

# **Networks as the Pipes and Prisms of the Market<sup>1</sup>**

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This article draws an analytical distinction between two types of market uncertainty: egocentric, which refers to a focal actor's uncertainty regarding the best way to convert a set of inputs to an output desired by a potential exchange partner, and altercentric, which denotes the uncertainty confronted by a focal actor's exchange partners regarding the quality of the output that the focal actor brings to the market. Given this distinction, the article considers how the value of "structural holes" and market status vary with these two types of uncertainty. The article proposes that the value of structural holes increases with egocentric uncertainty, but not with altercentric uncertainty. In contrast, the value of status increases with altercentric uncertainty, but declines with egocentric uncertainty. Thus actors with networks rich in structural holes should sort into markets or market segments that are high in egocentric uncertainty; high-status actors should sort into markets that are low in egocentric uncertainty. Support for this claim is found in an examination of the venture capital markets.

## INTRODUCTION

Economic sociologists and organizational scholars have traditionally regarded networks as the "plumbing" of the market. In this view, networks are the channels or conduits through which "market stuff" flows, where "market stuff" encompasses information about exchange opportunities as

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well as the actual goods, services, and payments that are transferred between buyer and seller. Research emphasizing the role of networks in job search (Granovetter 1974; Fernandez and Weinberg 1997), the significance of interlocking directorates in corporate decision making (Davis 1991; Haunschild 1993), and the importance of the pattern of intersectoral flows for firm profitability (Burt 1992) are all exemplary of this particular perspective.

Given an understanding of networks as pipes, one of the central analytic questions becomes: What network position is most beneficial? In his answer to this question, Granovetter (1974) emphasized the importance of a position characterized by weak, bridging ties. Burt (1992) refined the argument, decoupling the benefits of bridging ties from the average strength of those ties. As Burt writes, tie weakness is a correlate rather than a cause of the value deriving from bridging ties. In fact, controlling for the extent to which a tie serves as a bridge to distinctive sources of information, stronger ties are actually more beneficial than weak ties since they allow a greater volume of resources to move between actors. Such an argument is complemented by an ever-larger volume of research on buyer-supplier relations that emphasizes the relative advantages of more intensive, long-term relations over weaker, short-term market transactions (Dore 1983; Uzzi 1996). The principle of nonredundancy or, to use Burt's terminology, the cultivation of structural holes emerges as the fundamental principle guiding the formation of ties. When "ego" is tied to a large number of "alters" who themselves are not tied to one another, then ego has a network rich in structural holes.

More recently, a second view of networks has arisen in the sociological research on markets. In this second view, a tie between two market actors is not only to be understood as a pipe conveying resources between those two actors; in addition, the presence (or absence) of a tie between two market actors is an informational cue on which others rely to make inferences about the underlying quality of one or both of the market actors. For example, Baum and Oliver (1992) show that day care centers can enhance their legitimacy in the eyes of potential consumers by establishing ties to prominent organizations in the community, such as governmental agencies or church groups. Similarly, in a study of investment banks (Podolny 1993), I argue that the syndicate relations between investment banks are important not only because these syndicate relations imply the transfer of resources between banks but also because these syndicate relations provide the basis for a status ordering that corporate issuers and investors use to make inferences about the quality of the banks. Indeed, an increasingly broad array of work highlights how an actor's pattern of market relations are informational cues on which other market actors rely

to make inferences about the quality of that actor (Han 1994; Stuart, Hoang, and Hybels 1999).

One particularly distinct but nonetheless related piece of research within this second view is Zuckerman's (1999, 2000) research on firm valuation. Zuckerman examines the extent to which a firm's valuation and divestment activities are driven by the cognitive classifications employed by the financial analysts of the major securities firms. A financial analyst at a major securities firm does not track and aim to predict the performance of all firms; rather, he or she focuses on some particular subset of firms. Zuckerman argues that the choice of subset is strongly informed by institutionalized cognitive categories that permeate the profession. A category such as health care might be institutionalized, but a category like entertainment might not. Zuckerman then contends that analysts are less likely to track firms whose portfolio of business lines does not conform neatly to these institutionalized categories. Since a lack of attention from analysts raises a firm's costs of capital, a firm has a strong incentive to divest those businesses that make it difficult for analysts to assign firms to one of the categories. As with these other examples, the pattern of exchange relations in which a firm engages (i.e., its pattern of acquisitions and divestments) is not only relevant because of the resources that flow between firms but also because of how the pattern of those resource flows affect the perceptions of third parties.

Stated generally, this second view posits that a market relation between A and B is not only relevant to market outcomes as a conduit of resources or information passed between A and B. The relation is also relevant because it affects some third actor's perceptions of the relative quality of the product services that A and B offer in the market. Raised to a level of metaphorical abstraction, networks are not only pipes carrying the stuff of the market; they are prisms, splitting out and inducing differentiation among actors on at least one side of a market.

When work emphasizing the perceptual consequences of exchange relations is set alongside the structural hole argument, an interesting tension emerges. Whereas the structural hole logic pushes actors to develop expansive networks, stretching beyond the boundaries of their current set of ties, the work emphasizing the perceptual externalities of tie formation highlights negative consequences that derive from this expansion. For example, elsewhere I have demonstrated the negative perceptual consequences that accrue to an actor who engages in an exchange relation with others that are significantly lower in status (Podolny 1994; Podolny and Phillips 1996). Similarly, Zuckerman (1999, 2000) suggests strong negative consequences of engaging in merger and acquisition (M&A) activity that expands a firm's identity beyond the bounds of the categories employed by the analysts. In the work on status, the bounds on expansion are

vertical in nature; in Zuckerman's work on firm boundaries, the bounds on expansion are horizontal. Yet in both cases, there are clear negative consequences that derive from a lack of bounds on bridges that an actor may build to different segments of the market or economy.

How do we reconcile these principles of network expansion and exclusion? One way is to assert simply that the status orderings and cognitive categories set the bounds within which actors are able to cultivate structural holes. In effect, perceptual orderings set a landscape for the formation of structural holes; the gradient of the landscape rises at the bounds of status positions and cognitive categories, greatly inhibiting the formation of ties to actors that may lie on the other side of these perceptually defined hills. In this view, the pursuit of structural holes and the avoidance of perceptual boundaries are countervailing principles that have roughly equally relevance in all markets.

Another way to reconcile the principles is to argue that the relevance of each principle is contingent on certain features of the market. There is increasing evidence that the rewards of status are contingent on the uncertainty that buyers face (Podolny 1993; Podolny, Stuart, and Hannan 1996, Stuart et al. 1999). While few contingent effects of structural holes have been identified in the market, some work on intraorganizational mobility has sought to identify the contingent effects of structural holes within organizations (e.g., Burt 1992, 1997; Gabbay and Zuckerman 1998; Podolny and Baron 1997). Some of the findings of this research have relevance in the market context. For example, Burt (1997) demonstrates that the more that an actor is surrounded by structurally equivalent others, the less benefit that the actor receives from structural holes in his or her network. Gabbay and Zuckerman (1998) find that structural holes are more beneficial when the overall network of ties is less dense. The market-related implication of both pieces of research is that structural holes are less beneficial in more crowded, interconnected markets.

