Bridge Supervision: Correlates of a Boss on the Far Side of a Structural Hole

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ABSTRACT

Bridge supervision occurs when the connection between manager and boss is a network bridge between separate social worlds. Improved communication technology has facilitated the use of bridge supervision. Manager and boss can easily interact by audio or on screen as a pair of people disconnected from surrounding colleagues. At what cost to manager and effective management? We argue that bridge supervision affects the way in which a manager plays his or her role, but not how well the role is played. We find clear support for the argument in a traditional corporate hierarchy. Managers operating under bridge supervision exclude the boss from their work discussion and are conservative in expressing emotion. Behavioral correlates notwithstanding, compensation and good ideas have their familiar association with network brokerage independent of bridge versus embedded supervision. In sum, bridge supervision affects manager style, but not performance. We discuss implications for future research.

Management research — drawing on psychology and sociology, rooted in the "Golden Age" of social psychology — has done well in connecting performance with the social network around a manager. Managers who coordinate across disconnected colleagues are, relative to peers, associated with higher compensation, more positive evaluations, proposing more valuable ideas, and faster promotion to leadership positions (critique and review in Kwon et al., 2020; Burt, 2021; Tasselli & Kilduff, 2021; Brass, 2022). Tradition in this research is to model the manager as ego dealing with variably connected colleagues. The colleagues can vary in their attributes or distribution in social structure so as to make ego's interface with colleagues more or less advantageous, but the focus is on the interface: ego draws upon and deals with a surrounding network of colleagues.

The focus has been productive, but it ignores a network condition that occurs with some frequency: There are social environments in which one colleague stands out from the others, not in the familiar network sense of being more central, or in some other way distinguished by the network structure around ego. Rather, the one colleague stands out because ego's role is so much defined exogenously in terms of the colleague that ego's behavior in his or her role is in some large part dependent on the network around the colleague as well as the network around ego. To make accurate network predictions about ego, data on the network around ego, traditionally termed an "ego network" (Perry, Pescosolido & Borgatti, 2018; Small et al., 2021), needs to be expanded to describe the "dyad network" composed of ego, the colleague, key contacts they share, and key contacts they have separately. How ego and colleague plug into one another's networks is a factor in ego's behavior. A factor in the behavior of a child is the network around parent and child (Coleman, 1988, 1990). A factor in the way a husband or wife plays their role is the network around both husband and wife (Bott, 1955, 1957). A factor in the behavior of a buyer or seller is the network around both buyer and seller (Bernstein, 2016, 2019; Casciaro &

Piskorski, 2005). A factor in the technologist's innovation is the network around technologist and administration partner (Ter Wal, Criscuolo, McEvily, Salter, 2020).

We make no pretense that attention to dyad networks is an innovation. The above research is well known and goes well back in time. But dyad networks have not been an element in research on the competitive advantage provided by a manager's network. We draw on previous work to integrate dyad networks into that ongoing research.

We focus on one of the core role relations in a manager's network, the supervisory relation between manager and boss. In a brilliant piece of sociological reasoning, Stolzenberg (1978) long ago argued for bringing the boss into analyses of income and status achievement. Research at the time had long ignored employers in favor of describing the extent to which a man benefited from the occupational status of his parents. Stolzenberg argued that large organizations could be multipliers in that people who get a job in a large organization have access to more resources that help them do more with their education and abilities (cf., Coleman, 1988, 1990, on social capital as a multiplier of returns on human capital). Current argument and evidence gets closer to the people involved, describing the extent to which, and conditions under which, the network structure around a manager is a correlate of earnings and achievement. Still, there is an important element missing that is highlighted by Stolzenberg's call to "bring the boss back in," namely, the boss continues to be ignored in the network theory predicting manager performance. We know quite a bit about the performance implications of the network around a leader, but precious little about the performance implications of where the boss is located in that network, or where the leader is located in his or her boss' network.

Ostensible exceptions illustrate the point. Bosses have certainly been distinguished in network research. For example, in "Bringing Managers Back In," Castilla (2011) analyzes the extent to which support staff in a large organization are given different work evaluations by

their current boss versus previous boss. Castilla (2011:679) reports more similar evaluations when current and previous boss are socially connected (ever worked previously in the same office) or demographically similar (gender/race/nationality), but the social network around bosses and employee remains implicit in the analysis. Armed with explicit network data, Burt (2007, 2010) tests for spillover benefits from affiliation with a network broker, and in one test specifically for spillover benefits from having a boss who is a network broker (Burt, 2010:103-105). The manager's boss is brought into the analysis, but only as a disconnected variable: network measures of the boss's network are added to the equation predicting manager performance from network measures of the manager's network. The analysis includes no information on a manager's connection with his or her boss, or the boss' location in the manager's network, or the manager's location in the boss' network. Armed with fulsome network data across levels of supervision, Mehra, Dixon, Brass, and Robertson (2006) study a company's sales managers in terms of their network of friendships with other sales managers, with leaders above them, and with subordinates within the team run by a manager. Teams making high sales tend to be run by managers central in the networks of other managers, leaders, and members of their team. Team sales are a performance metric at the level of subordinates, but Mehra et al. analyze sales in the aggregate, at the team level, which measures team manager performance. Bosses of individual team managers are not distinguished in the networks, and where supervision is clear — between manager and team member — member performance is not distinguished. This is not criticism of the study. It is merely an observation that the study is about performance implications of team leader networks, not the performance implications of dyad networks.

Further back in time, Podolny and Baron (1997) argued for distinguishing structural holes in networks of different kinds of relations. Structural holes in a manager's buy-in network create confusion and stress for a manager – which should have a negative effect on

promotion. Structural holes in the information network should have the benefits sketched in the structural hole argument – which should have a positive effect on promotion. Consistent with their argument, Podolny and Baron (1997:688) show that promotion in fact has a positive association with dense buy-in networks ("indirect ties") and a negative association with dense information networks. The key point for this paper is that Podolny and Baron's focus on authority versus information relations did not require the boss to be distinguished in the analysis, nor the boss's contacts to be included. Further back in time, leader-member exchange theory (LMX) is rich with correlates of supervision (Gerstner & Day, 1997, review), but blind to the surrounding network in which supervision is embedded (promising exceptions are discussed in our conclusion).

Inspired by the thrust of Stolzenberg's question for stratification research, we ask the same question for network research predicting manager performance. What we have in mind is illustrated in Figure 1. The figure contains sociograms of two dyad networks, drawn from a study population to be introduced shortly. Connected people who connect with the same other people are close together in the sociogram (Borgatti, 2002). The focal manager (ego, indicated by a dark square) has a set of work contacts (dark dots). A bold line connects focal manager to boss, who is surrounded by boss work contacts (hollow triangles).

Both networks in Figure 1 illustrate what we will term "bridge supervision." The key feature common to the two networks is that manager and boss have no mutual contacts. A further wrinkle is that the manager in Figure 1A is a network broker — a manager whose network connects across structural holes. More specifically, the manager in Figure 1A has strong connections with three core people in his team, and they have strong connections with one another, but the manager's several other connections are with colleagues outside his group, disconnected from one another (Hansen & von Oetinger, 2001, on "T-shaped" managers). The many structural holes spanned by the network in Figure 1A define low

network constraint for the manager (17.12), which is well below average in the study population (-1.23 z-score). (Network constraint is high if a manager's contacts are few, talk to one another directly, or share information indirectly via a central contact. We return to this in the data section.) With such a network, rich in access to structural holes, the manager in Figure 1A is predicted by network theory to be a high performer. In some ways he is and in some ways not: In a survey of ideas for improving the organization, he contributed an idea evaluated by top management to be more valuable than the average idea they heard (0.50 z-score idea value), but his salary is well below average (-1.73 z-score salary).

One explanation is the network around manager and boss. The boss has a large network of contacts, also rich in structural holes (-1.61 z-score constraint), and she is doing extremely well in the organization (4.20 z-score salary in a job rank only slightly higher than the manager's). None of the manager's contacts is connected to the boss and none of the boss' numerous contacts is connected to the manager (9 manager contacts, 29 boss contacts, 0 mutual contacts). There is one indirect connection through a manager contact to a boss contact.

In short, manager and boss live in separate social worlds. Their supervisory relationship is a network bridge between the worlds. Perhaps the social distance between manager and boss puts the manager low in the boss' priorities for salary increases. Perhaps the distance frees him from the status quo to have a more independent view of operations so his idea for improving the organization is of higher value in the eyes of top management than it would have been if he were buried in the boss' network. On the other hand, his disconnection from his boss can limit his familiarity with corporate news. One of the managers in a situation like Figure 1A — nine manager contacts, zero mutual with the boss, -0.51 z-score network constraint — offered the following suggestion to improve the supply-chain organization: "Eliminate the Sourcing Council and delegate authority over all purchases to the local

business unit. My business/organizational philosophy is inextricably rooted in decentralization and flattened hierarchies, no ifs, ands, or buts. Centralization and stovepipe organizational structures are always dysfunctional." The manager might be correct, but he is definitely unwise in being so flatulently authentic. The company sourcing council is chaired by the executives judging ideas. They see little value in this idea (-.66 z-score).

——— Figure 1 About here ———

In Figure 1B, it is again true that none of the manager's contacts is connected to the boss and no boss contact is connected to the manager (6 manager contacts, 9 boss contacts, 0 mutual contacts). But here, the manager's contacts are densely interconnected. Of 15 possible connections between the manager's six contacts, nine are strong, which defines a high level of density (60% density, 1.62 z-score in the population). In other words, beyond having no mutual contacts with his boss, this manager has built up a close circle of colleagues that excludes the boss. That close circle of colleagues will create local social norms that can be foundation for manager opposition to the boss (in sentiment and opinion, if not behavior). The manager in Figure 1B operates under an average level of network constraint (39.18 points, 0.01 z-score) so he is expected by network theory to be an average performer. Indeed, his salary is slightly below average (-.36 z-score), but top management sees little value in his idea for improving the organization (-1.04 z-score). Does the boss have difficulty seeing the manager's virtues because of the separation between boss and manager? Is the manager in fact a mediocre performer, so the boss keeps him at arm's length, whereupon the manager found solace in a circle of local friends? How disconnected does the manager feel? For example, one of the managers in a situation like Figure 1B — four contacts, 100% density, does not cite her boss as someone with whom she often discusses work — was primarily troubled by the large number of people reporting to her supervisor (22 managers to one boss in her unit), which means that staff like her "does not get the direction nor support needed to

excel and improve processes." She recommended three ways to improve the situation: "(1) Relieve managers that oversee large staffs from other responsibilities so that they can manage their staff, or (2) Add more senior managers so that the staffs are smaller, or (3) Put in place a second line of supervision that can direct and support the staff." In short, this manager proposed to increase supervision costs — not a valuable idea according to the two executive judges (-0.27 z-score).

In contrast to bridge supervision in Figure 1, Figure 2 contains the sociogram of a dyad network around what we will term "embedded supervision," following Granovetter's (1992:44) image of structural embedding. Manager and boss have several mutual contacts (dark triangles), and only one contact that is not connected directly to his boss (1 contact unique to the manager, 13 contacts unique to the boss, 4 mutual contacts). Deep in the boss' network, with little personal access to structural holes, the manager's network constraint score is slightly above average (42.15 points of constraint, 0.13 z-score). The manager is predicted by network theory to be a perfectly adequate performer. In fact, the manager's salary is well above average (1.14 z-score), however, his idea for improving operations is evaluated by top management to have little value (-1.43 z-score idea value). Perhaps we have in this manager a person of modest ability whose ideas are evaluated to have little value when engaged by top management, but whose friendly loyalty to his immediate supervisor elicits positive evaluation and corresponding compensation within his boss' span of control. On the other hand, does the manager feel oppressively supervised by the boss? "Too much micromanagement!" is how one manager described the organization from his situation similar to Figure 2 (one contact unique to manager, 14 contacts mutual with boss).

——— Figure 2 About here ———

Our goal is to replace the anecdotal explanations in the above paragraphs with systematic evidence across managers. Our discussion is in four parts: We begin with a discussion of network theory and research to make predictions about behavior and

performance correlates of bridge versus embedded supervision. We then introduce measures

for a study population in which compensation and good ideas are known correlates of

manager networks. We present results, then conclude and discuss future research.

BRIDGE VERSUS EMBEDDED SUPERVISION

A continuum from embedded supervision to bridge supervision exists in terms of variation in

segregated cohesion. At the embedded end, manager and boss are peas in the same pod: a

pair of people connected by a supervision relationship, jointly dealing with mutual colleagues

connected with one another. At the bridge end of the continuum, manager and boss are

connected by a supervision relationship that reaches across a structural hole between manager

and boss; manager contacts are variably connected with one another and disconnected from

boss contacts, who are variably connected with one another. The more dense the connections

on either side of the structural hole, the deeper the structural hole, and the more that

supervision has to be exercised as a bridge across the structural hole. Manager and boss are

jointly members of the same constituency under embedded supervision (Figure 2). Under

bridge supervision, the manager answers socially to a constituency separate from the

constituency to which the boss answers, the manager playing to his colleagues as the boss

plays to her colleagues (Figure 1). Whether by accident or intent, manager and boss playing

to different colleagues can end up working at cross purposes. But when the colleagues on one

side of the supervision bridge are strongly connected to one another, they are a constituency

likely to agree with one another in the propriety of their interests being served (Figure 1B).

