



The paradox of weak ties in 55 countries



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ABSTRACT

People find jobs through their social networks using ties of different strengths. Intuitively weak ties might be less useful because people communicate less often with them, or more useful because they provide novel information. Granovetter's early work showed that more job-seekers get help via acquaintances than friends (Granovetter, 1973). However, recent work on job-finding (Gee et al., 2017) shows an apparent paradox of weak ties in the United States: most people are helped through one of their numerous weak ties, but a single stronger tie is significantly more valuable at the margin. Although some studies have addressed the importance of weak ties in job finding within specific countries, this is the first paper to use a single dataset and methodology to compare the importance of weak ties across countries. Here, we use de-identified data from almost 17 million social ties in 55 countries to document the widespread existence of this paradox of weak ties across many societies. More people get jobs where their weak ties work. However, this is not because weak ties are more helpful than strong ties – it is because they are more numerous. In every country, the likelihood of going to work where an individual friend works is increasing – not decreasing – with tie strength. Yet, there is substantial variation in the added value of a strong tie at the margin across these countries. We show that the level of income inequality in a country is positively correlated with the added value of a strong tie, so that individual strong ties matter more when there is greater income inequality.

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1. Introduction

The fact that the majority of jobs are found through social network ties helps to explain the existence of socioeconomic, geographic, and racial concentration of unemployment.¹ Additionally, individuals who find a job via a social contact have longer tenure and higher productivity.² Thus, how individuals use their social networks to obtain new employment is an important question.

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¹ See Topa (2011), Jackson (2011), Munshi (2011a), Ioannides and Loury (2004) and Marsden and Gorman (2001).

² See Brown et al. (2016), Beaman (2012), Beaman and Magruder (2012), Mayer (2012), Shue (2013), Wei et al. (2012), Schmutte (2015), Bandiera et al. (2009), Babcock (2008), Tassier (2006), Loury (2006), Castilla (2005), Elliott (1999), Marmaros and Sacerdote (2002), Topa (2001) and Simon and Warner (1992).

A person's social network is made up of ties of varying strength (e.g. a close friend is a strong tie while an acquaintance is a weak tie). In this paper we use de-identified, aggregate data from Facebook including almost 17 million social ties in 55 countries to ask which type of social tie is most useful in job finding, and whether it varies by country. We measure tie strength as the amount of contact or as the number of mutual friends between two friends; more contact or more mutual friends indicate greater tie strength. From a research perspective we would like to observe how each person used their social network to find their current job by monitoring a person during their job search. However, such monitoring is not feasible (nor desirable from a privacy perspective) for the whole Facebook population. So we use a proxy variable for job help by counting pairs of friends who eventually work at the same employer.

Although some studies have addressed the importance of tie strength in job finding within specific a country, this is the first paper to use a single dataset and methodology to compare the importance of tie strength across countries. We find that in all 55 countries more people get jobs where their weak ties work. However, this is not because weak ties are more helpful than strong ties – it is because they are more numerous. In every single country, the likelihood of going to work where a specific friend works is increasing – not decreasing – in tie strength. Yet, there is substantial variation in the added value of a strong tie at the margin across these countries. We show that the level of income inequality in a country is positively correlated with the added value of a strong tie, so that strong ties matter more when there is greater income inequality.

In the next section we briefly describe some related literature. Section 3 describes the data, Section 4 presents the results and Section 5 discusses the results and next steps.

2. Related literature

More than 40 years ago, Mark Granovetter identified the strength of weak ties in social networks (Granovetter, 1973). Although close friends and “strong ties are more motivated to help” each other, he argued that acquaintances and weak ties are more effective because they “are more likely to move in circles different from our own and will thus have access to information different from that which we receive.” (1371) To support his claim of the “primacy of structure over motivation,” (Ibid.) he constructed a network model to show that denser connectivity to mutual neighbors among strong ties can generate a redundancy of information flow, and he cited a small labor market study he had conducted in a suburb of Boston, Massachusetts, in which he found that most people who got help finding a job said they got help from someone with whom they rarely interacted.

Granovetter's paper ignited interest in social networks in sociology and spurred research on whether weak ties were better for information transmission in a wide variety of settings.³ For example, a global study of the “small world” phenomenon (Milgram, 1967) found that people who successfully navigated a large social network to connect to an unknown person were more likely to rely on weak ties (Dodds et al., 2003). And a widely-cited study of creativity suggested that teams that include weak ties are more productive, perhaps because weak ties inject novel ideas into the group (Guimerà et al., 2005). However, a number of studies have recently questioned the effectiveness of weak ties, showing that weak ties are less likely to share novel health information (Centola, 2010) and news stories (Bakshy et al., 2012); weak ties do not contribute to the spread of health behaviors (Christakis and Fowler, 2007) or political behaviors (Bond et al., 2012; Jones et al., 2013); weak ties receive a lower volume of novel information in recruiting networks (Aral and Alstyne, 2011); and small groups with more weak ties are less likely to survive (Palla et al., 2007). Furthermore, there are studies that find that weak ties may be more useful only under certain circumstances like when demand for information is low (Carpenter et al., 2003).