While some work has identified the contingent effects of status and other work has identified the contingent effects of structural holes, no work has sought to enumerate boundary conditions that determine whether an exclusive or expansionary network is more advantageous. Though a complete enumeration of such boundary conditions is beyond the scope of this article, it is possible to take some initial steps in that direction by focusing on a more specific question: How does market uncertainty affect the relative advantage of a high-status position versus a position characterized by numerous structural holes? This is the central question that is addressed in the theory section of this article. Consideration of this question in turn gives rise to specific hypotheses regarding how a firm's network position affects its relative participation in a given

market or market segment, where markets and market segments can be characterized in terms of the uncertainty underlying actors' decisions.

## THEORY

In order to answer how market uncertainty affects the relative advantages of a high-status network versus a network with considerable structural holes, it is first necessary to adopt the perspective of a focal producer and distinguish two types of market uncertainty. The first type is the uncertainty that the producer has regarding market opportunities and the set of resource allocation decisions that will best enable the producer to realize those opportunities. An automobile producer, for example, faces some uncertainty in deciding which hiring decisions, supplier relations, and production choices will result in a vehicle that is perceived by some set of buyers to provide considerable value. This type of uncertainty can be labeled "egocentric uncertainty" since the focal producer is the actor who is uncertain. The second type is the uncertainty that consumers or possibly other constituencies, such as potential alliance partners, have about the quality of goods or services that the producer presents to them in the market. In the automobile example, potential purchasers of automobiles face considerable uncertainty regarding which vehicle will provide them with the most value. This type of uncertainty can be labeled "altercentric uncertainty" because the producer's alters—the consumers or potential alliance partners—are the actors who are uncertain.<sup>2</sup>

A market or market segment can rate highly on one type of uncertainty without rating highly on the other. For instance, consider the four markets represented in figure 1, beginning with the market for a particular vaccine, such as polio or smallpox, in the upper left-hand quadrant. The most salient source of uncertainty in this market is in that which underlies the development of the vaccine. Once the vaccine is developed and is given regulatory approval, there is little uncertainty on the part of consumers

<sup>2</sup> Given a highly reified market in which there are consumers on one side and producers on another side, one could perhaps label egocentric uncertainty as producer uncertainty and altercentric uncertainty as consumer or market uncertainty. However, there are three reasons that I prefer this particular nomenclature. First, in most markets, consumers are not the only actors evaluating producers as a potential exchange partner. In a large number of markets, producers are also evaluated by potential alliance partners or by intermediaries between consumer and producers, such as distributors or retailers. Second, a nomenclature based on the terms ego and alter is quite consistent with the network literature's focus on exchange relations (see Burt 1992). Finally, as I discuss in the conclusion, the arguments developed in this article potentially apply in domains outside the market. As a result, it seems reasonable to use language that is not specific to the market context.

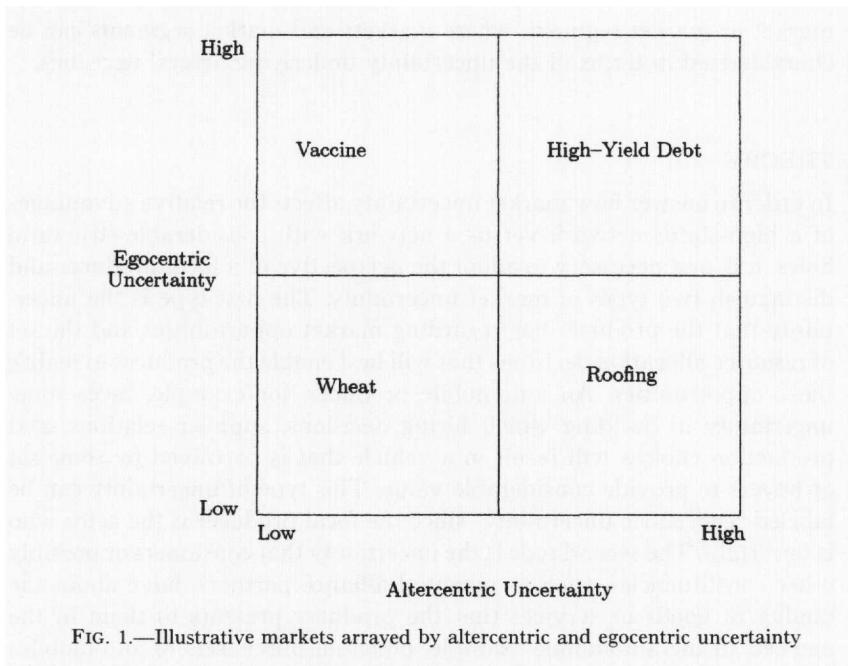


FIG. 1.—Illustrative markets arrayed by altercentric and egocentric uncertainty

as to whether they will benefit from the innovation. Accordingly, a market for a vaccine is a market that rates high on egocentric uncertainty, but low on altercentric uncertainty. Alternatively, consider the market in the lower right-hand corner, a regional market for roofers. "Roofing technology" is relatively well understood, and while roofers may face some uncertainty as to who needs a roof in any particular year, they can be confident that every homeowner will need repair work or a replacement every 20 years or so. By sending out fliers or advertising in the yellow pages, they can be assured of reaching a constituency with a demand for their service. However, because an individual consumer only infrequently enters the market, the consumer is generally unaware of quality-based distinctions among roofers. The consumer may be able to alleviate some of this uncertainty through consultation with others who have recently had roof repairs; however, the need for such consultation is an illustration of the basic point. Only through such search and consultation can the consumer's relatively high level of uncertainty be reduced. Accordingly, this is a market that is comparatively low in terms of egocentric uncertainty, but relatively high in terms of altercentric uncertainty. Many of the standard "asymmetric information" models in economics—like reputation models or signaling models—assume market conditions that are implicitly high on altercentric uncertainty and low on egocentric uncer-

tainty. However, such asymmetric information is not the only condition that would imply this combination of altercentric and egocentric uncertainty. Another instance of this combination is “conspicuous consumption” markets, in which buyers purchase goods not so much for their inherent quality but in order to demonstrate that they are part of an elite that consumes a particular brand. In this case, the uncertainty of the buyers is less about the inherent quality of the good and more about the trends in tastes and fashion that will lead one brand or style to become identified with elite status.

Finally, there are some markets that may be high or low on both egocentric and altercentric uncertainty. Particularly during the time of its emergence, the market for noninvestment grade, or “junk” debt, rated high on both types (Podolny 1994). Conversely, the market for wheat can be characterized as low on both. The technology and demand for wheat is generally well understood by wheat farmers, and the standardization of the product means that buyers face relatively little uncertainty about the quality of the product.

The distinction between egocentric and altercentric uncertainty is important because it lays a conceptual foundation for an important difference between the pipes and prism perspectives. Whereas the pipes/structural holes perspective has generally concerned itself with the usefulness of networks in reducing egocentric uncertainty, the prismatic/status perspective has focused on how networks reduce altercentric uncertainty.