Such cohesive, informal groups exercise social pressure on members to privilege their

interests over the interests of outsiders (Festinger, Schachter & Back, 1950; Schachter, 1951,

for classic research; Burt, 2005:Chp. 4, 2010: Chp. 8, for review in terms of subsequent

network analysis). We use the term "bridge supervision" to refer to a condition in which the

relationship between manager and boss is a network bridge between two social worlds. The fewer mutual contacts shared by manager and boss, the more separate their social worlds, and so the more bridge-like the supervisory relationship. The more dense the connections among a manager's exclusive contacts, the more those contacts are a constituency for the manager separate from the boss — and so the more bridge-like the supervisory relationship. Note that cohesion alone does not indicate bridge supervision. The managers in Figure 1A and Figure 2 are both embedded in dense networks. It is the cohesion of manager 1A's exclusive contacts that deepens the structural hole spanned by his bridge to the boss.

The logic of bridge supervision is symmetric from the perspective of manager or boss so it can be studied from either side. Bridge supervision exists when manager and boss deal with different colleagues, but the manager's colleagues can be cohesive regardless of the boss, and result in the manager treating the boss as an outsider. The boss' colleagues can be cohesive regardless of the manager, which would result in the boss treating the manager as an outsider. We expect that cohesion on both sides of the bridge makes for a stronger condition of bridge supervision. We choose to tell the story from the manager's side of the bridge because that is where most research provides representative data.

Bott Hypothesis: Conjugal Role Segregation

Given the network structure defining a condition of bridge supervision (separate, cohesive constituencies around manager versus boss), and the network mechanism of social pressure for conformity within cohesive informal groups, bridge supervision has expected correlates described as "role segregation" in Bott's (1955, 1957) classic network analysis of conjugal roles (which has inspired research well into contemporary practice, Bidart, 2021). In the early 1950s, clinical psychologist Elizabeth Bott studied twenty families in London to describe and explain variation in the way that husband and wife played their conjugal roles. There was nothing remarkable about the families; in fact, they were selected for study precisely because

there was nothing remarkable about them. The study was initially titled "A Study of Ordinary Families" (Bott, 1955:345; see Savage, 2008, for related work by Bott's colleagues).

Bott reported a conspicuous difference between families in the extent to which husband and wife segregated their conjugal roles into stereotypical gender behavior. The Newbolts illustrated high segregation (Bott, 1957:70-73, our labels in parentheses): (Decisions) Husband controls the finances, with the wife given an allowance to maintain the household, and wife controls the household (rent, utilities, food, cooking, cleaning, etc.). (Privacy) Conjugal role activities between husband and wife are treated as the legitimate interest of one's friends. (Homophily) Husband and wife take it for granted that men have interests different from women. (Compatibility) Husband and wife deemphasize the importance of physical sexuality to a happy marriage. At the other extreme, Bott (1957: 79-84) described low segregation in five families: (Decisions) Husband and wife jointly determine the family's major financial decisions and both maintain the household. (Privacy) The conjugal relation is deemed private, outside the legitimate interests of one's friends. (Homophily) Husband and wife discuss as an open question the extent to which men and women have different interests. (Compatibility) Physical sexuality is emphasized as an important component in a happy marriage.

Variables like education, occupation, parental background and so on, would be prominent in a routine sociological explanation of Bott's observations. Limited to so few observations, Bott could not clearly rule out such explanation, but she felt that the usual social and psychological variables did not account for the differences she observed.

Instead, Bott (1957:65-70) saw explanation in the network around husband and wife. Segregated conjugal roles occur in networks that look like Figure 1. Husband and wife have strong relations with different people, the wife socializing with her friends, and the husband with his, so they play their conjugal role to their respective constituencies, rather than to one

another. In addition, segregation was high when the husband's friends met independent of the husband and the wife's friends met independent of the wife — as illustrated by the clusters around manager and boss in Figure 1B. In contrast, Bott (1957:74ff.) found low-segregation conjugal roles in networks that looked like Figure 2. Husband and wife share mutual friends, so each is friend to the other's friends, and they end up playing their conjugal role with respect to one another rather than to external constituencies.

Bridge Supervision and Manager Role Segregation

To the extent that networks operate in the workplace as they do in the neighborhood (an analogy, not an isomorphism), bridge supervision should be associated with work role segregation similar to the conjugal role segregation described by Bott. Corresponding to Bott's dimensions of conjugal role segregation associated with husband and wife socializing in separate networks, we distinguish in Table 1 dimensions of work role segregation. These are kinds of conditions expected to result from bridge versus embedded supervision.

Two points about Table 1 warrant note before we dig into it. First, the rows are symptoms of bridge supervision, not the substance. The substance is described in the previous section: exclusive and cohesive colleagues around a manager. When such a condition occurred around a spouse, Bott found the four dimensions in the rows of Table 1 descriptive of how a spouse segregated behavior in his or her conjugal role. The rows of Table 1 are conditions expected to result from bridge versus embedded supervision. Second, the table is a workplace analogy to Bott's observations, not a delineation of the data to be analyzed here. Our measures indicate three of the four rows in the table.

——— Table 1 About Here ———

The first two rows in Table 1 concern operations. With respect to decisions, managers operating under bridge supervision are more likely to take for granted that managers have a domain of authority separate from the boss. Boss issues are "above my pay grade." This is

not to say that managers operating under embedded supervision exercise joint authority with their boss. Rather, manager and boss are simply understood to overlap in expertise and experience such that manager and boss discuss decisions — not every decision, but some. The boss has a legitimate interest in manager decisions, and the manager has a legitimate interest in boss decisions.

With respect to privacy, managers operating under bridge supervision are more likely to feel that colleagues have a legitimate interest in what the manager and boss discuss. "What was that about?" "What came up in the last meeting?" "How did she respond when you told her that?" This is not to say that managers operating under embedded supervision never discuss with colleagues the content of meetings with their boss, but it would be viewed as rude for a colleague to ask for that information if the manager did not initiate discussion. Managers under embedded supervision own the content of manager-boss discussions jointly with the boss. Managers under bridge supervision take away from meetings with the boss juicy bits of information to share with colleagues. We cannot test the privacy dimension with the data to be analyzed here, but we include it in Table 1 because it was a dimension of role segregation in Bott's observations, making breeches of confidentiality a consequential implication of bridge supervision.

The two other dimensions in Table 1 are emotional. In Bott's analysis of conjugal roles, husband and wife in segregated roles see one another as fundamentally different kinds of people. In the workplace, managers operating under bridge supervision live in a social world separate from the world in which their boss lives. The manager can come to think of the boss as a different kind of person. There is acknowledged complementarity between manager and boss, but not a feeling of homophily (homophily is a tendency for relations to develop between people similar in some significant way, Lazarsfeld & Merton, 1954: 23-24; McPherson, Smith-Lovin & Cook, 2001:416-417).

Personal compatibility is a related dimension. In Bott's analysis, couples playing joint conjugal roles emphasized the importance of sexual compatibility — an opinion that stood in contrast to the opinion expressed by the role-segregated Newbolts that compatibility was not of central importance. Reaching for a similarity between manager and boss, managers operating under bridge supervision are more likely to opine that it is not essential to get along personally with the boss. "The boss does her job. I do mine. We get it done." Embedded supervision involves more social contact because of shared contacts, so getting along with shared contacts must translate into some manner of getting along with each other. If manager and boss do not get along personally, then they are more likely to feel the strain of not getting along because they socialize with mutual contacts. In short, whether they do or do not get along personally, manager and boss connected by embedded supervision are more likely to opine that personal compatibility is valuable to productive supervision.

To summarize, the four dimensions of role segregation vary on a broad contrast between personal and impersonal. Managers operating under bridge supervision are more likely to have an impersonal, distant connection with their boss. Manager and boss in Figure 1 come together under bridge supervision as representatives of separate constituencies. The manager is playing his role with respect to his colleagues. The boss is an element in his role performance, not the object. You do not have to like or admire the person who is your boss. You just have to deal with it. Like the color paint on the walls, or variably adequate wireless access, the boss is a characteristic of the situation subject to discussion with colleagues. In short, we expect bridge supervision to be associated with role segregation between manager and boss, giving us two hypotheses, one for each indicator of bridge supervision:

> *Hypothesis 1: The probability of role segregation decreases with the number of mutual contacts shared by manager and boss.*

> *Hypothesis 2: The probability of role segregation increases with the density of connections among a manager's exclusive contacts,*

where exclusive contacts are colleagues connected to the manager but not to the manager's boss. It is important here to control for the extent to which the manager is a network broker since brokers are less constrained by their network so they are more likely to behave independent of the boss as well as any other one contact.

Bridge Supervision and Manager Performance

For performance implications of bridge supervision, we lean on accumulating research about the connection between manager network and performance. Information and legitimacy are the two key variables in this research. Network brokers — managers with large, open networks — have information breadth, timing, and arbitrage advantages in detecting and developing good ideas (reviews by Burt, Kilduff & Tasselli, 2013; Baer, Evans, Oldham & Boasso, 2015; Kwon et al., 2020; Burt, 2021). Legitimacy enters as a contingency factor. For a would-be broker to benefit from his or her information arbitrage, the target audience has to accept the broker as a legitimate source of advice (Rider, 2009; Burt & Merluzzi, 2014; Burt, 2021).

Bridge supervision could have implications for the information and legitimacy components in the network prediction of performance. Under bridge supervision, a manager is more likely to circulate in pools of information separate from the boss, which increases the odds that the manager can provide the boss with a different perspective. On the other hand, the manager operating under bridge supervision is more likely to come up with ideas that are creative but also out of touch with current thinking in upper management. In casual meetings with the boss, the manager hears about people opposed to the boss's interests, alternative projects under consideration, people doing well, and people on the periphery. It is also in these casual meetings that the boss gets a sense of the manager's competence and common sense. To the extent that our first two hypotheses are true, social and emotional distance between manager and boss under bridge supervision means that the manager is less up to date

with interests and initiatives further up the corporate ladder, at least as the boss knows those interests and initiatives. Continuing the same line of thought into legitimacy, a manager operating under bridge supervision is not in the audience to which the boss plays. When allocating pay raises, or recommending people for promotion, boss priorities are to take care of the closer subordinates whose virtues are more obvious to the boss. Recall in Figure 1 that the salaries of the managers operating under bridge supervision are below average. The salary of the manager in Figure 2, operating under embedded supervision, is well above average.

But the managers in Figures 1 and 2 were selected for illustration, and the Bott Hypothesis is not about the adequacy with which roles are performed. It is about the way in which roles are performed. In fact, despite the illustrative cases in Figures 1 and 2. and despite role segregation correlates of bridge supervision, we do not expect bridge supervision to be correlated with performance. Our reason is that evidence from multiple organizations supports the argument that a manager's returns to brokerage are independent of the networks around his or her colleagues (Burt, 2007, 2010). On average, the network effect on performance comes from a manager's own network. Network advantage is a social psychological story about processing diverse information, rather than a diffusion story about locating scarce information. What matters are the skills acquired by working in a network rich in structural holes. Therein a manager develops human capital skills for moving information between people who think differently; skills of analogy, framing, conflict, patience. It isn't the diverse bits of information obtained that is the key to sustained advantage. It is the skills that ego develops in such a network for processing and recombining diverse bits of information.

Then again, dyad networks are not studied in the earlier work. The boss is included in the work when the boss is cited as a work-discussion colleague, but ignored if he or she is not cited. And, because there is no attention to the dyad network around manager and boss in the

earlier work, there is no analysis of how performance varies as a function of connections between manager and boss contacts. So — given correlates of bridge supervision that on face value could affect performance — we cannot be sure in our expectation about performance. Nevertheless, other factors constant, our expectation from prior work is that performance is independent of bridge supervision:

> *Hypothesis 3: Manager performance is independent of bridge supervision, as indicated by a lack of manager-boss mutual contacts or dense connections among a manager's exclusive contacts.*

Again, exclusive contacts are colleagues connected to the manager but not to the manager's boss. As with the first two hypotheses, it is important to include the control for access to structural holes. Even if the role segregation correlates of bridge supervision could potentially erode performance, there is the positive effect of bridge supervision freeing some managers to develop as a network broker, which is associated with high performance.

Hypothesis 3 is a null hypothesis. We do not intend to prove it. We simply expect it, and want to be explicit about that expectation. The hypothesis is important to test as an expectation because of its foundation in earlier research, and as a key practical implication of bridge supervision. If replication corroborates our evidence supporting Hypothesis 3, then the difference between bridge and embedded supervision washes out of the performance equation. That implies organizations face no performance costs in adopting the more-flexible, less-expensive bridge supervision, and the decision between bridge versus embedded supervision is a question of manager style rather than a criterion of effective management.

DATA

To test the hypotheses, we turn to a population of supply-chain managers in a large American electronics company. The company is a leader in its industry, with establishments in several urban centers across North America. It is not one of the electronics firms celebrated in the

press for innovation and progressive views. Reliability is a priority as much as innovation, and there is a traditional respect for corporate hierarchy. The data we use — obtained from company personnel records and a network survey — are well suited to our hypotheses, known for their evidence of compensation and creativity associated with network structure: The compensation, idea value, ego-network constraint measure, and control variables were used in Burt (2004) to show that managers with networks rich in structural holes enjoy higher compensation than peers and are more likely to come up with good ideas. The data were also used in Burt (2007) as one of three study populations used to test for spillover advantage from neighbor networks. Baseline established by those articles, we here look into the network structure of how supervision is exercised, and whether bridge supervision explains why some managers perform higher or lower than expected from prior prediction.

