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In business-to-business markets, top marketing and sales executives (TMSEs) have considerable influence on their organizations' customer strategies. When TMSEs switch firms, a pattern of informal organizational connections results; this pattern reflects the flow of information and knowledge among firms and creates managerial social capital in the process. To model this information flow, the current study considers information reach and richness, conceptualized according to the network position (i.e., centrality and brokerage) of the firm in the TMSE mobility network, which can be constructed by tracing executive movements through the work experience records of TMSEs in an industry. TMSE tenure (i.e., time with the firm) and firm market orientation constitute critical moderators, which capture motivation and ability at the individual and firm level, respectively. Data from the semiconductor industry and a model that corrects for unobserved heterogeneity and endogeneity suggest that managerial social capital enhances firm performance; however, TMSE tenure and firm market orientation are essential for absorbing the benefits of managerial social capital.

Keywords: chief marketing officer tenure, executive affiliations, managerial social capital, motivation–ability, social network

Mobility of Top Marketing and Sales Executives in Business-to-Business Markets: A Social Network Perspective

The role of marketing as a customer-facing function is well established (e.g., Kumar et al. 2011; Moorman and Rust 1999). In business-to-business (B2B) markets, this role is carried out by the marketing and sales functions,[1] whose top executives have considerable influence over organizational strategy, structure, and culture (Coff 1997). For example, Michael MacDonald, the president of global accounts and marketing operations at Xerox Corporation, has been lauded as a "change agent" for his efforts to steer the company into new markets and profitable growth.[2] Because of this influence, critical organizational outcomes, such as firm growth and profitability, depend on top executives' values and cognitions (Finkelstein, Hambrick, and Cannella 2009). These values, in turn, develop over the course of the executives' work lives, which often include work at multiple firms. The executives' affiliations with past employers provide them with social ties across firms; at the firm level, these social ties, emanating from both the prior work affiliations of current top marketing and sales executives (TMSEs) and the current affiliations of prior TMSEs who have left, might provide opportunities for firms to acquire external business knowledge through the social capital that results from such relationships (Yli-Renko, Autio, and Sapienza 2001). Thus, the relevant research question is, "Do the social ties of TMSEs

[1]In marketing literature, the sales function often is subsumed within marketing, such that sales represent a type of promotion. In practice, especially in B2B markets, marketing and sales functions often are distinct, headed by separate executives (e.g., chief marketing officer, chief sales officer). For simplicity, we refer to these executives as "top marketing and sales executives" (TMSEs), who might include vice presidents of marketing or sales or chief marketing or sales officers.

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[2]See http://adage.com/article/btob/michael-mac-donald-president-global-accounts-marketing-operations-xerox-corp/264956/ (accessed April 2016).

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created through their prior work affiliations actually result in improved firm performance?"

To assess the performance implications of social ties based on prior TMSE affiliations, we turn to social network theory and construct TMSE mobility networks, which reflect the experience records of all TMSEs in an industry. In these networks, we consider two firms connected if a current TMSE of a firm worked at the other firm in the past. By generalizing this pattern to the entire industry, we can derive a social network based on TMSE mobility. That is, we use the experience records of TMSEs in an industry to represent the structure of organizational interactions in that industry, as they pertain to the exchanges of information, knowledge, and resources related to the market or customers. In the resulting TMSE mobility network, we conceive of managerial social capital as derived from the social ties a TMSE has with former colleagues from previously affiliated firms. Such managerial social capital grants the firm an opportunity for information access, captured in measures of information reach (i.e., volume and speed of information access) and information richness (i.e., novelty and nonredundancy of information).

To assess information reach and richness, we use the position of a firm in the TMSE mobility network, as manifested by its centrality and brokerage position, respectively. Information reach indicates that a network actor has many direct ties with other actors, and more direct ties grant direct access to more information. Direct ties also allow faster and more reliable information access because the information does not need to go through intermediaries. Information richness instead refers to the firm's access to nonredundant information from disconnected network subcomponents. However, effective information acquisition is constrained by organizational information assimilation and utilization processes (Rindfleisch and Moorman 2001). We capture these processes through TMSE integration into the current organization (i.e., tenure) and the firm's knowledge base and market focus (i.e., market orientation) as critical moderators of the efficacy of managerial social capital. These moderators are based on motivation and ability factors at the individual and firm level, respectively.

The results from our investigation of a TMSE mobility network in the semiconductor industry suggest that both individual- and firm-level motivation and ability are essential for obtaining the benefits associated with managerial social capital. We find significant positive interactions of market orientation (firm-level motivation and ability) with both information reach and richness and of TMSE tenure (individual-level motivation and ability) with information reach. From a managerial perspective, our results suggest that the information reach and richness that emanate from centrality and brokerage positions of a firm in a TMSE mobility network, combined with motivation and ability, improve firm market valuations by anywhere from $6 million to $39 million (in our sample, the average firm valuation is $3 billion).

We thus contribute to social network literature in B2B markets, research on the influence of chief marketing and sales officers on firm performance, and human resources research in organizational behavior and labor economics. First, with social networks based on TMSE mobility, we reveal which information resources a TMSE brings to the firm. Second, we consider executive movements and the role of their links, then conceptualize TMSEs' managerial social capital. Third, our multilevel conceptualization of motivation and ability depicts how these critical moderators enhance the efficacy of managerial social capital for firm performance. We thus establish the importance of TMSEs for access to information resources, as well as the benefits of increasing TMSE tenure.

In the next section, we present our conceptual background, which leads to our research hypotheses. After outlining the methodology and data analysis approach, we summarize our results. We conclude with the contributions of our research and some managerial implications.

THEORETICAL FRAMEWORK

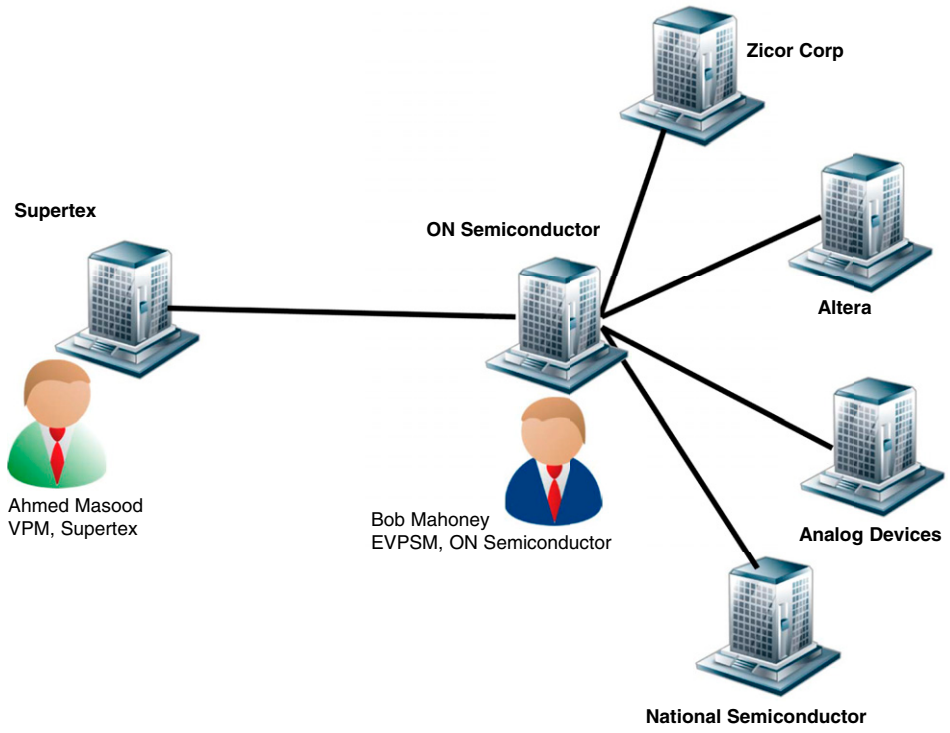
Executives, including TMSEs, frequently move from one firm to another during their career progression. The movement of TMSEs thus provides a mechanism for developing interfirm linkages, resulting in information flows and communications across linked firms (Pfeffer and Leblebici 1973). For example, when a TMSE at one firm leaves to join another, that executive brings implicit information about business practices, customers, and market strategies (Boeker 1997). The executive also might maintain personal and professional relationships with ex-colleagues; even after leaving the firm, s/he retains these social ties that allow for the exchange of ideas and information between firms.[3] By sharing information about customer relationship management or sales force automation software, TMSEs likely learn from others' experiences, avoid pitfalls, and improve performance. Information about industry trends, product innovations, emerging market segments, and new markets also can be shared through TMSE mobility networks.

The connections among firms created by movement of TMSEs produce, at the industry level, a social network in which firms are connected through the prior work affiliations of their TMSEs. We illustrate the social network of a subset of our sample in Figure 1. The TMSEs are affiliated with firms through their experience, such that the affiliations pertain to current and previous employers. Movement from one firm to another implies a link between the two firms, which represents a social tie due to executive movement. Because executives might have worked at many firms before moving to the current firm, links also accrue, from all erstwhile employers of the TMSE to the current employer, resulting in a network of social ties created due to executive movement. For example, in Figure 1, Bob Mahoney was an executive vice president of sales and marking for ON Semiconductor (ONNN) in 2006 and previously worked (in chronological order) for Zicor Corporation, Altera, Analog Devices, and National Semiconductor. This pattern of work experience results in links between ONNN and Zicor, Altera, Analog Devices, and National Semiconductor. Ahmed Masood, the vice president of marketing of Supertex in 2006, had previously worked for ONNN. His movement from ONNN to Supertex resulted in a link between the two firms. These links create opportunities to access external business knowledge, through informal, bidirectional information exchanges by TMSEs and their

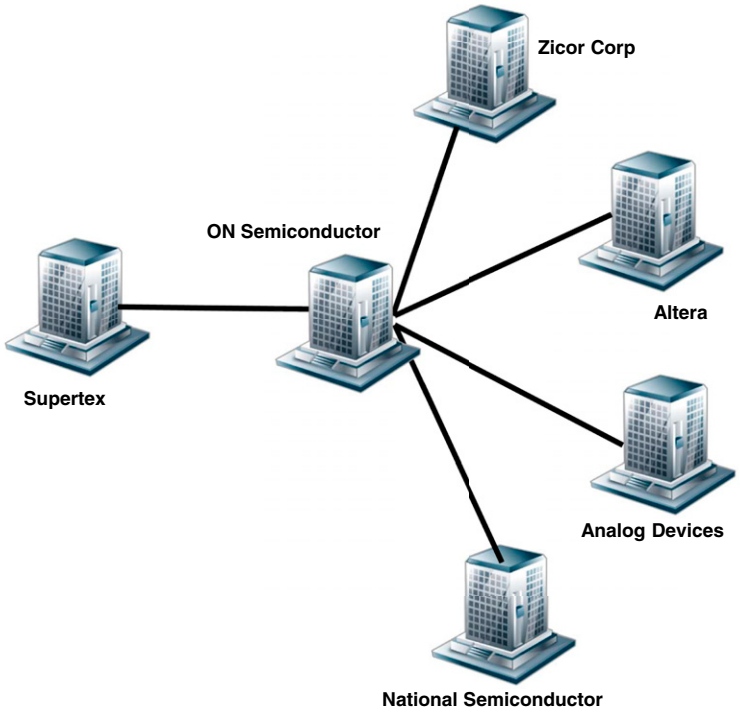
[3]Some firms have clear policies for ending such communication, such as nondisclosure or lock-in agreements. But considerable evidence indicates that personnel movement leads to information exchanges. For example, "American Express estimates that 30% of customers would follow their financial advisor to a new firm" (Palmatier, Scheer, and Steenkamp 2007, p. 185), such that these salespeople can contribute knowledge about product offerings, pricing, customer preferences, and customer acquisition strategies. Similarly, board interlocks facilitate information sharing and the adoption of business practices across firm boundaries (e.g., poison pills, golden parachutes; Mizruchi 1996).