### Structural Holes and Egocentric Uncertainty

Burt (1992) argues that structural holes yield both information benefits and control benefits. For the purposes of this discussion, I set aside consideration of the control benefits because there is as yet no theoretical or empirical basis for asserting that they vary with egocentric or altercentric uncertainty. Focusing on the information benefits, it is clear that a network position with many structural holes is beneficial primarily because it resolves ego’s uncertainty about the market decisions that ego needs to make. Again, to return to Granovetter’s example of job search, bridging ties are valuable primarily because they increase ego’s (i.e., the job searcher’s) information about the breadth of opportunities that are presented in the market. If the job searcher had complete information on all job opportunities, then structural holes would be of no value. In the interorganizational context, ties between corporate actors on one side of a market take numerous forms, such as alliances, syndicate relations, interlocking directorate ties, or simply personal relations among the leaders within an industry. The basic claim is that the more structural holes that exist in a firm’s network of relations with other firms, the greater

the information that the focal firm has about a wide range of market opportunities and the greater the information about how to fill those opportunities.<sup>3</sup>

This observation that structural holes reduce egocentric uncertainty has important implications for a firm's choice of markets and market segments because related markets or market segments frequently vary in terms of their egocentric uncertainty. For example, consider cultural organizations, such as a film studio, record company, or art gallery. Such cultural organizations must make decisions about the genres or styles that they will produce and/or broker to the broader public. Often these genres can be ranked in terms of the uncertainty around standards of quality (e.g., Greenfeld 1989). Or, consider the primary securities markets. These markets can at least sometimes be distinguished in terms of uncertainty confronting investment banks (e.g., Podolny 1994).

Because structural holes help reduce egocentric uncertainty, firms possessing many structural holes in their network should seek out markets and market segments that are characterized by this type of uncertainty. Conversely, firms possessing few structural holes in their network should avoid such contexts since the lack of structural holes is most disadvantageous when there is much to learn. Or, stated in the form of a hypothesis:

**HYPOTHESIS 1.—*The more (fewer) structural holes in a producer's net-***

<sup>3</sup> In the earliest formulation of his structural hole argument, Burt (1992) also suggested that structural holes in ego's network might be valuable in establishing a broad, positive reputation. If ego is only connected to a small, tightly bound clique of individuals, then there are at most only a small group of individuals who will be exposed to ego's reputation. Conversely, if ego is connected to a large number of individuals who are themselves disconnected, then ego can more easily establish a broad, positive reputation. If this relationship between structural holes and reputation exists, then the value of structural holes would also be enhanced by altercentric uncertainty. When altercentric uncertainty is high, those with many structural holes in their network would have a reputational advantage over those with few structural holes in their network. However, research by Burt and Knez (1995) finds that a broad, expansive network is not more conducive to a positive reputation. A broad, expansive network reduces the variance in an actor's reputation across a set of alters, but it does not improve the mean reputation across those alters. That is, actors with many structural holes in their network are less likely to have a very negative reputation, but they are also less likely to have a very positive reputation. As the number of structural holes in an actor's network increases, so does the probability that the actor will have a middle-of-the-road reputation. Since structural holes do not have a positive effect on an actor's reputation, the value of structural holes is enhanced only by egocentric uncertainty and not by altercentric uncertainty.

*work, the more that it will sort into (away from) market segments that are high in egocentric uncertainty.<sup>4</sup>*

### Status and Egocentric Uncertainty

The value of status varies with these two types of uncertainty in a different way. As noted above, previous research has shown that the value of a producer's status in the market hinges on the uncertainty that the producer's constituencies have about the quality of the good or service that the producer and its competitors offer on the market. If consumers face little or no uncertainty about the quality of the goods that confront them, then the value of status as a signal of quality is essentially zero. Accordingly, for status to be of some value, there must be some minimal level of altercentric uncertainty. However, as suggested in figure 1, given some minimal level of altercentric uncertainty in a market, it is possible for egocentric uncertainty to vary somewhat independently of the level of altercentric uncertainty. What is the effect of varying egocentric uncertainty on the value of status?

In order to answer this question, it is helpful to remember that the advantage of status rests at least in part on the fact that potential exchange partners would rather enter into an exchange relation with a high-status rather than a low-status producer if only because high status is a signal of quality (Podolny 1993). To oversimplify somewhat, *ceteris paribus*, the highest-status producer should essentially have its choice of exchange partner. To be sure, the highest-status producer may have reason to avoid entering into exchange relations with some potential exchange partners. For example, the highest-status producer may wish to avoid exchange relations with a low-status actor either because the producer believes the low-status actor to be of low quality or because the producer is simply concerned that the affiliation with a low-status actor will lower the producer's own status. Yet, what is important for our purposes is that the highest-status producer has greater discretion than other producers in choosing an exchange partner. While the highest-status producer may generally wish to avoid entering an exchange relation with low-status

<sup>4</sup> In this hypothesis as well as the one developed in the next section, I use the term "sort" intentionally to reflect the fact that the matching of network to segment can result both from strategic action and constraint. As I discuss further below, it is possible to exploit some features of the data to provide some insight into the mechanism underlying the sorting process in the particular context being analyzed. However, it should be clear that at a general level, sorting could result either from strategic anticipation of the advantages or disadvantages of a particular network configuration or from external environmental pressures.

others, the highest-status producer may also decide on occasion that the potential benefits of such a relation outweigh the potential costs.

The value of such enhanced access is contingent on the extent to which the high-status producer is able to ascertain what combination of exchange relations will actually result in a superior quality product or service. A higher-status producer may have greater access to upstream suppliers, providers of financial capital, human capital, and alliance partners, but unless the producer knows what combination of those relations will result in a higher-quality product, the enhanced access is of little value.

Since a market segment that is high in egocentric uncertainty is by definition one in which the producer is not certain what combination of inputs is likely to result in the most desirable output, status is of little value in such a context. When egocentric uncertainty is low, a producer does not know how it should best use the enhanced access that status provides.

This observation is perhaps best captured by framing the matching process in markets in terms of a queuing imagery. Imagine that producers queue up for whatever exchange opportunities they would like to pursue, and their position in the queue is a function of their desirability as an exchange partner. To the extent that others prefer to enter into an exchange relation with a higher-status producer than a lower-status producer, then *ceteris paribus* the highest-status producer should be at the front of the queue, the second highest-status producer should be next in line, and so on. However, when egocentric uncertainty is high, the highest-status producer does not know for which exchange opportunities it should queue up. As a result, in the high egocentric uncertainty context, its status is of little value; in contrast, in the low egocentric uncertainty context, there is tremendous benefit in being able to be at the front of the queue. This reasoning gives rise to the following hypothesis:

**HYPOTHESIS 2.**—*The higher (lower) a producer's status, the more likely it will sort into (away from) market segments that are low in egocentric uncertainty.*

Once again, it is important to reemphasize that hypothesis 2 is premised on the assumption that there is some basic level of altercentric uncertainty ensuring the relevance of status in a market. If consumers and other relevant constituencies have no uncertainty about the quality or value of what is offered by producers in the market, then status is of essentially no value. However, in a market in which consumers face some minimum level of uncertainty as to the quality differences of producers, then producers should attempt to shift to those segments of the market where the distinguishing features of their networks are of the greatest value.

Before moving to the empirical analysis, a simple example should help to illustrate the joint implications of these two hypotheses. Consider a

college or university department making decisions about the hiring of faculty. The college or university department enters into exchange relations in the academic labor market with the hope of offering some combination of research and teaching excellence that is valued by the various constituencies that provides the larger institution of which it is a part with funds (i.e., incoming students, alumni, grantmaking institutions, etc.).

With some oversimplification, one can think about the department's hiring decisions as taking place in one of two market segments: a junior segment, consisting of newly minted Ph.D.'s, and a senior segment, consisting of those who have held an academic position for a number of years and most likely have tenure at their current institution. Since more information is known about the individuals in the senior segment than in the junior segment, the junior segment is obviously one that is relatively high in egocentric uncertainty, and the senior segment is obviously one that is relatively low.