Dependent Variables: Performance

Compensation and good ideas are our performance measures. Compensation is a familiar hard measure of network-relevant performance, known to increase with access to structural holes (for review, Burt, 2005: Chp. 1; Kwon et al., 2020:1100). Creative good ideas are a familiar soft measure of performance relevant to network brokerage. Network brokers score high on creativity when creativity is measured by supervisor summary opinion of a subordinate's work (Perry-Smith 2006; Jang 2017; Carnabuci and Quintane 2018), by executive opinion of a manager's best idea for improving the organization (Burt 2004, 2005, Chap. 2), or by external critical opinion of final product (Fleming & Marx 2006; Fleming, Mingo & Chen 2007; deVaan, Vedres & Stark 2015; Soda, Mannucci & Burt 2021).

From company records, we have relative manager performance at the time of the survey measured as z-score salary ($-1.86 \leq$ z-score salary ≤ 4.08). Salary is determined in the usual way: a manager's boss recommends a salary increase at the end of the year, then people higher up the chain of command go with the recommendation, or cut it back, or make it a

little more generous. All three actions occur, but standard practice is to give the boss a budget constraint, and go with boss recommendations. Thus, as usual, compensation is a reason for managers to stay on the good side of their boss.

In preparation for re-organizing the supply-chain organization, an online survey was run to learn what the organization's current network structure looked like, a structure upon which any re-organization would have to be built. In the spirit of crowdsourcing the re-organization, surveyed managers were asked: "From your perspective, what is the one thing that you would change to improve [the company's] supply chain management?" The box into which responses were typed held a maximum of 2000 characters. All 673 managers in the study population were invited to the survey website, of whom 455 completed the survey (68%). The 455 survey respondents do not differ significantly from the 218 non-respondents in salary, business unit, geographic location, job rank, or demographic controls for age, race, gender, and education.

The goal was not to evaluate the ideas for creativity per se, but rather to assess for valuable creativity. That assessment was judged by two executives, each leading one of the company's largest business units, geographically distant from one another. Both judges were prominent for their experience in running their respective supply chain organizations. These judges were the people who would sponsor ideas, and whose careers would rise or fall with the value of the ideas they sponsored.

Each judge was given a list of the ideas, source unattributed, and asked to rate ideas on a five-point scale in response to the question: "How much value could be generated if the idea were well executed?" Each judge dismissed some ideas as not worth rating. As one judge expressed himself (Burt, 2004:379): "for ideas that were either too local in nature, incomprehensible, vague, or too whiny, I didn't rate them." Dismissed ideas were given a rating of zero. The six-point ratings from zero to five pass tests for bias, consistency between

judges, and face validity as discussed in the published report (Burt, 2004:377-386; 2005:66-72). We average the judge ratings for each idea and, since only the relative ratings of alternative ideas matter here, we standardize the average rating to a z-score measuring the extent to which an idea is judged more valuable than others (-1.43 ≤ z-score ≤ 2.05).

Dependent Variables: Role Segregation

Network data were collected by the usual survey method of name generators and interpreters (e.g., Marsden 2011; Perry et al., 2018:35-127). The questionnaire contained two name generators. After managers were asked for their idea to improve the supply chain, they were asked if they had discussed the idea with anyone. If yes, they were asked to provide the name of the person with whom they had discussed the idea. Next they were asked: "More generally, who are the people with whom you most often discuss supply-chain issues?" Up to seven names were recorded, for a total of eight names. The questionnaire then listed two name interpreters. The first asked for years of acquaintance with each cited person. The second asked about connections among the cited contacts. The respondent was guided through a matrix in which the respondent's perceived connection between each pair of cited people was coded as "often," "sometimes," or "rarely" discussing supply-chain issues with one another.

Citing the Boss as a Core Discussion Partner

We use failure to cite the boss as an indicator of role segregation. The boss was not mentioned by title in the network survey. Managers were asked to talk about their behavior, naming colleagues with whom they most often discussed work. Note that the manager does not have to cite the boss, each manager had up to eight opportunities to cite the boss, and

citation from the boss to a manager is a separate consideration.[1] We identify bosses from

company personnel records, from which we know that the majority of managers cite their

boss as a discussion partner. A third of them did not (33%). Not citing the boss reflects three

dimensions in Table 1: "Decisions" if the manager views the boss as working in a separate

decision domain so they need not discuss their work, "Homophily" if the manager views the

boss as a kind of person different from the manager so discussion is fraught with

misunderstandings, or "Compatibility" if the manager does not personally enjoy discussion

with boss. A boss-citation indicator does not measure specific role segregation conditions

expected from bridge supervision. It captures a fundamental condition: The boss does not

occur to a manager when naming up to eight people with whom the manager often discusses

work.[2]

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[1]Citations between manager and boss are related, but asymmetrically. Of the managers who did not cite their boss, none are cited by their boss. Of the managers who did cite their boss, two thirds are cited by their boss (65%). But some non-citing bosses could not cite the manager because they did not respond to the survey or were outside the study population ("Assembling the Dyad Network" in the Data section). Of the bosses with opportunity to cite a manager, almost all cited the manager who cited them (98%). Span of control contributes to the asymmetry. A manager has one formal boss available to cite. A boss can have multiple subordinate managers. The more subordinate managers a boss has, the less likely manager or boss cite the other. Of the 111 managers who report to a boss with one or two subordinates, 84% cite the boss as a discussion partner, and 62% are cited by their boss. Of the 168 managers who report to a boss with more than a dozen subordinates, those odds drop by almost half (49% cite the boss, 33% cited by the boss). Span of control is a suggestive route into the origins of bridge supervision, to which we return at the end of the paper in discussing future research.

[2]Not citing the boss as a discussion partner is a binary measure of tie strength — no citation indicating minimum strength. There is a qualitative difference between the binary measure and a continuous measure. Once the boss is on a manager's screen as a discussion partner, balance theory predicts that manager-boss emotional closeness increases with volume and strength of connections through mutual friends. Given an association between bridge supervision and not citing the boss, the association will be stronger for a continuous measure of tie strength because the latter captures two effects: the effect of bridge supervision blocking a manager seeing the boss as a discussion partner plus the balance-theory effect of emotional closeness increasing with number of mutual friends (e.g., Reagans, Singh & Krishnan, 2015). We are interested in the bridge-supervision component.

Displaying Emotion Up the Chain of Command[3]

We looked for an auxiliary segregation indicator with which we could corroborate results from the boss-citation indicator. Company personnel records provided no data on employee satisfaction or engagement. In the interest of securing a high response rate, the online survey was short, only asking for network and idea information immediately relevant to the pending re-organization.

We take advantage of the language used to propose an idea to get a sense of how a manager felt when sharing his or her idea. Where citing the boss as a discussion partner indicates communication, our second indicator is about communication comfort. We measure the emotion expressed in a manager's idea text. Displaying emotion indicates two dimensions in Table 1: the understanding presumed when talking to a person socially similar to yourself (Homophily), and the comfort of talking to someone who understands you and cares about how you feel (Compatibility). If bridge supervision fosters social and emotional distance between manager and boss as hypothesized, then presenting an idea to superiors should be less comfortable for a manager operating under bridge supervision that it would be for a manager under embedded supervision — the latter more accustomed to informal discussion with the boss, the former feeling like he or she has just walked "on stage." In a personal presentation, speaker discomfort can manifest in the choppy cadence of spoken text, or discomfort visible in a speaker's physical movements. With cadence and physical movement invisible in written text, an indicator of discomfort is a lack of emotion, the personal self kept hidden (Kahn, 1990). Emotion linked with network structure promises network consequences for creativity, engagement, and job satisfaction correlates of emotion (e.g., Barsade & Gibson, 2007; Casciaro, 2020), which is especially relevant here since comfort sharing ideas

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[3]We appreciate Yuki Yasuda's suggestion to consider this emotion indicator.

with the boss likely amplifies over time, positive becoming more positive, and negative becoming more negative (Li & Tangirala, 2021).

We ran the idea texts through LIWC, widely-used text software that has been found reliably credible in distinguishing emotion (Pennebaker, Mehl & Niederhoffer, 2003; Kahn et al., 2007; Tausczik & Pennebaker, 2010). The software identifies kinds of words by matching them to its dictionary. Emotion words in LIWC include terms such as happy, sunny, gloomy, smiling. For example, here is an idea judged high-value in which the manager encourages top management to endorse a behavior (2.05 z-score value, LIWC emotion words underlined): "Encourage the businesses to share best practices, get agreement and lift these to corporate. This would minimize duplication of effort at the business to business unit levels. If we want to become a CMMI level 5 SCM organization, we need to standardize. IPDS will support those activities." Burt (2010: 259-264) links LIWC emotion output with network brokerage under the argument that network brokers are more comfortable with diverse audiences, so they should be more comfortable displaying emotion when they propose an idea. For more detailed evidence linking LIWC output with brokerage, see Goldberg, Srivastava, Manian, Monroe, and Pott (2016).

We have from each manager a text of up to 2000 characters. Texts contain on average 60 words. The texts are short, but they were sufficient for senior executives to reliably and predictably evaluate the value of manager ideas (Burt, 2004). We focus here on a broad distinction between text with versus without emotion. Emotion is not rare in the idea texts. Four out of five managers use one or more words indicating emotion. Still, use of emotion words is the strongest content distinction between the texts.[4] According to our Hypotheses 1

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[4]This statement is based on a principal component analysis of a 455 by 73 data matrix in which rows are managers and columns are LIWC word frequencies. The strongest factor distinguishes function from content words. Maximum loadings on the first factor are for pronouns (.83) and the

and 2, the one in five managers who do not express emotion are likely operating under bridge supervision.

Background Data

The study population is stratified across three broad job ranks: manager, higher rank, and highest rank, with directors and vice presidents in the highest rank. Salary increases up the ranks from an average -0.71 z-score salary in the manager rank, 0.23 in the higher rank, and 1.98 in the highest rank (31.23 t-test). Managers at all ranks are assigned to one of two roles in the supply chain: Some purchased goods from external vendors. Others moved goods inside the company. We include the role distinction because purchasing paid a higher salary (1.05 z-score higher on average, 5.4 t-test), and could have affected a manager's access to structural holes since it involved contacts in other companies.

Company personnel records show that most of the study population is male (74%), Caucasian (86%), and, on average, in their late 40s with 18 years seniority in the company. Many have spent their whole career in the company. A larger number have spent their whole career in the industry. Between seniority and age, age is more strongly correlated with performance, so we use age as a control for work experience. Many of the managers have graduate degrees (36%), and almost all have taken college courses. At the same time, a substantial minority have not completed sufficient college coursework to obtain a bachelor's degree (23%). We tested race, gender, and marital status to include as control variables in the

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aggregate category of function words (.81). Function words connect content words: pronouns (<u>he</u> is a new victim), prepositions (go <u>to</u> the store), articles (a, the), and auxiliary verbs (verbs that indicate the tense, mood, or voice of other verbs, e.g., I <u>would have</u> gone). Content words are sentence elements held together by function words. The second factor extracted in the principal component analysis is the strongest content distinction between texts (eigenvalue is 64% as large as the one for the first factor). The second factor distinguishes texts primarily by emotion, which reinforces our decision to use emotion as our second indicator of role segregation (maximum factor loading on second factor is .69 for the LIWC emotion category, closely followed by words for achieve, drive, negative and positive emotion, and adjectives like "very" to express intense nouns and verbs).

models, but none was a statistically significant predictor or slope-adjustment in the analysis. Given likely reader interest in race and gender, we include for reassurance a dummy variable, "Minority," distinguishing managers who are women or other than Caucasian. If we replace the minority variable with contrast between men and women, or Caucasian versus other race, we obtain the same negligible results reported here with the minority variable.

To hold constant compensation differences between business units, we predicted salary from job rank, job role, age, and education then regressed the residuals across dummy variables distinguishing fifteen business units. Salaries were significantly low in the one unit for which supplies were largely commodity goods so supply-chain managers were not required to have technical expertise (distinguished by a dummy variable "LowTech"). Salaries were significantly higher in four units where supply-chain managers had to deal with higher-end electronic equipment and components (distinguished by a dummy variable "HighTech").

To hold constant differences between office locations, we then took residuals from the above regression model, augmented with the two organization controls (LowTech and HighTech), and distributed the residuals across a map of the United States to find pockets of deviant salaries. Residuals were significantly high in two high-cost urban areas, defined by two dummy variables "Urban 1" and "Urban 2."

Network Variables

The network survey provides 5,010 observations of 4,139 relationships distinguished on five levels of connection between people, some of whom work outside the supply chain (quantitative scores for levels of connection are based on a loglinear analysis of the network data, Burt, 2004:361n): One person cited the other both as someone with whom their idea was discussed and with whom supply-chain issues were frequently discussed, or colleague(s) reported that the two people often discussed supply-chain issues (1,363 relations, strength

1.00). One cited the other as someone with whom he or she frequently discussed supply-chain issues, but not as someone with whom their idea was discussed (1,188 relations, strength .86). Colleagues said that the two people sometimes discussed supply-chain issues, but neither cited the other (675 relations, strength .65). One cited the other only as someone with whom their idea was discussed (333 relations, strength .50). Neither person cited the other and colleagues said the two people rarely discussed supply-chain issues (580 relations, strength .00).