In a companion paper (Gee et al., 2017) we attempt to reconcile these two different sets of results in the US labor market with a simple hypothesis that Granovetter himself pointed out in a footnote in his original paper (Granovetter, 1973). Although it may be true that weak ties are *individually* less effective in transmitting plentiful information, they may be *collectively* more important than strong ties because they are more numerous. This would explain why some studies show that the probability of a successful information transmission is increasing with tie strength, while others show that weak ties are responsible for most of the successes (in obtaining jobs, finding a person in the network, acquiring novel ideas, and so on). This distinction is important, because scholars sometimes mistakenly confuse the two levels of analysis, thinking that a large number of successful transactions between weak ties implies that weak ties are also individually more effective.

In our US study we identify a seeming paradox of weak ties. The paradox is that most people are helped through one of their numerous weak ties, but a single stronger tie is significantly more valuable at the margin. Many other studies have addressed how people use their networks to find jobs within a specific country,⁴ but each has varied in its methodology and definition of tie strength so it is difficult to compare the results across countries. For example in the US in the 1970s, most jobs came from weak ties when measured by contact (Granovetter, 1973), while in 1980s China most jobs came from a strong tie using self-reported tie strength (Bian, 1997). So it remains an open question as to whether strong ties are more useful in each country, and how that compares across nations.

³ See Onnela et al. (2007), Borgatti et al. (2009) and McAdam (1986).

⁴ See Kramarz and Skans (2014), Bayer et al. (2008), Yakubovich (2005), Bian (1997), Granovetter (1995), Granovetter (1983), Pool (1980) and Granovetter (1973).

3. Data

We use data from Facebook users and their friends from 55 countries. All data were de-identified and analyzed in aggregate, and this project was ethically and legally reviewed and approved by the Human Research Protections Program at the University of California, San Diego.

A person's Facebook network is not necessarily her true network, and many unobservable interactions take place outside the Facebook platform. However, real-world tie strength can be accurately predicted by Facebook interactions. For example [Gilbert and Karahalios \(2009\)](#) asked 35 people to describe their tie strength with a random subset of all their Facebook friends, and were able to use Facebook data to predict the survey-reported tie strength with 85% accuracy. More recently, [Jones et al. \(2012\)](#) asked over 700 people to report their closest friend, and they could predict the named friend using interactions on Facebook with 92% accuracy. Additionally in the US 40% of social network users have created online links with their closest friends on social networking websites ([Hampton et al., 2011](#)). Facebook users are not a randomly selected sample of the population in the 55 countries in our sample. However, as of 2015 around two-thirds of internet users in 27 of the 55 countries in our sample accessed Facebook.⁵

To generate our sample, we restricted data for our study to all users on Facebook between ages 16 and 64 who list at least one employer and at least one school on their Facebook profile and who end up working at the same firm (as of January 2011) as a pre-existing friend. We restricted our sample to people who ended up working at the same firm as a friend because we are most interested in identifying which type of tie is most helpful for those people who have actually been helped. We connected each user to all their Facebook friends who reside within the user's country between ages 16 and 64 who list at least one employer and at least one school on their Facebook profile. We then restricted our sample to those 55 countries where there were at least 1000 users who worked with a pre-existing friend in the raw data. For countries with more than 1.5 million user-friend observations in total we took a random sample of 10,000 users and connected those randomly selected users back to all their friends within the country.⁶ For the remaining countries we collected data on all users and all their friends within the country. Our final sample consists of 337,421 users who end up working at the same firm as at least one friend, for a resulting 16,949,230 user-friend pairs.⁷

3.1. Measuring job help

A survey of Facebook users might be an ideal way to identify which ties were helpful in job finding, but surveys may suffer from low response rates and faulty memory of events that took place in the past. So instead of a survey-measured outcome we created a measure called a "sequential job" that is meant to capture the idea that friends help each other get jobs where they currently work. We define a sequential job as having occurred if (i) a user and a friend self-report that they are working at the same employer, (ii) the friend started work with the employer one or more years before the user started work at that same employer, and (iii) the two were friends for one or more years prior to working together.⁸ This definition helps to ensure that two people did not become friends while working together (since the friend was working for the employer before the user joined the firm) and reduces the likelihood that the friends were hired together (since a year or more must pass between their start dates). A sequential job might occur for many reasons including but not limited to: a friend acting as a formal referral, offering advice about the interview process, passing along information about a vacancy or acting as a role model.

It is possible that our three sequential job criteria may be met accidentally. That would mean that two ties eventually work together, but the friend was not actually helpful in the job finding process. To validate our sequential job measure in March 2015 we collected a survey-based measure of job help, and we are able to replicate our analysis using this survey based outcome as described in the Online Appendix Section A.6.

The mean sequential job rate across all of these pairs in all countries is about 3.7%, meaning that on average, a person with 100 friends would get help from 3.7 of their friends securing a job where the friends worked. Sequential job rates ranged from 1.6% in Indonesia to 10.4% in the United Arab Emirates.⁹

3.2. Measuring tie strength

We measured the tie strength of these user-friend pairs using three metrics that closely match those used in previous work and that are predictive of real world friendships ([Jones et al., 2012](#); [Ugander et al., 2012](#); [Gilbert and Karahalios, 2009](#); [Backstrom et al., 2006](#); [Granovetter, 1973](#)). The first is frequency of exchanged posts, which is the number of times a user

⁵ <http://www.statista.com/statistics/278435/percentage-of-selected-countries-internet-users-on-facebook/>.

⁶ Canada (CA), Germany (DK), the United Kingdom (GB), Indonesia (ID), India (IN), Malaysia (MY), the Philippines (PH), and the United States (US).

⁷ See Online Appendix Fig. 9 which displays the number of observations by country numerically and visually.

