***
				(0.007)	(0.006)
Same 4-digit SIC				3.133***	3.066***
				(0.088)	(0.113)
Same county dummy				1.065***	1.136***
				(0.148)	(0.158)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No	Yes
No. of obs. (thousands)	6,952	6,952	6,952	6,952	6,951
Pseudo R^2	0.008	0.036	0.038	0.136	0.142

attenuates the effect of historical interlocks. These results suggest that the direction of interfirm connections *does* matter, and is consistent with the idea that access to nonpublic information is more important for acquirers than for targets. This is perhaps unsurprising given that targets, at least in the case of cash deals, need care only about the price received, whereas acquirers must also consider the synergies associated with a particular deal.

B. Does a Director's Role Influence the Effect of a Historical Interlock?

We now consider a number of director characteristics and how they affect the explanatory power of historical interlocks. We do this because understanding how various forms of director heterogeneity affect target choice can help to distinguish whether historical interlocks predominantly reflect factors other than the transfer of information. For example, whereas the information view predicts that nonpublic information about potential targets will affect merger decisions, the psychological biases interpretation suggests that directors' personal biases toward familiar targets could affect target choice and are directly related to the extent of an interlocked director's influence over the acquirer's board. To explore these effects, we first interact historical interlocks with indicators set to unity if a historically interlocked director is an executive, is an insider, or has a high ownership stake at

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the acquirer, presuming that such directors can influence acquisitions more than other board members can.[24]

Columns 1, 2, and 3 of Table 5 report estimates from adding these interactions to the baseline specification (i.e., the logit model in column 5 of Table 3). A positive coefficient for any of these interactions would suggest that director influence, and thus psychological bias, can explain at least part of the effect of historical interlocks on target choice. The coefficients for the interactions with whether the director is an executive or insider are both negative and not statistically significant, and their inclusion does not affect the sign, statistical significance, or overall magnitude of the direct coefficients on historical interlocks. The interaction with high ownership in column 3, however, generates a positive coefficient that is statistically significant at the 10% level. Although this result seems to offer some weak evidence for the psychological biases view, there is a potentially mitigating effect because to the extent that a higher ownership stake aligns a director's incentives with those of shareholders, such a director might be more thorough in considering a potential acquisition.

TABLE 5

Mergers and Director Characteristics

Table 5 reports estimates from logit regressions for the likelihood of a merger where the dependent variable equals unity if an acquisition is announced by firm *i* for potential target *j* in period *t*. Each column reports estimates using the full specification of equation (4) and interacts historical interlock with an indicator variable for an individual director characteristic. Columns 1, 2, and 3 employ binary indicators set to unity if a historically interlocked director also is an executive, is an insider, or holds an ownership stake of more than 1% at the potential acquirer in *t*. Columns 4, 5, and 6 include indicators set to unity if a historically interlocked director was also an executive, an insider, or a former employee at the potential target during past service there. Robust standard errors clustered at the firm-pair level appear in parentheses beneath the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	1	2	3	4	5	6
Historical interlock	3.975***	4.038***	3.309***	3.241***	3.188***	3.739***
	(0.206)	(0.211)	(0.374)	(0.285)	(0.398)	(0.200)
Historical interlock × Executive (acquirer)	−0.456					
	(0.363)					
Historical interlock × Insider (acquirer)		−0.561				
		(0.346)				
Historical interlock × High ownership (acquirer)			0.727*			
			(0.419)			
Historical interlock × Executive (target)				0.981**		
				(0.391)		
Historical interlock × Insider (target)					0.841**	
					(0.428)	
Historical interlock × Former employee (target)						1.088**
						(0.466)
Full vector of controls	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs. (thousands)	6,951	6,951	6,951	6,951	6,951	6,951
Pseudo R^2	0.142	0.142	0.143	0.143	0.143	0.143

[24]Information on individual directors' roles and ownership stakes is available in the IRRC data set. We define an "insider" as a director who is a current executive or employee of the corporation, or would be classified as an "affiliated outside director." The latter includes, among others, former officers, executives, and employees of the corporation and those connected to current officers through family, professional, financial, and charitable relationships.