Where multiple observations of a relationship are contradictory, we use the strongest reported value. For example, if one manager cites another as a frequent discussion partner, and there is a second observation in which a mutual colleague reported that the two managers "sometimes" discuss supply-chain issues, then the connection between the two managers is set to .86 because of the stronger connection implied by the direct citation. Consistency is more typical than contradiction: Stronger relations were more likely to be cited by both managers involved, more likely to be reported by multiple respondents, and more likely to be reported between people perceived to often discuss supply-chain issues. At the other extreme, managers perceived to "rarely" discuss supply-chain issues almost never cited one another.

Assembling Dyad Networks

We assembled a supervision dyad network for each of the 455 survey respondents: A respondent is the first person in the network, followed by the respondent's boss (identified from company HR records), with the supervision relationship between them fixed at maximum-strength. Then contacts are added who are strongly connected with either the respondent or the boss (relations strength .86 or 1.0). Then, with network membership defined, the data are read again to fill in discussion relations between each pair of people in the manager-boss dyad network.

Networks around some bosses are under-reported. The data were collected to describe networks around the respondents, not the bosses. We know a boss's network as it is known to the survey respondents. Of the 157 bosses who supervise the 455 respondents, some responded to the survey (94), some did not respond (40), and some were not invited to respond because they work outside the supply-chain organization (23). The further away the boss, the less his or her network is likely to be known to the respondents. For example, the average ego network size of 11.92 for supply-chain bosses who responded to the survey, drops to 9.15 for supply-chain bosses who did not respond (-2.34 t-test, P ~ .02), and drops further to 4.39 for bosses outside the supply-chain organization (-5.18 t-test, P < .001). Our control for possible under-reporting distinguishes bosses in the supply chain who did respond to the survey, versus those who did not, versus those beyond the supply chain who could not.

Bridge Supervision: Mutual Contacts

The first dimension to bridge supervision is the depth of the structural hole between manager and boss. We have a count of mutual colleagues. When the networks around manager and boss overlap not at all, their supervision relationship is a bridge by definition in graph theory. The networks in Figure 1 are examples (mutual = 0). In contrast, supervision is socially embedded to the extent that manager and boss share mutual discussion partners. The network in Figure 2 is an example (mutual = 4, dark triangles in Figure 2).[5] We expect lower levels of role segregation from managers who have a higher number of mutual contacts with the boss.

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[5]Structural equivalence is a broader measure focused on the extent to which manager and boss have exclusive contacts (cf., Soda and Zaheer, 2012, on structural equivalence; Ter Wal et al., 2020, on "overlapped networking"). Manager and boss are structurally equivalent to the extent that they have the same relations with the same colleagues (Wasserman & Faust, 1994:366-375). Euclidean distance between manager and boss measures their nonequivalence as: $d_{12} = (\Sigma_k [z_{1k} - z_{2k}]^2)^{.5}$, where k goes from 3 to N in a dyad network (manager is first person, boss is second), and z_{1k} is the symmetric fractional strength of connection between manager and kth person. Euclidean distance between manager and boss increases with the extent to which the manager discusses work with

Bridge Supervision: Exclusive Density

Colleagues connected to manager but not boss are manager-exclusive contacts. Manager-exclusive density is the average strength of connection between a manager's exclusive contacts.[6] We are using density to measure the extent to which a manager has a cohesive circle of colleagues apart from the boss, so density is set to zero for managers who have no exclusive contacts or only one. Exclusive density is zero for the network in Figure 2 because the manager has only one contact that is not connected to his boss. We multiply density by 100. There are 15 possible connections among the six contacts exclusive to the manager in Figure 1B, of which nine are maximum strength (1.0) and six are disconnects (minimum strength, 0.0), so exclusive density equals 60.0 for the manager in Figure 1B. We expect higher levels of role segregation from managers embedded in higher levels of exclusive density.

Network Brokers

We control for the extent to which a manager has a network rich in structural holes, which indicates a manager rich in opportunities to be a network broker. It is not clear how information breadth, timing, and arbitrage advantages increase with the number of holes to which a manager has access, but it is relatively clear that a closed network offers no such advantages.[7] We use the summary index, network constraint, to measure a manager's lack of

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colleagues disconnected from the boss, and the boss discusses work with colleagues disconnected from the manager. We get the same results using Euclidean distance to measure bridge supervision that we get with number of mutual contacts, so we report on the more obvious count measure.

[6]We get the same results if we replace exclusive density with number of contacts exclusive to manager, or sum of relations among manager-exclusive contacts (cf., Reagans et al., 2015:1405, and 1412, n5), so we report results with the standard measure of summed ties divided by number of ties.

[7]Two situations could be considered exceptions. One is a closed network around a partnership of network brokers (Aral & Van Alstyne, 2011). Each partner's brokerage creates value, and closure among the partners facilitates them exploiting complementary advantages ("structural autonomy," Burt, 1992:44-45). Second, a closed network early in a career can act as a cocoon for development as a network broker (Burt & Opper, 2017:526; Zhao & Burt, 2018:387; Burt, 2019a:29; Lee & Gargiulo,

brokerage opportunities within the dyad network around manager and boss. The index varies

with three network qualities: size, density, and hierarchy or centralization (Burt, 1992: Chp.

2). Constraint is high if a manager's contacts are few, talk to one another directly (density) or

they share information indirectly via a central contact (hierarchy/centralization). We multiply

scores by 100 to discuss points of constraint. The manager in Figure 1A has a network rich in

structural holes. His 17.12 points of constraint are well below average (-1.23 z-score). The

manager in Figure 2 has access to structural holes between his one exclusive contact (solid

dot) and the contacts he shares with his boss (solid triangles). His 42.15 points of constraint

are about average (0.13 z-score).[8]

RESULTS ON ROLE SEGREGATION

Table 2 contains models predicting manager role segregation. Means, standard deviations,

and correlations are given in Table 3. Negligible results at the top of Table 2 show that the

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forthcoming). Neither exception is a concern here since our study population is established managers in a traditional bureaucracy.

[8]There is a change to usual practice here. Constraint is usually computed for the ego-network around a manager. Here, we compute it within the dyad network around manager and boss. The manager's number of contacts is usually the same in both computations (1 higher in dyad network for managers who have no ego-network discussion connection with boss), but constraint can be lower in a dyad network because interdependence between contacts is weakened if manager contacts are also connected within the boss' network. The dyad component measuring contact j constraint on manager i, c_{ij}, increases with proportional strength connections among contacts ($c_{ij} = [p_{ij} + \Sigma_k p_{ik}p_{kj}]^2$, for $i \neq k \neq j$) and proportional contact p_{kj} decreases if contact k has connections in both the manager's network and the boss' network. To be sure that the change from ego to dyad networks did not create a disconnect with prior research, we computed constraint within both dyad and ego networks. On average, network constraint is lower in dyad networks (37 points versus 45 points in ego-networks), but the two measures are closely correlated (.95 for log scores, .91 for raw scores). The magnitude of difference between the two constraint scores varies from zero to 50 points around a mean of 9 points, and is correlated .69 with the level of constraint in a manager's ego-network (closed ego-networks can be more changed by weakening interdependencies between contacts in the dyad network). When magnitude of score difference is regressed across the variables in Table 2, magnitude increases primarily with level of constraint in a manager's ego-network (12.00 t-test, P < .001), is lower for managers who cite the boss (because the boss is already in the ego-network; -4.52 t-test), and is lower for managers operating under bridge supervision (because bridge supervision is associated with low network constraint; -7.17 t-test for a bridge-supervision dichotomy, P < .001). In short, the results discussed in the text are reached with constraint scores for dyad or ego networks.

role-segregation indicators do not differ systematically by manager background or position in the organization. Regressions not presented show that bridge supervision varies with the control variables — it is most likely among lower-rank managers in major urban areas outside high-tech businesses — but the negligible control results in Table 2 imply that role-segregation symptoms of bridge supervision are scattered across the company. Two control coefficients in Table 2 are statistically significant at a .05 level, but with a dozen control variables being tested in four predictions, we are comfortable attributing those two coefficients to random chance.

——— Table 2 and Table 3 About Here ———

Excluding the Boss as Discussion Partner

Bridge supervision is closely associated with not citing the boss as a work discussion partner. Among managers operating under embedded supervision, nine out of ten cite their boss (85%). The odds drop to four out of ten among managers operating under bridge supervision (39%). With control variables held constant and embedded supervision as reference, the odds of not citing the boss as a discussion partner are nine and a half times higher under bridge supervision ($e^{2.25}$ in Model 2 is 9.49).

Turning to details, Model 1 is a logit equation predicting which managers exclude the boss from their core discussion partners. The negative coefficient for network constraint shows that network brokers, the managers whose networks bridge structural holes in the organization, are likely to operate independent of their boss (-2.22 coefficient, -5.27 test statistic, P < .001). In other words, the more closed the network around a manager, the more likely the manager cites his or her boss as a core discussion partner. Bridge supervision also matters. Managers who exclude their boss as a discussion partner have fewer mutual contacts with the boss (-.60 coefficient, -7.88 test statistic, P < .001; Hypothesis 1 supported), and

have more-densely interconnected colleagues disconnected from the boss (.019 coefficient for exclusive density, 4.02 test statistic, P < .001; Hypothesis 2 supported).

Boss networks are subject to under-reporting if a manager's boss did not respond to the survey, or was not included in the survey (see "Assembling the Dyad Network" in Data section). We added two dummy variables to the prediction, one distinguishing managers whose supply-chain boss did not respond to the survey, and a second distinguishing managers who reported to a boss outside the supply chain organization (which means the boss was not invited to the survey). Having a non-respondent supply-chain boss is irrelevant to the results (-1.43 test statistic in Model 1, P ~ .15), but managers who report to a boss outside the supply chain are unlikely to exclude their boss from their core discussion partners (-2.77 test statistic in Model 1, P ~ .006). Regardless, conclusions about bridge supervision hold. With the two controls added to Model 1, uncited bosses are still less likely for managers who share mutual contacts with the boss, and still more likely for managers with densely connected contacts disconnected from the boss (respective test statistics of -8.15 and 3.61, P < .001 for both).

The shape of the association with bridge supervision is displayed in Figure 3. Role segregation increases up the vertical axis, indicated by the percent of managers who do not cite the boss. The horizontal axis shows the overlap between manager and boss discussion partners. To the left in the graph, the three lines are high for managers who share no mutual contacts with their boss. The lines slope down to the lower right — the tendency for a manager to cite the boss increases as manager and boss have an increasing number of mutual discussion partners.

Differences between the lines in Figure 3 show how exclusive density is associated with role segregation. The dashed line describes the 228 managers who have no group affiliation apart from the boss, in the sense that exclusive density is zero. These managers have no discussion partners who are not also connected to the boss, or they have a single

excusive discussion partner (e.g., the manager in Figure 2), or they have a scattered collection of discussion partners, none of whom is connected to any of the others. These managers all tend to include their boss as a core discussion partner, the odds increasing with the number of manager discussion partners also connected to the boss (dashed line slopes down in Figure 3, $r = -.93$ in the graph).

——— Figure 3 About Here ———

Solid lines in Figure 3 describe managers who have a group affiliation apart from the boss, in that exclusive density is greater than zero. These managers have two or more discussion partners connected to one another and not connected to the boss (nonzero density means that there are nonzero relations between a manager's exclusive discussion partners). Nonzero exclusive density has a 30 median value. The thin solid line in Figure 3 describes the 118 managers with 30 or lower nonzero exclusive density (e.g., the manager in Figure 1A). The bold solid line describes 109 managers with above 30 exclusive density (e.g., the manager in Figure 1B). The lines twine around each other to the left in the graph, well above the dashed line. In other words, level of exclusive density is not as consequential as the binary difference between zero versus nonzero. Ultimately, number of mutual contacts trumps exclusive density. Managers who share five or more mutual discussion partners with their boss almost all cite the boss as a core discussion partner.

As a summary heuristic, the shaded area in Figure 3 encloses managers who can be said to operate under bridge supervision. Any such heuristic must involve some arbitrary choices, but at minimum, bridge supervision ought to include the 78 managers who have zero discussion partners in common with their boss, two of whom are the focal managers in Figure 1. And even if manager and boss share a few mutual discussion partners, there can be bridge supervision if the manager has created a cohesive constituency separate from the boss. Given the entwined solid lines in Figure 3, the shaded area is extended out to four mutual contacts

for managers with nonzero exclusive density. At five mutual discussion partners, a manager is likely to cite the boss even with a cohesive group of colleagues separate from the boss (bold solid line is 0% at five mutual contacts).

Model 2 in Table 3 summarizes using the binary distinction between managers operating under bridge supervision (shaded area in Figure 3) versus embedded supervision. With bridge supervision defined jointly by few mutual contacts combined with manager-exclusive density, network constraint is no longer a predictor. There is no direct association (-.26 coefficient in Model 2, -.70 test statistic, P ~ .49), nor indirect as a bridge-supervision slope adjustment; -.60 coefficient, -1.14 test statistic, P ~ .26). If the slope adjustment is removed, there is still no direct association (-.26 coefficient increases to -.51, but is still negligible; -1.61 test statistic, P ~ .11).The key predictor is bridge supervision (2.25 coefficient, 9.22 test statistic, P < .001). With the two controls for under-reported boss network added to Model 2, uncited bosses are still more likely for managers operating under bridge supervision (9.08 test statistic, P < .001)

Not Getting Emotional with Higher Management

Bridge supervision is associated with not displaying emotion. Among managers operating under embedded supervision, two in ten use no emotion words in their text idea (18%). The odds are three in ten among managers operating under bridge supervision (29%). With control variables held constant and embedded supervision as reference, the odds of managers not displaying emotion in their idea text are twice as high under bridge supervision ($e^{.68}$ in Model 4 is 1.97).