Figure 1
SAMPLE TMSE MOBILITY SOCIAL NETWORK

A: Tracing Executive Movement



B: Firm-Level TMSE Network Links



Notes: This figure depicts the network for six firms (as opposed to 108 in our sample). In Panel A, at the firm level, the links indicate the current TMSEs (in 2006) or previous TMSEs who moved to other firms. Bob Mahoney was Executive Vice President of Sales and Marking (EVPSM) for ON Semiconductor in 2006 and previously worked for Zicor Corporation, Altera, Analog Devices, and National Semiconductor (in chronological order). This pattern of work experience results in links from Zicor, Altera, Analog Devices, and National Semiconductor to ON Semiconductor. Ahmed Masood was Vice President of Marketing (VPM) of Supertex in 2006 and previously worked for ON Semiconductor. His movement results in a link between the two firms. Panel B illustrates the network that results from aggregating all these links at the firm level, which can also be represented as a graph.

erstwhile colleagues. The directionality of the link—whether due to the current TMSE or an erstwhile TMSE of the firm—should not matter. By aggregating such links at the firm level, we can create a social network for the industry.

TMSEs' Prior Affiliations as Managerial Social Capital

It is possible to understand economic actions by examining social relations within which firms are embedded (Granovetter 1985). The TMSE mobility network represents social ties among firms that provide those firms with opportunities to access information and knowledge and thus achieve performance improvements. Some firms in the network have better opportunities to access resources and information, because of their better social ties, and this advantage can be represented as social capital, or "the aggregate of the actual or potential resources linked to possession of a durable network of relationships" (Bourdieu 1985, p. 248). Social capital consists of (1) the relationship itself, which provides access to resources possessed by the associated parties, and (2) the nature and amount of those resources (Xiong and Bharadwaj 2011). For example, a focal firm with a social tie to another firm can create social capital by exchanging information and knowledge; it also might get access to some complementary technology or resources that otherwise would not be accessible, thereby creating additional social capital. Our concept of "managerial social capital" refers specifically to the social capital created by movements of TMSEs in an industry, such that the social network results from the past work affiliations of TMSEs for all firms in the industry. Thus, managerial social capital provides a firm with an opportunity to access information from the TMSE mobility network.

Network Positions and Managerial Social Capital

The position of a firm in the social network that has been created by the movement of TMSEs should determine the firm's opportunities to access information and resources (Burt 2000). Previous research has shown that the network position of an actor determines the volume, quality, and novelty of information available to that actor (Grewal, Lilien, and Mallapragada 2006; Nerkar and Paruchuri 2005). Consistent with Obstfeld (2005), we theorize that the information value of a firm's network position depends on two dimensions: information reach and information richness (Mallapragada, Grewal, and Lilien 2012; Nerkar and Paruchuri 2005). Information reach depends on centrality (Freeman 1979; which relates to Obstfeld's [2005] notion of the action problem[4]), such that it reflects the volume of information and speed with which it can be accessed. Information richness is based on the brokerage position (Burt 2005; which relates to Obstfeld's [2005] concept of the idea problem[5]), and the focus is novel, nonredundant information.

To understand how centrality (and brokerage, as we discuss subsequently) leads to information reach (richness, for brokerage) in the context of a TMSE mobility network and managerial social capital, we use an illustrative network. In Figure 2, nodes 3 and 16 represent centrality positions; these firms have the most links with other firms (six each). Because of their many direct connections, these nodes have access to a greater volume of information and can access other nodes in the network directly, without needing to go through intermediaries. Thus, they also enjoy greater speed of information access.

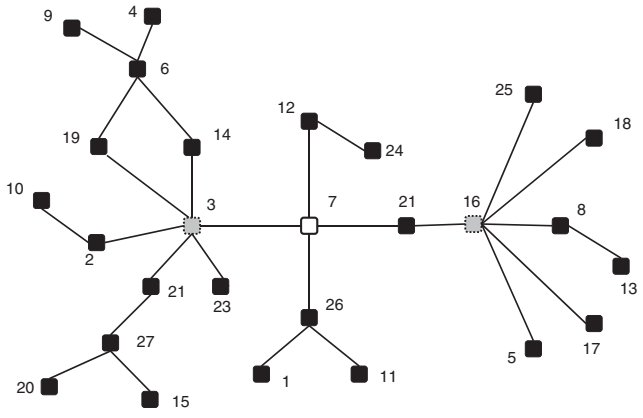
Brokerage implies a bridging position; in extreme cases, removal of the brokerage position causes the network to break into disconnected subcomponents (Kilduff, Angelmar, and Mehra 2000). Such a position generates information benefits because information tends to be relatively redundant in any given subcomponent (Burt 1992). It also relates to the concept of structural holes (Burt 1992). Firms that occupy bridging positions, covering the structural hole, thus have a distinct advantage; they have access to information from disconnected subcomponents of the network, which tends to be novel, nonredundant, and rich (Granovetter 1973). In Figure 2, node 7 occupies the strongest brokerage position; it connects two subcomponents of the network and thus has access to diverse information from both subcomponents (information richness). If we were to remove node 7, the network would break into four subcomponents, which indicates the importance of the node's brokerage position.

Motivation and Ability

A firm's managerial social capital, derived from its TMSE mobility network, indicates opportunities for the firm to

Figure 2

INFORMATION REACH AND INFORMATION RICHNESS NETWORK POSITIONS



Notes: Nodes 3 and 16 (gray) represent information reach position; node 7 (white) has an information richness position. Nodes 3 and 16 represent central positions because they have a high number of links from other firms (both nodes have six), such that they can access other nodes in the network through direct paths without going through intermediaries. Node 7 enjoys the highest brokerage position in this network; it connects two subcomponents of the network: one in which node 3 has high centrality and another in which node 16 has high centrality. Therefore, node 7 has access to diverse information from both subcomponents and can combine this diverse information to its own advantage. If we remove node 7 from the network, the network breaks into four subcomponents, which highlights the importance of node 7's brokerage position.

[4]The action problem refers to the difficulty of coordinating in a social network; as the density of connections in a social network decreases, it becomes more difficult to coordinate with dispersed and unconnected actors (Obstfeld 2005). In contrast, as the centrality of an actor in a social network increases, the actor has more ties with other actors in the network, so centrality provides increased information reach. Increased information reach improves the ability to share information faster, arrive at possible consensus, and achieve coordination among network actors, thus solving the action problem.

[5]The idea problem refers to the difficulty associated with generating novel ideas in a social network (Obstfeld 2005). As the density of connections in a social network increases, similar information and thinking pervades the network, and innovative ideas are rationalized. Lower network density instead can foster more diverse ideas, because rich information is available, and the sparseness of the network ensures that heterogeneous ideas are not rationalized easily.

acquire external business knowledge. However, beyond knowledge acquisition, organizational learning requires knowledge assimilation and utilization (Argote and Miron-Spektor 2011; Moorman 1995). To account for these processes, we consider the motivation and ability of both the organization and the TMSE to assimilate and use knowledge, in line with the motivation–ability framework (Merton 1957). Motivation and ability studies appear in diverse fields (e.g., consumer behavior [MacInnis, Moorman, and Jaworski 1991], marketing strategy [Boulding and Staelin 1995], organization behavior [Grewal, Comer, and Mehta 2001]), and the extent to which a firm learns from information sources appears to be a function of its motivation and ability to use that information (Moorman and Miner 1997).

Specifically, in a TMSE mobility network, motivation and ability reflect factors at two levels: the individual and firm levels. Social network researchers acknowledge the importance of organizational variables as critical moderators of information access benefits arising from a firm's network position. For example, Cassiman and Veugelers (2006) point to the importance of internal research and development capabilities (firm-level factor) for external knowledge acquisition, and Wuyts and Dutta (2014) show that firms' internal knowledge creation strategies determine their ability to benefit from particular alliance constellations. Because motivation and ability should be critical moderators of the opportunities presented by information access, we designate individual- and firm-level motivation and ability as potential contingency mechanisms that can constrain the efficacy of information access opportunities that arise from managerial social capital.

We assess these levels of motivation and ability according to the integration of the TMSE into the organization (i.e., tenure) and the firm's market-relevant know-how and focus (i.e., market orientation). With increasing tenure, the TMSE becomes more closely integrated into the firm, with more intense interactions with organizational members, less cognitive distance from top management, and increased individual-level knowledge conversion and creation, thus leading to increase in motivation. Further, over time the TMSE increases his or her ability to decipher which social ties are most beneficial in assimilating and utilizing information assessed through managerial social capital. Thus, with TMSE tenure we assess individual TMSE-level motivation and ability.

A firm with a strong market orientation also accumulates more market-relevant knowledge, which in turn should enhance the firm's ability to make sense of, assimilate, and use new external knowledge, in line with absorptive capacity literature (Cohen and Levinthal 1990). Market orientation also captures a motivational aspect, because it implies that the firm is focused on collecting information about customers and competitors and leveraging that information to create customer value and improve firm performance (Kumar et al. 2011). As Slater and Narver (1995) suggest, a firm's strategic orientation provides a cultural foundation and knowledge base for organizational learning, so market orientation implies the broader context of a learning organization. Therefore, we use market orientation to capture firm-level motivation and ability.

HYPOTHESIS DEVELOPMENT

Our theoretical model in Figure 3 reflects the preceding discussion. We use a motivation–ability–opportunity framework and consider the firm's opportunity to access external business knowledge in terms of information reach and richness (centrality and brokerage position of the firm in the TMSE mobility network). The critical moderators of TMSE tenure and organizational market orientation (motivation–ability factors) then influence the effects of information reach and richness on firm performance.

Information Reach and Firm Performance

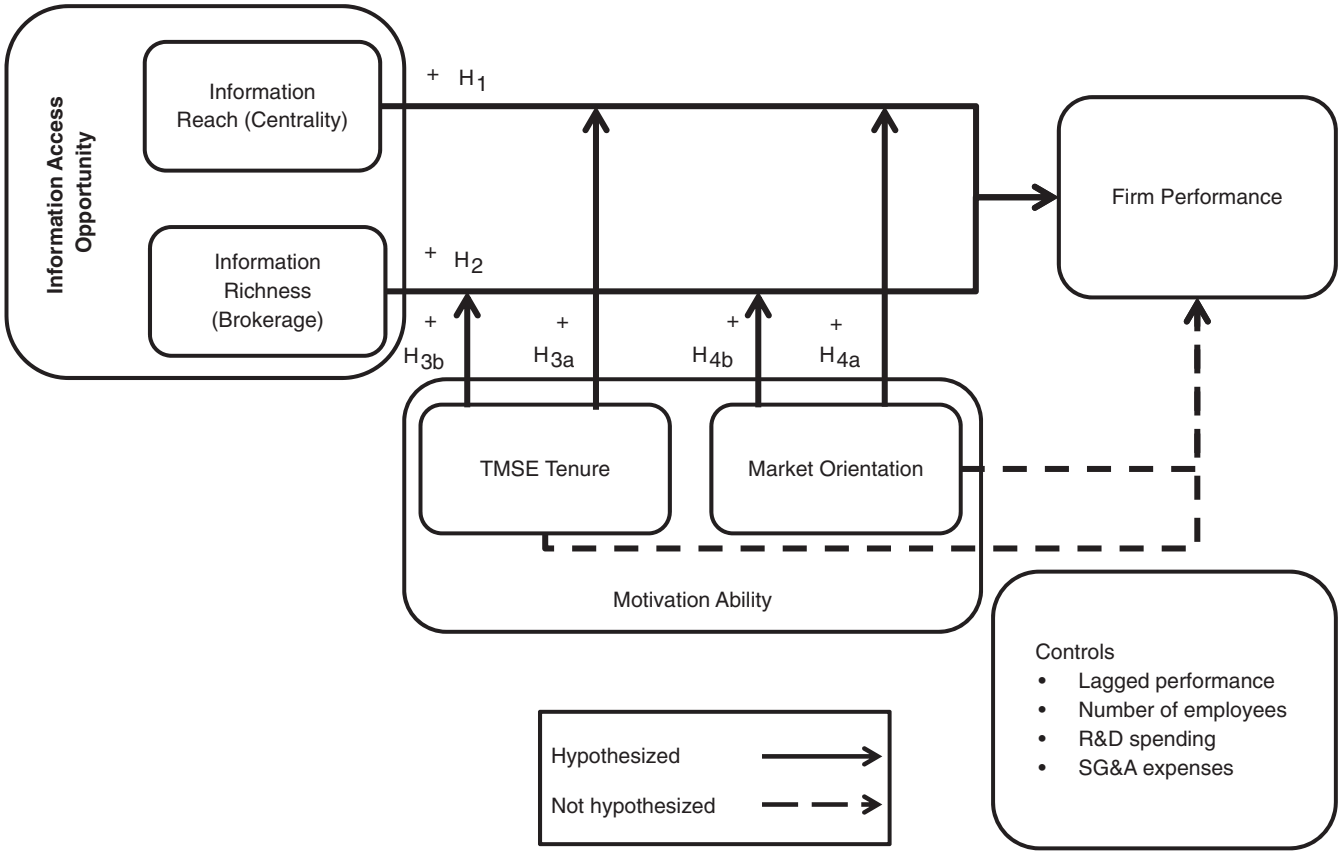
From a TMSE mobility network perspective, an increase in information reach implies that a firm can access information faster, more efficiently, and at a lower cost (Fang et al. 2016). Access to a larger information base at a faster rate should help the firm notice market fluctuations and develop strategies to satisfy customers; for example, acquired information and knowledge can help the firm develop new products that reflect changing customer needs and access new market segments (Joshi and Sharma 2004). External sources of information and knowledge are especially critical to innovation processes (Cassiman and Veugelers 2006). Access to a larger information set through network position–based information reach facilitates information evaluation and verification (Mizruchi 1996), so the firm can reduce the possibility of information distortion during transmission (Fang et al. 2016). Because this greater information reach in the TMSE mobility network helps the firm gather competitive, customer, and market intelligence, it can tweak its marketing strategies and thereby improve its performance. Metaphorically, information reach helps the firm keep its ears firmly to the ground. As a resource, information "is the foundation of competitive advantage and economic growth and the key source of wealth" (Vargo and Lusch 2004, p. 9). Faster access to a larger base of reliable information should enable the firm to perform better in terms of market sensing and customer linking (Day 1991). The competitive advantages stemming from this information reach should improve firm performance overall. Therefore, we posit:

