Strength Matters:
Tie Strength as a Causal Driver of Networks' Information Benefits

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Abstract

Studies of social networks have often taken the existence of a social tie as a proxy for the transmission of information. However, other studies of social networks in the labor market propose that the likelihood of information transmission might depend on strength of the tie; and that tie strength is a potentially important source of the tie's value. After all, even if job seekers have social ties to those who have valuable job information, the seekers will gain little information benefit when the ties do not actually transmit the information. This paper clarifies the conditions under which social ties might provide information benefits. We use a survey vignette experiment and ask MBA students about their likelihood of relaying job information via strong ties (to friends) or weak ties (to acquaintances), holding constant the structural locations spanned by the tie and job seekers' fit with the job. The results support the claim that strength of tie has a causal effect on the chances of information transmission: potential referrers are more likely to relay job information to their friends than to acquaintances. The larger implication of these findings is that whatever benefits there might be to using weak ties to reach distant non-redundant information during job search, these benefits need to be considered against the likely fact that people connected via weak ties are less likely to actually share information about job opportunities than are people to whom the job seeker is strongly tied.

Keywords: Social networks, Tie strength, Labor market, Referral, Vignette experiment

1. Introduction

One of the most influential observations of the contemporary sociology is that characteristics associated with a social tie determine when the connected actor receives beneficial information. In particular, Granovetter (1973) argued that weak ties provide more information benefits than do strong ties, because weak ties tend to reach novel information that strong ties do not. Building on this insight, Burt (1992) argued that, even though weakness of ties may be correlated with greater information benefits, it is not the weakness of ties per se that causally helps an actor achieve information benefits. Rather, it is the tie's ability to bridge two actors without redundant ties (i.e., "spanning range") that provides actors with information benefits. In proposing that tie strength is only an *indicator* of the tie's spanning range and not a *causal* driver of the tie's value, Burt (1992, p.29) emphasized that information benefits are determined *only* by ties' spanning range and not their strength: "[t]here is no theoretical reason to expect a strong correlation between the strength of a relationship and the information benefits it provides [after controlling for the spanning range]."[1] This premise was adopted by subsequent studies with important substantive implications. For instance, research on the "small-world" phenomenon (Watts 1999; Watts and Strogatz 1998; Watts, Dodds, and Newman 2002; cf. Aral and Van Alstyne 2011; Centola 2010; Centola and Macy 2007) suggested that a few weak bridging ties can make a highly clustered network structure almost as efficient as a random network structure. If weak bridging ties are as likely to transmit information as are strong ties but can reach information unreachable by strong ties, weak bridging ties seem to promise a gain in efficiency with no apparent downside.

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[1] Note that Granovetter (1973) did not argue that tie strength has no effect on motivation, but he argued that tie strength is *also* an indicator of the spanning range.

Whereas this line of argument downplayed the causal effect of tie strength on information benefits, other studies of social networks in the labor market suggest that insofar as the ties have the same spanning range, strong ties might provide more information benefits by being more likely to transmit information (Bian 1994, 1997; Granovetter 1983, 1995; Murray, Rankin, and Magill 1981; also, see McGuire and Bielby [2015]; Hansen [1999]; Uzzi [1997]). Our general intuition also tells us that we are more motivated and thus more likely to help our family and friends (i.e., those connected via strong ties) than our acquaintances (i.e., those connected via weak ties) by relaying information we have. Accordingly, Obukhova (2012) offers evidence for tie strength's effect on information transmission: she suggests that job seekers get offers through strong ties more frequently than through formal means, but that the same is not true for weak ties. Marin (2012) provides more direct evidence by asking referrers in the labor market when and why they relay job information to someone; and concludes that the factors that drive information transmission "should favour information sharing with strong ties over weak ties" (Marin 2012, p.188). Insofar as information benefit is a function of a tie's ability to reach valuable information (i.e., spanning range) *and* the likelihood of actual transmission, Obukhova and Marin suggest that tie strength is an important causal driver of the tie's information benefits (albeit *not* the *only* causal driver; e.g., Cowan 2014). After all, even if a job seeker has a social tie to someone who has valuable job information, the seeker will gain little information benefit when the tie does not actually transmit the information.

Nevertheless, while these studies contribute to our conceptualization of tie strength, their observational data provide limited evidence for tie strength's causal effect. For instance, Obukhova's (2012) evidence is indirect, since she did not observe whether job applicants received more information via strong ties relative to weak ties. While Marin (2012) directly

observed the process of information transmission, her qualitative method does not allow her to control for other structural factors that are correlated with tie strength. As Reagans and McEvily (2003, p.241) put it, "because strong ties and social cohesion tend to co-occur, examining tie strength by itself creates the potential of observing effects of knowledge transfer that are actually due to cohesion." Insofar as the structural factors such as cohesion are associated with tie strength *and also* make information transmission more likely, we need direct evidence that attests to tie strength's causal effect, independent of other structural correlates.

Through a unique experimental design, this paper strengthens the basis for the causal claim that strong ties are more likely to transmit information than are weak ties. We provide MBA students at a university in the northeastern United States with a survey vignette experiment and ask about their likelihood of relaying job information to their friends or acquaintances, holding constant the structural locations spanned by the tie and job seekers' fit with the job. The results show that referrers are more likely to refer their friends than acquaintances to job opportunities. Moreover, this higher motivation to refer their friends holds, even when referrers potentially have to risk their reputation by participating in referral activity. Referrers are motivated to the extent that they are willing to risk their own reputation loss in order to help their friends, but they are not willing to do the same for their acquaintances (cf. Rainwater 1970, p.73; Smith 2005, 2007, p.101). Also, referrers still refer their friends at higher rates than they refer their acquaintances, even when they can gain a significant amount of monetary bonus by referring acquaintances (cf. Beaman and Magruder 2012).

Consequently, consistent with general intuition and Obukhova and Marin's interpretation, our findings demonstrate that people are more likely to transmit information via strong ties than via weak ties. We do not argue that tie strength is the *only* causal driver of social ties' value. Nor

do we argue that social ties' value is influenced more by tie strength than the structural range spanned by social ties. As Burt argued, ties' spanning range may still influence social ties' value via enabling them to reach more novel information. But we here provide conceptual underpinning and evidence that tie strength *also* influences ties' value by making information more likely to travel, moderating the effect of ties' spanning range. In this way, tie strength is not just a correlate, but an important determinant of the value of social ties. We conclude by discussing potential sources of motivation caused by tie strength and highlighting several implications of our results to studies of labor market and social network.