Turning to details, the dependent variable in Model 3 is a binary distinction between managers who use one or more emotion words in their idea text (0) versus those who keep emotion out of their text (1). Model 3 shows emotion independent of all three network variables. The association with bridge supervision is obscured by two issues: a low level of

prediction (pseudo R^2 is .06 for Model 3 versus .27 for Model 1), and interaction with

network brokerage. If the two bridge-supervision indicators are removed from Model 3, there

is a strong association with network constraint (2.71 test statistic, P ~ .007). In other words,

managers in more closed networks are less likely to display emotion in their idea texts

(consistent with analysis showing that network brokers are more likely to use emotion words,

Burt, 2010:259-264). If network constraint is removed from Model 3, there is a strong

association with mutual contacts (-2.69 test statistic, P ~ .007). In other words, managers who

share more discussion partners with their boss are more likely to display emotion in their idea

texts.

To control for interaction between bridge supervision and network constraint, Model 4

contains level and slope adjustments for the summary distinction in Figure 3 between bridge

versus embedded supervision. Managers operating under bridge supervision tend not to

display emotion in their idea texts, but network brokers rise above that tendency.

Figure 4 displays the association in Model 4. The vertical axis compares managers for

the absence of emotion words in their idea text. Managers are distinguished across the

horizontal axis in Figure 4 by the extent to which they have access to structural holes.

Network brokers are to the left (low constraint). Managers embedded in closed networks are

to the right (high constraint). Regression lines are estimated through the plotted data, which

are averages within five-point intervals of network constraint (with scores above 60 points

combined for embedded supervision because of few observations). The control variables in

Model 4 are largely negligible, so zero-order associations in Figure 4 are close approximation

to the Model 4 associations with controls.

——— Figure 4 About Here ———

Three network associations are illustrated in Figure 4. First, managers operating under

embedded supervision are all likely to express emotion in their idea text. The solid dots are

low in the graph. The bold regression line through the solid dots corresponds to the negligible positive association with network constraint in Model 4 (.54 coefficient, 1.33 test statistic, P ~ .18).

Second, managers operating under bridge supervision are less likely to express emotion in their idea text. The hollow dots are high in Figure 4, corresponding to the statistically significant level effect for bridge supervision in Model 4 (.68 level effect, 2.71 test statistic, P ~ .007).

Third, network brokers are likely to express emotion in their idea text regardless of whether they operate under bridge or embedded supervision (solid and hollow dots cluster together in lower-left corner of Figure 4). As the network around a bridge-supervised manager closes, however, the manager becomes increasingly likely to show no emotion in his or her idea text. This is described by the dashed line through the hollow dots in Figure 4, corresponding to the statistically significant slope adjustment in Model 4 for network constraint on bridge-supervised managers (1.30 coefficient, 2.13 test statistic, P ~ .03). At the highest levels of network constraint, to the right in Figure 4, 80% to 90% of bridge-supervised managers show no emotion in their idea texts. At the lowest levels, among the network brokers to the left in Figure 4, 80% to 100% of bridge-supervised managers show emotion in their idea texts.[9]

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[9]Text length facilitates expressing emotion. Managers who write longer idea texts are less likely to leave emotion words out of their text (-4.07 test statistic, P < .001, if text length is added to Model 4). Perhaps managers who feel more strongly about their idea write longer texts, or managers include emotion words if they write long enough. Regardless, our empirical results are supported by network brokers writing longer texts (-2.54 t-test for log network constraint predicting text length, P ~ .01), and bridge-supervised managers writing shorter texts (-2.59 t-test for binary bridge supervision distinction predicting text length, P ~ .01). Our conclusions from Table 2 are not affected, so we do not discuss text length in the analysis. Text length is a detail in the mechanism by which emotion is a displayed correlate of bridge supervision, so it warrants recognition. Of course, for the same reason that bridge-supervised managers are expected under Hypotheses 1 and 2 to be uncomfortable displaying emotion, it follows that they would be uncomfortable speaking for a longer time or expressing themselves in longer text.

RESULTS ON MANAGER PERFORMANCE

Predictors from Table 2 are used in Table 4 to predict salary and value of a manager's proposed idea to improve the supply-chain organization. The bottom two rows of Table 4 contain a summary F-test for the null hypothesis that distinguishing bridge-supervised managers adds nothing to the predictions. All four test statistics fail to reject the null. In support of Hypothesis 3, manager performance is independent of bridge or embedded supervision.

The graph to the left in Figure 5 shows salary closely associated with access to structural holes. Regression lines are estimated through the plotted data, which are averages within five-point intervals of network constraint (with scores above 60 points combined for embedded supervision because of few observations). Regardless of bridge supervision (dashed regression line through hollow dots) or embedded supervision (solid line through solid dots), network brokers enjoy higher salaries than colleagues in more closed networks. Downward-sloping lines in the graph correspond to the -.32 coefficient in Model 5 and -.41 coefficient in Model 6 (P < .001). The similarity of the two lines is reflected in the negligible test statistics for bridge supervision.

——— Table 4 and Figure 5 About Here ———

The control variables are important here to be sure about the irrelevance of bridge supervision for performance. Salary is closely patterned by job rank. Relative to salaries in the highest rank, salaries in the two other ranks are significantly lower (-1.16 coefficient in Model 5 for next lower rank, -9.26 test statistic; -1.99 coefficient for the still lower rank, -15.23 test statistic). In addition, salaries are higher for older managers, especially if they completed college, and if they work in one of the two high-cost urban areas. Salaries are lower, on average, for managers who work in the in the low-technology business unit.

Predicting good ideas is simpler than predicting compensation. Regardless of job rank, age, education, business unit, and location, network brokers propose ideas perceived to have higher value. Managers who have broad, open networks that reach into different parts of the organization are more likely to come up with ideas deemed valuable. As illustrated by the graph to the right in Figure 5, the perceived value of a manager's idea decreases systematically as the network around a manager becomes more closed (-.51 coefficient for network constraint in Model 7, -3.75 test statistic, $P < .001$) — and that association holds equally for managers who operate under bridge supervision or embedded supervision.[10]

Nor do we find evidence of indirect association between performance and bridge supervision. To the extent that direct communication with the boss and expressing emotion contribute to manager performance, then bridge supervision could indirectly lower performance because bridge-supervised managers are less likely to cite their boss as a discussion partner, and less likely to express emotion when they propose an idea to higher-ups. But the supervision correlates of citing the boss and expressing emotion are independent of performance, just like bridge supervision itself. Adding a predictor to distinguish managers who cite the boss as a discussion partner does not improve prediction (0.75 and -.20 test statistics for Models 5 and 7 respectively, $P > .56$). A predictor that distinguishes managers who express emotion in their idea text is similarly negligible (-.50 and 1.23 test statistics for Models 5 and 7 respectively, $P > .22$).

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[10]The published report on brokers proposing good ideas includes tests for two potential response biases in the evaluations of idea value (Burt, 2004:383-384): a test for the character length of the text proposing an idea (in case longer texts received more favorable evaluation), and a test for the sequential order in which an idea was evaluated (in case the executives judged ideas late in the sequence less carefully or less positively than they did ideas early in the sequence). We do not include the tests in Table 4 because adding the length of the text proposing an idea, and the sequence in which a judging executive encountered the idea, adds nothing to the predictions (0.34 $F_{(2,438)}$ for Model 7, $P \sim$ .71; 0.27 $F_{(2,439)}$ for Model 8, $P \sim$ .77).

CONCLUSIONS

Bridge supervision occurs when the connection between manager and boss is a network bridge between separate social worlds (Figure 1). We drew on the Bott Hypothesis to infer that bridge supervision should be associated with manager-boss role segregation in the form of separate decision making, less privacy, a lower sense of homophily, and less emphasis on personal compatibility (Table 1). We argued that bridge supervision is associated with how a manager plays his or her role (Hypotheses 1 and 2), but not how well the role is played (Hypothesis 3). Returning to a management population in which compensation and good ideas have known network correlates, we show strong empirical support for the hypotheses. Managers operating under bridge supervision exclude the boss from their work discussion and are conservative in expressing emotion (Table 2, Figure 3, and Figure 4). Behavioral correlates notwithstanding, compensation and good ideas have their usual association with network brokerage independent of bridge supervision (Table 4 and Figure 5).

Contributions

The study makes four contributions. The first is to deepen understanding of a condition prevalent in organization life, and likely to become more prevalent: bridge supervision. Bridge supervision is attractively inexpensive in time and energy, and has become more feasible with advances in communication technology (Parkes, 2021). More recently, the exogenous shock of Covid-19 expanded the population of managers operating under bridge supervision, some of whom will continue in the future operating under bridge supervision. If the results from this study hold up in replication studies, then a widening use of bridge supervision can be expected to have behavioral consequences for work life, but not necessarily performance consequences.

Contribution two is that the study opens a new portal for exchange between network and management theory. There are various studies of how kinds of relations combine in a

manager's network to affect performance (e.g., Podolny & Baron, 1997; Burt, 2005; Soda & Zaheer, 2012; Turco, 2016; Gómez-Solórzano, Tortoriello & Soda, 2019). Ad hoc distinctions between kind of relations can erode the value of such work. Dyad networks open a new strategy for the work. We here study how an obligatory kind of relationship is performed as a function of the structure of the discretionary relations in which it is embedded. There is also broader management behavior to consider in light of bridge supervision. We have data on two manager behaviors – including the boss among one's core discussion partners, and expressing emotion in proposing an idea. What about the many other behaviors in the Bott Hypothesis — now implied by bridge supervision — and the broader range of behaviors and emotions studied in leadership research? We return to this below in discussing study limitations.

Contribution three is to research methodology. This study is an illustrative extension of the ego network around an individual to the dyad network around a pair of individuals connected by a critical kind of relationship — manager and boss, husband and wife, parent and child, client and account manager, CEO and union president, academic dean and provost, or any two key individuals tasked to coordinate with one another other. As discussed in the introduction, dyad networks are not a novel idea, but neither are they routine in the social network analysis toolbox. Analysis is typically of ego networks or whole networks (Perry et al., 2018; Small et al., 2021). Dyad networks are an intermediate strategy that captures variation across the contexts in which a critical kind of relationship exists, providing a lens on performance correlates of the relationship contingent on context. In fact, bridge supervision would be difficult to identify without knowing the dyad network around manager and boss.

Contribution four is the advance one step further in clearing away confounding factors in the thriving research on performance returns to network brokerage. There is value to

knowing about network effects, and bridge supervision has intriguing behavioral correlates to which we return below. But it is also valuable to know the limits of network effects. For example, the classic team network study by Bavalas, Leavitt, and Smith (Leavitt, 1951) showed that teammates communicating in a wheel network tend to be unhappy but complete simple tasks quickly. Guetzkow and Simon (1955) temper that conclusion by showing that teams learn to work within the network structure assigned to them, eventually reaching similar levels of efficiency (see also Burgess, 1968). Research has shown that manager gender can be a contingency factor for network brokerage (Ibarra, 1997; Burt, 1998; Brands & Kilduff, 2014), but it is often not a contingency factor, even in populations documented to favor investments in men rather than women (Burt, 2019b). Manager age can be a contingency factor for successful brokerage, but that fact varies so much between organizations that age is better understood as a company-specific contingency factor (Burt, 2018). Age and gender biases certainly exist in some organizations, but the fact that the biases exist somewhere is not to say that they exist everywhere. In short, a fourth contribution from this study is to know that despite bridge supervision having behavioral correlates that could be expected to lower performance, performance is robustly associated with network brokerage independent of bridge supervision. To predict manager performance, the ego network does not need to be expanded to the dyad network around manager and boss.

Limitations

The data in this study have two virtues, along with two provocative deficiencies. The virtues are the substance of the study population and the data quality. Regarding data quality we have in mind three things: (1) high, representative response to the survey, (2) unrestricted access to company personnel records when the data were collected, and (3) ego network data known to have construct-validity association with performance (Burt, 2004, 2007). Within the diversity of management network studies, the substance of the study population here has

the virtues of being large, heterogenous, and relatively generic. It is not a population in which individuals have substantial autonomy — say a population of senior investment bankers (Burt & Merluzzi, 2016), or software engineers in an open innovation population (Fleming & Waguespack, 2007). Individual autonomy makes such populations a productive site for studying variation in successful network brokerage, but bridge supervision applies more broadly to management in general. Neither is the population studied here a small group of co-located individuals (Barker, 1993; Sasovova et al., 2010), wherein the social psychology of management can be observed, but unmeasured contextual factors loom large for network effects. The population for this study is a relatively large number of representative managers scattered coast to coast across diverse parts of a very large organization. There is innovation in the organization — certainly there is incremental change discussed as innovation within the organization — but the focus is on efficient operation, with a healthy respect for tradition. All in all, this is a good place to make initial inquiries about bridge supervision.

Data virtues notwithstanding, two deficiencies are breadth and time. There is little information on manager affect or behavior, and the data describe a single moment in time. Given supportive results from the study, both deficiencies are promising opportunities for future research.