H_1: There is a positive relationship between the information reach resulting from a firm's centrality position in a TMSE mobility network and firm performance.

Information Richness and Firm Performance

The information richness that results from a brokerage position in the TMSE mobility network enables firms to access diverse pockets of disconnected information, facilitate sensemaking, foster creativity, and enjoy a knowledge advantage (Burt 2005; Thomas, Clark, and Gioia 1993). Information richness offers an opportunity to recombine information, cross-pollinate ideas and business practices, facilitate creative thinking, and increase the opportunities for radical innovation (Fang et al. 2016). Exposure to rich information flows also increases the likelihood that external information gets combined with existing knowledge bases, which leads to knowledge assimilation (Wuyts and Dutta 2014). Thus, in TMSE mobility networks, information richness might result if a TMSE moved across different segments of the industry (e.g., microprocessor, memory chip, and fabricator segments in the semiconductor industry), which leads to novel ideas and access to new sets of business practices. As innovation literature shows, information richness (i.e., brokerage) can increase innovation adoptions (Nerkar and Paruchuri 2005) and result in more breakthrough innovations (Fang et al. 2016). The ability to access rich information and thus better "sensemaking" leads to increased

Figure 3
THEORETICAL FRAMEWORK



and sustainable competitive advantages (Zaheer and Bell 2005), such that firms benefit from their increased innovation and performance (Hargadon and Sutton 1997). Therefore, we suggest:

H_2: There is a positive relationship between the information richness emanating from the firm's brokerage position in a TMSE mobility network and firm performance.

Moderating Role of Motivation–Ability Factors

Exposure to relevant external knowledge, achieved according to the firm's network position, is insufficient without parallel motivation and ability to internalize that knowledge. When a firm hires a new TMSE, it likely seeks to leverage his or her knowledge and managerial social capital base in conjunction with existing firm's social capital (stemming from erstwhile employees) to its own advantage. However, when the new TMSE arrives, s/he needs time to adapt and integrate into the new firm and its existing communication networks (Day 1991). Then longer tenure should "positively affect the likelihood of persons communicating with others" (Wagner, Pfeffer, and O'Reilly 1984, p. 76), and this increased communication should result in lessened cognitive distance among executives and increased motivation to work together. Increasing tenure also gives the TMSE more time to convert his or her private social capital into public social capital for the firm, such that other members of the firm can tap into the TMSE's social ties without necessarily participating in those ties (Inkpen and Tsang 2005). As TMSEs stay longer with the firm, they start to understand its culture, business practices, and strategies (Moorman 2008), which should increase both their motivation and ability to exploit external knowledge connections in the TMSE mobility network (due to their own social capital ties and the existing network ties from erstwhile TMSEs moving out of their current firm). They then can select what information is relevant and beneficial. With increasing tenure, a TMSE thus is both able and motivated to exploit external knowledge resulting from information reach and richness in the TMSE mobility network. We propose:

H_3: As TMSE tenure increases, the positive relationship of (a) information reach and (b) information richness with firm performance grows stronger.

Market orientation captures both the accumulated marketing knowledge base (ability) of the firm and its market focus and effort (motivation) to collect and disseminate information about customers and competitors across the firm. Accumulated marketing knowledge increases the firm's ability to make sense of, assimilate, and use newly accessible marketing

information (Cohen and Levinthal 1990). As this market orientation increases, the firm's ability to understand and evaluate the importance of external information, accessible through information reach and richness, also increases, which improves the firm's efficiency in terms of assimilating external information. This greater, more efficient use of external information available through the TMSE mobility network should help the firm make better marketing decisions and enhance its performance. A market orientation also implies a focus on gathering market intelligence, so the greater the firm's market orientation, the more motivated it should be to assimilate market intelligence by using the external information it gains from information reach and richness. That is, the greater the firm's market orientation, the better it is at absorbing and interpreting the managerial social capital emanating from information reach and richness, so the effectiveness of external information acquisition in terms of increasing firm performance should increase.

H_4: As a firm's market orientation increases, the positive relationship of (a) information reach and (b) information richness with firm performance grows stronger.

MODEL DEVELOPMENT

On the basis of the preceding discussion, we specify a base, Q:A linear regression model (M_{BASE}):

$$\begin{aligned}(1)\quad PERF_f = {} & \alpha_0 + \beta_1 REACH_f + \beta_2 RICHNESS_f + \beta_3 TENURE_f \\ & + \beta_4 MO_f + \beta_5 TENURE_f^2 + \beta_6 PERF_{f,lagged} \\ & + \delta_1 (TENURE_f \times REACH_f) \\ & + \delta_2 (TENURE_f \times RICHNESS_f) \\ & + \delta_3 (MO_f \times REACH_f) + \delta_4 (MO_f \times RICHNESS_f) \\ & + \gamma_j CONTROLS_{f,j} + \varepsilon_f,\end{aligned}$$

where the f subscript indicates the firm; PERF represents firm performance (outcome variable); REACH, RICHNESS, TENURE, and MO indicate information reach, information richness, TMSE tenure, and market orientation, respectively; $PERF_{f,lagged}$ is the one-year lagged performance measure; $TENURE^2$ represents the square term for tenure[6]; CONTROLS is a vector of control variables; α_0 is a constant intercept term; β, δ, and γ indicate regression coefficients for the main effects, interaction effects, and control variables, respectively; and ε_f denotes the error term, assumed to be i.i.d. normal distributed. The coefficients β_1 and β_2 map to H_1 and H_2, respectively; the coefficients δ_1 and δ_2 refer to H_3; and the coefficients δ_3 and δ_4 relate to H_4.

Equation 1 is appropriate if all firms in the sample are homogeneous in their relationships between performance and firm characteristics. In our single-industry (semiconductor) setting, heterogeneity at the industry level is not an issue; firm heterogeneity instead might be a potential confound, because firms pursue different strategic goals (e.g., niche positioning, cost leadership, growth strategies). In addition, we account for endogeneity that might arise with unobserved (to the researcher) variables that drive performance outcomes and key explanatory variables.

Observed and Unobserved Heterogeneity

To ensure that the hypothesized effects are identified, we control for observed and unobserved sources of heterogeneity. Several observed covariates likely influence firm performance; we include lagged performance, the firm's asset base, number of employees, research and development (R&D) spending, and selling, general, and administrative (SG&A) expenses. Firm performance is a sticky measure; it takes time for most strategic changes or efforts to affect performance outcomes. Thus, we use lagged performance. Lagged performance also can account for unobserved heterogeneity due to lagged unobserved variables. The organizational asset base enhances firm performance and correlates positively with firm size and age. For example, in the semiconductor industry, assets such as plants and machinery might be necessary to generate revenue for the firm. Similarly, the number of employees captures human capital, and R&D spending signals a focus on innovation, whereas SG&A expenses suggest an emphasis on marketing.

Our list of control variables is likely incomplete, because many unmeasured factors could influence firm performance. For example, firm culture might affect firm performance, yet researchers typically do not observe it. The failure to account for such factors can lead to statistically biased, inconsistent parameter estimates (e.g., Wooldridge 2002). To account for such unobserved heterogeneity (beyond what is accounted for by lagged performance measures), we follow a semiparametric approach. We represent the intercept term and error variance with a finite number of support points, as suggested by Heckman and Singer (1984) and Chintagunta (2001). Thus, we can respecify our model (M_{HET}) as

$$\begin{aligned}(2)\quad PERF_f = {} & \sum_{k=0}^{K} \alpha_k + \beta_1 REACH + \beta_2 RICHNESS_f \\ & + \beta_3 TENURE_f + \beta_4 MO_f + \beta_5 TENURE_f^2 \\ & + \beta_6 PERF_{f,lagged} + \delta_1 (TENURE_f \times REACH_f) \\ & + \delta_2 (TENURE_f \times RICHNESS_f) \\ & + \delta_3 (MO_f \times REACH_f) + \delta_4 (MO_f \times RICHNESS_f) \\ & + \gamma_j CONTROLS_{f,j} + \sum_{k=0}^{K} \varepsilon_{f,k},\end{aligned}$$

where α_k represents latent support points on the intercept, $\varepsilon_{f,k}$ denotes the error term for support point k, and the value of K is empirically determined on the basis of model fit (Wedel and Kamakura 2000).

Endogeneity

Concerns for endogeneity arise because some variables that remain unobserved or omitted might influence both firm performance and key explanatory variables. Before discussing the potential for an endogeneity bias for each of our key explanatory variables, we lay out our approach to correct for endogeneity when it arises. In the instrumental variable (IV) approach (Wooldridge 2009), the instruments do not correlate with the error term where the omitted variable resides (exclusion restriction), but they mimic an endogenous regressor

[6]We thank an anonymous reviewer for suggesting that we model the nonlinear effect of tenure. As we noted, a new TMSE likely needs time to adapt, integrate, and become engaged in existing communication networks (Day 1991). Therefore, during the initial adjustment phase, firm performance might suffer. Over time, as tenure increases, the TMSE gains an understanding of the firm (Moorman 2008) and thus can better exploit his or her external knowledge and connections from the mobility network. Thus, we model a nonlinear (curvilinear U-shaped) effect of time elapsed since the appointment of the TMSE.

(instrument relevance). However, it is not always feasible to find valid instruments. In such cases, a latent instrumental variable (LIV) approach (Ebbes et al. 2005) can correct for endogeneity (e.g., Grewal, Chandrashekaran, and Citrin 2010; Rutz, Bucklin, and Sonnier 2012). Specifically, with an LIV approach, we correct for the endogenous regressor by introducing a discrete unobserved latent IV with m categories that partitions the variance of the endogenous regressor into endogenous (possibly correlated with error term) and exogenous (uncorrelated with error term) components. Therefore,

$$X_f = \theta_l \widehat{Z}_f + \zeta_f, \tag{3}$$

where f is the subscript for the firm; X_f denotes the endogenous regressor; θ_l is the (m × 1) vector of category means; ζ_f refers to the error residual (possibly correlated with error term ε_f); and $\widehat{Z}_f$ is the unobserved discrete instrument (uncorrelated with ε_f and ζ_f, that separates the sample into m groups, where m > 1). The $\widehat{Z}_f$ and ζ_f values are as introduced in Equation 2 to correct for each possible endogenous variable.