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The information hypothesis also predicts that information about potential targets will have a greater effect on merger decisions when the historically interlocked director played an important role on the target's board during service there, because in these cases access to relevant nonpublic information about the target is likely to have been greater. In this case, we interact historical interlocks with indicators set to unity when the historically interlocked director was once an executive, insider director, or former employee of the target. Columns 4, 5, and 6 of Table 5 add these interactions to the baseline specification, and in all three cases the effect of historical interlocks continues to be positive, statistically significant, and similar in magnitude to the main estimates.[25] At the same time, and consistent with the information interpretation, the interaction terms are also positive and statistically significant.[26]

C. Historical Interlocks and Corporate Governance

Psychological biases and network connections may be more likely to dominate decision-making in firms with poor corporate governance (Masulis, Wang, and Xie (2007)). To test whether historical interlocks are influenced by firm-level governance, we collect data from the IRRC Corporate Takeover Defenses Database, which includes an index of overall governance quality originally constructed by Gompers, Ishii, and Metrick (2003) as well as information on individual governance provisions. If historical interlocks affect merger decisions more strongly for firms with weak governance provisions regarding agency conflicts between directors and shareholders, this would offer support for one or both of the alternative theories. We examine three characteristics of the acquiring firm's board. First, under "duties" provisions, directors are not precluded from acting in the interests of nonshareholders when evaluating an acquisition. Second, when the firm has indemnification contracts in place, directors are protected from certain legal actions such as lawsuits filed by shareholders for perceived breaches of fiduciary responsibility. Finally, "care" provisions limit director liability arising from breaches of their "duty of care."[27]

Imposing a requirement that governance data be available for each potential acquirer in every year would reduce the number of observations in our sample

[25] We also examined whether the tenure of the historically interlocked director at the target firm influences the results and found a small effect that is statistically significant at the 10% level. We next tested whether adding a second historically interlocked director would influence merger patterns and did not find an additional effect associated with more than one historical interlock between the two firms.

[26] Another possible factor affecting the explanatory power of historical interlocks is that the director received shares at the target firm during the director's service there. In this case, the director may find him- or herself years later in an influential position at the acquiring firm with the ability to influence the choice of a target. Being aware of the premium that will be offered for the target shares, the director would then have a personal reason for supporting the acquisition of that particular target. Although we do not have information about a current director's shareholdings of the potential target's shares at the time of acquisition, we do know whether the director held more than 1% of the target's shares in the year the director ended service there. When we include the interaction between historical interlocks and the dummy variable for previous target ownership, however, it is not statistically significant. We thank the referee for pointing out this possibility to us.

[27] A director's "duty of care" is a responsibility to be informed and active when making decisions and to use prudence and sound judgment.

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by 67% due to the Gompers et al. (2003) index covering only 5 years of our sample (1998, 2000, 2002, 2004, 2006), our own sampling restrictions described in Section III.B, and changes in the composition of the S&P 1500 over time. To facilitate comparisons with our earlier results, we therefore project values of the governance data forward into missing years to provide the same number of observations as in our other tests. Columns 1, 2, and 3 add interactions of historical interlocks with indicators for the "duties," "contract," and "care" provisions along with the individual indicators for these variables.[28] The interactions are not statistically significant and the direct effects of historical interlocks are largely unaffected, which is the opposite of the predictions of the network connections and psychological biases theories.

Next, we interact historical interlocks with the index of corporate governance, which is defined so that larger values reflect weaker governance. In doing so, we ask whether the effect of historical interlocks on target selection is stronger when the acquirer has weak governance. A positive coefficient on the interaction term would answer in the affirmative and offer support for the network connections or psychological biases theories. The regression reported in column 4 of Table 6, however, indicates a negative and statistically significant