We can now think about the personal ties of a department into its field as constituting the network of that department. The information provided by these ties can be used in evaluating the candidates in their respective market segments, and the network position of the department within the broader discipline can be characterized in terms of the volume of structural holes and status. A department with a network that is rich in structural holes is one in which the members of that department are connected to a large number of disconnected others within the field. A department with a high-status network is one in which the ties of its faculty members are primarily to (other) high-status departments.

Hypothesis 1 implies that the more structural holes in the department's joint personal network, the better that department will be in making hiring decisions in the junior segment. The personal information yielded by such a network will be helpful in this context in which there is typically little tangible information on which to make a hiring decision. In contrast, a network laden with structural holes will be of comparatively little value in the senior segment since there exists a detailed research and teaching history on which to base evaluations that is independent of the personal information yielded through the network. Hypothesis 2 implies that the greater the status of the department, the more that the department will be at an advantage in bidding for talent in the senior segment. While status may also be of some advantage in the junior segment, the high-status department faces much greater uncertainty as to who it should use its status to attract. The joint implication of the two hypotheses is therefore that departments with networks possessing numerous structural holes will tend to shift more of their hiring to the junior market, and high-status departments will tend to shift more of their hiring to the senior segment.

A reader familiar with the network conceptions of status and structural

holes might reasonably ask whether status and structural holes could have these apparently opposite effects on selection of market segments. It seems reasonable to anticipate a high correlation between an actor's status and the presence of structural holes in the actor's network. An actor with many structural holes in his or her network of exchange relations is, by definition, an actor that is quite prominent in the larger network of relationships—serving as a bridge and boundary spanner across numerous diverse cliques within the larger structure.

However, even if one expects that high-status actors will have a disproportionate number of holes in their network or that Burt's entrepreneurs will generally be high-status actors, the conceptual difference between a high-status network position and a position with many structural holes is sufficient for there to often exist a real trade-off between the formation of ties that will add structural holes to the network and ties that will augment the actor's status. Consider again the example of the high-status academic department. To the extent that the focal department has ties primarily to other high-status departments, the members of the focal department can maintain or perhaps even increase the department's status by building ties to another high-status department that is tied to other departments to whom the focal department is tied. Alternatively, the focal department could attempt to build ties to a middle-status or perhaps lower-status department to which no member of the focal department is currently tied. The first would be the more status-enhancing or status-maintaining option; the second option would be more consistent with maximizing the number of structural holes.

It is important to note that, in asserting that actors possessing networks with considerable structural holes will sort into market segments that are high in egocentric uncertainty and that high-status actors will shift into segments that are low in this type of uncertainty, I do not need to assume that market actors are cognizant of how the features of their network allow them to confront the problems of egocentric uncertainty. The linkage between network pattern and market segment requires only that firms respond to reinforcement of poor or strong performance across various segments. For example, a high-status firm need only be aware that its activities in a high-egocentric uncertainty segment are yielding a comparatively low return and that it therefore should direct resources toward the low-egocentric uncertainty segment. The firm does not need to be aware that its status is of less use in a high-egocentric uncertainty segment.

Notably, if such reinforcement is the primary driver behind the shift in segment, there is value in empirically distinguishing "focused" firms, whose fate is determined primarily by their performance in closely related markets or market segments from diversified firms, whose fate is determined by performance across a broad array of relatively distinct markets.

The business units of diversified firms will be relatively insulated from the costs of a mismatch between network and market segment since the continued viability of the unit depends not simply on its own actions but on the actions of other business units within the firm (Milgrom and Roberts 1992). This observation leads naturally to the empirical analysis.

To test these basic claims regarding the contingent effects of status and structural holes, I focus on the venture capital market, a market in which there is considerable altercentric uncertainty across all market segments and considerable variance in egocentric uncertainty between markets segments. This variation in egocentric uncertainty allows for a test of the basic hypotheses. While the vast majority of “producers” in this market are venture capitalists, there are a significant number of other entities—companies, investment banks, diversified financial firms—that try to decide which entrepreneurial firms they should fund and which they should not. As a consequence, in conducting the analysis, it will be important to attend to whether the hypotheses apply primarily to the venture capital firms or to these more diversified institutions.

### THE EMPIRICAL CONTEXT: VENTURE CAPITAL

In venture capital markets, venture capitalists occupy an intermediary or broker role between investors and entrepreneurial companies in need of financial capital.<sup>5</sup> A venture capital firm enacts this brokerage role by first raising money from the investors and placing the raised money into a fund. The fund is organized as a partnership, with the senior members of the venture capital firm serving as general partners and the investors as limited partners. The venture capital firm invests the fund’s money in entrepreneurial companies in exchange for an ownership stake. At the end of a fixed period of time, usually 7–10 years, the fund is dissolved. The venture capital firm takes a fraction of the proceeds, usually about 20%, and distributes the remainder to the limited partners in proportion to their original investment in the fund.

Venture capital firms are evaluated on their ability to generate high returns for their limited partners by successfully investing the fund’s resources. A venture capital firm may be managing more than one fund at a time, but the returns to the limited partner are based solely on the performance of the fund in which she or he invested. The more successful a fund, that is, the higher the return on investment paid to the limited partners at liquidation, the easier it is for a venture capitalist to raise

<sup>5</sup> This section draws heavily on the description of the venture capital industry in Podolny and Feldman (1997).

money for subsequent funds. Moreover, venture capital firms with a history of delivering extraordinary returns on investment to their limited partners not only find it easier to raise funds but also can increase the fraction of the proceeds that they keep for themselves.

For the purpose of this analysis, I regard investors as "consumers" and venture capital firms as "producers." From the perspective of the venture capitalist, the venture capital markets are characterized by both high egocentric uncertainty and high altercentric uncertainty, where investors constitute the critical "alters." Neither the investors nor the venture capitalists are highly certain of the benefit that they will derive from any particular investment. Even though some of the uncertainty associated with investments in this market can be "priced away" and thus transformed into risk, there remains considerable uncertainty in these markets that is difficult if not impossible to price. Venture capital emerged as an institution largely because traditional financing institutions were unwilling to invest in entrepreneurial firms lacking collateral. The origins of venture capital are thus indicative of the generally high level of egocentric and altercentric uncertainty in this particular market. In background interviews for this article, venture capitalists were quite open about the fact that there exist no reliable quantitative formulas for evaluating the risk associated with their investments.

A venture capital firm's quality is determined by its ability to make superior investment decisions in the context of this uncertainty. The venture capital firm must learn to identify characteristics of an entrepreneurial firm that increase the likelihood that the start-up will emerge as a success. In evaluating an entrepreneurial firm's chances for success, the venture capitalist will typically consider numerous factors. For example, the venture capital firm must assess the entrepreneurial firm's technology, the managerial ability of the firm's founders, the dynamics of the market(s) in which the entrepreneurial firm hopes to compete, and the potential responsiveness of the financial markets to a public offering of the entrepreneurial firm's equity.

While it should now be clear that the venture capital markets are characterized by a high level of altercentric and egocentric uncertainty, it is equally important to note that there is variance in the level of egocentric uncertainty across investments. To understand the basis for this variance, it is necessary to review in somewhat more detail how start-ups raise capital from venture capitalists. Entrepreneurial firms generally raise money in "rounds." That is, entrepreneurial companies do not receive a continuous flow of payments from venture capitalists. Rather, they seek financing over some discrete time period. At the end of the time period, the process is then repeated. In some rounds, a firm may require more

money than any one venture capital firm is willing to invest. In these cases, multiple firms may invest in a given round.