Information reach. As we elaborate subsequently, we use TMSE network degree (i.e., count of links) to measure information reach. The degree measure reflects the number of people who have joined the focal firm after leaving other firms in the industry or moved out of the focal firm to join other firms in the industry. Firms hire executives on the basis of their prior experiences and might explicitly hire an executive from a competitor to gain knowledge about its business practices and customer base. Other executives join or leave a firm for their own career progression. Such strategic intentions, on the part of either executives or the firm, are unobservable but might drive performance outcomes. We correct for this potential endogeneity of information reach using an LIV approach.

Information richness. We use brokerage to measure information richness, according to whether the firm sits at a structural position in the network, giving it the advantage of connecting different subcomponents of the network. In a TMSE mobility network, this structural position arises because TMSEs move among firms. Any firm in the network has some control over the TMSE it hires or fires but little control over TMSE movement among other firms in the industry. The brokerage position thus depends less on the focal firm's decision and more on the collective decisions of all firms in the industry. Collusion at the industry scale is unlikely for TMSE hiring and firing decisions, so it is difficult to argue that the brokerage position of firms in the TMSE network is endogenous.[7]

Market orientation. Market orientation is a firm capability that represents the market focus of the firm. A firm's strong market orientation might be manifest in several ways, such as its large marketing budget, exceptional marketing research capabilities, or large number of employees in the marketing function. Because the level of market orientation represents a strategic choice for a firm, the choices reflect consideration of performance outcomes, so market orientation should be endogenous. We account for it using the LIV approach.

Tenure with firm. The duration of a current TMSE's tenure depends on both individual TMSE decision making and firm decisions. The firm decides whether to retain or fire a TMSE, depending on whether its strategic objectives are being met. Some firm characteristics, such as compensation or challenges at the current job, also might affect the TMSE's decision to continue to work for or leave the firm. Because the TMSE might stay with or leave the firm due to some firm qualities and decision making that are unobservable by the researcher, we correct for the endogeneity bias associated with tenure with firm using the LIV approach.[8]

Model specification. The corrected variables $\widehat{MO}_f$, $\widehat{REACH}_f$, and $\widehat{TENURE}_f$ are the predicted values from the LIV correction step. Because they are uncorrelated with the error terms for the actual regressors MO, REACH, and TENURE, respectively, we introduce them in the main regression model with the additional error (residual) terms from the LIV correction step: $\zeta_{f,1}$, $\zeta_{f,2}$, and $\zeta_{f,3}$ (which could be correlated with the actual regressor). The updated regression equation, after correction for endogeneity (M_{FINAL}), is

$$\begin{aligned} PERF_f = {} & \sum_{k=0}^{K} \alpha_k + \beta_1 \widehat{REACH}_f + \beta_2 RICHNESS_f \\ & + \beta_3 \widehat{TENURE}_f + \beta_4 \widehat{MO}_f + \beta_5 \widehat{TENURE}_f^2 \\ & + \beta_6 PERF_{f,lagged} + \delta_1 \left(\widehat{TENURE}_f \times \widehat{REACH}_f\right) \\ & + \delta_2 \left(\widehat{TENURE}_f \times RICHNESS_f\right) \\ & + \delta_3 \left(\widehat{MO}_f \times \widehat{REACH}_f\right) + \delta_4 \left(\widehat{MO}_f \times RICHNESS_f\right) \\ & + \gamma_j CONTROLS_{f,j} + \rho_1 \zeta_{f,1} + \rho_2 \zeta_{f,2} \\ & + \rho_3 \zeta_{f,3} + \sum_{k=0}^{K} \varepsilon_{f,k}, \end{aligned} \tag{4}$$

where ρ_1, ρ_2, and ρ_3 are additional endogeneity bias correction parameters to be estimated.[9]

METHODOLOGY

Data Collection

To study the TMSE mobility network and its implications for a B2B market, we must first identify an industry. A single-industry setting enables us to build the work experience network among all firms in the industry, without overly complicating the effort with cross-industry movements or different roles for TMSEs across industries. However,

[7]In an alliance formation context, the arguments for driving toward a structural position and affecting the network structure would be stronger, and it might be plausible to argue that brokerage is endogenous.

[8]Because we model the importance of social networks, the potential for cross-sectional (spatial) dependence, arising from the social network space, is pertinent. For example, when a TMSE moves from one firm to another, the information reach of both firms increases, and the two firms also become closer in the social network space. As information reach increases, our network variables might constitute spatial covariates and capture some spatial (cross-sectional) dependence (similar to region dummies in spatial models; e.g., Choi, Hui, and Bell 2010). Furthermore, we include latent support points for the intercept term and the error variance; the support points for the intercept can be regarded as latent control functions (correcting for endogeneity; e.g., Wang, Saboo, and Grewal 2015). Using the latent support points for the error variance results in a complex error structure, which offers a correction for spatial dependence.

[9]The results remained similar when we used uncorrected variables to create the interaction terms (see Table 3).

choosing a single, massive industry (i.e., with hundreds of firms) also makes it cumbersome to gather data for all firms, find the experience records for all TMSEs, and track their movements. Accordingly, we chose the semiconductor industry: this important B2B sector had 2013 U.S. sales of $155 billion, yet it is relatively small in terms of the number of firms in the industry. Thus we can obtain the experience record for all TMSEs in the industry and feasibly establish connections among firms. We searched for all firms with a Standard Industrial Classification code of 3674 (semiconductors) in Compustat for 2006. Financial performance data for private firms and information about their TMSEs are not readily available, so we focus on listed U.S. firms. We also excluded international semiconductor firms to ensure that our dependent variable (Tobin's q), based on stock market measures, is not affected by global financial market differences and can be computed with the returns to a single market (i.e., U.S. stock market). Thus, we identified 138 U.S. semiconductor firms, of which 113 firms had usable data after we deleted those that exited the industry or were acquired by other firms. Five firms were missing data in our sample period, so we were left with 108 firms. We complemented these financial data with the work experience of the current TMSEs in all 108 firms, using data from companies' websites, Hoover's online database, LinkedIn, Forbes.com, and the LexisNexis database. We consider year-end stock closing prices on December 29, 2006, as reported in Compustat.

For the 108 firms in our sample, we identified 142 current TMSEs (in 2006), because firms used both joint and separate TMSE positions for marketing and sales. We gathered the work experience of all 142 TMSEs. With these work experience records, we created the mobility network for each of the 142 TMSEs, similar to the example network in Figure 1 for Bob Mahoney. For example, in that experience record, we would assign a value of 1 to the links from Zicor, Altera, Analog Devices, and National Semiconductor to ONNN. We implemented the same procedure for all the TMSEs and thereby obtained a complete 108 × 108 symmetric matrix of movement by TMSEs across firms within the semiconductor industry.[10] At the firm level, the links indicated a current TMSE or previously employed TMSEs who moved to other firms. In our example in Figure 1, for ONNN, links exist because Bob Mahoney previously worked for Zicor, Altera, Analog Devices, and National Semiconductor, and because Ahmed Masood moved to Supertex. In Figure 4, we present a complete graph of the relations among the 108 firms, derived from their TMSEs' work experience as of 2006.

To allay concerns that the cross-sectional nature of our data limits inferences of causal relationships, we note that our data set is a snapshot of the movement of a TMSE at a specific point in time, but the network variables and dependent variable are separated in time. Our network measures are calculated on the basis of TMSE movement (which could occur any point before December 1, 2006). Our dependent variable (Tobin's q) is calculated using the closing stock price reported on December 29, 2006.[11]

Measures

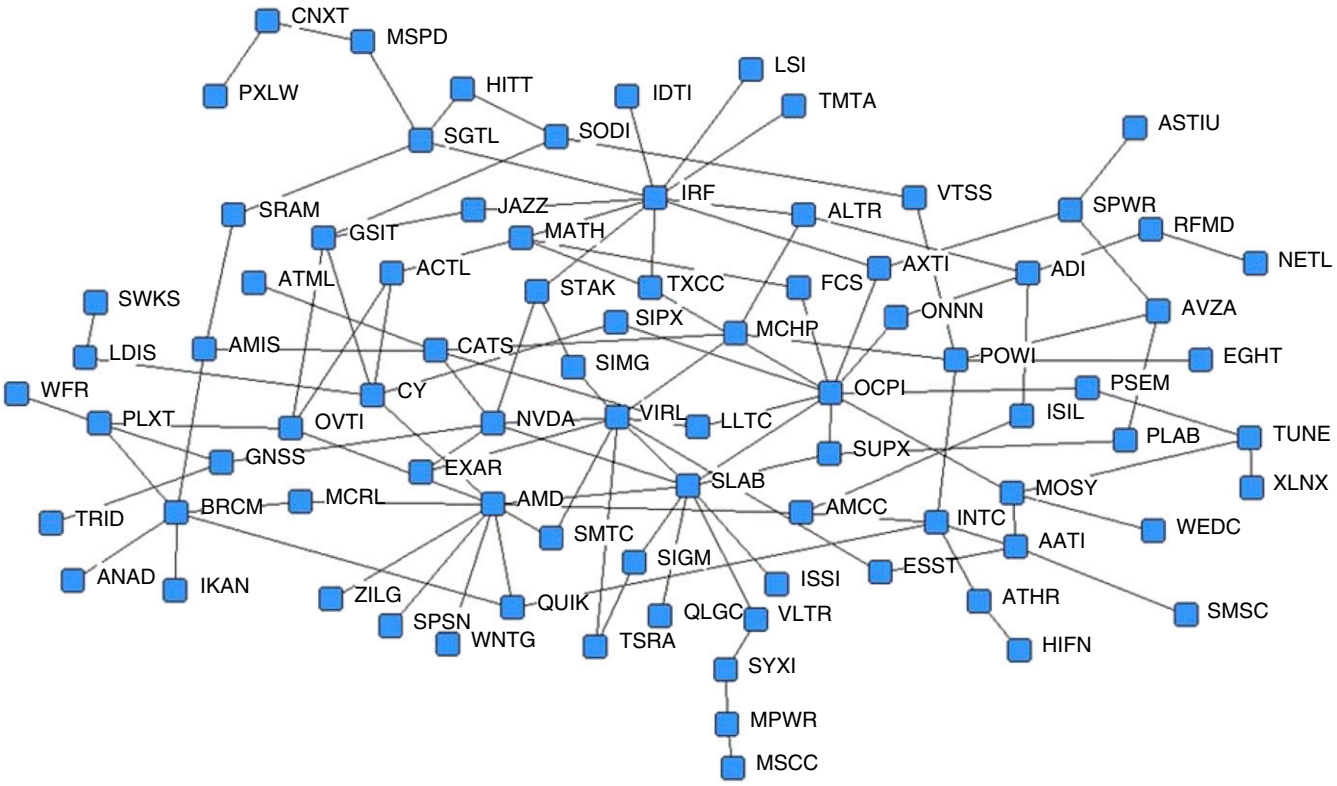
Dependent variable. To measure firm performance, we can use either historical performance measures (i.e., accounting measures), such as return on investment, or forward-looking measures based on the firm's stock price (i.e., stock market–based measures). Historical measures tend to be linked to the firm's strategic goals, such as being market leader, so they might differ across firms with distinct strategic intents. They also account for current performance outcomes due to decisions made in the past or assume that the impact of all firm decisions takes effect immediately. More realistically, though, most firm decisions and investments affect future earnings too (e.g., Geyskens, Gielens, and Dekimpe 2002). The forward-looking measures of the firm's stock price rely on anticipated future performance and factors that affect the value of future cash flows, and they account for current performance, as well as the impact of current and past decisions on future outcomes. They also tend to be agnostic in terms of firm goals, such that they can be compared across firms. Thus, we consider forward-looking measures more appropriate, in that they include both current and expected performance (Germann, Ebbes, and Grewal 2015).