TABLE 6

Historical Interlocks and Corporate Governance

Table 6 reports estimates from logit regressions for the likelihood of a merger where the dependent variable equals unity if an acquisition is announced by firm *i* for potential target *j* in period *t*. Each column reports estimates using the full specification of equation (4) and includes a characteristic of the acquirer's corporate governance along with its interaction with the presence of a historical interlock. These measures are described in Section V.C. Columns 1, 2, and 3 interact the presence of a historical interlock with indicator variables for duties, contract, and care (also discussed in Section V.C). Column 4 interacts historical interlocks with the governance index from Gompers et al. (2003). Columns 5 and 6 interact the presence of a historical interlock with indicators for the presence of control-share acquisition laws and supermajority provisions, respectively. The bottom row of estimates includes coefficients for each corporate governance term entering alone. Robust standard errors clustered at the firm-pair level appear in parentheses beneath the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	1	2	3	4	5	6
Historical interlock	3.820***	3.945***	3.914***	4.503***	3.841***	3.811***
	(0.192)	(0.204)	(0.231)	(0.679)	(0.191)	(0.197)
Historical interlock × Duties	0.342					
	(0.654)					
Historical interlock × Contract		−0.561				
		(0.444)				
Historical interlock × Care			−0.215			
			(0.338)			
Historical interlock × G-index				−0.073		
				(0.072)		
Historical interlock × Control-share					−0.061	
					(1.049)	
Historical interlock × Supermajority						0.287
						(0.566)
Governance term	−0.271	0.278**	0.353***	0.027	−0.023	−0.292*
	(0.215)	(0.109)	(0.097)	(0.019)	(0.234)	(0.164)
Full vector of controls	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs. (thousands)	6,951	6,951	6,951	6,951	6,951	6,951
Pseudo R^2	0.143	0.142	0.143	0.150	0.142	0.142

[28] Coefficients and standard errors for the respective noninteracted governance characteristics appear in the row labeled "governance term" in Table 6.

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coefficient on the interaction term, which is consistent with a stronger effect of historical interlocks for acquirers with *good* governance.

In columns 5 and 6 of Table 6 we interact historical interlocks with two additional measures of governance that address acquisitions specifically. Control-share acquisition laws deny voting rights to newly qualified large shareholders unless approved by a majority of disinterested shareholders, whereas supermajority provisions allow increases in the voting threshold needed to approve deals beyond state-level mandates so that mergers are less easily approved by shareholders. Neither of these terms is statistically significant when interacted with historical interlocks, however, and neither affects the magnitude of the direct effect of a historical interlock. These tests offer additional evidence that historical interlocks do not lead to acquisitions driven by value-destroying motives.

D. Historical Interlocks and Target Unfamiliarity

If historical interlocks reflect information that is useful for valuing targets, we would expect them to have a greater effect on target choice in environments where the deal is difficult to value. Although this is an imperfect indicator of informational proximity, difficulties in valuation could be related to geographic positioning, such as whether or not the two firms in a pair are headquartered in the same county. For example, it is common for executives in California's "Silicon Valley" to share ideas through social and network connections, and their relative proximity facilitates such exchanges.

To explore these implications, we interact historical interlocks with an indicator set to unity when the potential acquirer and target are headquartered in the same county. The information hypothesis predicts that these interactions will have a negative effect on target selection because the degree of overlapping nonpublic information provided by directors is likely to be smaller.

Table 7 presents the results. In the first row we reestimate the baseline specification of equation (4) including the interaction of historical interlocks with the same-county indicator on the right-hand side. This term enters negatively and is statistically significant, indicating that the effect of historical interlocks is greater for firm pairs where information asymmetries are likely to be largest. Column 2 includes estimates from an analogous exercise for contemporaneous interlocks and finds no such effect. In column 3 we include the interactions of both historical and contemporaneous interlocks with the same county dummy. In this case we find that the interaction with historical interlocks continues to enter negatively and at the 1% level, whereas the interaction with contemporaneous interlocks is not statistically significant.