⁸ See Online Appendix Fig. 6 for an example of how employment information is recorded on Facebook. See Online Appendix Fig. 5 for an example timeline.

⁹ See Online Appendix Section A.4 for summary statistics for each of the 55 countries.

posts on a friend's Facebook "wall". The second is tags as measured by the number of times a user tags a friend in a photo on Facebook.¹⁰

Both tags and posts are measured for one year before the user started her most recent job. We scale both of these measures as a fraction of the total number of interactions that user made the year before her most recent job started (in other words, what fraction of all tags/posts made by the user go to a single friend). The last measure of tie strength is friends shared in common, which is the number of mutual friends the user and friend share as a fraction of the total they could share (the Jaccard Index) measured one year before the user started her most recent job. In the Online Appendix Section A.2 we detail the descriptive statistics about users, their friends, and the attributes of their friendship by country. These three measures have an inter-correlation between 0.05 and 0.24, so they are not greatly correlated (see the Online Appendix Section A.13). We believe that each measure captures a different dimension of tie strength. Photo tags measure real-world interactions, while wall posts measure online interactions, and friends shared in common captures the idea of some friendship as bridges between different groups.

4. Results

To document the paradox of weak ties we need to ask two separate questions. First, do most sequential jobs *collectively* come from weak rather than strong ties, and is this because most ties are indeed weak. Second, is the probability of a sequential job from a *single* strong tie higher than the probability from a *single* weak tie.

4.1. Descriptive analysis

To address our first question we only need to perform a descriptive analysis of the data. To answer in the affirmative we need to show that the distribution of the proportion of sequential jobs that are transmitted from weaker versus stronger ties is skewed toward the weak end of the continuum. And we also need to show that the proportion of all friendships is skewed toward the weak end of the continuum. However, we caution that the distribution of tie strength is endogenously determined in general and for friendships with a sequential job. So, we cannot make any causal inference about the effect of a change in the distribution of tie strength on the sequential job rate.

The top row of Fig. 1 shows that most ties are weak, consistent with previous work about the Facebook network (De Meo et al., 2014). Across all 55 countries, there is no communication in 81.5% of the friendships as measured by exchanged posts (upper left) and in 93.5% of friendships as measured by exchanged photo tags (upper middle). The percentage of friends shared in common is less than 10 for 86.9% of the friendships (upper right).

Switching from the distribution of all friendships to the distribution of friendships where there was a sequential job, the middle row of Fig. 1 shows that most jobs *collectively* come from weaker ties. Approximately 75.3% of sequential jobs come from friends with 0 posts, 87.7% from friends with 0 tags, and 82.0% from relationships where the percentage of friends shared in common is less than 10. These results are consistent with previous work showing most jobs are obtained via weak rather than strong ties. However, it is important to remember that some of these claims were focused on weak ties having access to novel information (Granovetter, 1973, 1995), which suggests that weak ties should also be individually more helpful as well. However, others have noted that it may be the sheer number of any type of tie that might be useful (Pool, 1980). Note that Granovetter did mention the possibility that weak ties may be useful because of their quantity, but that he did not have the data to test this claim (Granovetter, 1973, 1983, 1995).

In all 55 countries we find support for the statement: most sequential jobs *collectively* come from weak rather than strong ties, and this is because most ties are indeed weak. In our data which uses standardized measures and methodology across 55 countries we find the majority of sequential jobs are transmitted through a weaker tie, and this is largely driven by the fact most ties are weak in many societies.

Our descriptive analysis thus far has shown weak ties are *collectively* useful. To see which type of tie is most useful *individually* we can begin by calculating the descriptive empirical probability of a sequential job conditional on tie strength. We do this by simply dividing the number of sequential jobs by the number of user-friend pairs among all user-friend pairs who exhibit a given level of tie strength. The bottom row of Fig. 1 shows that in all three cases across most of the 55 countries increasing tie strength also yields an increased probability of a sequential job. In other words, strong ties appear to be individually more helpful for finding a job than weak ties. This raw data suggests that the reason most sequential jobs occur between users and weak ties is not necessarily because weak ties are more helpful – it is because they are more numerous.

However, a key concern with this interpretation is that the association may be driven by other factors, namely that strong ties also tend to exhibit more similarity (homophily), so the strength of tie might simply be a proxy for user attributes that would make a person better suited or more interested in working where their friend already works. For example, two people who attended the same specialized college may be more likely to have a strong tie than two people who attended different

¹⁰ See Online Appendix Fig. 7 and Online Appendix Fig. 8 for an example of a Facebook post and tag.