Specifically, Tobin's q is a forward-looking, capital market–based measure of firm value, equal to the ratio of the firm's market value to the current replacement cost of its assets (Tobin 1969). It assesses the premium that the market is willing to pay, above the replacement costs of the firm's asset base. A firm that does not create incremental value has a Tobin's q of 1. The gap between a firm's Tobin's q and 1 indicates the degree of anticipated future abnormal returns and the intangible value of firm assets (Amit and Wernerfelt 1990). Tobin's q has gained wide acceptance as a measure of economic performance, in diverse fields such as marketing (Germann, Ebbes, and Grewal 2015; Sorescu and Spanjol 2008), finance, and economics (Giroud and Mueller 2011; Parcharidis and Varsakelis 2010). It also relates closely to corporate investment and financing decisions and risk management strategies (Bolton, Chen, and Wang 2011) and offers a good measure of the intangible resources that might underlie a firm's competitive advantage (Villalonga 2004). Managerial social capital in the TMSE mobility network represents the firm's opportunity to access intangible information resources, which the firm capitalizes on due to its

[10]To ensure that the network measures were not affected by dropping nodes in the network, we used all firms listed by the 142 TMSEs to form the mobility network and compute network measures. These added firms expanded the network because they included private and international entities, as well as firms that we had excluded because they were acquired or were multibusiness conglomerates (e.g., IBM, Philips). These nodes in the TMSE mobility network help us compute the network measure but are not used in the final modeling purpose, as is common in prior research (see Thomaz and Swaminathan 2015). We computed network measures both with and without these firms in the network, and the model results do not change. For the final model, we thus used the 108 firms for which we had available data about the performance outcome variable for the selected time frame (Tobin's q).

[11]We checked the company records and experience of all 142 TMSEs in our data set; no moves were reported later than November 2006. Therefore, the network measures and dependent variable are separated in time, which reduces the plausibility of a reverse causality argument in which performance affects network characteristics. Furthermore, only five TMSEs moved in or after September 2006 (i.e., minimum of three months after the TMSE joined and the performance measure) but before December 2006. Our results hold when we remove these five firms.

Figure 4
TMSE MOBILITY NETWORK IN SEMICONDUCTOR INDUSTRY FROM OUR DATA



Notes: The network depicts the largest, fully connected component of the TMSE network in our data. A fully connected component implies a path from any node in the network to every other node in the network. There are three pairs of nodes that were not connected to the main component and exhibited movement by TMSEs (not depicted).

motivation and ability, so Tobin's q is an appropriate performance measure in this context.[12]

Tobin's q is based on the supposition that securities markets are efficient in evaluating expected future revenue streams and determining the firm's value. To measure it, we use Chung and Pruitt's (1994) popular method (Gompers, Ishii, and Metrick 2003; Kaplan and Zingales 1997). We compute year-end measures (December 29, 2006, and December 30, 2005) of the ratio of the market-to-book value of firm assets, $Q = (MVE + PS + DEBT)/TA$, where MVE is (closing share price at the end of the financial year) × (amount of common stock outstanding); PS is the liquidating value of the firm's preferred stock; DEBT equals (short-term liabilities) – (short-term assets) + (book value of long-term debt); and TA is the book value of total assets. We obtained these variables from the CRSP and Compustat databases. We log-transformed Tobin's q to reduce skewness.

Independent variables. Social network analysis theory indicates that network actors can achieve information reach through their ties with other actors. To measure information reach in the TMSE mobility network, we adopted a degree centrality index. In our TMSE mobility network, degree centrality reflects the information flow between the connected firms. Incoming ties represent a TMSE joining the firm, and outgoing ties represent a TMSE leaving the firm. Both ties should enable flows of external knowledge into the firm, based on the TMSE's prior work experience. That is, degree centrality refers to the number of relations a firm receives (incoming ties) and sends out (outgoing ties) in the network, $P_D(n_i) = x_{+i}$, where n_i is an actor i (organization), x is the number of relations available to that actor (irrespective of tie directionality), and +i stands for all other firms in the network. To normalize degree centrality, we divided it by the maximum possible degree, expressed as a percentage (Freeman 1979).

To measure information richness, we rely on the brokerage position and a structural holes measure (Burt 1992) of the

[12]Firm stock return models that seek to link abnormal stock returns to unexpected changes in the explanatory variables (e.g., advertising spending) are relevant if the variables of interest can be measured at frequent intervals and vary frequently or if certain information available to markets moves the stock price immediately. The focus is on the change and the impact on change in performance. We are interested in modeling the overall performance implications of executive movement and social ties on firm performance, rather than the impact of reports of a TMSE leaving or joining a firm. Executive movement does not necessarily imply a change element, so modeling the impact of the level of marketing actions on Tobin's q as a performance measure is appropriate (see Srinivasan and Hanssens 2009, p. 300). To confirm this specification focused on the levels of the dependent and independent variables, we use lagged dependent variables, latent segments on the intercept term, and other observed control variables. The movement of TMSEs across firms is prevalent but not frequent, so modeling change in the network variables and linking them to abnormal stock returns would not be practical either.

degree to which a firm depends on directly connected neighbors to connect to others in the network. This network constraint is an index of how closely a firm's connections are linked. If its neighboring firms are all connected, the focal firm has access to the same information flows across its neighbors, so it is highly constrained. The greater the constraint, the fewer structural holes appear in its neighborhood, and the lower its brokerage position (i.e., the more constrained the firm is from acting as a broker). Therefore, $P_{i,j} = \Sigma_q P_{i,q} P_{q,j}$ such that $q \neq i,j$, where i is actor (organization) of interest, and j is a direct connection of actor i. Moreover, q is any other actor, so $P_{i,q} = 1$ if i is connected to q, and $P_{q,j} = 1$ if j is connected to q. If $P_{i,q} = 1$ and $P_{q,j} = 1$, i is constrained from acting as a broker between q and j, because they already are connected. We examine the increase in brokerage opportunities, so we subtract the constraint measure from 1 to obtain the brokerage score; this computed measure also is log-transformed (Burt 1992).

Moderating variables. We measure TMSEs' tenure in their current firm, from their hiring to 2006. Tenure indicates the length of time these executives have been involved in their current firm's strategies and activities, so it offers a proxy for the absorption and use of managerial social capital and other resources.

Organizational market orientation is a proxy for firm motivation and ability. We use the cognitive mapping method developed by Noble, Sinha, and Kumar (2002; see also Slater and Narver 1995) and sum our measures of customer orientation, competitor orientation, and interfunctional coordination to arrive at a market orientation measure. Specifically, we coded the text of the annual reports for all 108 semiconductor firms, using a two-step approach in NVIVO, a qualitative data analysis software. With a keyword search, we identified sentences referring to market orientations, then checked each sentence to see if it truly referred to a market orientation. The total number of sentences citing a market orientation offered a quantitative measure of three key components (customer orientation, competitor orientation, and interfunctional coordination). Table 1 contains some sample statements representing each market orientation component.

Control variables. We used performance data from 2005 to control for other firm factors that might affect firm performance, including lagged Tobin's q, number of employees, R&D expenses, and SG&A expenses. We mean-centered all explanatory variables before creating the interaction terms. In Table 2 we present the descriptive statistics and correlation matrix of the measures. The Appendix offers a more detailed description of our data.

Model Estimation

We estimated Equations 3 and 4 independently, then introduced the error terms (in addition to the predicted values that serve as instruments) from Equation 3 (one error term per endogenous variable) as covariates in Equation 4. As in traditional latent class regression analyses, we estimated both equations by maximizing the log-likelihood function (Wedel and Kamakura 2000). We mean-centered all the explanatory variables in the final model. We checked for multicollinearity; the variance inflation factors and condition index ruled out these concerns.

RESULTS

Model Selection

We first estimated Equation 3 to obtain the correction term for the endogeneity of market orientation (MO), information reach (DEG), and tenure with the firm (TENURE) using the LIV approach. We relied on the Akaike information criteria

Table 1
ILLUSTRATIONS OF ANNUAL REPORT CODING BY STRATEGIC ORIENTATION

Strategic Orientation	*Example of Coded Sentence from Annual Reports*
Competitor orientation	• Our strategy is to offer innovative solutions to markets in which our nonvolatile technologies have an inherent competitive advantage. (Actel) • We believe our advanced component design and manufacturing facilities, which would be prohibitively expensive to replicate in the current market environment, is a significant competitive advantage. (Bookham) • This environment is characterized by potential erosion of product sale prices over the life of each product, rapid technological change, limited product life cycles and strong domestic and foreign competition in many markets. Our ability to compete successfully depends on many factors. (Cypress Semiconductor)
Customer orientation	• We offer products at various levels of integration, allowing our customers flexibility to create advanced computing and communications systems and products. (Intel) • We will need to devote substantial resources to educate customers and end users about the benefits of VoIP telephony solutions in general and our services in particular. (8×8 Inc.) • We intend to drive the adoption of our next generation CSP and MCP technologies by collaborating with our customers to develop chip-scale and multichip packages to meet their specific product requirements. (Tessera Technologies)
Interfunctional coordination	• To manage our business effectively, we may need to implement additional and improved management information systems, further develop our operating, administrative, financial and accounting systems and controls, add experienced senior level managers, and maintain close coordination among our executive, engineering, accounting, marketing, sales and operations organizations. (AXT Inc.) • The acquisition requires integration of product offerings, manufacturing relationships and coordination of sales and marketing and research and development efforts. (Virage Logic)
Selling orientation	• Our net sales increase was driven by continued price increases on both sales of our excess polysilicon raw material and wafers combined with increased volumes. (Memc Electronic Materials) • We expect to fund any increases in inventory caused by sales growth or manufacturing planning requirements from our cash balances and operating cash flows. (White Electronic Designs)

Table 2
DESCRIPTIVE STATISTICS AND BIVARIATE CORRELATION COEFFICIENTS

	M	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
1. Tobin's q	2.30	4.11							
2. Information reach	2.14	2.19	−.13						
3. Information richness	.54	.37	.10	.17					
4. Market orientation	93.17	33.02	−.13	.26**	−.10				
5. Tenure	5.45	5.75	.02	.02	−.02	0			
6. Number of employees	3.41	10.02	−.04	.14	.10	.10	.39**		
7. R&D intensity	3.62	27.63	.05	.10	.04	−.18	−.08	−.04	
8. SG&A intensity	.84	3.34	0	−.11	.14	.03	−.11	−.02	.08

**Correlation is significant at the .01 level (two-tailed).
Notes: N = 108.

(AIC3) to determine the number of support points (Andrews and Currim 2003). A two-support point solution was best for MO, a three-support point solution benefitted DEG, and a four-support point solution was best for TENURE.[13] Before using the model in Equation 4 to test our hypotheses, we incorporated these support points to account for heterogeneity. The AIC3 indicated preference for the solution with two support points (the overall AIC3 values were 191.59, 186.97, 191.94, 199.61, and 207.79 for one to five support points, respectively).

Hypothesis Testing

In Table 3, we find evidence for persistence in Tobin's q ($\gamma = .78$, $p < .001$), as well as support for the nonlinear effect of tenure. That is, we find a negative main effect of the LIV-corrected tenure of TMSE ($\gamma = -.018$, $p < .10$) and a positive effect of its square term ($\gamma = .002$, $p < .05$). Initially, the relationship between tenure and performance is negative, but as the tenure of the TMSE increases, it prompts increasing returns for firm performance.[14] We do not find support for the main effects of information reach (H_1) or information richness (H_2), but because our model included moderating effects and all moderators were mean-centered, the main effect tests offer only limited interpretability. That is, these main effects indicate the effect of information reach, information richness, and tenure when the moderators are at their mean value of zero. We focus instead on the moderating effects.[15]

For the moderating effect of tenure with the firm, we find mixed support. The results confirm the interaction between tenure and information reach ($\gamma = .005$, $p < .05$), in line with H_{3a}, but not the interaction between tenure and information richness, in contrast with H_{3b}. Market orientation instead moderates the effects of both information reach and richness on firm performance. Specifically, we find a positive interaction effect of market orientation with both information reach ($\gamma = .007$, $p < .05$; H_{4a}) and information richness ($\gamma = .043$, $p < .05$; H_{4b}).[16]

Additional Analyses

Decay of ties. Because TMSEs might have worked at multiple firms prior to joining the current firm, more recent ties (i.e., most recent previous employers, in chronological order) might be stronger than more dated ties, due to decay effects. In particular, recent social ties might be more likely to be active, involving more frequent contacts and information exchanges than dated ties, which might be inactive or sporadic.[17] For example, in Figure 5, Bob Mahoney, the executive vice president of sales and marketing of ONNN in 2006, worked for Zicor Corporation five years ago, Altera six years ago, Analog Devices nine years ago, and National Semiconductor eleven years ago. This pattern suggests that the ties of ONNN with Zicor and Altera might be stronger, but the ties with Analog Devices and National Semiconductor might be decayed.