E. Historical Interlocks and Deal Outcomes

If historical interlocks provide a conduit for transmission of nonpublic information, we would expect to find performance-based evidence consistent with this advantage. In particular, more informed deals should be associated with higher or less variable announcement returns on average, and should have a lower incidence of extreme negative returns. Mergers among historically interlocked firms

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TABLE 7

Historical Interlocks and the Information Environment

Table 7 reports estimates from logit regressions for the likelihood of a merger where the dependent variable equals unity if an acquisition is announced by firm *i* for potential target *j* in period *t*. The variables of interest are historical interlocks in the first row, contemporaneous interlocks in the second row, and their respective interactions with a binary indicator set to unity if the two firms are headquartered in the same county. All columns report estimates using the full specification of equation (4) while including either or both of the interaction terms. Column 1 includes the interaction of the presence of a historical interlock and the same county dummy. Column 2 includes the interaction of the presence of a contemporaneous interlock and the same county dummy. Column 3 includes both interaction terms. All estimating equations include fixed effects for years and for major 10-category SIC divisions. Robust standard errors clustered at the firm-pair level appear in parentheses beneath the estimated coefficients. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	1	2	3
Historical interlock	4.196***	3.840***	4.211***
	(0.185)	(0.189)	(0.185)
Contemporaneous interlock	1.157***	1.101***	1.006***
	(0.255)	(0.304)	(0.308)
Historical interlock × Same county dummy	−2.072***		−2.145***
	(0.570)		(0.596)
Contemporaneous interlock × Same county dummy		0.284	0.586
		(0.568)	(0.525)
Full vector of controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
No. of obs. (thousands)	6,951	6,951	6,951
Pseudo R^2	0.144	0.144	0.142

should also have higher probabilities of completion and shorter lags between announcement and effective dates. In this section we explore the effects of historical interlocks on these outcome measures. Because the tests require only data on actual deals, we work with all announced mergers for which the acquirer and target are both in the IRRC data set and have the required balance sheet items available from Compustat, and we do not restrict the sample to deals within major (10-category) SIC industries.

1. Announcement Returns

We begin by estimating an ordinary least squares (OLS) regression of abnormal returns around the announcement day:

$$\mathrm{CAR}_{ijt} = \alpha_1 + \alpha_2 H_{ijt} + \alpha_4 I_{ijt} + \alpha_5 Z_{ijt} + \tau_t + \varepsilon_{ijt},$$

where CAR_{ijt} is the acquirer's cumulative abnormal return after a merger is announced between firms i and j in year t, H_{ijt} and I_{ijt} represent historical and contemporaneous interlocks, the Z_{ijt} are deal characteristics, and the τ_t are fixed effects for years. We calculate abnormal percentage returns using standard event study methods (Brown and Warner (1985)) over a 3-day window around the announcement date using the difference between the stock returns and the market model measured by the Center for Research in Security Prices (CRSP) equal-weighted index.[29] The average acquirer's cumulative return in our sample of mergers among S&P 1500 firms is −2.5%.

[29] We obtain similar results with alternative methods for computing cumulative returns (e.g., using different event windows and alternative proxies for the market model).

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Column 1 of Table 8 presents estimates from this regression. Z_{ijt} includes the relative size of the two firms (Moeller, Schlingemann, and Stulz (2004), Alexandridis, Fuller, Terhaar, and Travlos (2013)), the logarithm of the total transaction value, and indicators for whether the deal was unsolicited (Schwert (2000)) and whether payment was made primarily in cash (Huang and Walkling (1987), Travlos (1987)). The presence of a contemporaneous interlock lowers announcement returns by 1.8 percentage points on average and the coefficient is statistically significant at the 5% level.[30] The coefficient on historical interlocks is positive but not statistically significant.[31]