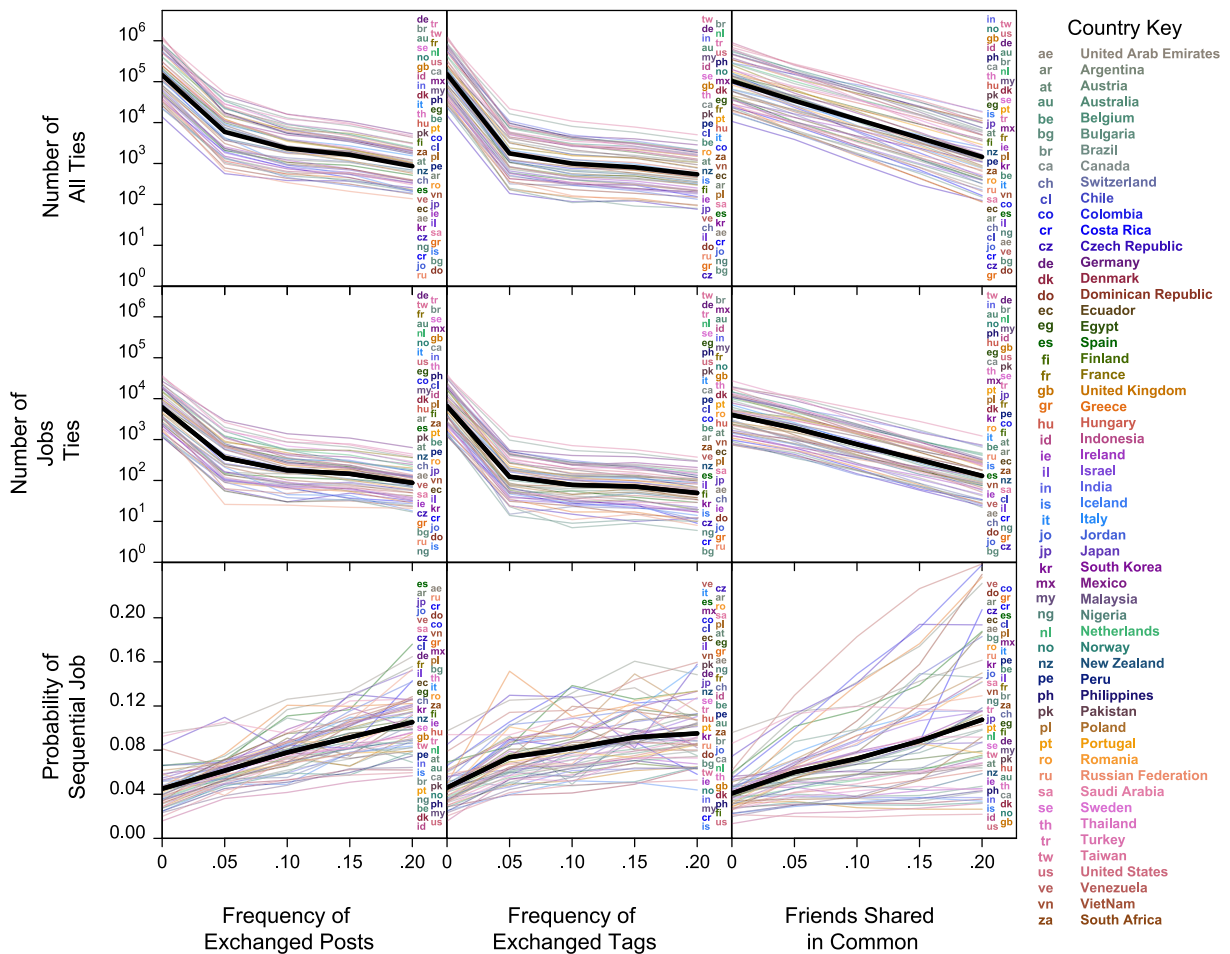


Fig. 1. Most social ties are weak (top row) and most sequential jobs occur via weak ties (middle row), but the probability of a sequential job increases with tie strength (bottom row). Tie strength measures include past-year frequency of “wall” posts made between two users as a fraction of all their wall posts (left column); past-year frequency of photo tags made between two users as a fraction of all their photo tags (middle column); and number of friends shared in common between two users as a proportion of all their friends (right column). All measures were taken prior to an observed “sequential job”, which is defined as a user starting work at a firm where a friend has worked for at least one year (among users who have been friends for at least a year prior to working together). Each thin colored line indicates the values for a particular country (see key) and the thick black line indicates the average across all countries. Values shown are measures from bins of 0.05 widths.

schools, and also may be more likely to work at the same employer. Therefore, to test the individual effectiveness by tie strength, we conduct an inferential analysis using a regression model and placebo test in the next subsection.

4.2. Inferential analysis

To answer our second question “is the probability of a sequential job from a *single* strong tie higher than the probability from a *single* weak tie?” We need to move past a descriptive analysis of the data. We want to explore the relationship between tie strength and the propensity that a user i eventually works with a friend k . We begin this section by exploring the correlations between increasing tie strength with a single tie and the probability of a sequential job from that tie.

4.2.1. Correlational evidence

We do so using the following linear model¹¹:

$$J_{ik} = \beta T_{ik} + \alpha X_{ik} + E_i + \epsilon_{ik}$$

¹¹ One might believe there is a non-monotonic relationship between likelihood of a sequential job and tie strength. Additionally our dependent variable takes the value 0 or 1, so a logit model may be appropriate. In the Online Appendix Section A.7 we discuss how we found that the relationship is linear and show our results are robust to the use of logit model.