2. Theory

2.1. Tie Strength as a Correlate, Not a Cause

Granovetter's (1973) Strength-of-Weak-Ties hypothesis was powerful because it proposed the counterintuitive structural value of weak ties (for earlier studies of the similar argument, see Liu and Duff [1972]; Rogers and Bhowmik [1970]). By discovering that tie strength may be a correlate of the tie's spanning range, he made an important contribution to our understanding of weak ties' value (see Granovetter [1973, p.1063] for the discussion of the "forbidden triad"). Yet, Granovetter did not see tie strength *only* as an indicator of spanning range. Rather, he was careful to suggest that tie strength may have a direct causal effect on information transmission. Granovetter argued that unsuccessful job seekers may be rescued by strong ties in their network, thus attributing some causal effect of tie strength to the chances of information transmission. In revisiting the topic ten years later, Granovetter (1983, p.211) suggested that those who share strong ties "were more easily called on and willing to help," even though they might be limited in the amount of novel information. Albeit lacking direct evidence

for tie strength's causal effect, Granovetter consequently suggested that tie strength as well as the tie's spanning range might affect social ties' value.

By contrast, Burt (1992) had another view. He saw tie strength's only effect as working through the tie's spanning range: he argued that one of his contributions is to clarify that the causal driver of social ties' value is non-redundancy and not tie strength (1992, p.25-30). Ultimately, he concluded that the spanning range is the only causal driver of information benefits; and that "there is no reason to expect any causal effect of tie strength" (Burt 1992, p.30). Since tie strength does not matter, Burt (1992, p.30) argued that a strategic actor should focus on building as many bridging ties as possible, irrespective of their strength (cf. Podolny and Baron 1997). Consequently, since tie strength does not causally affect social ties' value, Burt (1992, p.35) proposed to "leap over the motivation issue" by taking the structure as an indicator of both opportunity and motivation to help a tie.[2]

It is important to clarify the logic behind this premise i.e., why information benefits may depend not on tie strength but solely on the spanning range. In particular, note that this premise does not dismiss the actual transmission as an important element of information benefits. In fact, while Burt did not empirically observe actual transmission of information, he conceptualized information transmission as the key way in which social ties provide value: "[T]he probability of receiving network benefits from a cluster has two components, the probability that a contact will transmit information to you and the probability that it will be transmitted to the contact" (Burt 1992, p.25). Information benefits would not be realized if the tie that *can* reach novel and valuable information *does not actually* transmit the information. Tie strength might have no

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[2] Burt (1992:24-25) acknowledged that "[j]udging friends on the basis of efficiency is an interpersonal flatulence from which friends will flee." In this respect, he hinted that the social ties' content may be an important topic in studying social ties' value. Nevertheless, his overall argument treats social ties of differential strengths as equally likely in transmitting information.

effect on information benefits *not* because the actual information transmission is not important, but because tie strength does not seem to be a causal determinant of the likelihood of transmission of information: "Information benefits are expected to travel over all bridges, strong or weak" (Burt 1992, p.30).

Eventually, this premise was widely adopted by many studies of social networks to conceptualize tie strength only as a correlate of the tie's structural range. One prominent example is the research on the small-world phenomenon (Watts 1999; Watts and Strogatz 1998; Watts et al. 2002; cf. Aral and Van Alstyne 2011; Centola 2010; Centola and Macy 2007). This line of research suggests that even a minimal number of bridging ties can make the highly clustered network structure efficient. One random actor in highly clustered networks cannot efficiently transfer his information to another random actor, since the actor cannot easily get to an actor in another cluster without bridging ties. Yet, even only a few bridging ties in the highly clustered networks can make information travel from one random actor to another random actor quite efficiently. Simulating the effect of a few bridging ties on the entire network structure, Watts and Strogatz (1998) powerfully illustrated the value of weak bridging ties. And crucial in their model is the premise that tie strength does not have any effect on information transmission. By suggesting that a weak bridging tie relays information as likely as a strong redundant tie, these models drew implications on the value of weak bridging ties.

2.2. Strength Matters: Tie Strength as a Cause

However, contrary to the widely adopted premise, other studies of social networks in the labor market suggest that actors are differentially motivated to send information to their select connected contacts. And this argument raises doubts as to whether all social ties are equally

likely to transmit information. For instance, Smith (2005) observed that labor market brokers in poor black neighborhoods sometimes refrained from referring job seekers because these brokers were mindful of the reputation cost associated with referring (also, for studies that point out the reputation cost associated with referral, see Bewley [1999, 297]; Fernandez, Castilla, and Moore [2000, 1291]; Gërxhani, Brandts, and Schram [2013]; Marin [2012]; Saloner [1985]; Sheppard and Belitsky [1966, 187-188]). Prior to Smith (2005), research on social networks attributed differences in information benefits from social ties to the "wrong networks" in which disadvantaged actors were embedded (Aldrich et al. 1989; Cromie and Birley 1992; Fernandez and Fernandez-Mateo 2006; Ruef, Aldrich, and Carter 2003), but Smith (2005) powerfully argued that information benefits may vary systematically even within the same networks (also, Abraham 2015; Fernandez-Mateo and King 2011; Wilson 1996).

Labor market studies further pointed out that information transmission via social ties might depend on tie strength specifically. While some scholars have argued that weak ties are more helpful for job search success (Granovetter 1973; Lin, Ensel, and Vaughn 1981; Wegener 1991), other studies suggest that strong ties are associated with better labor market outcomes (Bian 1994, 1997; Murray et al. 1981; cf. Montgomery 1992; for a possible resolution between the two, see Barbulescu [2015]; Yakubovich [2005]). More recent studies suggest that strong ties may be more helpful for getting jobs because family and friends (i.e., contacts who are connected through strong ties) are more motivated to help job seekers and relay information about jobs than are acquaintances (i.e., contacts who are connected through weak ties; Marsden and Campbell 2012, p.20; also, see Bian et al. [2015]). These studies provide useful directions in accounting for the systematic variation in the benefits of transmission that cannot be accounted for by range. However, evidence from these studies cannot rule out that strong ties provide more relevant (thus

more valuable) information than do weak ties. Job seekers may get jobs via strong ties more frequently because strong ties provide information that better suits job seekers' qualifications (Cingano and Rosolia 2012; Horvath 2014; McDonald 2011). Also, friends may have information that homophilious job seekers prefer (Mouw 2003). For instance, Trimble O'Connor (2013) finds that those sharing strong ties are more likely to be familiar with one another's qualifications; and that "contacts are better able to help when they are familiar with job seekers' work qualifications than when they are unfamiliar" (p.594). In such cases, those sharing strong ties might benefit, even if strong ties were not any more likely to transmit information than were weak ties. Consequently, those studies cannot test whether tie strength is a causal mechanism behind information transmission via social ties.