To measure this impact, we use a decay factor d to weight the ties. We note the order of moves by each TMSE and compute an ordinal list of the resulting ties. The weight for each tie comes from raising the decay factor d to the ordinal position minus 1. For example, in Figure 5, the tie weights for ONNN are as follows: Zicor = d^{1-1} (because the ordinal position of the move is 1), Altera = d^{2-1}, Analog Devices = d^{3-1}, and National Semiconductor = d^{4-1}. The tie between ONNN and Supertex is defined by the ordinal position of Ahmed Masood's move, equal to 1, so the weight is d^{1-1}. With these assigned weights, we derive a weighted network. To compute the centrality and brokerage measures, we use the tnet package in R and follow the model estimation procedure used

[13]The AIC3 values for one through five support points, respectively, were as follows: market orientation = 1,068.26, 1,066.83, 1,074.18, 1,080.10, 1086.10; degree = 481.59, 436.69, 431.47, 435.16, 439.38; tenure = 689.22, 642.48, 621.56, 614.28, 620.29.

[14]We also find increasing returns of TMSE tenure, and this nonlinear effect suggests an interesting avenue for further research. Are there boundaries on these returns to TMSE tenure? Research into this question might build on studies of CEO tenure or its seasonality and its impact on performance (Hambrick and Fukutomi 1991).

[15]The error term introduced to account for the endogeneity of market orientation is statistically significant; thus, market orientation without an LIV correction would be endogenous and lead to inconsistent parameter estimates.

[16]Because Tobin's q was log-transformed, the coefficient must be interpreted as a percentage change. Thus, for a one-unit change in the interaction term of market orientation and centrality position, Tobin's q changes by .10%.

[17]Similar to the strength of weak ties (Granovetter 1973), the decay of ties offers a potential proxy for the strength of ties between firms. In this case, the most recent links arguably might provide access only to information that the TMSE already knows, without any added value, whereas dated ties could provide access to more novel and nonredundant information, because over time, the TMSE moves further from the information realm designated by dated ties. Therefore, dated (decayed) ties might provide novel information access and be more valuable.

Table 3

EFFECT OF TMSE NETWORK POSITIONS, MARKET ORIENTATION, AND TENURE ON PERFORMANCE (DV = TOBIN'S Q)

	Latent Support Points Model (M_{HET})	*Latent Support Points Model with LIV-Corrected MO, DEG, and Tenure and Interaction Terms (M_{FINAL})*	
Predictors	*Coefficient*	*Coefficient*	*Hypotheses Supported?*
Main Effects			
Lagged DV	.798*** (.041)	.78*** (.038)	
Information richness (BROKER)	.003 (.003)	.001 (.001)	No (H_2)
Information reach (DEG)	$.1 \times 10^{-3}$ ($.5 \times 10^{-3}$)		
Market orientation (MO)	.001 (.001)		
Tenure of TMSE (TENURE)	−.019* (.009)		
TENURE × TENURE	.002** (.001)		
LIV-corrected information reach (DEG LIV)		−.001 (.002)	No (H_1)
LIV-corrected marketing orientation (MO LIV)		.001 (.012)	
LIV-corrected tenure of TMSE (TENURE LIV)		−.018* (.01)	
TENURE LIV × TENURE LIV		.002** (.001)	
DEG LIV error term		−.032 (.043)	
MO LIV error term		−.023** (.010)	
TENURE LIV error term		−.009 (.033)	
Interactions			
MO × DEG	$.1 \times 10^{-3}$ ($.4 \times 10^{-3}$)	.007** (.003)	Yes (H_{4a})
TENURE × DEG	.004* (.002)	.005** (.002)	Yes (H_{3a})
MO × BROKER	.043** (.019)	.043** (.019)	Yes (H_{4b})
TENURE × BROKER	.019 (.017)	.014 (.015)	No (H_{3b})
Support Points for Intercept			
Class 1	.124*** (.052)	.135*** (.046)	
Class 2	.096 (.099)	−.097 (.099)	
Control Variables			
Employees	−.206*** (.065)	−.209*** (.061)	
R&D intensity	$.2 \times 10^{-3}$ (.001)	$.4 \times 10^{-4}$ (.001)	
SG&A intensity	−.024*** (.009)	−.025*** (.007)	
R^2	.947	.949	

*$p < .10$.
**$p < .05$.
***$p < .01$.
Notes: Standard errors are in parentheses. We report two-tailed p-tests.

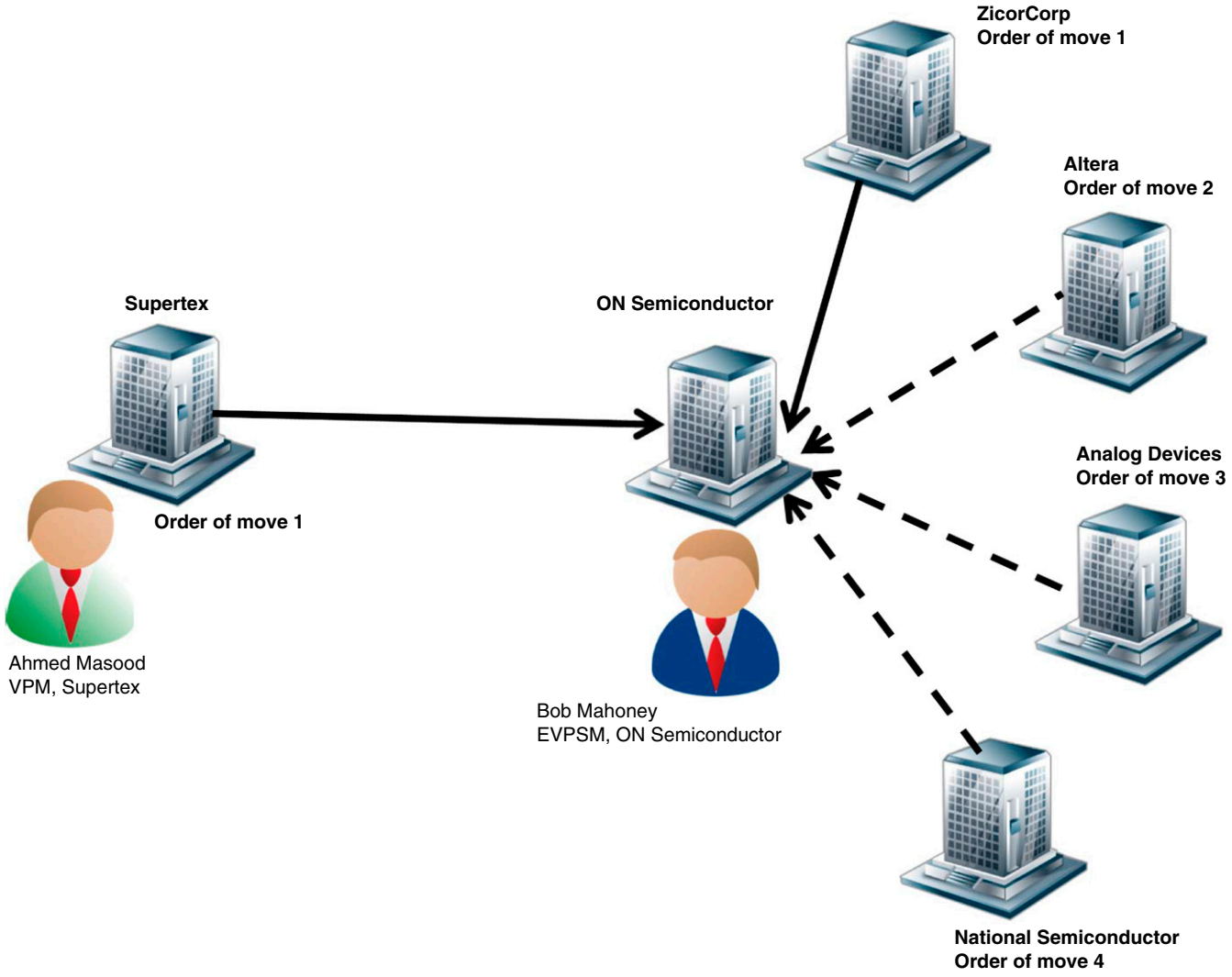
for our hypothesized model. The results in Table 4,[18] after we account for tie decay, are similar to the results without this consideration (i.e., Table 3). In addition to the consistent support for the interaction of TMSE tenure with information reach and of market orientation with both information reach and richness, we find a positive main effect of information richness ($\gamma = .069$, $p < .001$). With the decay of ties, the network becomes sparser, and the importance of a brokerage position increases even further. Thus, irrespective of the time elapsed since the TMSE joined a firm, managerial social capital provides opportunities to access external business information. Even if a tie is dated, it can still lead to valuable, novel information exchanges that can enhance firm performance.

Types of ties. Our model combines three types of ties: sales, marketing, and hybrid ties. In B2B markets, marketing and sales functions have different responsibilities and unique thought worlds (Homburg, Jensen, and Krohmer 2008; Kotler, Rackham, and Krishnaswamy 2006). Therefore, the different types of ties could lead to different information flows, with varying effects on firm performance. To incorporate this possible difference, we coded each tie as sales, marketing, or hybrid (e.g., positions with joint marketing and sales responsibility). At the firm level, we aggregated the ties and classified all 108 firms into the pertinent categories, such that 32 firms had only sales ties, 28 had only marketing ties, and 48 firms had both marketing and sales ties (whether due to hybrid ties or the movement of multiple executives). Two dummy variables, TieSales,and TieSalesMarketing (base = TieMarketing), when incorporated in the analysis, did not exert any significant effects. Therefore, the various types of ties do not appear to have differential effects on firm performance in the context of TMSE mobility networks.

Additional exploratory analysis. Post hoc, we conducted additional exploratory analyses with different dependent variables: return on assets (ROA), which is an accounting-based measure, and systematic and idiosyncratic risk, which are market-based measures. The rest of the model stayed the same, with the lagged dependent variable, same controls, LIV correction terms, and squared term for tenure. The results are presented in Table 5. For ROA, we find positive main effects of

[18]For the decay factor d, we present the results for .95 and .85; when we expanded the factors to .75, the results remained similar. We also tried an alternative approach to set the weights, using the years since the move to the focal firm as an exponential weight parameter. With this approach, we raised the decay factor d to power of the number of years since the move. Thus, in Figure 5, the ONNN tie weights would be as follows: Zicor = d^5, Altera = d^6, Analog Devices = d^9, and National Semiconductor = d^{11}. However, this approach creates a missing-information problem; for about 18% of ties in our data set, we lack the exact duration of the tenure with each past employer. All we have is ordinal information about the order of moves. If we exclude ties with missing information, it results in a sparse network that yields inconsistent values for the centrality and brokerage variables.

Figure 5
DECAY OF TIES IN TMSE MOBILITY SOCIAL NETWORK



Notes: This figure depicts the same network of six firms shown in Figure 1. At the firm level, the links indicate the current TMSEs (in 2006) or previous TMSEs who moved to other firms. Bob Mahoney was Executive Vice President of Sales and Marking (EVPSM) for ON Semiconductor in 2006 and previously worked for Zicor Corporation (five years ago), Altera (six years ago), Analog Devices (nine years ago), and National Semiconductor (eleven years ago). This pattern of work experience results in a recent link (solid line) from Zicor to ON Semiconductor (order of move 1) and dated links (dashed lines) from Altera (order of move 2), Analog Devices (order of move 3), and National Semiconductor (order of move 4) to ON Semiconductor. Ahmed Masood was Vice President of Marketing (VPM) of Supertex in 2006 and previously worked for ON Semiconductor. His movement results in a recent link between the two firms (order of move 1). The time aspect and the order of the movements can be used to assign weight to the links and compute a weighted graph.

information richness ($\gamma = .049$, $p < .10$), market orientation ($\gamma = .004$, $p < .10$), and tenure ($\gamma = .075$, $p < .01$). We also note a positive interaction of information reach with market orientation ($\gamma = .003$, $p < .05$), in line with H_{4a}, and with tenure ($\gamma = .014$, $p < .05$), in support of H_{3a}. The lack of interaction of information richness with market orientation or tenure offers no support for H_{3b} or H_{4b}.