The data available for this study are limited to two manager behaviors: citing the boss as a discussion partner, and expressing emotion when proposing an idea to executives. Supervision is such a central dimension to organization life that the role segregation associated with bridge supervision is relevant to organization behavior broadly conceived (e.g., Hersey, Blanchard & Johnson 2012), including the sentiments associated with behavior (Barsade & Gibson, 2007), each of which can be used to define a kind of relationship for study (Casciaro, 2020). At minimum, a promising next step would be to test Hypotheses 1 and 2 with more diverse data on the segregation dimensions in Table 1. Note that the

proposed research can be conducted easily with data already in hand. In a management population for which network and performance data are available (and there are many such populations judging from the many published papers on network correlates of performance) all one has to do is identify each manager's boss, assemble the dyad network around each manager-boss pair, then compute network measures to test the hypotheses. The ready availability of data means likely replication tests with a broader range of manager behaviors.

Suppose that replication studies with diverse behavioral correlates continue to show that bridge supervision is uncorrelated with performance. Performance could still be affected by bridge supervision in ways missed because of the other data deficiency in this study: Cross-sectional comparisons within a study population can miss cumulative and systemic effects of bridge supervision on performance.

A cumulative effect could emerge from the immaturity of manager-boss relations subjected to bridge supervision, or from the duration of bridge supervision. With respect to the former, bridge supervision could be a negligible disturbance to established manager-boss relations but corrosive to new relations (Catalini, 2018; Li & Tangirala, 2021), whereupon the role segregation associated with bridge supervision could have a strong effect on performance in an organization with frequent boss rotations, but not in an organization, such as the study population here, in which manager and boss have known one another for 7.6 years on average (see Bidart, 2021:149-155, for speculation about network evolution from initial Bott conditions).

Or, consider a manager operating long-term under bridge supervision. In the short run, people can adapt to a difficult situation — as they have in response to Covid-19. In the long run, energy and morale can dwindle. A component subject to hard use is a component likely to have short operational life. Our cross-sectional data do not indicate intensity or duration of exposure to bridge supervision. Cross-sectional evidence that would promise insights from a

study over time would be bridge supervision associated with indicators of disengagement such as decreased average productivity, poor attendance at company events, low average job satisfaction, frequent sick days, missed deadlines, and of course, exit (Kahn, 1990; Rothbard, 2001; Spreitzer et al., 2005; Rich, Lepine & Crawford, 2010; Parkes, 2021). Language is a relatively novel indicator of engagement. Srivastava, Goldberg, Manian, and Potts (2018) show that before a manager quits her job, she begins to use language different from colleagues. The separate colleagues with whom manager and boss communicate under bridge supervision are likely to facilitate such divergence in language.[11] On a more traditional note, leader-member exchange theory (LMX) is especially promising because it defines multiple dimensions of the supervisory relationship (Gerstner & Day, 1997). Which LMX dimensions are most associated with bridge supervision? There is precedent for LMX research incorporating elements of the dyad network in which supervision is embedded. For example, Sherony and Green (2002) show that two coworkers who feel positive about the boss tend to feel positive toward each other, Venkataramani, Green, and Schleicher (2010) show that branch bank employees have more positive relations with bosses who are well-connected with other bosses, and Wang, Hu, and Dong (2015) show that subordinates who are socially central with diverse contacts tend to have more positive relations with their boss.

Supervision observed over time raises questions about bridge supervision's origins. To what extent is bridge supervision a boss characteristic (she prefers to supervise at arm's length), a manager characteristic (he is a coyote, always circling the flock rather than joining

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[11]One of the AMJ reviewers speculated on language difference emerging from bridge supervision. We agree with the potential of exploring such language difference, but we do not find supporting evidence within the idea texts. The two principal LIWC dimensions to the texts are use of function words and emotion display (footnote 4). There is negligible similarity between manager and boss on either dimension (respectively, .09 and .04 correlation, 1.53 and 0.79 t-test, P ~ .13 and .43). A logit model predicting the binary bridge-supervision variable in Table 2 from manager-boss difference on the two factors reveals negligible prediction (1.81 chi-square, 2 d.f., P ~ .40).

in), or a condition characteristic of certain organizations, certain kinds of work, or certain pairs of individuals? Origin stories are not to be confused with bridge supervision itself. The network mechanism to which managers are exposed when operating under bridge supervision is expected to result in the manager displaying the role segregation in Table 1. We do not know how the effect varies with the duration of time for which a manager operates under bridge supervision, but the network mechanism is assumed to begin affecting a manager as soon as he or she begins operating under bridge supervision.

Origin stories add to bridge supervision a sense of how bridge supervision's network mechanism combines with other mechanisms to affect manager behavior and performance. To provide a felt reality for bridge supervision, we introduced it with anecdotal origin stories about the people in Figures 1 and 2. Bridge supervision now introduced, we close with brief speculation about origins to stimulate future research.

Consider a broad distinction between intentional and unintentional bridge supervision. Relative to embedded supervision, bridge supervision requires less time and energy from manager and boss so it could originate as a by-product of people looking to make efficient use of their time. For example efficiency origins, consider geography, budget, formal structure, or career. When geography makes it difficult for the boss in one country to stay in touch with the manager in another country, embedded supervision is especially time consuming — so bridge supervision is likely to result in manager and boss focusing on their respective country constituencies (as could result from other known homophily factors beginning with race, gender, and age; McPherson et al., 2001:419 ff.). When budgets are tight, or the supply of bosses pinched, bosses can be asked to supervise more direct reports, so bosses have less time for any one manager — and bridge supervision is likely to result for some managers. When a manager focuses on making a name for himself by steering around

boss and boss' contacts to avoid credit for his work being attributed to the boss — bridge supervision can be expected as a by-product.

Origin differences can affect evidence of the role segregation expected from bridge supervision. If bridge supervision is in place for reasons of geography, then the role segregation resulting from bridge supervision will likely be amplified by the lack of homophily between manager and boss.[12] If bridge supervision is in place because of tight budgets, then role segregation resulting from bridge supervision could be amplified by other alienating conditions imposed by company policy emphasizing short-term cost. If bridge supervision is in place because of bosses having to supervise large numbers of subordinates, then the role segregation expected with bridge supervision could be obscured by the consequences of bosses having little time to spend with individual managers.[13] If bridge

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[12]Geography seems irrelevant to the population studied here. All managers work in the U.S., but 175 work in a state other than the one in which their boss works, some pairs on opposite coasts. Interstate supervision is independent of bridge supervision (1.05 chi-square, 1 d.f., P ~ .30), and independent of citing the boss as a discussion partner (1.25 chi-square, 1 d.f., P ~ .27). Gender homophily is more encouraging. Of the four gender combinations between manager and boss, bridge supervision is associated with one: 56% of men who report to a woman operate under bridge supervision (versus 38% for the other three gender combinations, 8.12 chi-square, 3 d.f., P ~ .04). The fact that men tend to engage in bridge supervision when reporting to a woman is an interesting lead for future research. In this population, however, gender mix is independent of citing the boss (3.03 chi-square when added to Model 2, 3 d.f., P ~ .38) and displaying emotion (0.33 chi-square when added to Model 4, 3 d.f., P ~ .95).

[13]This point emerged in exchange with one of the AMJ reviewers. Span of control matters in the population studied here, but not for bridge supervision. We have from company HR records the number of managers who report to the boss of each manager. There are 54 managers who report to a boss to whom no one else reports. There are 168 managers who report to a boss to whom more than a dozen managers report. Managers who report to a boss to whom many others report are less likely to cite the boss as a discussion partner (footnote 1). However, there is no association with bridge supervision. We looked at various treatments of boss span of control (binary, categorical, count). All show two things: First, span is independent of bridge supervision. For example, predicting the bridge-supervision dummy variable in Model 2 from number of subordinates to a manager's boss yields a negligible test statistic of 0.83 (P ~ .41). Second, adding boss' number of subordinates to the models in Tables 2 and 4 has no effect on the results discussed in the paper. For example, adding boss' number of subordinates to Model 2 reveals that managers with a boss to whom many others report tend not to cite the boss as a discussion partner (5.61 test statistic), but the negative effect of network constraint remains about the same (-2.08 coefficient, -4.86 test statistic, versus -2.22 in Table 2), the negative effect of mutual contacts remains about the same (-.63 coefficient, -7.36 test statistic, versus -.60 in Table 2), and the positive effect of exclusive density remains about the same (.018 coefficient,

supervision is in place as a by-product of the manager operating independently, prediction is difficult. Bridge supervision will contribute to role segregation, but manager success independent of the boss brings its own exhilaration.[14]

Bridge supervision need not be a by-product. It can be intentional. The boss could have a low opinion of the manager such that time with the manager is frustrating, and requests for more contact time irritating. A solution is to keep the manager at arm's length. At the other extreme, the boss could have a high opinion of the manager and want to facilitate the manager's development. A father helps his daughter learn to ride her bicycle not by holding her upright but by letting her build confidence and experience to ride independently, his hands a distance from her sides ready to catch her if she begins to fall. Similarly, a nurturing boss could engage in bridge supervision to give an able subordinate freedom to develop skills as a manager.

Here too, origins could have consequences. If bridge supervision is in place because of the boss' low opinion of the manager, then the role segregation expected of bridge

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3.70 test statistic, versus .019 in Table 2). In sum, boss span of control does not undo our cross-sectional results, but its close association with citing the boss as a discussion partner indicates that managers feel detached from a boss to whom many others report, making boss span of control a promising site for future research on role segregation.

[14]This possibility is consistent with our results: bridge supervision is associated with role segregation (Table 2) but network constraint trumps bridge supervision in predicting salary and good ideas (Table 4). Data over time are needed to assess when bridge supervision is associated with development. This point emerged in exchange with another AMJ reviewer. One indicator of manager independence is the extent to which he or she operates as a network broker (i.e., operates under low network constraint, such as the manager in Figure 1A). On average, network brokers enjoy salaries higher than their peers and propose ideas judged more valuable than the ideas of peers (Table 4). Do network brokers develop under bridge supervision? Our cross-sectional data show that network brokers tend not to share colleagues with their boss (-.55 correlation in Table 3 between constraint and mutual contacts), but they also tend not to develop a closed circle of exclusive contacts (-.14 correlation with manager exclusive density), so some network brokers operate under bridge supervision and some do not (-.01 correlation between constraint and bridge supervision). To determine when bridge supervision develops managers as network brokers, we would need to separate managers whose network brokerage was high before and after they operated under bridge supervision (selection story) from managers whose network brokerage is higher after bridge supervision (development story). Kleinbaum and Stuart's (2014) analysis of manager networks before and after a job at corporate headquarters is an exemplar.

supervision is likely to be amplified by a variety of other ways in which the boss expresses her low opinion. If bridge supervision is in place to facilitate the manager's development, then the role segregation expected of bridge supervision could be reversed by a variety of other ways in which the boss expresses his high opinion of the manager.

We cannot address these origin questions with our cross-sectional data. Looking to future research, however, knowing why bridge supervision is in place is likely to be valuable in the search for stable role segregation correlates.

We close on the breadth of bridge supervision in an organization. In the population studied here, 40% of managers are coded as operating under bridge supervision (Figure 3). Suppose that percentage were 60%, or 90%. Is there a threshold percentage, a tipping point, at which the system breaks down because bridge supervision is alienating too many managers from the workplace? This is not a question about thresholds for individual action, which is familiar in network analysis (Granovetter, 1978; Valente, 1996), but rather a question about the system in place after choices have been made. As Schelling (1975: 19) so nicely states the issue: "How well each does for himself in adapting to his social environment is not the same thing as how satisfactory a social environment they collectively create for themselves."

A systemic bridge-supervision effect would not show up as a regression slope across managers observed at the same time in the same population. It would show up in the intercept; as an average performance difference between populations; either the same population observed when bridge supervision is rare versus a later time when bridge supervision is widespread, or separate populations in which bridge supervision is low in some populations versus widespread in others. This paper has been about bridge supervision as an individual difference, but the subject can be studied equally well in terms of work cultures associated with widespread bridge supervision. For example, free-lance writers operate under bridge supervision from a contracting publisher. Regional managers operate under bridge

supervision from corporate headquarters. To what extent are the role segregation dimensions

in Table 1 behavioral correlates of being free-lance, or leading a field office?