Obukhova (2012) offers important evidence for this mechanism among job searchers in China. By contrast to many prior studies, her unique dataset allows her to observe social ties that led to unsuccessful as well as successful job searches, which many prior studies could not observe. She observed that job seekers get offers through strong ties more frequently than through formal methods. Weak ties were not any more helpful than the formal methods. Based on this observation, she argued that friends and family are more motivated than are acquaintances to transmit job information to job seekers. Furthermore, she rules out the alternative explanation that strong ties connect job seekers to more relevant (thus valuable) job information. She observed that job seekers do not prefer the offers that they get via strong ties relative to offers obtained through weak ties. With this evidence, she argued that the value of strong ties relative to weak ties likely comes from their being more likely to transmit information, and not higher relevance of the information. However, Obukhova did not directly observe information transmission. Thus, while Obukhova's evidence is consistent with tie

strength's effect on information transmission, her indirect observation does not allow us to confirm tie strength's causal effect (also, for another study that investigates the causal effect of strong ties for hiring but does not directly observe information transmission, see Godechot [2016]).

Marin (2012) offers rich qualitative evidence that addresses this issue. By directly observing referral behaviors of insurance agents, she reported that only 27% of her informants referred someone to the job opportunity that they came across. By reporting the strikingly high selectivity, Marin argued that it is important to learn what drives the motivation to relay the job opportunity. Marin identified four distinct factors her informants considered before transmitting information i.e., desire to help the contacts, concerns for reputations, reluctance to appear intrusive, and fears of awkwardness. Marin argued that these four factors shaped her informants' motivation to transmit information, generally favoring family and friends over acquaintances as targets of referral. Her direct observation bolsters confidence that tie strength has an effect on transmission of information. However, her qualitative evidence leaves unclear whether tie strength *in itself* has a causal effect on information transmission, or whether tie strength is only spuriously correlated with other structural factors that actually drive transmission. Other research suggests that the latter might be the case. In particular, Reagans and McEvily (2003) suggest that those connected via a strong tie might be able to share knowledge with one another more easily *not* because their strong tie causes easier information transmission, but because those connected via a strong tie are also more likely to have similar contacts and thus encounter familiar information repeatedly (cf., Hansen 1999). When controlling for such structural correlates (e.g., shared contacts), Reagans and McEvily (2003, p.240) find that tie strength has little to no effect. Consequently, Marin's (2012) evidence – albeit direct – does not sufficiently test tie strength's

independent causal effect. We need direct evidence that attests to tie strength's causal effect on motivation to transmit information, *independent of other structural factors such as cohesion.*

3. Empirical Setting

Our overall objective is to test whether tie strength causally affects the likelihood of information transmission. Toward this goal, we designed a vignette experiment wherein potential referrers can refer their friends or their acquaintances to a hypothetical job opportunity. While qualitative observational studies (e.g., Marin 2012; Smith 2005; Uzzi 1997) identify strong ties among actors, those studies cannot separate out effects of other variables that are often correlated with tie strength (Mouw 2003, 2006; Reagans 2005; Reagans and McEvily 2003). In a vignette study, experimental procedures can be used to control factors that are often correlated with tie strength in order to isolate its causal effect. Parsing out the effect of tie strength from other structural factors is especially important in our study, since we are trying to build on Marin (2012) and Reagans and McEvily (2003) and empirically test whether tie strength has an independent causal effect on information transmission. Also, experimental procedures also allow us to control for (often unobservable) social similarity, and we can directly test whether tie strength drives more likely information transmission independently of other factors that also drive information transmission. By doing so, we can build on previous studies and empirically test what is driving more likely information transmission among those who share socially similar characteristics (cf., McPherson, Smith-Lovin, and Cook 2001). Our vignette experiment further holds constant potential referrers' opportunity to refer (Fernandez and Fernandez-Mateo 2006), the amount of potential referrers' knowledge about job seekers (Aral and Van Alstyne 2011; Marin 2012; Trimble O'Connor 2013), potential referrers' knowledge about job seekers'

qualifications (Marin 2012; Smith 2005), and job seekers' search status (McDonald and Elder 2006).[3] Because tie strength is the only variable affecting potential referrers' likelihood to refer job information, we can isolate the causal effect of tie strength on the motivation to refer.

Our vignette setting concerns referral activities concerning job openings in the labor market. The labor market serves as an attractive vignette setting for our empirical test because referral activities embody a familiar information transmission process wherein potential referrers decide whether or not to transmit the job information to their contacts. Prior studies also suggest that it may be costly for referrers to refer their contacts: when referrers decide to relay job information to their contacts, they consider how they would appear to the employer and try to manage their reputation (Marin 2012; Smith 2005). That is, once potential referrers transmit the information to their contacts, their reputation as judges of quality candidates is on the line. If tie strength is a meaningful causal driver of social ties' access benefit, tie strength should have an effect on information transmission even when it is costly (cf. Rainwater 1970; Smith 2005, 2007, p.101). Our vignette takes advantage of this feature by testing whether referrers transmit information even when they need to risk their reputation by vouching for their contacts.[4]

Moreover, practically, referring is an important part of the hiring process (Fernandez and Weinberg 1997; Fernandez et al. 2000). In the 1991 General Social Survey, when respondents were asked "Please tell me all the ways that you found out about this job," the most common

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[3] Extant literature suggests that the likelihood of information transmission might vary depending on these factors that our vignette holds constant. The main focus of our vignette is to test the main effect of tie strength on the likelihood of information transmission, holding constant those factors while only varying tie strength. To the degree that other factors render the effect of tie strength spurious, holding these factors constant it should make it more difficult to find the effect of tie strength.

[4] There might be other costs associated with transmitting information via social ties, besides reputation, e.g., time it takes to relay the information. We use the reputation cost as one example of such cost, since it seems very salient in the referral process, based on prior research. We thank a reviewer for helping us clarify this point.

response (37%) was "From someone who already worked there." The prevalence of referring in the hiring process suggests that the instances where information can potentially be relayed via social ties are a general context for studying tie strength's effect on information transmission.

3.1. Procedures

We distributed an anonymous vignette survey to first-year MBA students at a university in the northeastern United States. They took the survey during an orientation session on "Networks and Job Search," and were given ten minutes to take the survey.[5] MBA students are suitable for our vignettes, since they are both knowledgeable about the referral process and sensitive to the reputation cost associated with job referrals,[6] as confirmed by their responses (more below; also, see Greenberg and Fernandez 2016 and Appendix). In their responses to questions about background, more than half of our sample (50.3%) reported that they had applied to a job that they learned about through social ties. Also, more than half (59.7%) reported that they had solicited someone to be their employee referral to a job opening at their company. These numbers likely suggest that an even higher percentage of our sample is experienced in the referral process, since our participants may have chosen not to apply to jobs to which they had been referred. Similarly, they may have decided not to refer anyone even when they knew of opportunities and qualified candidates. As discussed above, Marin (2012) reported that her informants referred someone to a job only 27% of the time when they had the opportunity to do

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[5] The session happened in September 2010 with first-year MBA students; all our participants were new to campus. Students took the survey in the beginning of the session, right after the instructor introduced himself to the class. While everyone at the session took the survey, four participants' responses were illegible, so they were excluded from the analysis.
[6] Most MBAs in our sample are relatively young (average age is around 28) and early in their career (average years of experience is around 5), both of which might make them more vulnerable to reputation risks than those who are more established in their career.

so. These responses help us build confidence that a vignette about referral can properly test the effect of tie strength on information transmission for our sample, without making the hypothetical nature of the vignette too salient. In the discussion section below, we further elaborate on ramifications of using this sample and design.