For systematic risk, we find negative main effects of information richness ($\gamma = -.154$, $p < .10$), market orientation ($\gamma = -.014$, $p < .05$), and tenure ($\gamma = -.033$, $p < .01$) but positive main effects of information reach ($\gamma = .059$, $p < .01$) and the squared tenure term ($\gamma = .004$, $p < .01$). The negative (positive) effect implies a reduction (increase) in systematic risk, such that the stock price's variation diminishes (increases) relative to market variations. We find support for a positive interaction of information reach with market orientation ($\gamma = .002$, $p < .01$) and a negative interaction of information reach with tenure ($\gamma = -.010$, $p < .01$) but no support for the interactions involving information richness.

For idiosyncratic risk, none of the four variables reveal any main effects. Instead, we find support for a positive interaction of information richness with tenure ($\gamma = .0001$, $p < .10$), though even this effect size is very small. This finding seems in line with a general definition of idiosyncratic risk, which by nature is unpredictable and can be minimized only through diversification. That is, it is affected by events or decisions that have strong impacts throughout the firm, such as management changes, product recalls, or environmental changes, so this

Table 4
ANALYSIS WITH DECAY OF TMSE NETWORK TIES

	Ordinal Decay of Ties: d = .95		*Ordinal Decay of Ties: d = .85*	
Predictors	*Coefficient*	*Hypotheses Supported?*	*Coefficient*	*Hypotheses Supported?*
Main Effects				
Lagged DV	.818*** (.046)		.807*** (.049)	
Information richness (BROKER)	.069*** (.008)	Yes (H_2)	.075*** (.009)	Yes (H_2)
LIV-corrected information reach (DEG LIV)	−.068 (.059)		−.073 (.052)	
LIV-corrected marketing orientation (MO LIV)	.011 (.012)		.011 (.012)	
LIV-corrected tenure of TMSE (TENURE LIV)	−.004 (.013)		−.003 (.013)	
TENURE LIV × TENURE LIV)	.003*** (.001)		.003*** (.001)	
DEG LIV error term	−.000 (.056)		−.001 (.055)	
MO LIV error term	−.005** (.002)		−.004** (.002)	
TENURE LIV error term	−.026 (.039)		−.025 (.039)	
Interactions				
MO LIV × DEG LIV	.009** (.004)	Yes (H_{4a})	.010* (.006)	Yes (H_{4a})
TENURE LIV × DEG LIV	.002** (.001)	Yes (H_{3a})	.002** (.001)	Yes (H_{3a})
MO LIV × BROKER	.039** (.019)	Yes (H_{4b})	.036** (.019)	Yes (H_{4b})
TENURE LIV × BROKER	.045 (.040)	No (H_{3b})	.014 (.015)	No (H_{3b})
Support Points for Intercept				
Class 1	.129* (.072)		.127* (.072)	
Class 2	−.308 (.436)		−.300 (.432)	
Control Variables				
Employees	−.171** (.077)		−.168*** (.077)	
R&D intensity	$.3 \times 10^{-3}$ (.001)		$.3 \times 10^{-3}$ (.001)	
SG&A intensity	−.022*** (.009)		−.015*** .004	

*$p < .10$.
**$p < .05$.
***$p < .01$.
Notes: Standard errors are in parentheses. We report two-tailed p-tests.

type of risk is more appropriate for event studies that seek to decipher the impacts of specific events.

The additional exploratory analysis with different dependent variables provides support for our conceptualized model and suggests that the variables under consideration—information reach, information richness, market orientation, and TMSE tenure—affect firm performance and firm risk. Although we specifically conceptualized relationship between managerial social capital and firm performance, it is a worthwhile avenue for future researchers to explore the relationship between managerial social capital stemming from TMSE mobility networks and firm risk.

DISCUSSION

Recognizing the importance of TMSEs to firm performance, we have sought to understand the influence of their social ties, developed through their past affiliations. Therefore, we have derived TMSE mobility networks and modeled the flow of information about customers and markets by considering information reach and richness, which reflect managerial social capital. This managerial social capital—resulting from the firm's position in industry-wide TMSE mobility networks, which in turn reflect TMSEs' past affiliations—adds value in the form of information reach and richness. These information benefits depend on firm- and individual-level motivation and ability; firm motivation and ability (i.e., market orientation) positively moderates the impact of information reach (i.e., centrality position) and information richness (i.e., brokerage position) on firm performance. TMSE motivation and ability (i.e., tenure) positively moderates the impact of information reach.

Limitations

Before we delve into the theoretical implications of our research, we acknowledge its primary limitations. The data we collected were specific to the TMSE network we studied at a single point in time, so our findings suffer the conventional limitations of one-shot data and research designs. However, the measurement of the network variables precedes the measurement of our dependent variable (Tobin's q), and we model the first lag of the dependent variable. Still, this single snapshot might mask the effect of some important variables and insights, which could be revealed by mapping the movement of executives across firms using longitudinal data. We created a TMSE mobility network for semiconductor firms listed in U.S. stock exchanges; those who have worked at private or international firms also have social ties that might provide useful access to nonredundant and novel information. Due to data availability considerations, however, our focal network is limited to firms listed on the U.S stock exchange. Furthermore, the semiconductor industry sees rapid technological advancements and short product life cycles. In such a dynamic industry, the value of external information might be less relevant because of ever-changing information realm; our effects might be stronger for industries that face a more stable and less dynamic environmental context. In a stable environmental context, external information as accessed through the TMSE mobility network might be more relevant and

Table 5

ADDITIONAL ANALYSIS WITH ALTERNATIVE PERFORMANCE MEASURES: LATENT SUPPORT POINTS MODEL WITH LIV-CORRECTED MO, DEG, AND TENURE AND INTERACTION TERMS (M_{FINAL})

	DV		
Predictors	*ROA*	*SR*	*IR*
Main Effects			
Lagged DV	.781*** (.055)	.061*** (.021)	.51*** (.041)
Information richness (BROKER)	.048* (.028)	−.154* (.084)	.001 (.001)
LIV-corrected information reach (DEG LIV)	$.08 \times 10^{-3}$ (.006)	.059*** (.012)	$.5 \times 10^{-3}$ ($.4 \times 10^{-3}$)
LIV-corrected marketing orientation (MO LIV)	.004* (.002)	−.014** (.006)	$-.1 \times 10^{-3}$ ($.1 \times 10^{-3}$)
LIV-corrected tenure of TMSE (TENURE LIV)	.007*** (.002)	−.033*** (.011)	$-.1 \times 10^{-3}$ ($.1 \times 10^{-3}$)
TENURE LIV × TENURE LIV	$.2 \times 10^{-3}$ ($.2 \times 10^{-3}$)	.004*** ($.7 \times 10^{-3}$)	$.2 \times 10^{-3}$ ($.3 \times 10^{-3}$)
DEG LIV error term	.008 (.014)	.090 (.07)	$.2 \times 10^{-3}$ ($.4 \times 10^{-3}$)
MO LIV error term	$-.8 \times 10^{-3}$ (.003)	.011 (.008)	$.2 \times 10^{-3}$ ($.2 \times 10^{-3}$)
TENURE LIV error term	.005 (.01)	.022 (.031)	$.1 \times 10^{-3}$ ($.4 \times 10^{-3}$)
Interactions			
MO × DEG	.003** (.001)	.002*** ($.1 \times 10^{-4}$)	$.1 \times 10^{-3}$ ($.2 \times 10^{-3}$)
TENURE × DEG	.0142** (.007)	−.010*** (.002)	$-.1 \times 10^{-3}$ ($.3 \times 10^{-3}$)
MO × BROKER	$.1 \times 10^{-3}$ ($.1 \times 10^{-3}$)	−.002 (.003)	$.2 \times 10^{-3}$ ($.3 \times 10^{-3}$)
TENURE × BROKER	−.001 (.001)	.019 (.013)	$.1 \times 10^{-3}$* ($.5 \times 10^{-4}$)
Control Variables			
Employees	.049*** (.018)	.087 (.06)	−.002*** ($.9 \times 10^{-3}$)
R&D intensity	−.005*** ($.1 \times 10^{-4}$)	−.004*** ($.5 \times 10^{-3}$)	$.1 \times 10^{-4}$ ($.2 \times 10^{-4}$)
SG&A intensity	−.0167*** (.002)	.075*** (.004)	.001*** ($.1 \times 10^{-3}$)
R^2	.888	.926	.922

*$p < .10$.
**$p < .05$.
***$p < .01$.
Notes: Standard errors are in parentheses. We report two-tailed p-tests. ROA = return on assets; SR = systematic risk; IR = idiosyncratic risk.

consistent and therefore might have an amplified impact on performance.[19]

Theoretical Implications

With this study, we contribute to two research streams. First, we conceptualize a social network based on TMSE movement across firms as opportunities to access information resources, and we detail the impact of these informational resources on firm performance. Extant research emphasizes the presence of TMSEs in the C-suite and uses individual characteristics or firm-level variables to explain the impact of these resources (e.g., Germann, Ebbes, and Grewal 2015). We extend this research stream; in addition to individual characteristics (e.g., education; Wang, Saboo, and Grewal 2015) and firm-level factors (e.g., customer power [Boyd, Chandy, and Cunha 2010], marketing department power [Feng, Morgan and Rego 2015]), we add to this sparse literature in marketing on the impact of TMSE on firm performance. We show that in appropriate conditions of TMSE tenure and firm market orientation, information accessed through TMSEs' social ties also can enhance firm performance.

With our study, we also contribute to a much broader organization behavior literature that considers the impact of CEO, CFO, CMO, and other C-suite members on firm performance. While diversity in a CEO's past affiliations and experiences is related to strategic dynamism and openness to experimentation and change (Crossland et al. 2014), and higher CEO social capital is related to higher CEO compensation (Belliveau, O'Reilly, and Wade 1996), to the best of our knowledge, our study is the first to document a relationship between managerial social capital (resulting from top management team members' mobility within an industry) and firm performance.

These benefits also might be situated in the broader research context related to the impact of human resources on performance, as addressed in organizational behavior (Collins and Clark 2003) and labor economics (Bertrand 2009) research. By considering the combined impact of TMSE past affiliations and TMSE tenure on firm performance, we establish the importance of both their presence and their tenure. In the technologically intensive semiconductor industry, which is generally characterized by rapid technological advancements and short product life cycles, TMSEs critically connect customers' needs with firm strategies. Firms in such industries place a premium on TMSEs' ability to make good decisions quickly in response to real-time information (Collins and Clark 2003). The firm's position in the TMSE mobility network offers a source of valuable external market information, which should help TMSEs leverage external information in their decision making and achieve competitive advantages.

With greater tenure, the TMSE also becomes more socially integrated with the firm, which likely results in increased collaborative problem solving (De Cremer et al. 2008), facilitates knowledge exchanges and combinations (Tsai and Ghoshal 1998), and increases the value of external information even further. Because a TMSE requires time to apply his or her

[19]We thank an anonymous reviewer for bringing out this potential difference based on industry dynamism.

managerial social capital to a new firm and improve its performance, firms might be better off if they take a long-term perspective and encourage stable TMSE tenure. In a related sense, hiring trends seem to be emphasizing the need for top executives with general skills, rather than just firm-specific skills, such that the percentage of CEOs who are externally recruited is increasing (see Bertrand 2009). The benefits of information access, gained through TMSE mobility networks, also depend on hiring an external TMSE with past affiliations to other firms. The benefits of this information access are moderated by individual and firm factors, so our findings reveal the importance of firm-level capabilities and skills, and the firm-specific knowledge captured by TMSE tenure, as mechanisms to take advantage of managerial social capital.