TABLE 8

Historical Interlocks and Deal Outcomes

Table 8 reports estimates of regressions where the dependent variable for an announced acquisition by acquirer *i* of target *j* in year *t* is cumulative announcement returns (column 1), an indicator taking a value of 1 if the deal is closed and 0 otherwise (column 2), and, for deals that are closed successfully, the number of days between announcement and closing (column 3). The variables of interest are the historical and contemporaneous interlocks (defined in Section III.A). The control variables, described in Section V.E, are indicators for whether the deal was a majority cash transaction and whether it was unsolicited, along with the value of the transaction measured in logarithms and the ratio of total assets for the two firms. Robust standard errors appear in parentheses beneath the coefficient estimates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Announcement Returns	Deal Success	Completion Time
Variable	1	2	3
Historical interlock	0.002	16.424***	−28.199**
	(0.011)	(0.626)	(10.762)
Contemporaneous interlock	−0.017**	0.936	−2.941
	(0.008)	(0.680)	(20.732)
Relative size	0.008***	0.668***	−7.771
	(0.002)	(0.240)	(4.867)
Transaction value	−0.007***	0.390***	16.434**
	(0.003)	(0.151)	(5.437)
Cash	0.024**	0.338	−8.399
	(0.005)	(0.386)	(11.119)
Unsolicited	0.014**	−2.614***	42.611
	(0.006)	(0.337)	(28.965)
Year fixed effects	Yes	Yes	Yes
No. of obs.	750	750	619
R^2	0.14	0.35	0.20

We do find, however, that historically interlocked deals are associated with lower variability in announcement returns. Specifically, the standard deviation of announcement returns is 0.51 percentage points for deals where the acquirer and target are historically interlocked and 0.69 percentage points for deals where

[30]Cai and Sevilir ((2012), Tab. 4) find a positive effect of contemporaneous interlocks on an acquirer's abnormal returns using a finer specification than ours. We found, however, that including additional controls such as industry fixed effects and the Tobin's Q of acquirer and target do not affect our result. We attribute the difference to the fact that our sample from the IRRC data set is limited to firms in the S&P 1500 and thus contains large acquirers and targets whose behavior is more likely to be scrutinized by investors. In this context, it is natural to suppose that investors will penalize mergers associated with potential conflicts of interest (i.e., contemporaneously interlocked directors).

[31]The fact that we do not find historical interlocks related to higher announcement returns could signal that the acquirer is paying a fair (i.e., informed) price for the target, whereas overpayment would be associated with negative acquirer returns.

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they are not. A variance-ratio test indicates that this difference is significant at the 1% level.

To examine whether extreme negative outcomes are less likely for historically interlocked deals, we compute the percentage of deals without a historical interlock that have announcement returns lying more than 1 standard deviation below the mean of deals without a historical interlock. This 1-standard-deviation cutoff lies at −0.91%, and 13.5% of deals without a historical interlock lie beneath it. In contrast, only 11.1% of historically interlocked deals have announcement returns below this cutoff. The paucity of extreme negative announcement returns for historically interlocked deals relative to their counterparts without a historical interlock is even more pronounced when we choose a more extreme cutoff: 4.3% of deals without a historical interlock have negative announcement returns at least 2 standard deviations below their mean (i.e., less than −1.6 percentage points), whereas only 2.2% of historically interlocked deals have cumulative returns below this lower cutoff.

We conclude that evidence in favor of historical interlocks enhancing announcement returns is weak, but evidence that they reduce return variability and extreme negative outcomes is much stronger.

2. Deal Completion

We next examine whether announced historically interlocked deals are more likely to be completed by estimating the following logit equation:

$$\Pr(S_{ijt} = 1) \quad = \quad \alpha_1 + \alpha_2 H_{ijt} + \alpha_4 I_{ijt} + \alpha_5 Z_{ijt} + \tau_t + \varepsilon_{ijt},$$

where S_{ijt} is an indicator variable taking a value of unity if an announced acquisition of target j by acquirer i in year t completes successfully, and 0 otherwise.[32] Similar to other recent studies of deal completion rates such as Branch, Wang, and Yang (2008), about 15% of announced deals in our sample fail to complete after announcement. Column 2 of Table 8 regresses deal success on the presence of a historical interlock and the full set of control variables used in column 1. The coefficient on historical interlocks is large and statistically significant at the 1% level. The marginal effect, computed using the logit odds ratio at the covariate means, indicates that historically interlocked deals are 9.9% more likely to complete relative to deals without a historical interlock. At the same time, contemporaneous interlocks do not have statistically significant effects on deal completion times.