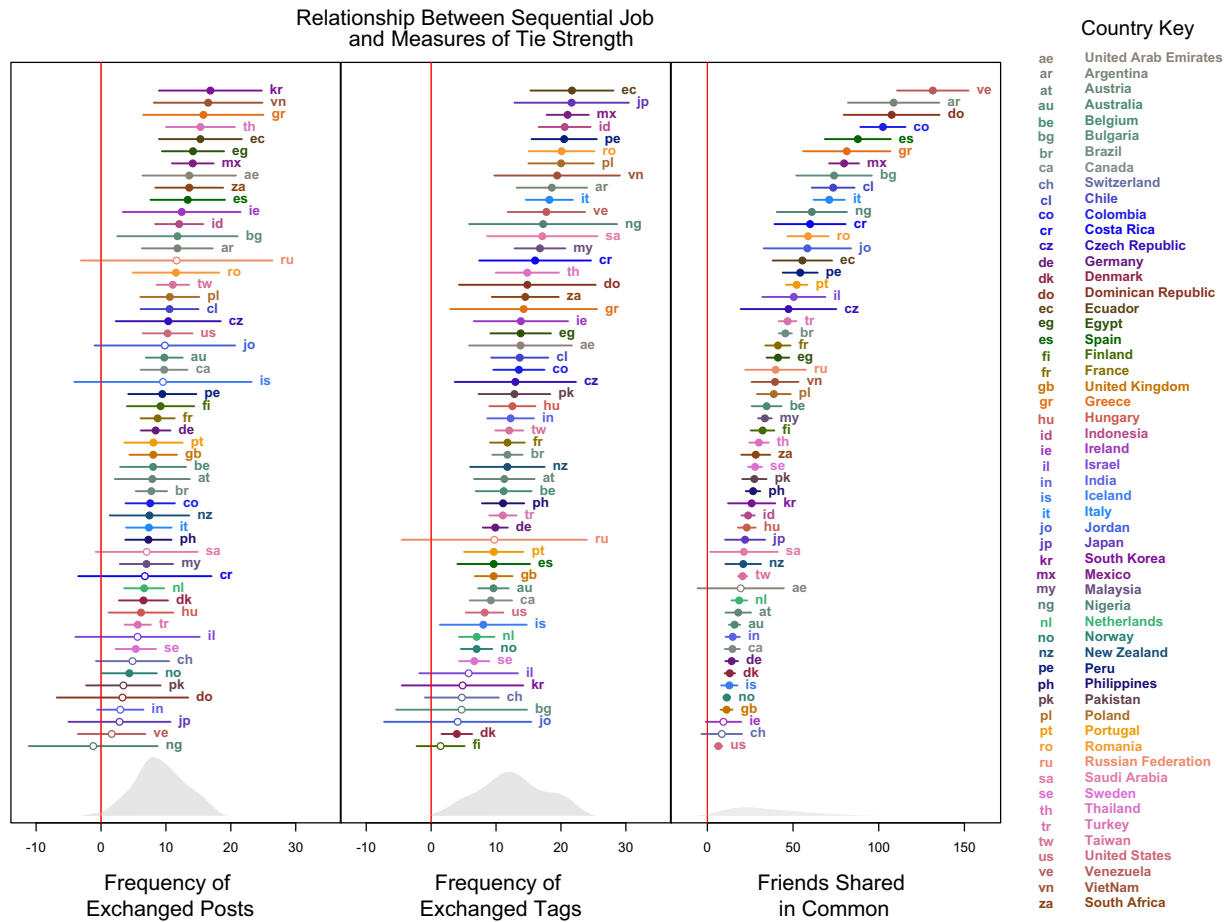


Fig. 2. The probability of a sequential job is increasing in tie strength across 55 countries. Each point shows the estimated coefficient from within-subject fixed effects regressions of sequential job on tie strength plus numerous controls for homophily (see Online Appendix). These coefficients correspond to the percentage increase in probability of a sequential job if we change a friend from being the weakest possible tie to the strongest possible tie. Horizontal lines indicate 95% confidence intervals, and the country code is indicated to the right (see key). All coefficients are positive and most are significantly different from zero (insignificant results indicated by an open circle). Tie strength measures include past-year frequency of “wall” posts made between two users as a fraction of all their wall posts (left column); past-year frequency of photo tags made between two users as a fraction of all their photo tags (middle column); and number of friends shared in common between two users as a proportion of all their friends (right column). In the Online Appendix, we show that these relationships are robust to the use of a logistic regression model.

A user i with N friends has a sequential job dummy variable for each of those friends: $J_{i,k=1}, J_{i,k=2}$ up to $J_{i,k=N}$. We let T_{ik} represent a vector of our tie strength variables: tags, posts and mutual friends. We include a user fixed effect, E_i , that controls for all observable and unobservable attributes about the individual (age, sex, personality, ability, and so on). We also have a vector of friendship-level control variables X_{ik} including measures for differences between the user and friend in age, gender, marital status, education, geographic region and city, and school of attendance for secondary, post-secondary, and graduate school. The inclusion of these friendship-level controls helps to control for the idea that stronger ties may be more likely to be similar (homophily) and so these friends may be more likely to work at the same employers, even in the absence of actual help.

To confirm that the probability of a sequential job from a single strong tie is higher than the probability from a single weak tie we would need the coefficients on the tie strength measures, the vector β , to have all positive entries. Note these results may not be the true causal effect of tie strength on the likelihood of a sequential job because T_{ik} is endogenous, $E[T_{ik}\epsilon_{ik}] \neq 0$. We will address this issue with a placebo test.

First let us describe the results of running this statistical analysis for each country as shown in Fig. 2. Each column of Fig. 2 shows the coefficient on one of our three tie strength measures for each separate country regression, and these coefficients can be interpreted as the expected difference in the percentage chance of getting a job if we increase tie strength from the lowest possible value (no interactions or friends shared in common) to the highest possible value (all interactions are with a single friend or all friends are shared in common with a single friend). Across all three measures, there is a positive association between tie strength and the probability of a sequential job in all 55 countries (with just one exception, a negative and statistically insignificant association between posting and a sequential job in Nigeria). And the vast majority of these

associations are significantly different from zero ($p < 0.05$ for each closed circle in Fig. 2). In other words, job help *increases* with tie strength, suggesting strong ties are individually more effective than weak ties.