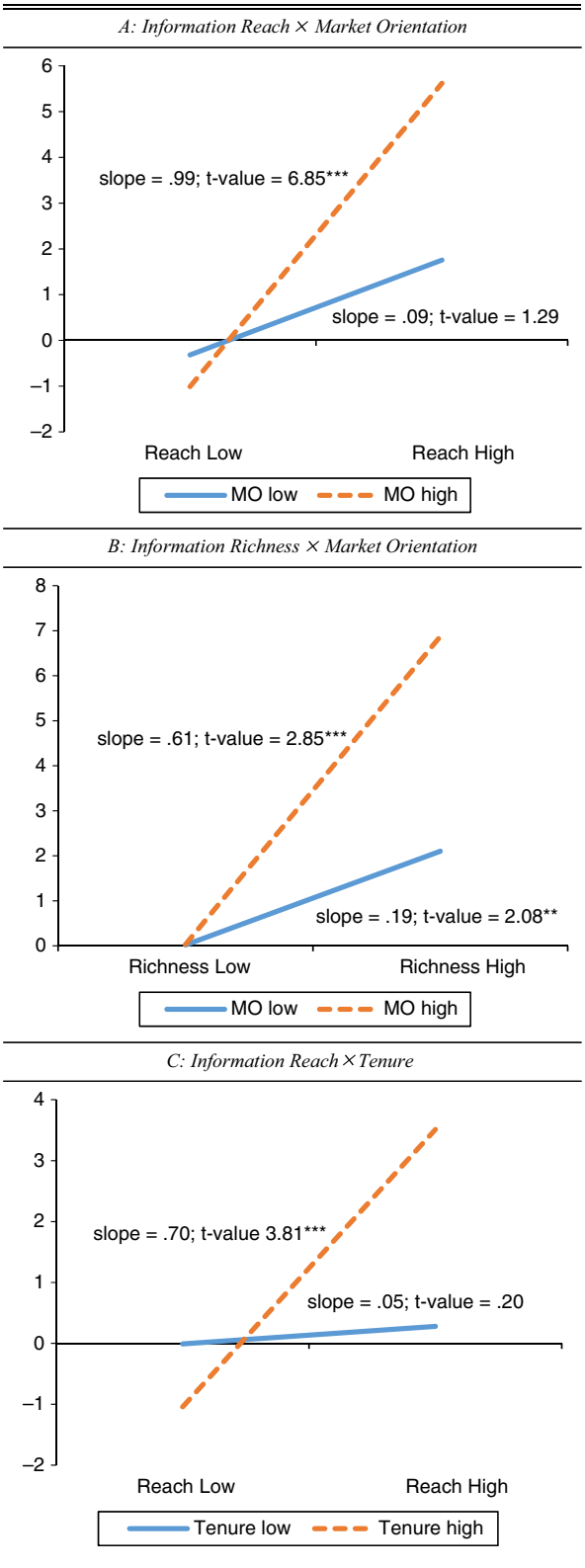
Second, in relation to social networks research, we present executive movement as a network phenomenon, creating informal linkages among firms that result in information flows. Prior literature documents knowledge spillovers in intracorporate networks (Tsai 2001), such as those resulting from scientists' mobility within and across regional labor markets (Almeida and Kogut 1999), alliance portfolios (Wuyts and Dutta 2014), R&D consortiums, trade associations, industrial districts (Inkpen and Tsang 2005), or peer networks (Grewal, Lilien, and Mallapragada 2006). We also show that knowledge spillovers in informal networks within an industry, due to TMSE movements, affect firm performance. Managerial social capital provides means for B2B firms to acquire external knowledge about markets, customers, and business practices. Considering informal social network mechanisms among the top management members and the flow of information among B2B firms thus is essential to understanding the impact of social relations on firm performance.

Our findings are also situated in the emerging stream of social network research that considers organization variables as facilitators for taking advantages of social capital and network positions. For example, as we noted previously, Zaheer and Bell (2005) find that a firm's innovation capabilities moderate effect of network positions on firm performance, and Wuyts and Dutta (2014) show that internal knowledge creation strategies affect firms' ability to benefit from particular alliance constellations. A broker's individual past experiences also enables him or her to identify opportunities and act on them (Burt 2012). With a motivation–ability framework, we further show that both individual- and firm-level motivation and ability are essential to efforts to absorb the benefits of managerial social capital in informal interfirm networks. Therefore, it is important to consider organizational variables as moderators when investigating mechanisms that help firms use social capital gained from their network positions.

Managerial Implications

To explore the nature of the benefits arising from managerial social capital, we conducted both graphical and simple slope analyses (Aiken and West 1991). In Figure 6, we present graphical analysis of significant interactions from our final model for low and high ($\mu \mp 1.5 \times \sigma$, respectively) levels of information reach and for information richness at low and high levels of moderators (tenure and market orientation). The graphs in Panels A and B show that market orientation interacts with information reach and richness, respectively, to affect firm performance. In Panel A, for firms with high market orientation, having higher information reach is positively

Figure 6
GRAPHICAL ANALYSIS OF MODERATION EFFECTS ON FIRM PERFORMANCE



Notes: The y-axis in each panel depicts Tobin's q. For each of the variables, low and high values signify $\mu \mp 1.5 \times \sigma$, respectively. Reach = information reach; Richness = information richness; MO = market orientation.

associated with performance (simple slope analysis: β = .99, $p < .01$). Therefore, at higher levels of information reach, firms derive more benefit from high market orientation. In Panel B, for firms with low market orientation, having higher information richness is positively associated with performance (β = .19, $p < .05$). For firms with high market orientation, having higher information richness is positively associated with performance (β = .61, $p < .01$). In Panel C, TMSEs with high tenure better leverage the benefits arising from information reach to improve performance (β = .70, $p < .01$). Simple slope analysis also suggests that interactions involving low levels of market orientation and tenure do not yield statistically significant results (Panel A and C). These results highlight the importance of an appropriate network position and of the moderators.

Our findings suggest that firms should work to hire TMSEs with the appropriate mix of prior work affiliations in order to benefit from the social ties of these newly hired TMSEs. If firms intend to benefit from such social ties, they also need a market orientation, and they should help the TMSEs integrate into their firm, so that they can absorb, assimilate, and use the information that emanates from the social ties. Market-oriented firms that give their TMSEs time to integrate should benefit from investing in hiring TMSEs with high managerial social capital.

Conclusion

We have proposed a nuanced conceptualization of TMSEs' past affiliations. Although our research focuses on the semiconductor industry, the results may provide insights for firms in various industries, particularly technologically intensive ones, in accordance with the theory we lay out to develop our hypotheses. In addition to interfirm interactions through traditional strategic alliances, firms can recruit executives with desirable past affiliations and social ties as a mechanism to enhance their external knowledge acquisition.

APPENDIX: MODEL-FREE EVIDENCE

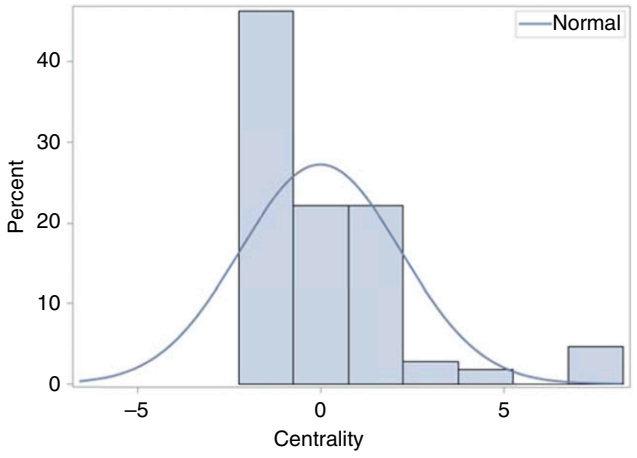
Some examples of firms from our data set:

- Nvidia has high Tobin's q (2.68), high degree centrality (1.66 units above mean), above-average brokerage (.14 units above mean), market orientation near average (9 units above average), and tenure of just 2 years (3.45 years below average).
- AMD has above-average Tobin's q (1.04), high degree centrality (5.66 units above average), very high brokerage (.36 units above average), very high market orientation (92 units above average), and tenure of 5 years (mean).
- Optical Communication Products has very low Tobin's q (.17), high degree centrality (5.66 units above average), high brokerage (.33 units above average), average market orientation (95 units, with 93 units as mean), and low tenure of 1 year (average is 5.45 years).
- TriQuint Semiconductor Inc. has low Tobin's q (.49), high market orientation (78 units above average), weak network positions (−1.14 units below average centrality, −.54 units below average brokerage), and low tenure (2.45 years below average).

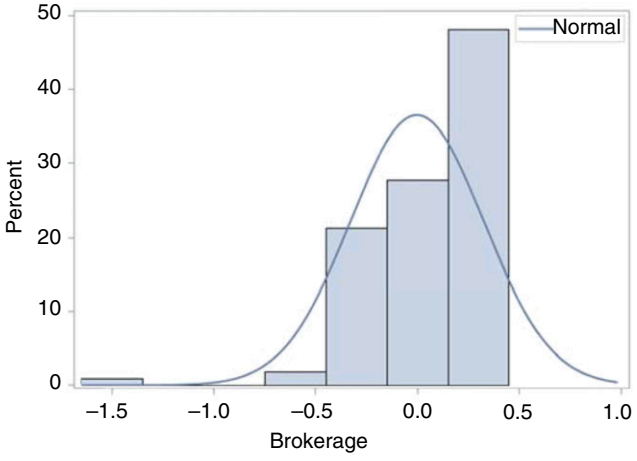
As these examples indicate, it is important to consider the interaction of centrality, brokerage, firm ability (market orientation), and firm motivation (tenure) to understand the benefits of a network position. Market orientation alone is not enough (e.g., TQNT); firms also need a strong network position. Figure A1 contains the distribution plots for the variables of interest.

Figure A1
DISTRIBUTION PLOTS FOR INFORMATION REACH (CENTRALITY), INFORMATION RICHNESS (BROKERAGE), MARKET ORIENTATION, TENURE, AND TOBIN'S Q

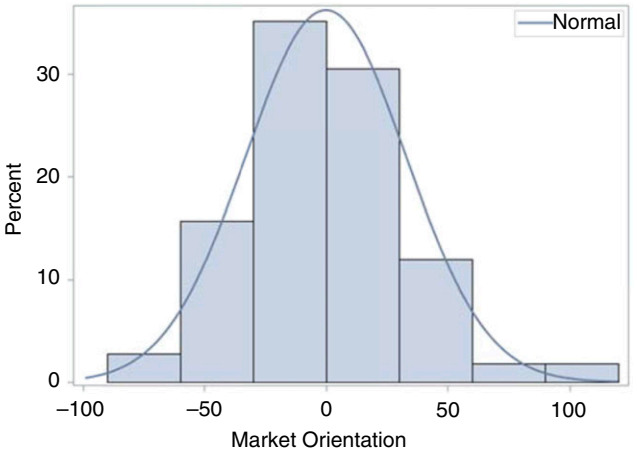
A: Centrality Distribution



B: Brokerage Distribution



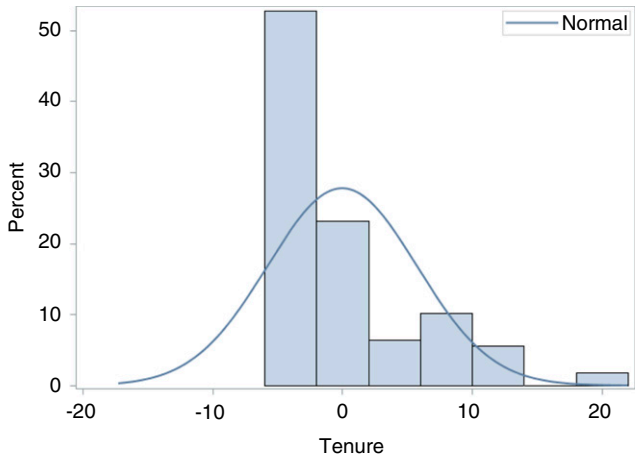
C: Market Orientation Distribution



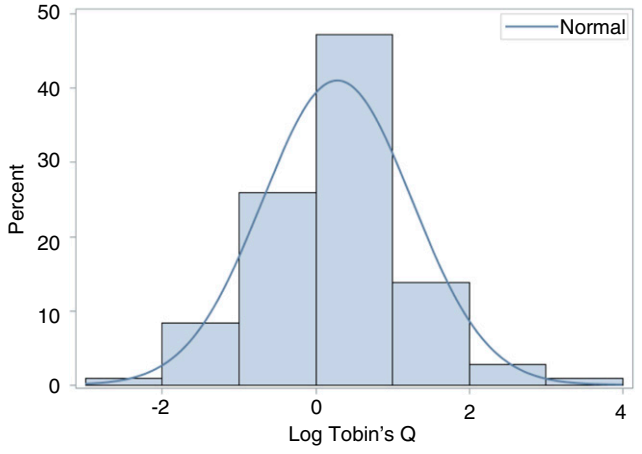
Notes: All these panels depict histogram and density plots for mean-centered variables.

Figure A1
CONTINUED

D: Tenure Distribution



E: Log-Transformed Tobin's q Distribution



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