There are two possible designs for the vignette that serve our purpose. A first possible vignette might ask participants to choose among relaying information to friends (i.e., those connected via strong ties), relaying information to acquaintances (i.e., those connected via weak ties), and withholding their information; and we can test to which party participants are more likely to transmit information (or when they decide not to withhold the information). However, this design conflates why participants are motivated one way or another: do participants relay information to friends because they want to help their friends, or is it because they do not want to help their acquaintances? Therefore, we opted for an alternative design where one group of participants is given a choice between relaying their information to their friends and withholding the information. The other group of participants is given a choice between relaying their information to their acquaintances and withholding (more details on the design below). By comparing the likelihood of transmission in this between-person design, we can more directly test how likely participants are to relay information via their strong ties versus how likely they are to relay information via their weak ties.

After receiving the survey in the beginning of their orientation session, participants were randomly assigned to one of four conditions using a paper and pencil survey instrument, in a two-by-two between-person design. Along one factor, we manipulated strength of tie. Following Marsden and Campbell's (1984) findings that "closeness" is the best indicator of tie strength, we operationalized strong ties as friends and weak ties as acquaintances. This was our main

manipulation for the overall objective of our empirical test. Along the second factor, we manipulated whether or not the referrer's firm pays a referral bonus. As suggested by Beaman and Magruder (2012) in their field experiment, cash bonuses likely affect actors' referring behavior. Participants in one set of conditions were not told anything about a bonus; participants in the other set of conditions were told that their firm was offering $1,000 for referring a successful hire. This second manipulation would allow us to test whether tie strength's effect can be bought with economic incentives. This manipulation also puts the vignette in the real-world setting, where cash bonuses are often paid for successful referrals (more below; Fernandez and Weinberg 1997; Fernandez et al. 2000). Table 1 reports the number of participants for the four cells of the design.

Table 1 – Distribution of participants into each condition[a]

	Friend	Acquaintance	Total
No bonus	55	46	101
$1,000	48	47	95
Total	103	93	196

[a]200 participants received the survey, but responses from four participants were illegible or left blank. Therefore, we excluded them from the analysis.

Participants in all conditions read the following scenario, on the first page of the survey:

You are working at an IT firm. You often spend time on-line posting to list-serves and in large internet chat-rooms discussing technical questions related to your work. Recently, you have received several emails from the HR department encouraging employees to refer software developers.

To this description, the following phrase was added for the two bonus scenarios: "*[HR Department is] offering a bonus of $1,000 to employees who refer successful candidates who stay with the firm for at least a 90 day probation period.*" The context of "*IT firm*" was chosen in

order to provide generic description of a company that is a familiar and plausible employer for our participants without raising concerns on some context-specific characteristics of other industries (e.g., family businesses).

For the strong tie conditions, participants were told on the second page that "*You become aware that Robert, who also participates in the list-serve, is looking to change jobs. Robert is a close friend. Robert's credentials and experience might make him a good fit for the job at your firm.*" Participants in the weak tie conditions were told on the second page that "*You become aware that Ben, who also participates in the list-serve, is looking to change jobs. Ben is not someone you know personally. Ben's credentials and experience might make him a good fit for the job at your firm.*"[7] This design is grounded in previous studies, where there is precedent for thinking of friends as strong ties (e.g., Granovetter 1973; Marsden and Campbell 1984, 2012). Similarly, there is precedent for thinking of industry contacts (e.g., Ruef et al. 2003) or members of the same cooperatives (e.g., Abraham 2015) as weak ties, since they represent those who have interacted with one another before but do not know each other closely. The vignette controls for structural factors such as cohesion by implying the same structural location (i.e., being in the same list-serve) but manipulates only strength of ties.

Finally, we intentionally left the job seeker's qualification ambiguous and constant across conditions, so that participants face similar levels of uncertainty as to how qualified the job seeker is. Controlling for perceived qualifications of contacts is especially important, since those sharing a strong tie might be more familiar with one another's qualifications (cf., Trimble O'Connor 2013). Also, it is worth noting that there is no a priori reason to think that participants

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[7] We did not vary the gender of the potential target of referral, since we were primarily interested in testing tie strength's effect on information transmission in general. The gender of participants (i.e., potential referrers) does not affect the results. Some prior and ongoing studies investigate how the gender of the target affects the likelihood to refer (cf., Abraham 2015; Fernandez-Mateo and King 2011).

in our sample are more likely to think that their friends are more qualified than acquaintances in the given vignette. We tell participants that both friends and acquaintances have "*credentials and experience* [that] *might make him a good fit for the job at your firm*," and both friends and acquaintances seem to be from the same background. The balance of qualification between friends and acquaintances then suggests that participants in all conditions face the same reputation risk when referring the job seeker – i.e., if participants choose to relay the information to their contacts, their reputation as a "good referrer" is equally at risk in all conditions. Afterwards, the questions for the likelihood of referring were then asked (described in detail below). The survey concluded with a few questions about participants' background and experience with referring. See Appendix Table 1 and Appendix Table 2 for the further description on participants' background and randomization check.[8]

We measured the likelihood of referring by asking participants in all conditions: "*How likely are you to do each of the following*?" The first statement was "*Contact [Robert or Ben] and encourage him to apply for the job as your referral.*" Participants were asked to rate their likelihood of referring from 1 to 9, from "*Not Very Likely*" to "*Very Likely.*" To make sure that participants know the monetary benefit of referring for the bonus conditions, the following phrase was added "*(in which case, you would be eligible to receive the referral bonus of $1,000)*" to this item in bonus conditions.

As discussed above, studies suggest that reputation risks may be an important factor affecting people's willingness to transmit job information in the labor market. Therefore, we also asked participants how likely they are to "*Contact [Robert or Ben] and encourage him to apply*

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[8] None of the non-randomized individual-specific variables, including gender, age, work experience, and international experience, affect the results (in main effect or interaction effect), so we do not discuss them further.

for the job, but NOT using your name." To make sure that participants know what it means to

refer without using their names, for the bonus conditions the phrase "*(in which case, you would*

NOT be eligible to receive the referral bonus of $1,000)" was added to this item.

Lastly, it is worth clarifying what the bonus in this experimental setup means to our

participants and what its theoretical implications might be. As paying a bonus for a successful

referral is a common practice in US industries, our participants are likely to be familiar with

monetary incentives for (successful) referrals and can easily envision playing the role of

potential referrer in our hypothetical scenario. Theoretically, the bonus represents one of a few

motivators (yet an important one) for one's propensity to transmit information via social ties.