Rounds can be categorized into stages. For the purpose of this analysis, I divide rounds into three stages. Start-ups that do not have a viable product are regarded as being in the first stage. At this stage, the entrepreneurial firm may have little more than an idea or concept for a product. At least some of the financing in this stage is referred to as “seed” or “start-up” financing. Once an entrepreneurial firm establishes the viability of its product, that firm may pursue financing for the commercial manufacturing and sales of its product. I denote such financing as second-stage financing. Second-stage financing takes place after a company has initiated production but typically before the company has become profitable. Finally, the company enters third-stage financing when it is profitable and is pursuing capital for further expansion. As a company progresses through the various stages, its value increases. From the perspective of the venture capital firm, that is, from the perspective of an investor purchasing equity in a company, the highest returns are to be found when a company that was financed in the early stage proves to be successful. Because there is less uncertainty in the later stages, the returns from a successful late-stage investment are smaller.

An entrepreneurial company does not necessarily begin to receive financing in a seed or a start-up round, and a company need not go through all stages of financing before being acquired or going public. For example, because they have high capital needs in the product development stage, biotechnology firms typically go public long before they have a marketable product.

On the other side of the market, a venture capital firm need not invest in a firm in the earliest stage in order to make an investment in a later stage. However, once a firm makes its initial investment, it obviously has privileged access to information about the firm and accordingly the uncertainty around a reinvestment decision is very different than the uncertainty around an initial investment decision. This fact has important implications for the empirical analysis. In examining the investment patterns of venture capital firms, I will only focus on initial investments made in a start-up since the initial investment generally implies a high likelihood that the firm will invest if and when others make subsequent investments in the firm.

More generally, for the purposes of this article, what is important about these stages is that they provide a basis for categorizing investments in terms of the egocentric uncertainty faced by the venture capitalist at the time of the resource allocation decision. The later the stage of the investment at which a venture capitalist first becomes involved with a start-

up, the less uncertainty that the venture capital firm confronts regarding the outcome of an investment decision.

## MODEL

To test the hypotheses elaborated above, I propose the following model:

$$\bar{R}_{i,t+1} = \alpha H_{i,t} + \beta S_{i,t} + \sum_{k=1}^n \gamma_k + \sigma_i + \tau_t + \epsilon_{i,t+1},$$

where  $\bar{R}_{i,t+1}$  denotes the average stage of firm  $i$ 's initial investments in year  $t + 1$ ,  $H_{i,t}$  denotes a measure of the structural holes in firm  $i$ 's network in year  $t$ ,  $S_{i,t}$  signifies the status of venture capitalist  $i$  in year  $t$ ,  $\gamma_1 - \gamma_n$  represents a set of control variables,  $\sigma_i$  indicates a firm-specific effect for venture capital firm  $i$ , and  $\tau_t$  reflects a time-specific effect for year  $t$ . The central hypotheses are that  $\alpha < 0$  and  $\beta > 0$ . That is, the more structural holes in a firm's network, the earlier the stage in which the firm first invests in a start-up. Conversely, the higher a firm's status, the later the stage in which the firm invests.

The model can be estimated using conventional ordinary least squares (OLS) techniques for the analysis of panel data. The firm-specific effect  $\sigma_i$  absorbs all of the between-firm variance in the model estimation. As a consequence, the estimates of the other terms are not confounded by any unobserved variables that are time-invariant. Moreover, the absorption of between-firm variance with these firm effects gives us greater confidence that the changes in the values of the independent variables at time  $t$  are temporally followed by a change in the outcome measure at time  $t + 1$ . Absent these firm-specific effects, one might worry that there is some unobserved attribute that varies across firms and leads firms with a disproportionate number of structural holes (at time  $t$ ) to also have a disproportionate number of early-stage investments (at time  $t + 1$ ). However, because only within-firm variance is used in the estimation of the network effects, we can rule out the confounding effects of any unobserved variables that systematically differ across firms.

## DATA AND MEASUREMENT

The data for this examination were obtained from the Securities Data Corporation's (SDC) Venture Economics database. The SDC collects information on numerous financial markets and then sells this information to the various financial communities. The SDC assimilates the information

in the Venture Economics database from both public and private sources. Venture capitalists use this data to obtain benchmarks for their performance, and entrepreneurs use this data to better understand venture capitalists' investment preferences.

Though the SDC has information on entrepreneurial start-ups dating back to the early 1970s, data from the 1970s is extremely scant, raising the possibility that much of the data from this time period is missing. Because of concerns about the scantness of the data during the early period, I limit the analysis to the time period between 1981 and 1996, inclusive, though I also use data from 1980 for the purpose of constructing independent variables that rely on a one-year historical "window."

In addition to deciding on an appropriate time period for the analysis, one also needs to decide which actors to include in the population of "producers" making resource allocation decisions. The SDC venture capital database includes information on the investments of venture capital firms as well as information on the investments of diversified financial institutions, nonprofit organizations such as governments and universities, and wealthy individuals. Some of these entities only make episodic investments and accordingly appear in the data only a few times. Since the network and identity of an actor making only infrequent investments is not meaningfully bound to the venture capital community, it seems important to exclude those actors who make only infrequent investments in this market. As a selection rule, I require that an actor make at least five investments in year  $t$  (i.e., the lagged year) to be included in the population for that particular year. Such a selection threshold seems conservative; that is, I am including actors for whom venture capital is most likely not a principal form of economic activity. However, it seemed preferable to err on the side of inclusion than exclusion.

Even with this selection rule, one ends up with a number of actors in the analysis that are not venture capital firms. Using a variety of archival sources, I categorized entities investing in start-ups into seven categories: venture capital firms, consumer banks (e.g., First Boston), investment banks (e.g., Goldman Sachs), nonbank financial institutions such as insurance companies or investment funds (e.g., Fidelity, Allstate Insurance), nonfinancial firms (e.g., Apple Computer, Raytheon Corporation), non-profit institutions such as governmental organizations or universities, and, finally, individual investors. For the sake of exposition, I will refer to all of the actors as venture capitalists insofar as they are all making decisions about which start-ups to fund. However, being a venture capitalist obviously does not imply that an actor is a venture capital firm.