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A. Bridge Supervision of Network Broker

9 manager, 29 boss, 0 mutual, 8.33 edensity, 17.12 network constraint (-1.23 z-score), -1.73 z-score salary, 0.50 z-score idea value
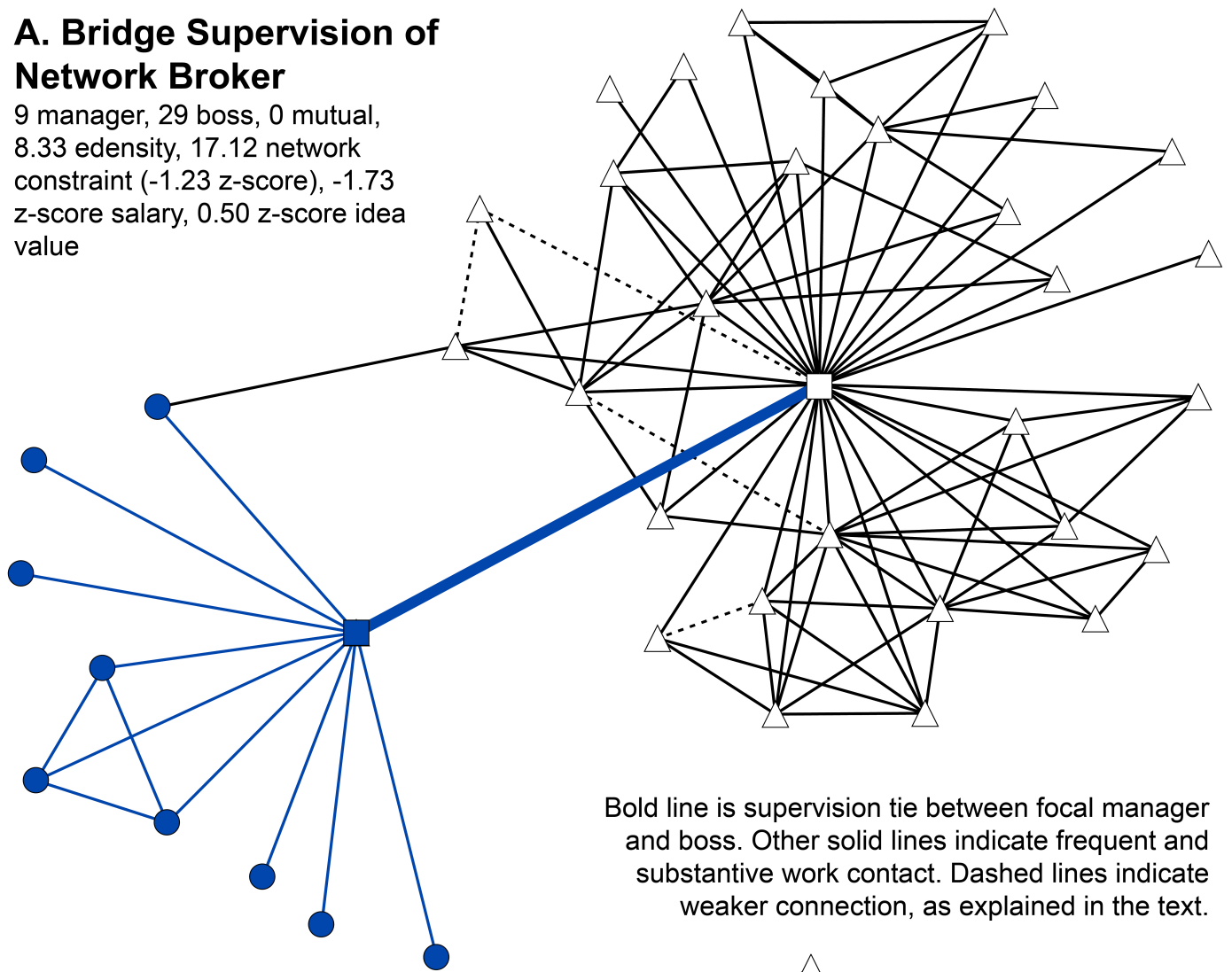
Bold line is supervision tie between focal manager and boss. Other solid lines indicate frequent and substantive work contact. Dashed lines indicate weaker connection, as explained in the text.

■ Focal Manager
□ Manager's Boss
● Manager's Contacts
△ Boss' Contacts
▲ Joint Contacts
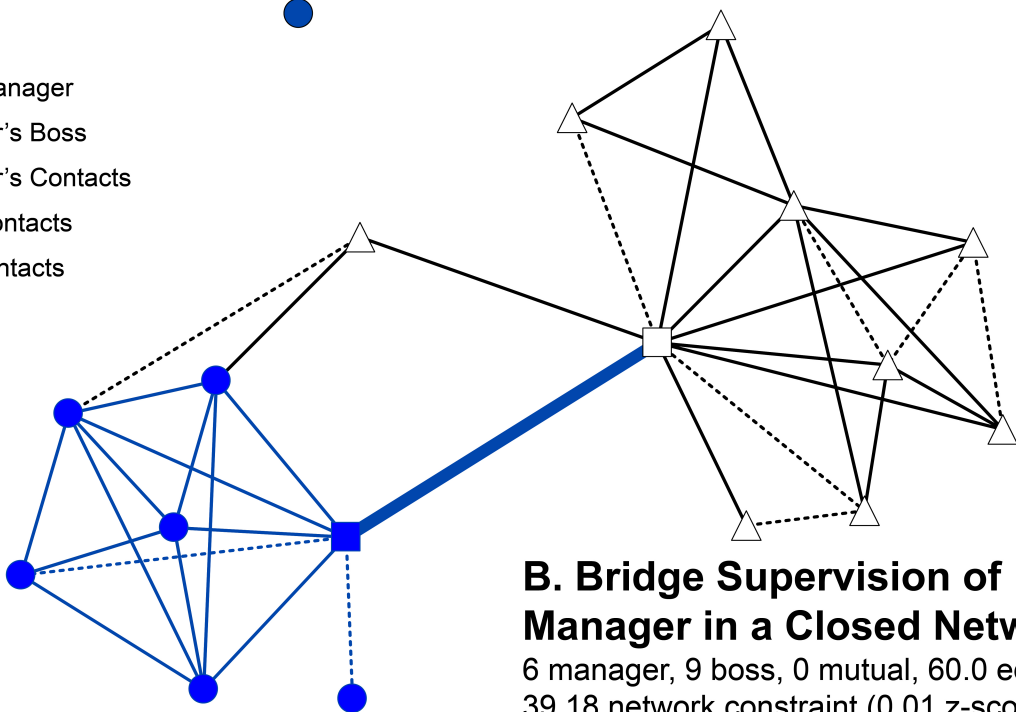
B. Bridge Supervision of Manager in a Closed Network

6 manager, 9 boss, 0 mutual, 60.0 edensity 39.18 network constraint (0.01 z-score), -.36 z-score salary, -1.04 z-score idea value

Figure 1. Managers Operating Under Bridge Supervision

Legend:
- ■ Focal Manager
- □ Manager's Boss
- ● Manager's Contacts
- △ Boss' Contacts
- ▲ Joint Contacts

1 manager, 13 boss, 4 mutual, 0.0 edensity, 42.15 network constraint (0.13 z-score), 1.14 z-score salary, -1.43 z-score idea value

Bold line is supervision tie between focal manager and boss. Other solid lines indicate frequent and substantive work contact. Dashed lines indicate weaker connection, as explained in the text.

Figure 2.

Manager Operating Under Embedded Supervision.
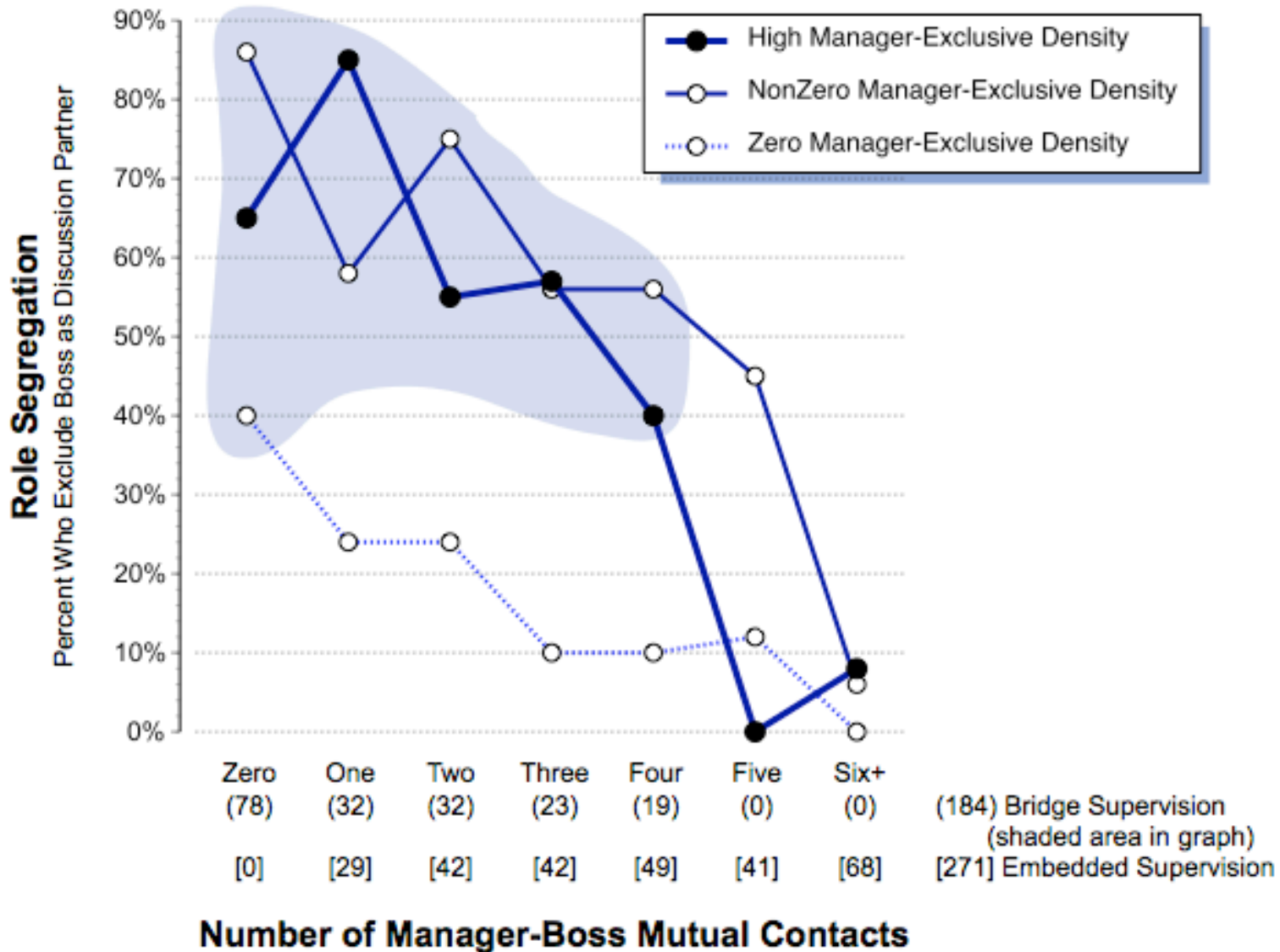
**Figure 3. Bridge-Supervised Managers
More Often Exclude the Boss from Their Core Discussion Partners.**
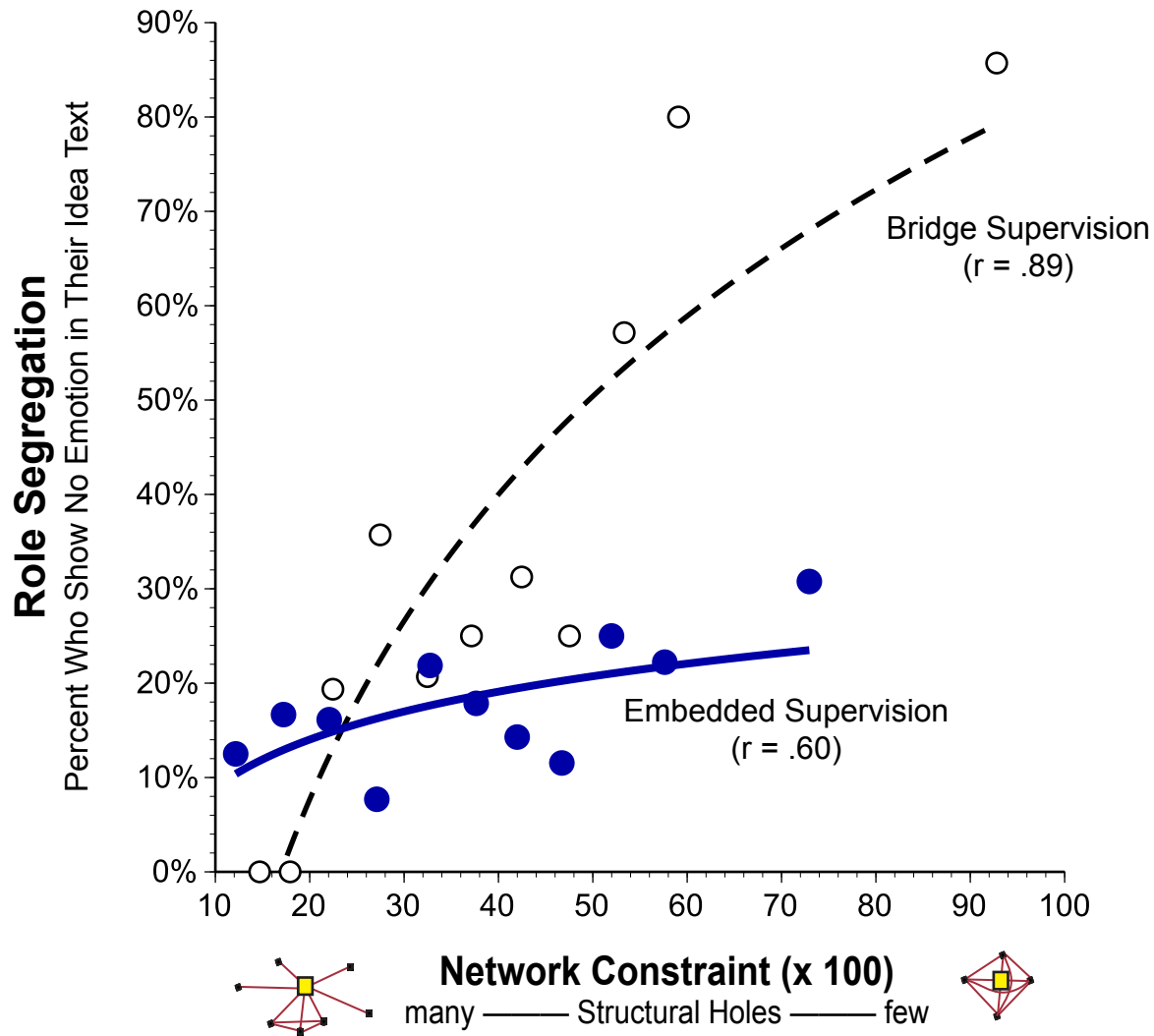
**Figure 4. Bridge-Supervised Managers
Are Less Likely to Show Emotion When Pitching Idea.**