There are of course other plausible motivators for one's propensity to refer, such as social

rewards for one's prosocial activities (Simpson and Willer 2015). Since the monetary bonus is a

common motivator for referral in the labor market, it is included in our experimental setup, in

addition to tie strength (which is the focus of our question). Finally, it is worth noting that the

bonus amount ($1000) is a plausible amount of bonus awarded for a successful referral among

our participants. If anything, it might represent a lower bound: MBAs from the same program of

our participants reported in the same year that they have received as much as $30,000 for a

successful referral. The mean bonus amount our participants report for a successful referral is

$2153 (see Appendix for more).

3.2. Dependent Variables

There are two dependent variables of interest. The first is the response to the first

question (How likely are you to…Contact [friend or acquaintance] and encourage him to apply

for the job?). This measures participants' willingness to transmit information about the

hypothetical job opening, as well as their willingness to incur any associated reputation costs. This dependent variable allows us to test whether strong ties are more likely to transmit information than are weak ties.

The second dependent variable is the difference between the response to the first question (i.e., propensity to refer) and the response to the second question (i.e., propensity to refer without reputation risk). Recall that the second question asks participants how likely they are to refer without their names attached, and that the only difference between the first and the second questions is how likely one is to attach one's name to the referral activity. Therefore, this second dependent variable (i.e., the difference between the response to the first question and the response to the second question) measures participants' propensity or willingness to risk their reputation, or "stick their necks out" for their job seeking contacts. Note that conceptually, the value of this measure can be negative as well as positive: the negative value indicates that participants want to protect their reputation rather than risking it. Alternatively, the positive value means that they are willing to risk their reputation by referring. Thus, a bigger positive value of this measure suggests that participants are more willing to risk their reputation for their job seeking contacts. This dependent variable allows us to test tie strength's even when referrers have taken into consideration reputation costs.

4. Analyses

4.1. Tie strength's effect on information transmission

We first directly test whether referrers' willingness to transmit information about a job opening (i.e., refer) depends on tie strength. In order to do so, we test whether they refer their friends with greater likelihood than their acquaintances, pooling data across the two bonus

conditions. The results show that participants were more likely to refer their friends (mean=7.99; n=103) than their acquaintances (mean=5.70; n=93; t-statistic=8.50; p-value<0.001).[9] This finding is consistent within the two bonus conditions as well. When not offered any referral bonus, participants were much more likely to refer their friends (mean=8.09; n=55) than their acquaintances (mean=4.91; n=46; t-statistic=9.05; p-value<0.001). This was also true, even when participants were offered a bonus: participants were more likely to refer friends (mean=7.88; n=48) than acquaintances (mean=6.47; n=47; t-statistic=3.64; p-value<0.001). Table 2 summarizes these findings.

Extant literature suggests that a monetary bonus can make social ties more likely to transmit information (Beaman and Magruder 2012). In other words, strong ties might be more likely to transmit information than weak ties, but the effect of tie strength can be overridden by encouraging weakly tied actors with a monetary bonus (see e.g., Fernandez et al. [2000, 1333] discussion of people "referring their dogs" for a bonus). Therefore, we test whether social ties are more likely to transmit information when contacts are paid for transmitting information to their acquaintances. The results show that unpaid participants are still more likely to refer their friends (mean=8.09; n=55) than are paid participants to refer their acquaintances (mean=6.47; n=47; t-statistic=5.03; p-value<0.001). Interestingly, participants were not more likely to refer their friends when they were paid the bonus than when they were not paid the bonus (t-statistic=0.80; p-value=0.43). Rather, if anything, participants were more motivated to refer their friends without a bonus (mean=8.09; n=55) than with a bonus (mean=7.88; n=48). One way to interpret this result is that the benefits endowed by strong ties is barely affected by a bonus, at

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[9] While t-test is efficient, it also assumes equal variance between two populations. Violation of this assumption may decrease the validity of the test especially when the sample sizes are unequal. Therefore, we also use Mann-Whitney U test as well, and all results are substantively the same (Fay and Proschan 2010; Mann and Whitney 1947).

least within the bounds of our empirical design.[10] By contrast, participants showed a higher

willingness to refer their acquaintances when they were paid (t-statistic: 3.49; p-value<0.001).

Regression analysis reported in Appendix Table 4 further confirms that the bonus successfully

encouraged our participants to be more likely to transmit information when they were doing so

via weak ties, but the bonus did not make a difference when they were transmitting information

via strong ties.

Table 2 – Response to the first question (i.e., mean propensity to refer with name attached) where participants were asked how likely they were to refer their friends or acquaintances for the hypothetical job opportunity. The possible value ranges from 1 to 9, from "Not very likely" to "Very likely," respectively. Standard deviation is reported in the parentheses.

	Friend	Acquaintance	Difference[a]
No bonus	8.09 (0.89) [N=55]	4.91 (2.24) [N=46]	***
$1,000	7.88 (1.70) [N=48]	6.47 (2.05) [N=47]	***
Difference[a]	NS	***	

[a]P-value from the t-test on difference between the two values. The bottom row denotes p-value between "No bonus" and "$1000" conditions in each respective tie strength condition. The right-most column denotes p-value from the t-test on difference between "Friend" and "Acquaintance" conditions in each respective bonus condition. **p<0.01; ***p<0.001; NS means p>0.05

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[10] We are cautious not to overclaim implications of this finding, however, since participants' likelihood to refer their friends was close to the maximum possible value (9).

4.2. Willingness to Risk Reputation

The previous analysis shows that participants are more likely to pass along job information to their friends than to their acquaintances. However, as discussed above, extant literature raises the issue of how reputation risk might also affect people's propensity to refer (Rainwater 1970; Smith 2005, 2007, p.101). Insofar as the monetary incentive represents the benefit of referring, the reputation risk represents the potential cost that referrers have to incur when transmitting information via social ties. In other words, even though participants were more willing to refer their friends, they may not be more willing to risk reputation for their friends than their acquaintances. Yet, because the candidate's qualifications were held constant across conditions, the previous analyses did not vary the potential reputation cost associated with referring the candidate. Here, we directly test whether friends are more likely to pass along job information, despite the possible reputation risk associated with referral activity. Recall that the measure represents participants' propensity to "stick their necks out" for their job seeking contacts, so that the positive value of the measure represents the extent to which they are willing to risk their reputation for their contacts; and the negative value represents the extent to which they want to refrain from risking their reputation. Table 3 presents this measure, and Appendix Table 3 shows raw responses to the second question.