Table 1 reports the distribution of actors across the various categories. Despite consulting a number of sources, I could not classify approximately 12% of the investing entities. The first column lists the number of actors

TABLE 1  
CATEGORIES OF FINANCIAL SUPPORTERS OF START-UPS

| Financial Supporters          | <i>N</i> | <i>N × T</i> | <i>N</i> of Investments |
|-------------------------------|----------|--------------|-------------------------|
| Venture capitalist .....      | 248      | 1,788        | 9,853                   |
| Investment bank .....         | 13       | 126          | 1,129                   |
| Diversified financial .....   | 18       | 101          | 670                     |
| Consumer bank .....           | 7        | 41           | 204                     |
| Governmental organization ... | 2        | 5            | 26                      |
| Nonfinancial firm .....       | 28       | 163          | 1,607                   |
| Individuals .....             | 10       | 57           | 262                     |
| Uncertain .....               | 50       | 204          | 770                     |
| Total <i>N</i> .....          | 387      | 2,485        | 13,547                  |

in each category. The second column lists the number of actor-years in each category, and the third column lists the number of investments with each category. (The actor-years need not be consecutive, but for the vast majority of actors, they are consecutive.) As noted above, one would expect the theory discussed above to apply most strongly to those entities whose primary form of economic activity is venture capital. The more that a decision-making entity is subject to competitive stimuli from outside of the venture capital markets, the less that the competitive dynamics within this market should lead to the sorting processes specified in the hypotheses. Accordingly, I will conduct the analyses with the population of investing entities defined in three ways: (1) only U.S.-based venture capital firms ( $N = 248$ ), (2) U.S.-based venture capital firms and other U.S.-based financial institutions ( $N = 238 + 13 + 18 + 7 = 276$ ), and (3) all entities making more than five investments in year  $t$  ( $N = 387$ ). If reinforcement-based learning is the driving mechanism behind the sorting process, one would expect the strongest effects of network on sorting in the subsample of dedicated venture capital firms, somewhat weaker effects in the sample that includes all financial firms, and the weakest effects in the full population.<sup>6</sup>

#### Dependent Variable: Average Investment Stage

Measuring the average stage of a venture capitalist's investments is straightforward. The SDC Venture Economics database categorizes investments into the three investment stages discussed above. To reiterate,

<sup>6</sup> One might reasonably ask why I do not simply construct interaction effects by type of firm. The reason is that the inclusion of firm-specific effects precludes the estimation of such interaction effects.

TABLE 2  
DISTRIBUTION OF FUNDING BY  
STAGE

| Stage     | <i>N</i> of Investments |
|-----------|-------------------------|
| 1 .....   | 7,525                   |
| 2 .....   | 4,706                   |
| 3 .....   | 1,300                   |
| Total ... | 13,531                  |

NOTE.—Total number of investments for this table is 16 less than the total number of investments in table 1 due to missing data on investment stage for 16 investments.

an entrepreneurial firm is considered a first-stage investment when it does not yet have a viable product. It is identified as a second-stage investment when it has a viable product but is not yet able to profitably manufacture and distribute the product. Finally, the entrepreneurial firm is categorized as a third-stage investment when it is generating a profit. Table 2 reports the distribution of investments across the stages. As should be clear, there is a strong decline in the number of stage 3 investments. This implies that the vast majority of firms either go public or fail before becoming profitable.

I assign first-stage investments a value of 1, second-stage investments a value of 2, and third-stage investments a value of 3. I then add up the values associated with a firm's investments in a given year and divide by the total number of investments. The range of this variable is accordingly 1–3.

There are two concerns that one can have about this dependent variable. First, because the stages are simply ordinal, there is an obvious arbitrariness in assuming that the interval distance between the values for stage 1 and 2 is identical to the interval distance between the values for stage 2 and stage 3. That is, one could just as easily assign stage 1 investments a value of 0.5 rather than a value of 1, and such a change would obviously affect the value of the dependent variable and accordingly the point estimates in the analysis. Second, because the dependent variable is bounded at one and three, heteroscedasticity is a concern. On account of these two issues, I will conduct the analyses with a second dependent variable—the proportion of investments that are *not* in stage 1.<sup>7</sup> Because this variable is a proportion, heteroscedasticity is less of a

<sup>7</sup> I used the proportion *not* in stage 1, rather than proportion in stage 1, as the dependent variable so that the hypothesized coefficients are in the same direction as when the dependent variable is average investment stage. With both dependent variables, a higher value means that the firm has a portfolio of investments that is more shifted to the later rounds.

concern, and because the proportion implicitly dichotomizes the coding of investments into those that are in stage 1 and those that are not in this stage, interval distance is not a concern. Of course, this outcome measure is not as sensitive to stratification in the later rounds. However, to the extent that the results are robust across both outcome measures, we can be relatively confident in the analyses.

### Independent Variables

*Structural holes.*—To measure the structural holes in a venture capitalist's network, I rely on Burt's (1992) measure of autonomy. Formally, Burt (1992) defines actor  $i$ 's autonomy as follows:

$$H_i = 1 - \sum_{i'} (p_{ii'} + \sum_q p_{iq} p_{qi'})^2, i \neq i' \neq q,$$

where  $p_{ii'}$  denotes the proportion of  $i$ 's network that is invested in the relation with  $i'$ ,  $p_{qi'}$  indicates the proportion of  $q$ 's network that is invested in its relation with  $i'$ .<sup>8</sup>  $H_i$  can range from 0 to 1. As  $i$  is connected to an infinite number of others who are themselves disconnected,  $H_i$  approaches 1. If  $i$  is connected to only one other actor,  $H_i = 0$ . For the purposes of this analysis, I identify a venture capitalist's network from the venture capitalist's joint involvement in financing entrepreneurial start-ups. That is, when venture capitalist  $i$  invests in the same start-up as venture capitalist  $i'$ , I code that joint participation as a tie between  $i$  and  $i'$ . Therefore,  $H_i$  is a positive function of the number of different venture capitalists with which  $i$  is involved and the extent to which those other venture capitalists themselves invest in numerous, different start-ups. Conversely, if  $i$  makes a small number of investments, and the other venture capitalists in these investments constitute a clique with identical investment patterns, then  $H_i$  will be relatively low.

Because I am examining changes in the stage in which venture capital firms invest over time, I allow the venture capitalist's network to vary over time and identify the structural holes in actor  $i$ 's network at time  $t$  as  $H_{it}$ . I use a moving "one-year window" to identify ties among venture capitalists. That is, venture capitalist  $i$  and venture capitalist  $i'$  have a tie if they jointly financed a start-up in the same year. Burt's autonomy measure allows for a continuous measure of tie strength. For the purpose of the analysis, I weight a tie between two venture capitalists by the number of deals that they jointly finance.

*Status.*—To measure the status of the venture capital firms in year  $t$ ,

<sup>8</sup> Burt uses  $A_i$  as the notation to represent the autonomy of actor  $i$ ; however, I use  $H_i$  to make it clear that this is the indicator of the extent of holes in an actor's network.

I construct a matrix based on the joint involvement of venture capitalists in financing entrepreneurial start-ups. That is, I construct a matrix  $R_t$  in which cell  $R_{iit}$  denotes the number of times that venture capitalist  $i$  and  $i'$  jointly financed a start-up in year  $t$ . Given  $R_t$ , I then calculate status scores based on Bonacich's (1987) measure:

$$s_t(a, B) = \sum_{\kappa=0}^{\infty} aB^\kappa R_t^{\kappa+1} \mathbf{1}.$$

In this expression,  $a$  is an arbitrary scaling coefficient,  $B$  is a weighting parameter that can range between zero and the absolute value of the inverse of the value of the maximum eigenvalue of the matrix  $R_t$ ,  $\mathbf{1}$  is a column vector where each element has the value "1," and  $s_t$  is also a column vector where element  $S_{i,t}$  denotes the status of venture capitalist  $i$ . Given this specification, a venture capitalist's status is a function of the number and status of the firms with which it jointly finances start-ups; the status of these financing partners is in turn a function of the number and status of their syndicate partners, and so on. Particularly given that I include the number of deals in which a venture capitalist has participated as a control variable in the analysis (see below), this status measure reflects the extent to which a firm has financing partners who are "players." Status scores are standardized such that the highest status firm in any given year has a status of "1." The  $B$  parameter is set equal to the reciprocal of the maximum eigenvalue, though there is an extremely high correlation among status scores for different values of this parameter. The distribution is skewed, with many more low-status firms than high-status firms. This skewed distribution is consistent with the status distributions observed in other industries, such as investment banking (Podolny 1993) and wine (Benjamin and Podolny 1999). Descriptive information reported in table 3 provides more information on the distribution of the status score.