Not only are the associations statistically significant, but in many cases increased tie strength is associated with a very large change in the magnitude of having a sequential job. However the magnitude of the association varies widely by country. For example in Ecuador going from the lowest to highest possible frequency of tags between the user and friend is associated with a 21.7 percentage point increase in the likelihood of a sequential job from that friend (null 95% confidence interval 15.3–28.1). Yet in Denmark it is only associated with a 3.9 percentage point increase (null 95% confidence interval 1.6–6.3). These results suggest that when a strong tie exists in a user's network, that person is more likely to be helpful in job finding than a weaker tie but that the amount of extra help varies by country.

Although we have controlled for all unobservable and observable attributes of the user with a fixed effect and many measures of homophily between users and friends, it is still possible that there is some un-measured attribute that is associated with both a sequential job and tie strength. For example, a user Luke and his friend Obi-Wan Kenobi may both enjoy light-saber fighting so they spend a lot of time tagging each other in light-saber fighting photos and they also both eventually work at the same workplace, the Alliance. We cannot observe their mutual love of light-saber fighting. So one might mistakenly conclude that the strong tie caused the sequential job, when in reality it was their mutual love of light-saber fighting.

4.2.2. Causal evidence

To address this issue we have created a placebo test to put a lower bound on the causal portion of the relationship between tie strength and probability of a sequential job. In this test we reverse the temporal ordering and define each sequential job as occurring for the friend (who got the job first) rather than the user (who got the job later) as we did in our companion paper (Gee et al., 2017).

For example, our data record a sequential job from a pre-existing friend Obi-Wan (O) to a user Luke (L), when Luke joins Obi-Wan's employer ($J_{i=L,k=O} = 1$). If Luke had 3 friends then we connected Luke back to all his friends $k = O, B, C$ to find our correlational estimates. We know that Obi-Wan must have helped Luke find his job because Obi-Wan started at the employer at least a year before Luke. So our original estimating equation would be:

$$J_{i=L,k=O,B,C} = \beta_{org} T_{i=L,k=O,B,C} + \alpha_{org} X_{i=L,k=O,B,C} + E_{i=L} + \epsilon_{i=L,k=O,B,C}$$

In our placebo test we artificially code Obi-Wan as getting his job from Luke, even though this is impossible so that $J_{i=O,k=L} = 1$. Then we connect the placebo sequential job recipient (e.g. Obi-Wan) to all their friends, so if Obi-Wan had 5 friends then we connect Obi-Wan to his friends $i = L, W, X, Y, Z$. We measure tie strength for Obi-Wan to his friends over the same time period as in the original data. So our placebo estimating equation would be:

$$J_{i=O,k=L,W,X,Y,Z} = \beta_{plc} T_{i=O,k=L,W,X,Y,Z} + \alpha_{plc} X_{i=O,k=L,W,X,Y,Z} + E_{i=O} + \epsilon_{i=O,k=L,M,N,O,P}$$

In short, if in the original data user Luke has a sequential job from friend Obi-Wan ($J_{L,O} = 1$), in the placebo data we artificially record the sequential job as coming from Luke to Obi-Wan instead ($J_{O,L} = 1$) even though that is impossible given the true timing of events. Then we perform the analysis using this placebo data.¹² We compare the results of the same model used on this placebo data to our original results. Any difference in the coefficients is attributable to the friendship specific unobservable variables, so this is essentially like including a friendship specific fixed effect. The difference between β_{org} and β_{plc} is a lower bound on the causal portion of an attribute's effect on a sequential job.

¹² In this example the original data could look like the following:

User of interest	Friends	Sequential Job Dummy
Original data		
L	O	1
L	B	0
L	C	0
Original rate = 33.3%		

And the placebo data could look like the following:

Placebo user of interest	Placebo's Friends	Placebo Sequential Job Dummy
Placebo data		
O	L	1
O	W	0
O	X	0
O	Y	0
O	Z	0
Placebo rate = 20%		