We first assess the internal validity of the reputation risk. Participants were anonymous in our empirical design; therefore, it is possible that participants did not care about their reputation in our setting. However, other studies suggest that participants manage their reputation even in anonymous experimental settings (e.g., Hahl et al. 2015; Yamagishi and Mifune 2008; cf. Salganik, Dodds, and Watts 2006). Indeed, our results show that participants cared about their reputations, at least to the extent that they were willing to put economic value on their

reputations. Using the difference between the response to the first question and the response to the second, we show that participants were more willing to stick their necks out when they were paid (mean=3.58; n=95) than when they were not paid (mean=2.12; n=101; t-statistic=2.80; p-value<0.01).

We now directly test whether the effect of tie strength holds even when actors care about their reputation. Accordingly, we find that participants were in general more willing to risk their reputation by referring their friends (mean=4.43; n=103) than to risk their reputation by referring their acquaintances (mean=1.05; n=93; t-statistic=7.00; p<0.001). This main result demonstrates the effect of tie strength, despite the potential reputation risk for the referrer. We further find that unpaid participants were more willing to risk their reputation by referring their friends (mean=4.38; n=55) than to risk their reputation by referring their acquaintances (mean=-0.59; n=46; t-statistic=8.08; p-value<0.001). Although the value is not significantly different from zero, it is worth noting that unpaid participants were more willing to protect their reputation than they were to risk it for their acquaintances, represented by the negative absolute value. By contrast, the positive absolute value for the unpaid participants with opportunities to refer their friends suggests that unpaid participants *were* willing to risk their reputation for their friends. Even when paid, participants were more willing to risk their reputation for their friends (mean=4.48; n=48) than to risk their reputation for their acquaintances (mean=2.66; n=47; t-statistic=2.70; p-value<0.01).[11] Table 3 summarizes these findings. Additional analyses show that unpaid participants were more willing to risk their reputation for their friends (mean=4.38;

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[11] As in the first set of analysis, when our participants were deciding whether or not to risk their reputation by referring their acquaintances, a bonus made a difference and effectively encouraged them to risk their reputation (t-statistic: 4.75; p-value<0.001). Analyses presented in Appendix Table 5 also confirm these results.

n=55) than paid participants were for their acquaintances (mean=2.66; n=47; t-statistic=2.83; p-value<0.01).

In sum, these results demonstrate the robust effect of tie strength on the motivation to relay information. Even when people face risks to their reputation, they are more likely to transmit information to friends than acquaintances. Moreover, the boost in the motivation to refer associated with strong ties is robust to a hefty sum of monetary incentives, at least within the bounds of our empirical design. The fact that tie strength's effect works with both positive incentive (e.g., monetary bonus) and negative incentive (e.g., reputation risks) demonstrates that tie strength in itself is an important determinant of the value of social ties.

Table 3 – Participants' willingness to risk her reputation for her contact. The measure comes from the difference between the response to the first question (i.e., propensity to refer) and the response to the second question (i.e., propensity to refer without name attached). Substantively, the measure represents participants' propensity or willingness to risk their reputation. The negative value means that participants want to protect one's reputation; the positive value means that they are willing to risk their reputation by referring. Standard deviation is reported in the parentheses.

	Friend	Acquaintance	Difference[a]
No bonus	4.38 (2.79) [N=55]	-0.59 (3.30) [N=46]	***
$1,000	4.48 (3.27) [N=48]	2.66 (3.29) [N=47]	**
Difference	NS	***	

aP-value from the t-test on difference between the two values. The bottom row denotes p-value between "No bonus" and "$1000" conditions in each respective tie strength condition. The right-most column denotes p-value from the t-test on difference between "Friend" and "Acquaintance" conditions in each respective bonus condition. **p<0.01; ***p<0.001; NS means p>0.05

4.3. External and Internal Validity of Our Vignette Design[12]

Like any other vignette experiments, our design is limited in that it presents a hypothetical situation, and that the responses do not necessarily materialize into actual behaviors. But as mentioned above, our vignette purposefully represents a plausible and familiar scenario for our participants, potentially making results more generalizable. Moreover, our setting might serve as a *conservative* research design for studying tie strength's causal effect on information transmission. If anything, insofar as our vignette presents a hypothetical situation to participants, it would be surprising that our participants refer their friends and acquaintances with differential likelihood: why not say that they would refer everyone and appear friendlier, when there is no cost of answering that way? Insofar as we are focusing on the *difference* between the likelihood to transmit information via strong ties and the likelihood via weak ties, and insofar as participants in all conditions faced equally hypothetical opportunities to transmit information, any differential likelihood to transmit information would provide a stronger footing for the causal effect of tie strength.

Lastly, note that our experimental setup relies on a subtle verbal manipulation of tie strength. Insofar as tie strength is most likely to depend on the cluster of characteristics and emotions, any effect that comes from the simple verbal manipulation would be surprising. While any vignette studies contain a risk of producing a demand effect, the subtlety of cues on differential tie strength likely ameliorates such concern. Finally, even if such cues come across

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[12] We thank a reviewer for helping us clarify this point.

less subtle than anticipated to our participants, participants in all conditions were exposed to the cues of the similar salience: therefore, the differential likelihood of tie strength's effect is likely not the outcome of a demand effect.

5. Discussion and Conclusion

Much of the contemporary research on social networks has overlooked the causal effect of tie strength on access to information. Burt's (1992) premise travelled far in some studies of social networks, as the research on the small-world phenomenon adopted the premise and suggested important implications of weak ties. Yet, direct evidence on tie strength's causal effect (or a lack thereof) was non-existent. To this, our experimental design allows us to bolster claims of a causal effect of tie strength on the chances of transmitting information about a job vacancy. Moreover, insofar the value associated with strong ties might come from greater relevance, greater knowledge, more numerous opportunities, and homophilious association, as suggested by some previous studies, our experiment provides the most direct test where all those factors are controlled. Our findings then imply that in addition to structural range, the likelihood of information transmission needs to be considered as an important determinant of social ties' value.[13] Consequently, our contribution is two-fold: theoretical in providing a clearer conceptual underpinning to conditions under which social ties might provide information benefits; and empirical in strengthening the causal claim about tie strength.

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[13] We are not in any way suggesting that actors more likely get their friends *hired*. Our question here concerns whether strong ties are more likely to transmit information. Yet, to the degree that employers give some weight to having been referred in their screening decisions (Fernandez and Galperin 2014; Granovetter 1979), it might well be that such a preference for strong ties do indeed affect hiring outcomes.

5.1. Why Are Strong Ties More Likely to Transmit Information?

While our empirical test does not identify a specific source of higher motivation associated with strong ties, there are a few different possible sources of the motivation (see Marin [2012, p.188-189] for further discussion). One of the possible sources is actors' concern for the "shadow of the future." Axelrod (1984) suggests that cooperation may emerge when the chances of continued interaction are great enough, because actors who are likely to interact with one another in the future expect to be reciprocated. More recent research empirically tests emergence of cooperation between two actors expecting to interact in the future (see Simpson and Willer [2015] for review). Then, insofar as actors expect to interact with their friends and family in the future more so than do they with their acquaintances, they might be instrumentally more motivated to help their friends and family.