Conversations with those in the industry provide at least anecdotal support for the use of this particular measure. Lower-status venture capitalists express a strong desire to be included on deals financed primarily by higher-status firms, and higher-status venture capitalists occasionally refuse to finance a venture if that venture is receiving financing from a lower-status venture capitalist. In effect, to be high-status is to be an insider; to be a low-status actor is to be an outsider, and joint financing constitutes a symmetrical form of deference in which each venture capitalist acknowledges the standing of the others that are included in the deal.

*Control variables.*—I include two control variables in the analysis. First, I include the number of investments made by the venture capitalist in

year  $t$ . There are several reasons to include this variable as a control variable. First, to the extent that there is evidence consistent with the elaborated hypotheses, I would like to disentangle the effects of status and structural holes from the volume of activity in which a venture capitalist is engaged. It is possible that at least some observed network effects could be the spurious consequence of the volume of activity in which a venture capitalist participates. Second, the number of deals in which an actor is engaged is a measure of an actor's experience, and to the extent that the actor learns from experience, an actor's total amount of investments should reduce the uncertainty that it confronts in making subsequent investment decisions. Since there is more egocentric uncertainty and thus more to learn about investing in the early stages than in the late stages, I would expect that such learning from experience would have a greater effect on a firm's ability to make judicious early-stage investments than judicious late-stage investments. In effect, whereas status should push firms to make more late-stage investments, experience—like structural holes—should push actors to engage in a high proportion of early round investments.

A second control variable is the number of funds from which a venture capital firm makes investments in year  $t$ . As noted above, a venture capital firm can have more than one fund from which it makes investments at any particular time. There are three reasons for including this control variable. The first two reasons are similar to the reasons for including the lagged number of deals as a control variable. As with number of deals, lagged number of funds is likely to be an indicator of both size and experience. To the extent that the number of funds is an indicator of size, I want to distinguish any potential structural hole and status effects from a possible size effect. To the extent that number of funds is an indicator of experience, number of funds should have a negative effect on the average stage of a venture capital firm's investment. The third reason for including this control variable is to rule out an alternative explanation for the hypothesized effect of status. I have argued that high-status firms should be more likely to make late-stage investments because status is most valuable in those market segments in which a firm knows how to best leverage its status in forming exchange relations. However, if higher-status firms generally have access to more financial resources than lower-status firms, high-status firms may be forced to make more late-stage investments because—with the notable exception of biotechnology start-ups—early-stage investments generally have small capital requirements. For example, the capital requirements for a first-stage software company, which is engaged in the development of a product, are typically much less than the capital requirements of a second- or third-stage software company, which must either put together or at least outsource manufac-

TABLE 3  
DESCRIPTIVE STATISTICS

| VARIABLE                | MEAN            |        |                 |                    |
|-------------------------|-----------------|--------|-----------------|--------------------|
|                         | 25th Percentile | Median | 75th Percentile | Average Investment |
| Stage .....             | 1.56 (.46)      | 1.20   | 1.50            | 1.90               |
| Structural holes ...    | .83 (.17)       | .81    | .88             | .93                |
| Status .....            | .11 (.16)       | .01    | .04             | .13                |
| <i>N</i> of deals ..... | 34.79 (39.83)   | 11     | 22              | 43                 |
| <i>N</i> of funds ..... | 2.24 (1.74)     | 1      | 2               | 3                  |

NOTE.— $N \times T = 2,470$ . Total  $N \times T$ (investor-years) for this table is 15 less than the corresponding total in table 1 due to missing data on average investment stage for 15 investor-years. Numbers in parentheses are SDs.

turing and distribution functions. Put simply, the high-status firms may simply have too much money to invest in early-stage firms. In short, there are at least two reasons to expect that the effect of number of funds will be positive and at least one reason to expect that the effect will be negative. Since I include this variable only as a control, I do not hypothesize as to whether the negative or positive effect should be stronger.

Finally, in addition to these two control variables, I include firm-specific effects,  $\sigma_i$ , and period-specific effects,  $\tau_t$ . These effects simply control for unobserved heterogeneity that would be common either to all of the observations drawn from a particular firm or all of the observations drawn from a particular year.

## RESULTS

Table 3 presents the descriptive statistics for both the dependent and explanatory variables. Table 4 reports the bivariate correlations between the main explanatory variables in the analysis. It is noteworthy that the correlation between structural holes and status is 0.23. While the correlation is statistically significant, it should be clear that the two measures are empirically distinguishable.

Table 5 depicts the regression results when the population includes only identified venture capital firms. Models 1 and 2 respectively exclude either status or structural holes; models 3 and 4 represent the complete model. The difference between models 3 and 4 is in the dependent variable. In model 3, the dependent variable is average investment stage. In model 4, the dependent variable is proportion of investments not in stage 1.

Looking first at the control variables, number of deals done over the last year does not have a significant effect on average round of investment. Number of funds does have a significant negative effect in the first column,

TABLE 4  
CORRELATIONS OF EXPLANATORY VARIABLES

| Variables               | Status | <i>N</i> | <i>N</i> of Funds |
|-------------------------|--------|----------|-------------------|
| Structural holes ...    | .23    | .26      | .19               |
| Status .....            | ...    | .71      | .55               |
| <i>N</i> of deals ..... | ...    | ...      | .75               |
| <i>N</i> of funds ..... | ...    | ...      | ...               |

NOTE.—All correlations are statistically significant at the  $P < .05$  level.

when status is excluded from the analysis. However, the variable becomes marginally insignificant when status is included.

Turning to the main effects, the results are consistent with the basic hypotheses. The fact that these results are based on within-firm variance is especially noteworthy. Because all cross-sectional variation is removed due to the inclusion of the fixed-effects for each firm, the results show how a firm's investment decisions change as the firm's network changes. As a venture capital firm acquires a "deal-flow" network that is characterized by numerous structural holes, the firm makes a greater proportion of its investments in the earlier stages. As the firm acquires a network that is indicative of greater status, it makes a greater proportion of its investments in the later round. Notably, the results are robust with respect to the different operationalizations of the dependent variable.

However, because both operationalizations of the dependent variable are ratio variables, there is some ambiguity in how to interpret shifts in the variable. A positive shift could imply an increase in the numerator, a decrease in the denominator, or both. For example, simply by looking at the dependent variable, we cannot tell if high-status firms are undertaking less early-stage investments, more late-stage investments, or both. However, the control variable for number of deals helps to resolve this ambiguity. Because number of deals is not significantly related to average investment stage, those firms that add late-stage investments must be reducing their early-stage investments. Similarly, those firms that are increasing their number of early-stage investments are reducing the number of late-stage investments. Thus, the structural hole effect implies a true shift from late stage to early stage, and the status effect implies a true shift from early stage to late stage.<sup>9</sup>

<sup>9</sup> To the extent that there is reason to worry about reverse causality, it is possible to provide a check by repeating the analysis, but rearranging the temporal sequencing of the variables. Specifically, one can perform the analysis with average investment stage at time  $t$  and the network variables measured at  $t + 1$ . The coefficients associated with the network variables are insignificant, with both  $t$ -ratios less than 1. This check provides some added confidence that the causality flows in the hypothesized direction.