To examine whether, from the perspective of acquiring-firm boards and management, historical interlocks reduce uncertainty surrounding deal completion, we compute the standard deviation of completion rates for historically interlocked deals and those without a historical interlock. The standard deviation of the former is 0.14, whereas the standard deviation of deals without a historical interlock is 0.37. A variance ratio F-test indicates that this difference is significant at the 1% level.

[32]These data are available from the SDC Platinum Database.

3. Time to Completion

We next examine whether mergers with historical interlocks are completed more rapidly relative to other deals. Rapid integration might reflect greater confidence on the part of the board and management of the acquiring firm. It could also reflect a reduced need to rely on due diligence after the announcement. We estimate the following equation on announced deals that end up being completed successfully:

$$T_{ijt} = \alpha_1 + \alpha_2 H_{ijt} + \alpha_4 I_{ijt} + \alpha_5 Z_{ijt} + \tau_t + \varepsilon_{ijt},$$

where T_{ijt} is the number of days between announcement and completion. The average completion time in our sample is 142 days and has a standard deviation of 102 days.

Column 3 of Table 8 regresses completion times on historical interlocks and the full set of controls from column 1. The coefficient on a historical interlock is negative and statistically significant, indicating that historically interlocked deals take 28 days less on average to be completed. Contemporaneous interlocks, on the other hand, have no significant effect on deal completion times.

With respect to uncertainty in deal completion times, we find that the standard deviation of time to completion is 74 days for deals where the acquirer and target share a historical interlock and 117 days for deals where they do not. The variance ratio F-test indicates that this difference is statistically significant at the 1% level.

F. Summary

We now pause to summarize the evidence reported so far about how historical interlocks matter in merger decisions. And although the transfer of information across firms is intuitive and appealing, it is possible that other channels are at work. The psychological biases hypothesis, which predicts that directors choose targets based on agency conflicts stemming from social or network connections, is perhaps the main contender. We conduct several tests for psychological biases, but none indicates that they affect the operation of historical interlocks. Indeed, if historical interlocks operated through social connections, those from targets to potential acquirers (i.e., reverse historical interlocks) would also affect acquisition decisions, but the results in Table 4 show that this is not the case. Psychological biases could also come into play if socially connected directors, even if only historically interlocked, have greater influence over acquisitions when they hold more important positions at the acquirer, but the results in Table 5 show that this is also not the case.

As discussed earlier, director–firm matching predicts a spurious correlation between interfirm director connections and mergers due to similarities among firms. The failure of reverse historical interlocks to predict acquisitions in Table 4, however, provides no support for this alternative, and we offer further evidence against a role for director–firm matching in Section VI. Cross-firm director connections may be related to mergers because an acquirer's directors are sometimes placed on the target's board to facilitate the deal. But because our historical interlocks specifically omit firms that shared a director within the past 2 years, they are

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unlikely to be related with director take-on, that is, the tendency for an acquirer to add members from a potential target's board in advance of a planned deal.

With respect to deal outcomes, the psychological biases hypothesis predicts that director-connected deals will perform worse than the average deal. The results in Table 8 show that this is true in the case of abnormal returns for contemporaneously interlocked firms, but not for historical interlocks.

On the other hand, director experience may well confer information that is useful for identifying suitable targets or negotiating better deal terms. And consistent with the information hypothesis, the results in Table 5 show that historical interlocks matter more when the interlocked director played a larger role on the potential target's board. We also find that historical interlocks have a greater effect on merger decisions when the historically interlocked director has a larger stake in the acquiring firm (Table 5), the director's current firm has better corporate governance (Table 6), and the firm pairs are not in close proximity (Table 7). We find that historical interlocks favorably influence deal success probabilities and time to completion, but that this is not the case for contemporaneous interlocks (Table 8). Finally, historical interlocks associate with a strong reduction in deal outcome uncertainty for abnormal returns, success probabilities, and times to completion. These results are again consistent with the information hypothesis and inconsistent with agency conflicts driving our main results.

Taken together, our findings are supportive of the information hypothesis and difficult to reconcile with the alternatives, and especially with the psychological biases perspective.