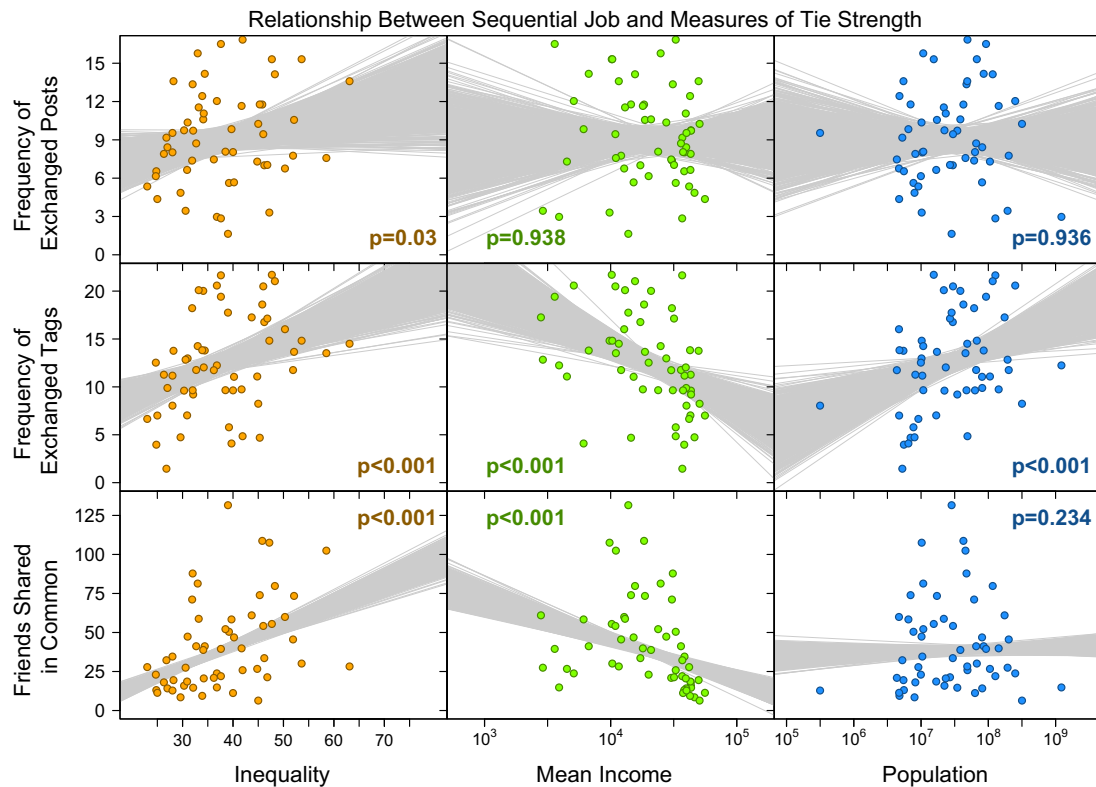


Fig. 3. People rely more on strong ties for job help in countries with greater inequality. Coefficients from regressions of sequential job on tie strength are compared to measures of inequality (Gini coefficient), mean income per capita, and population, all measured in 2013. Gray lines indicate 95% confidence regions from 1000 simulated regressions that incorporate uncertainty in the country-level regressions (see Online Appendix). In each simulated regression we draw each country point from the distribution of regression coefficients implied by the estimate and standard error for that country and measure of tie strength. *P* values indicate the simulated probability that there is no relationship between tie strength and the other variable. In the Online Appendix, we show in multivariate regressions that the relationship with inequality is robust to inclusion of several control variables or the use of a logistic model.

It is very important to note that we do not expect $\beta_{plc} = 0$ since there is probably some friendship specific unobservables that we have not controlled for that are driving some of the similarity in workplace between a user and his or her friends. However, if $\beta_{org} > \beta_{plc}$ then some of the relationship is causal.

The Online Appendix Section A.11 details the placebo test results by country. We find that the coefficients are larger using the original data rather than the placebo data in most comparisons (95% of the time for tags, 71% for posts, and 98% for shared friends). This suggests that increased tie strength – not just omitted variable bias – explains at least some of the observed sequential jobs.

In all 55 countries we find support for the statement: the probability of a sequential job from a *single* strong tie is higher than the probability from a *single* weak tie.

4.3. Cross country analysis

Although there is a robust relationship between individual tie strength and sequential jobs across all 55 countries, there is substantial variation in associations across these countries that may reflect differences in their economies. There is a history of studying how employment is affected by inequality (Goos et al., 2009; Autor and Dorn, 2013), income (Okun, 1963; Lee, 2000), and population (Bloom and Freeman, 1986).

In Fig. 3 we examine the relationship between the magnitude of the effect of strengthening a tie on a sequential job from that tie with country level measures of economic inequality (based on the Gini coefficient, mean = 38, min = 23 in Sweden, max = 63 in South Africa), average income (as measured by per capita 2012 GDP (PPP) which compares GDP on a purchasing power parity basis divided by population as of 1 July for the same year, mean = 25,060, min = 2800 in Nigeria, max = 55,900 in Norway), and total population (mean = 75,071,198, min = 315,281 in Iceland, max = 1,220,800,359 in India). All country statistics were drawn from the CIA World Factbook in August 2013.

We run 1000 simulated regressions (also known as a parametric bootstrap) for each set of country coefficients from the three different measures of friendship strength using each of the three country-level measures. So in total we have a set of nine simulated regressions. Each of the simulated regressions has an *n* of 55. With these simulated regressions, we are able to incorporate the uncertainty from the original estimated coefficients and standard errors – reported in Fig. 2 – into the

estimated relationship between the size of the relationship between a sequential job and each measure of tie strength and each of the country-level variables. For each simulation, we draw a value for the dependent variable – which we denote as $\tilde{\beta}_j$ – for each country j from a normal distribution in which the mean is country j 's estimated coefficient and the standard deviation is the estimated standard error of country j 's coefficient such that $\tilde{\beta}_j \sim N(\hat{\beta}_j, SE(\hat{\beta}_j))$. We repeat this procedure for each of the three tie strength coefficients and each of the three country-level variables for 9 different simulated regressions, which are shown in Fig. 3.

The first column of Fig. 3 shows that increased tie strength is positively correlated more staunchly with sequential jobs in countries with more inequality, and this result is significant for all three measures of tie strength ($p \leq 0.03$). The second and third columns of Fig. 3 shows that there is also a weak negative relationship with average income for two of the tie strength measures. In wealthy countries, people may rely less on strong ties, consistent with the finding that network “diversity” (as measured by the number of ties that bridge across groups relative to all ties) is associated with local economic development (Eagle et al., 2010). Last there is a positive relationship with population for one of the tie strength measures, but additional multivariate modeling suggests that the relationships with income and population are not robust to controlling for inequality (see Online Appendix Section A.14). So we will only discuss some possible mechanisms for the relationship between inequality and the greater effectiveness of strong ties in the next subsection.