Another possible source of higher motivation associated with strong ties is one's affinity to one's friends and family (e.g., Granovetter 1973, 1983): actors simply like their friends and family more than their acquaintances, so they relay job information via strong ties more frequently than via weak ties. They may also think it almost a duty to help their friends and family, out of a sense of obligation. Becker (1976) provides a variant of this argument, where an increase in one's friends and family's (e.g., child's) utility elevates one's (e.g., parent's) own utility *not* because one expects to be reciprocated in the future, *but solely* because one enjoys knowing that one's friends and family experienced an increase in utility. These arguments suggest that strong ties might be more likely to transmit information than weak ties even without the possibility of future reciprocation. We cannot adjudicate between these motivations in the current study. Based on our causal evidence we have offered here that tie strength is a causal

driver of information transmission, future work should investigate the extent to which the

"shadow of the future" governs this effect and what other sources of motivation there might be.

5.2. Implications to the Research on the Small-World Phenomenon and the Labor Market

Implications of our findings are especially far-reaching to the research that assumed that

tie strength does not affect access to information. As introduced earlier, Watts and Strogatz

(1998) argued that even a minimal number of weak bridging ties can make the highly clustered

network structure highly efficient. However, such a conclusion was possible because they

assumed that information always travels through any social ties without regard to why the sender

is motivated to pass along the information. Several studies do suggest that the "free" information

transmission is quite common (e.g., Fleming, King, and Juda 2007; Uzzi and Spiro 2005), but

such an assumption may not hold in other contexts where the sender of information cares about

the cost of transmitting the information; and violation of the assumption may reduce the value of

weak bridging ties. In fact, Reagans and Zuckerman (2008, p.5) adopt Watts and Strogatz's

simulation model and adjust the parameter about the likelihood of information flow (so that

strong redundant ties transmit information more likely than weak bridging ties). When weak ties

do not transmit information as much as strong ties do, Reagans and Zuckerman find that a few

weak bridging ties do not make the network structure as efficient as Watts and Strogatz

suggested.[14] In our study, we do not directly test how the causal effect of tie strength leads to

social ties' value in the whole network structure. However, those simulation studies imply that

the differential likelihood of information transmission might be an important determinant of

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[14] Similarly, Boorman (1975) parameterizes his simulation model so that strong ties are more likely to transmit information. When also assuming that strong ties require more resources to maintain, Boorman's simulation model suggests that having strong ties is more preferable than weak ties if actors need surer access to job information.

social ties' value to the whole network structure, and our results provide empirical validation to such parameter choices used in the simulation studies – i.e., lower likelihood of information transmission via weak ties than that via strong ties.

We also highlight a tension in employer-referrer-job seeker triadic relationships in the labor market (Rubineau and Fernandez 2015; Bidwell and Fernandez-Mateo 2008). It is now well known that referrers play an important role in facilitating the match between employers and job seekers. However, prior research on labor market has often overlooked referrers' motivation to transmit information in the employer-referrer-job seeker triadic relationships. We show that strong ties provide one logic through which referrers decide to pass along information. Moreover, even though employers often try to encourage referrals to qualified candidates through the use of referral bonuses (Fernandez and Weinberg 1997; Fernandez et al. 2000), we show that strong ties are relatively immune to such a mechanism. As a result, referrers are put in role conflict between employers and job seekers, both of whom referrers might feel obligated to serve. While role conflict of brokers has long been documented in the brokerage literature (Fernandez and Gould 1994; Friedman and Podolny 1992; Gould and Fernandez 1989; Podolny and Baron 1997; Xiao and Tsui 2007; see Fernandez and Castilla [2001, p.90] for possible role conflict in the labor market context), literature on labor market intermediaries has tended to examine positive aspects of referral activity for the demand-side (Fernandez and Weinberg 1997; Fernandez et al. 2000; Marsden and Gorman 2001) and the supply-side (Bidwell and Fernandez-Mateo 2008, p.160-172; Granovetter 1995; Fernandez and Galperin 2014; Greenberg and Fernandez 2016; Obukhova and Lan 2013; Rubineau and Fernandez 2015; Yakubovich 2005). Fernandez and Fernandez-Mateo (2006; also, Fernandez and Sosa [2005]; Rubineau and Fernandez [2013]) hinted that referrers tend to serve their friends irrespective of employers'

concerns, but they did not observe the tension directly from the perspective of referrers. Future research should address how job market actors try to resolve such role conflict (cf. Beaman and Magruder 2012, p.3587-3588; Fernandez-Mateo 2007), as referrers may behave differently depending on for whom they want to manage their long-term reputation (e.g., Fernandez and Bond 2015).

On this point, it is worth putting our results in comparison to Smith's (2005, p.37), since she found that concern for friends and family is "secondary" to the concern for one's reputation risk in her context. By contrast, our findings show that participants are more likely to refer their friends irrespective of reputation cost. While we do not directly address why our findings show otherwise, one possible explanation is that it is just a matter of degree: strong ties are still more likely to transmit information than are weak ties, but sometimes concerns for reputation risks trump motivations propelled by strong ties. And such difference in degree may come from the fact that our study examines a very different sample (i.e., MBAs, who are who may be less threatened by the reputation risk and more used to having qualified friends and acquaintances) than Smith's sample of largely minority low wage and economically vulnerable workers. Future studies will therefore examine how higher motivation associated with strong ties changes depending on actors' perception of reputation risk associated with referral activity.

5.3. Possible Limits of Strong Ties

Lastly, we are cautious not to overclaim strong ties' value. Recall that while participants expressed a higher willingness to transmit the job information via strong ties, they were more likely to transmit via weak ties when they could ask their contacts not to put their reputation on the line (see Appendix Table 3 "no bonus" conditions). It might be awkward and perhaps even

insulting to ask one's contact not to use one's name, because it might convey the impression that one does not think highly of one's contact's ability to perform well on the job; in such a case, weak ties might be more likely to transmit the job information. Nevertheless, insofar as applying to a job as a referral might be more helpful than applying to a job as a non-referral, strong ties are still more helpful for beneficial information transmission, i.e., information benefits (Fernandez and Weinberg 1997; Fernandez et al. 2000; Fernandez and Fernandez-Mateo 2006). Yet, these results suggest that, when the situation mandates one to transmit information under the condition that our second vignette question provides (i.e., transmitting information without allowing the contact to reveal the source of information), one might be more freely transmit information via weak ties (cf., Simmel 1950).