VI. Robustness

In this section we summarize the results of additional tests to verify our main finding that a historical interlock increases the probability that a given directional firm pair will merge. The Internet Appendix (available at www.jfqa.org) describes these tests in more detail and presents the estimation results.

First, it is possible that firms' choices of directors are outcomes of optimization problems that take firm characteristics as inputs, and that these characteristics also affect the propensity of two firms to merge. Because many unobservable characteristics likely to be relevant for director selection are also persistent, we use a de-meaned linear probability model to address the "spurious correlation" that would arise from director–firm matching. This is equivalent to including fixed effects in a linear regression form of equation (4). We find that historically interlocked firm pairs are about 7.2 times more likely to merge relative to the average firm pair. This effect is larger than that found in our main logit models and is expected given the downward bias typical in coefficients from binary response models with rare events data. We also allow for time-varying unobservables and calculate that their effects would need to be nearly 10 times larger than the effects of observables to fully explain the effect of historical interlocks on acquisitions. Once director selection based on time-invariant firm-pair effects is considered, further selection on unobservables would need to be 60 times larger than on observables, which seems unlikely.

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We also examine the effects of historical interlocks on merger decisions with matching methods that control for endogeneity bias by comparing the conditional merger probabilities of historically interlocked firm pairs (the "treatment" group) with observationally similar pairs that are not historically interlocked (the "control" group). Using 1, 2, and 3 "nearest-neighbor" matches for each observation in the treatment group, we find that the effects of historical interlocks remain positive, large, and statistically significant.

We next conduct robustness checks on some decisions we made in building the sample. First, we check if our findings change when we define historical interlocks as situations where at least 1 (or 3) years have passed since the director last served on the target's board. The effects of historical interlocks are larger with the 1-year window and smaller with the 3-year window, which might be expected if the saliency of private information about a potential target diminishes with time, but remain positive and highly significant statistically. We also find that the effects of historical interlocks are nearly the same when we exclude partial share acquisitions from the set of mergers, impose the restriction that announced deals must exceed $100 million in value, or allow small-share acquisitions that are at least 10% of the target's shares.

It is also at least plausible that directors tend to move from smaller to larger firms over their careers, given that larger firms tend to have higher director compensation and directors might, on average, choose larger and more prestigious boards as they gain experience. If this is true, the firms most likely to be acquirers (i.e., larger firms) would also be those most likely to have historical interlocks with smaller firms (i.e., the most likely targets). Although we already control for the ratio of the assets of the potential acquirer and target in all of our specifications, we estimated specifications where the ratio also enters nonlinearly. We also limit the sample to firm pairs of roughly equal size (acquirer-to-target asset ratios between 0.75 and 1.25). In all of these models the effects of historical interlocks remain large, positive, and highly significant statistically. In the restricted sample, we find that 55% of all historical interlocks come from directors moving from larger to *smaller* firms. Although this falls to 45% when we consider all possible firm pairs, the results offer no reason to believe that directors, on average, move from smaller to larger firms, and hence this alternative story cannot explain our empirical results.

VII. Conclusion

The transfer of information about potential merger targets through the past experience of an acquirer's director is important for decisions in the market for corporate control. We show this by creating measures of interfirm director linkages from potential targets to potential acquirers. Using a current director's past service at a potential target as a proxy for this information, we find that firms with historical interlocks are more likely to initiate acquisitions with potential targets to which they are linked than those for which they have no historical interlock. The results indicate an effect of information transfer on acquisition patterns that is independent of other factors such as network connectedness, the tendency for directors to move to a likely target's board prior to acquisition, and observed and

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unobserved firm characteristics. A series of robustness tests confirms our main findings.

Our study provides an example of how boards and the information available to them directly affect a major corporate decision. In so doing, we provide greater understanding of how even small reductions in informational asymmetries can affect an acquiring firm's selection of acquisition targets. Although we do not offer a theory or evidence on what determines acquirers, the facts that director histories are traceable and that share prices of merger targets tend to rise suggest that there may be some value in better understanding these linkages.

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