4.3.1. Income inequality

It appears that individual strong ties are even more important for sequential jobs in highly unequal societies than they are in more egalitarian societies. Our study cannot identify whether the larger effect of tie strength on a sequential job causes inequality, or vice-versa, or if both are driven by a third factor.

One possible mechanism is that countries with greater inequality also have less trusting individuals (Bjornskov, 2007), and that this lack of trust drives strong ties to be more useful in job finding. In fact Bian (1997) finds that in a 1988 survey of Chinese workers most jobs were found through strong ties because jobs were supposed to be assigned by the state, and thus assigning a job to someone was a favor that would only be granted via a strong tie whom one trusts.

Another possible mechanism is that strong tie networks tend to form within a certain socio-economic status, so that when strong ties are more helpful in job finding this effectively locks people into their current income level and perpetuates inequality. Indeed Munshi and Rosenzweig (2006) show that in the highly unequal caste system in India, the labor market networks are within caste and so effectively work to lock people into a lower (or higher) wage occupation for generations. Similarly, Sanders and Nee (1987) document inequality in income between native-born and immigrant workers in the US. These findings imply the use of social ties in job finding creates persistent inequality. However, Sanders and Nee (1987) show that entrepreneur-bosses in these labor networks are able to earn wages similar to non-immigrants. And in a later paper Munshi (2011b) uses both theory and empirical work to show that network ties become more useful in entering a more profitable industry in communities with worse outside options. So there are pathways out of persistent inequality even when networks are used in job finding.

4.4. Robustness checks

Scale and privacy concerns prevented us from using written communication to individually identify whether one Facebook user helped another user find a job for the whole set of users in the study. However, we did conduct two additional surveys (one across all 55 countries and one in the US for our companion paper Gee et al. (2017)) of some of the people in our larger study to assess whether the “sequential job” proxy is a valid measure of job help (see Online Appendix Section A.6). The 55 country survey showed that we correctly identified a tie as helpful between 20% and 30% of the time. The most often cited reason for a tie being helpful was “told me about the job opening” or “said good things about me to other employees”. When we mistakenly identified a tie as helpful who the user said was not actually helpful the most often cited reason for the mistake was “this is a large employer in our area” that we both work at by accident. Although the survey results suggest our proxy variable is a noisy measure of true job help, we do not find any evidence that the proxy variable yields biased results. In fact, when we conduct a direct analysis of the survey data, it yields results that are statistically significant and substantively stronger than those we find with the proxy variable. In other words, with both the small scale precisely measured survey data and the large scale diffusely measured online data we find that individually stronger ties are associated with a greater likelihood of job help.

5. Conclusion

An extremely influential finding in the work about social networks and labor markets has been Granovetter's “strength of weak ties” result. In his empirical work he found that most jobs come from a weak tie rather than a stronger tie. But his data did not allow him to parse whether that meant that weak ties are *collectively* more helpful or *individually* more helpful in job finding. Also, his data were drawn from a suburb of Boston, so it was not clear how widely applicable his result might be. In this paper we reexamine the strength of weak ties result and test whether it holds in 55 different countries using a single methodology and a single dataset including almost 17 million social ties from Facebook. In the US there is a

documented paradox of weak ties (Gee et al., 2017): most people are helped through one of their numerous weak ties, but a single stronger tie is significantly more valuable at the margin.

We use a proxy for job help by identifying users who eventually work with a preexisting friend. And we use three objective tie strength measures: wall posts, photo tags, and friends shared in common. Like Granovetter we find that most jobs come from a weak rather than a strong tie in all 55 countries. With the caveat that most ties in general are weak rather than strong, so weak ties are *collectively* important because weak time are numerous in many different countries.

We test the second part of our paradox by testing if a single stronger tie is more valuable at the margin. In all 55 countries we find that an increase in tie strength is associated with an increase in the probability of working with a pre-existing friend for at least one of our tie strength measures. This positive relationship is not driven by observable or unobservable user-level variables or by observable friendship-level covariates. Additionally, after using a placebo test to put a lower bound on the causal portion of this positive relationship, we still find a positive relationship for 52 of the 55 countries using either tags or shared friends as our tie strength measures. However, the magnitude of the extra help from an individual strong tie varies widely across countries.

We use a simulated regression framework to show there is a robust correlation between the extra help from an individual strong tie and the level of income inequality in a country. Although our study cannot identify the direction of these relationships (or indeed if they are spuriously related to other factors), it suggests a number of interesting hypotheses about income inequality and tie strength.

But the relationship between the greater effect of a strong tie and inequality is more robust than the relationship with income itself, suggesting that studies of the effects of network diversity may want to consider not just total income but how it is distributed. Indeed, networks might even play a key role in helping to explain dramatic recent changes in income inequality (Sala-i Martin, 2006).

This study represents a first step towards reconciling the seemingly contradictory results that weak ties are individually less effective in transmitting information, yet collectively account for the most successes (jobs found, novel ideas, and so on) in many countries. Our results are specifically based on job search, but they suggest a re-examination of the weak tie paradox across countries, and in other settings like team productivity, disease contagion, the proliferation of trends, and marriage. It may be that across all domains, the strength of weak ties is not in their quality, but in their quantity.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.jebo.2016.12.004>

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