TABLE 5  
EFFECT OF EXPLANATORY VARIABLES ON INVESTMENT ROUND DISTRIBUTION WITH  
ONLY VENTURE CAPITAL FIRMS INCLUDED IN POPULATION

| VARIABLE             | MODEL                      |                           |                            |                            |
|----------------------|----------------------------|---------------------------|----------------------------|----------------------------|
|                      | 1                          | 2                         | 3                          | 4                          |
| Structural holes ... | -.14 <sup>+</sup><br>(.07) | ...                       | -.14 <sup>+</sup><br>(.07) | -.12 <sup>+</sup><br>(.05) |
| Status .....         | ...                        | .22 <sup>+</sup><br>(.10) | .22 <sup>+</sup><br>(.11)  | .13 <sup>+</sup><br>(.08)  |
| N of deals .....     | 2.9e-4<br>(5.8e-4)         | 4.5e-4<br>(6.5e-4)        | 3.23e-4<br>(6.5e-4)        | 4.9e-4<br>(4.9-4)          |
| N of funds .....     | -.02*<br>(.01)             | -.02<br>(-0.012)          | -.02<br>(-0.012)           | -.014<br>(.009)            |

NOTE.—N = 1,783. Dependent variable for cols. 1–3 is average investment round. Dependent variable for col. 4 is proportion of investments not in round 1. Indicator variables for years are not reported, but are included in all models. SEs are reported in parentheses.

<sup>+</sup> P < .05, one-tailed test.

\* P < .05, two-tailed test.

Table 6 reports the results for the full model with average investment stage as the dependent variable. However, the population is defined in three different ways. For the results in column 1, the population is defined only as venture capital firms. Accordingly, the results in this column are identical to the results in column 3 in table 6. Column 2 reports results when the population is defined as all financial institutions making investments in start-ups, and column 3 reports the results when the population is defined to include all actors making investments in start-ups. The effects are weaker—indeed, they are not statistically significant—when the population is defined to include all actors. The results are significant when the population is defined as all financial institutions, but the positive effect of status nonetheless declines. As noted earlier, such a pattern of results is consistent with a reinforcement-based mechanism. Relatively diversified actors, whose financial success is not strongly linked to their financial investments, are not nearly as responsive to the pressures to sort into a market niche in which their network fits the level of egocentric uncertainty.<sup>10</sup>

<sup>10</sup> While the results in table 5 are consistent with the hypotheses, one might still question why high-status venture capitalists move to the later stages. One's argument might go something like the following: while there is less egocentric uncertainty in the later stages than in the earlier stages, there is presumably also less altercentric uncertainty. Accordingly, while the ability of high-status venture capitalists to discriminate good from bad investments goes up in the later stages, the ability of investors to discriminate between good and bad investments presumably also increases. Investors therefore do not need to rely on the signal of status as much when they invest in late-stage investments as when they invest in early-stage investments. Thus, even if a high-status

TABLE 6  
EFFECT OF EXPLANATORY VARIABLES ON INVESTMENT ROUND DISTRIBUTION WITH  
DIFFERENT POPULATION DEFINITIONS

| Variables            | Venture Capital Firms<br>(1) | All Financial Firms<br>(2) | All Firms<br>(3)    |
|----------------------|------------------------------|----------------------------|---------------------|
| Structural holes ... | -.14 <sup>+</sup><br>(.07)   | -.14 <sup>+</sup><br>(.06) | -.06<br>(.06)       |
| Status .....         | .22 <sup>+</sup><br>(.11)    | .15 <sup>+</sup><br>(.09)  | .11<br>(.08)        |
| N of deals .....     | 3.23e-4<br>(6.5e-4)          | -1.9e-4<br>(4.4e.4)        | -1.5e-4<br>(4.7e-4) |
| N of funds .....     | -.02<br>(-.012)              | -.016<br>(.01)             | -.015<br>(.010)     |
| N × T .....          | 1,783                        | 2,046                      | 2,470               |

<sup>+</sup>  $P < .05$ , one-tailed test.

## CONCLUSION

At a specific level, this article has highlighted how structural holes and status represent assets for addressing different types of market uncertainty. Whereas previous research has highlighted the utility of status for reducing altercentric uncertainty, this article shows that status leads a focal firm to avoid segments that are high in egocentric uncertainty. In direct contrast, a network position with many structural holes leads a firm to select market segments that are characterized by this latter type of uncertainty.

At a broader level, this article has drawn attention to two alternative ways in which network scholars have conceptualized networks in markets. One is as a conduit or pipe for information and resources. The second is as a lens or prism through which the qualities of actors are inferred by potential exchange partners. While this first view has been well-developed

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venture capitalist has a better understanding as to where to "spend" its status in the later stages, the high-status venture capitalist cannot as easily capture the rents from that status. An increment in status accordingly would seem to have an indeterminate effect on average investment stage. However, such a concern is based on a false premise: as noted above, whereas venture capitalists make investments in individual start-ups, the investors who provide financial capital to the venture capitalists generally do not. Rather, they put their money into a venture fund, and the venture capitalist managing that fund will distribute the financial capital across a range of companies. Because investors typically put their money into this fund before they know which companies at which stages will be financed and because the fund is aggregated across multiple investments, the investor is not nearly as sensitive to shifts in uncertainty across investments as the venture capitalist. So, while egocentric uncertainty—the uncertainty of the venture capitalist—varies considerably from the early stage to the last stage, altercentric uncertainty can generally be regarded as constant. There is then no countervailing uncertainty-induced cause for high-status firms to shift to the early stages.

over the last decade or so, this second view has only recently been a defining orientation for network research.

In my view, a particularly important direction for future research will be to consider the macrolevel implications of these results. For example, if egocentric uncertainty undercuts a high-status firm's ability to sustain its status, one would expect much less stable status orderings in high egocentric uncertainty markets. Another direction for further research would be to apply the conceptual distinctions and test the basic hypotheses in other domains. For example, consider a political arena, like a legislature. Each politician within the legislature has bills that she wishes to pass, but in order to win approval, she must win the support of a majority of her colleagues. Just as one can apply the concepts of egocentric and altercentric uncertainty to the market, so one could apply egocentric and altercentric uncertainty to this domain. For example, in putting forward a bill on some complex topic like health care, the legislator putting forward the bill may face considerable egocentric uncertainty in trying to design a bill that will yield the outcome that she desires. There is also altercentric uncertainty; the colleagues of the legislator proposing the bill may have doubts as to the "quality" of the bill (i.e., whether the bill's espoused potential will be realized). As in the market, these types of uncertainty are analytically distinguishable. For example, the legislator may have no uncertainty about the actual impact of the bill either because the bill is not very complex or because the legislator has considerable knowledge of the issue area. However, if the legislative arena is characterized by considerable mistrust, there may nonetheless be considerable altercentric uncertainty. As in the market case, one would expect that a network rich in structural holes would be especially helpful in resolving egocentric uncertainty, whereas a high-status network would be especially helpful in overcoming the doubts of colleagues that would arise in a situation of high altercentric uncertainty. In short, regardless of whether one focuses on the macrolevel implications of this research within the market context or considers the applicability of the concepts and arguments in other contexts, the findings of this article lay a foundation for further research.

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