Ultimately, implications of our study provide scholars of social networks promising avenue for future research. The higher motivation associated with strong ties may have diminishing returns (e.g., Uzzi 1996). Also, strong ties may require more resources to maintain; thus actors may benefit from strong ties only when they need information to constantly flow to them (e.g., Boorman 1975). Careful consideration of our study vis-à-vis these studies therefore presents further opportunity for future research to explore bounds of the motivation associated with strong ties. Why are strong ties sometimes less helpful than weak ties, even though actors sharing strong ties are more motivated to help one another? Evidence from Chan (2009) and Desmond (2012) suggests that the motivation issue associated with social ties might determine the value of ties in often unexpected ways. These studies provide contexts where the higher motivation associated with strong ties is sometimes "turned off." Our study helps guide the future research to explore why the motivation issue associated with social ties results in their unexpected value. Consequently, whereas Burt (1992, 35) proposed to "leap over the motivation

issue," our study joins the stream of literature that brings the motivation issue back to research of social networks.

APPENDIX

Other questions were asked with the vignette to get a sense of participants' backgrounds. Responses to these questions were also used to check our randomization and test any mediation. For the randomization check, Appendix Table 1 reports two-way t-tests between two conditions that varied on tie strength, and Appendix Table 2 reports two-way t-tests between two conditions that varied on the amount of referral bonus. The tables show that participants in the four different conditions have the similar means of age and years of experience that are not significantly different. Other demographic variables such as participants' gender, experience of having been referred, and experience of having referred someone are comparable across different conditions as well.

Responses to the background questions reveal that, at least within our sample of first-year MBAs, referral activity is indeed a prevalent phenomenon in the labor market. This helps us build confidence that the labor market is the proper context to study the effect of tie strength on information transmission for our sample. 50.26% of the sample reported that they have applied to a job that they learned through social ties. Among them, 61.46% have taken the job. 59.67% of the entire sample reported that they have solicited someone to be their employee referral to a job opening at their company, and among them, 85.19% said that they have had people they referred apply for jobs at their company. Among experienced referrers, their referral bonus ranged from $0 to $10,000, with the mean at $2153.[15] 24.56% of those who said that they have been learned about a job through social ties reported that their referrers received a referral bonus, and 15.53% of those who said that they have referred someone reported that they received a referral bonus. It is worth noting that while these responses were collected after participants' social ties to their

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[15] Only 17 respondents gave answers to this question.

hypothetical contacts were manipulated, they were likely unaffected by manipulations: there are no a priori reasons to believe that manipulations on tie strength altered their memories on past referral experience and demographic information.

Appendix Table 1 – Two-way T-test for means between participants in the "Strong Tie" condition and participants in the "Weak Tie" condition

	Mean in the "Friend" condition (standard deviation)	Mean in the "Acquaintance" condition (standard deviation)	T-statistic[a]	N[b]
Age	27.92 (2.60)	27.84 (2.20)	0.22	193
Years of Experience	5.27 (2.44)	5.02 (1.65)	0.81	196
Gender (Female=1)	0.35 (0.48)	0.32 (0.47)	0.40	196
Have you been referred to a job opportunity before? (Yes=1)	0.54 (0.50)	0.57 (0.50)	-0.41	191
Have you referred someone to a job opportunity before? (Yes=1)	0.59 (0.49)	0.60 (0.49)	-0.15	181

[a]The t-statistic is from the two-way t-test. Depending on the sample size, t-test may be limited in testing whether randomization worked (whether the means of the two conditions are the same) because comparing means of two small samples will inevitably lead to insignificance. We compare the raw means as well in order to make sure that randomization has been done successfully.

[b]Number of cases differs across variables because of non-response.

Appendix Table 2 – Two-way T-test for means between participants in the "No bonus" condition and participants in the "$1000 referral bonus" condition

	Mean in the "No referral bonus" condition (standard deviation)	Mean in the "$1000 referral bonus" condition (standard deviation)	T-statistic[a]	N[b]
Age	27.93 (2.66)	27.84 (2.13)	0.26	193
Years of Experience	5.21 (2.23)	5.09 (1.96)	0.40	196
Gender (Female=1)	0.31 (0.46)	0.37 (0.48)	-0.91	196
Have you been referred to a job opportunity before? (Yes=1)	0.58 (0.50)	0.52 (0.50)	0.75	191
Have you referred someone to a job opportunity before? (Yes=1)	0.61 (0.49)	0.58 (0.50)	0.40	181

[a]The t-statistic is from the two-way t-test. Depending on the sample size, t-test may be limited in testing whether randomization worked (whether the means of the two conditions are the same) because comparing means of two small samples will inevitably lead to insignificance. We compare the raw means as well in order to make sure that randomization has been done successfully.

[b]Number of cases differs across variables because of non-response.

Appendix Table 3 – Response to the second question where participants were asked how likely they were to refer their friends or acquaintances for the hypothetical job opportunity without their names attached. The possible value ranges from 1 to 9, from "Not very likely" to "Very likely," respectively. The difference between these values and responses to the first question was used to calculate the second dependent variable.

	Friend	Acquaintance	Difference[a]
No bonus	3.71 (2.45) [N=55]	5.50 (2.55) [N=46]	***
$1,000	3.40 (2.40) [N=48]	3.81 (2.38) [N=47]	NS
Difference	NS	**	

[a]P-value from the t-test on difference between the two values. The bottom row denotes p-value between "No bonus" and "$1000" conditions in each respective tie strength condition. The right-most column denotes p-value from the t-test on difference between "Friend" and "Acquaintance" conditions in each respective bonus condition. **$p<0.01$; ***$p<0.001$; NS means $p>0.05$

Appendix Table 4 – Dependent variable is the respondent's rating to the question "*How likely are you to contact* [friend or acquaintance] *and encourage him to apply for the job as your referral*," ranging from 1 to 9, from "Not very likely" to "Very likely."

	Model 1	Model 2
Tie strength (strong=1)	2.32***	3.18***
	(0.26)	(0.35)
Bonus/100	0.06*	0.16***
	(0.03)	(0.04)
Tie strength × Bonus/100		-0.18***
		(0.05)
Intercept	5.38***	4.91***
	(0.23)	(0.26)
Adjusted R-squared	0.30	0.33
N	196	196

*p<0.05; **p<0.01; ***p<0.001

Appendix Table 5 – Dependent variable is the respondent's willingness to risk her reputation for her contact. The measure comes from subtracting the response to the second question ("*How likely are you to contact* [friend or acquaintance] *and encourage him to apply for the job, but NOT using your name*") from the response to the first question ("*How likely are you to contact [friend or acquaintance] and encourage him to apply for the job*").

	Model 1	Model 2
Tie strength (strong=1)	3.44***	4.97***
	(0.46)	(0.47)
Bonus/100	0.16***	0.32***
	(0.05)	(0.63)
Tie strength x Bonus/100		-0.31***
		(0.0.09)
Intercept	0.25	-0.59***
	(0.41)	(0.47)
Adjusted R-squared	0.24	0.28
N	196	196

*p<0.05; **p<0.01; ***p<0.001

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