(Note — Regression lines are estimated through the plotted data, which are averages within 5-point intervals of network constraint, with scores higher than 60 points combined in one category because of few observations.)
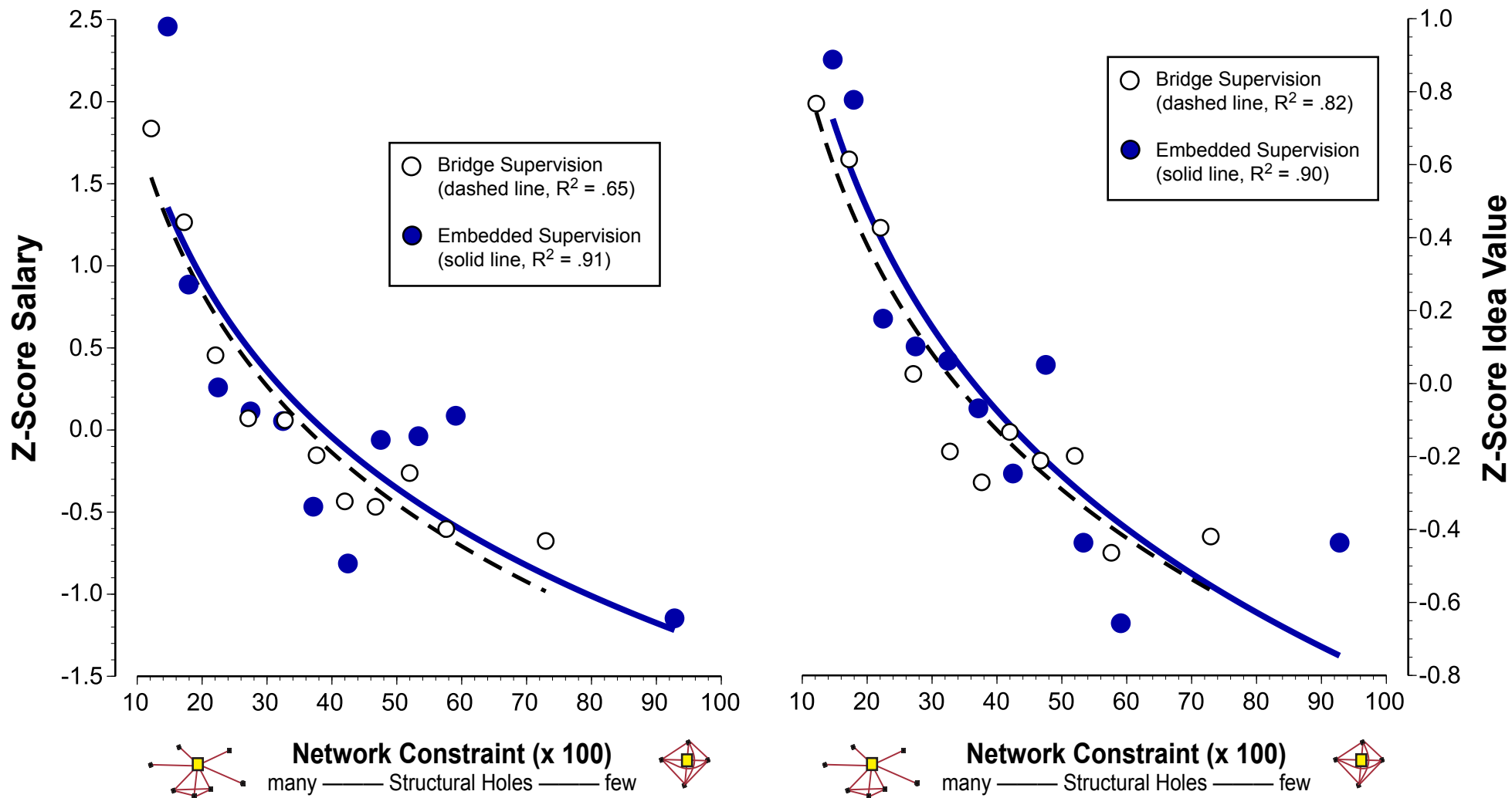
Figure 5.
Performance-Brokerage Link Unaffected by Bridge Supervision.

(Note — Regression lines are estimated through the plotted data, which are averages within 5-point intervals of network constraint, with scores higher than 60 points combined in one category because of few observations.)

Table 1.
Dimensions to Supervision Role Segregation

	Managers Operating under Embedded Supervision	Managers Operating under Bridge Supervision
Decisions	OVERLAPPING: Manager and boss discuss decisions	SEPARATE: Discussion is unnecessary; manager has authority in a domain separate from boss
Privacy	HIGH: Discussion with boss is private between manager and boss	LOW: Discussion with boss is legitimate interest of colleagues
Homophily	HIGH: Manager and boss are in many ways the same kind of person, with potentially different goals and interests	LOW: Manager takes for granted that manager and boss are different kinds of people with different goals and interests
Compatibility	VALUED: Personal compatibility is important to successful manager-boss operation	IRRELEVANT: Personal compatibility is not important to successful manager-boss operation

Table 2.
Bridge Supervision and Role Segregation

	Model 1	Model 2	Model 3	Model 4
Manager	.48 (.71)	.32 (.60)	.19 (.51)	-.16 (.51)
Higher Rank	.76 (.62)	.61 (.52)	-.41 (.47)	-.31 (.47)
Highest (Reference)	——	——	——	——
Purchasing	.61 (.39)	.48 (.36)	-.69 (.32)	-.78 (.32) *
Age	.01 (.02)	.01 (.02)	.03 (.02)	.03 (.02)
Minority	.05 (.27)	-.06 (.26)	-.17 (.26)	-.13 (.25)
Bachelor	.45 (.33)	.30 (.30)	.20 (.30)	.12 (.30)
Graduate	-.25 (.30)	-.31 (.30)	-.39 (.30)	-.36 (.31)
HighTech	.55 (.31)	.36 (.28)	-.13 (.27)	-.07 (.27)
LowTech	.03 (.54)	.03 (.49)	-.09 (.48)	.01 (.48)
Urban 1	.13 (.39)	.17 (.37)	.09 (.40)	.03 (.40)
Urban 2	-.16 (.38)	-.10 (.40)	.48 (.32) *	.55 (.32)
Network Constraint	-2.22 (.42) ***	-.26 (.38)	.60 (.36)	.54 (.41)
Mutual Contacts	-.60 (.08) ***	——	-.12 (.06)	——
Exclusive Density	.019 (.005) ***	——	-.0004 (.004)	——
Bridge Supervision (BS)	——	2.25 (.24) ***	——	.68 (.25) **
BS * Network Constraint	——	-.60 (.53)	——	1.30 (.61) *
Intercept	6.34	-2.12	-3.56	-3.94
Pseudo R^2	.27	.21	.06	.08

Note — These are logit regressions estimated across 455 managers predicting who does not cite the boss as a discussion partner (Models 1, 2) and the lack of emotion in a manager's idea text (Models 3, 4). Robust standard errors are in parentheses (Stata "robust"). Network constraint is entered as log constraint, and measured as a deviation from its mean in defining interaction terms. "Mutual Contacts" is the number of contacts mutual to manager and boss. "Exclusive Density" is the density of connections among manager contacts not connected directly with boss. "Bridge Supervision" is a binary variable defined by the shaded area in Figure 3.

* $P < .05$ ** $P < .01$ *** $P < .001$

Table 3. Means, Standard Deviations, Correlations

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1 Boss Not Cited as Discussion Partner	.33	.47	1.00																		
2 No Emotion in Idea Text	.22	.42	.07	1.00																	
3 Z-Score Salary	.00	1.00	.01	-.07	1.00																
4 Z-Score Idea Value	.00	1.00	.04	-.09	.32	1.00															
5 Manager	.51	.50	-.07	.10	-.73	-.26	1.00														
6 Higher Rank	.38	.49	.12	-.08	.35	.13	-.81	1.00													
7 Highest Rank	.11	.31	-.08	-.03	.63	.22	-.35	-.27	1.00												
8 Purchasing	.86	.34	.10	-.12	.23	.14	-.21	.15	.09	1.00											
9 Age (years)	49.17	7.33	.05	.06	.15	.05	-.10	.09	.02	-.03	1.00										
10 Bachelor	.67	.47	.06	-.05	.42	.21	-.43	.31	.21	.24	.00	1.00									
11 Graduate	.31	.46	-.01	-.09	.32	.16	-.31	.19	.20	.11	.09	.47	1.00								
12 Minority	.36	.48	-.06	-.02	-.17	-.03	.18	-.13	-.08	.03	-.10	-.22	-.10	1.00							
13 LowTech	.07	.26	-.05	.02	-.13	.06	.08	-.11	.05	-.17	.02	-.03	.08	.06	1.00						
14 HighTech	.32	.47	.03	-.03	.09	.01	-.07	.15	-.11	.15	.00	.05	-.03	.06	-.19	1.00					
15 Urban 1	.15	.36	.10	-.05	.18	.04	-.18	.17	.01	.15	.02	-.03	-.02	.25	-.09	.36	1.00				
16 Urban 2	.17	.37	-.04	.06	.34	.10	-.21	.00	.34	.01	-.06	.18	.08	-.13	.02	.07	-.19	1.00			
17 Network Constraint	3.51	.44	-.08	.16	-.57	-.32	.48	-.23	-.42	-.09	-.07	-.23	-.21	.16	.05	.05	-.15	-.10	1.00		
18 Mutual Contacts	3.18	2.79	-.34	-.16	.40	.18	-.31	.10	.34	.03	.02	.17	.17	-.04	-.02	.05	.03	.09	-.55	1.00	
19 Manager Exclusive Density	.18	.26	.29	-.002	.02	.08	-.01	.02	-.01	-.04	.05	-.003	-.02	-.11	-.01	-.14	-.02	-.04	-.14	-.08	1.00
20 Bridge Supervision	.40	.49	.48	.14	-.07	.01	.05	.02	-.11	.07	.06	-.003	-.02	-.08	-.03	-.11	.06	-.07	-.01	-.55	.51

Table 4.
Bridge Supervision and Role Performance

	Model 5	Model 6	Model 7	Model 8
Manager	-1.99 (.13) ***	-1.98 (.13) ***	-.38 (.20)	-.37 (.20)
Higher Rank	-1.16 (.13) ***	-1.15 (.12) ***	-.23 (.17)	-.22 (.17)
Highest (Reference)	——	——	——	——
Purchasing	.12 (.07)	.11 (.06)	.24 (.13)	.24 (.13)
Age	.01 (.003) ***	.01 (.003) ***	.004 (.005)	.004 (.006)
Minority	-.03 (.05)	-.03 (.05)	.11 (.10)	.11 (.10)
Bachelor	.18 (.06) **	.18 (.06) **	.19 (.12)	.19 (.12)
Graduate	.05 (.05)	.06 (.06)	.05 (.11)	.04 (.11)
HighTech	.10 (.06)	.10 (.06)	.08 (.11)	.07 (.11)
LowTech	-.32 (.09) **	-.32 (.09) **	.34 (.18)	.34 (.18)
Urban 1	.22 (.08) **	.21 (.08) ***	-.09 (.15)	-.09 (.15)
Urban 2	.30 (.08) ***	.30 (.08) ***	.05 (.13)	.05 (.13)
Network Constraint	-.32 (.08) ***	-.41 (.04) ***	-.51 (.14) ***	-.54 (.13) ***
Mutual Contacts	.01 (.01)	——	-.001 (.02)	——
Exclusive Density	.000 (.001)	——	.002 (.002)	——
Bridge Supervision (BS)	——	-.04 (.05)	——	.06 (.09)
BS * Net. Constraint	——	.16 (.15)	——	.07 (.22)
Intercept	1.58	1.96	1.39	1.54
R^2	.76	.76	.15	.15
$F_{(2,440)}$ Test No Bridge Supervision Effects	.49	.75	.91	.27
Probability No Bridge Supervision Effects	.61	.47	.40	.76

Note — These are OLS regressions predicting z-score salary (Models 5, 6) and value of manager idea (Models 7, 8). Robust standard errors are in parentheses (Stata "robust"). Network constraint is entered as log constraint, and measured as a deviation from its mean in defining interaction terms. "Mutual Contacts" is the number of contacts mutual to manager and boss. "Exclusive Density" is the density of connections among manager contacts not connected directly with boss. "Bridge Supervision" is a binary variable defined by the shaded area in Figure 3.

* P < .05   ** P < .01   *** P < .001