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PEOPLE I KNOW:
WORKPLACE NETWORKS AND JOB SEARCH OUTCOMES

by Federico Cingano* and Alfonso Rosolia *

Abstract

We examine the role of information networks in job-search outcomes of displaced individuals. We draw on longitudinal Social Security records covering the universe of worker-firm matches in a tight labor market in Northern Italy. Unlike previous research, we focus on workplace networks whose labor market attributes we are able to describe extensively. A workplace network is defined as all coworkers a displaced individual worked with prior to displacement. Estimates of network effects are thus affected by omitted variable bias if the labor market sorts workers across firms along relevant determinants of search outcomes and network characteristics or if past coworkers are exposed to the same shocks. The empirical strategy accounts for these possibilities by comparing subsequent outcomes of workers displaced by the same firm; in addition, we exploit the longitudinal dimension to develop controls for potential residual within-firm heterogeneity. In particular, we control for pre-displacement wages and employment status as well as descriptions of pre-displacement firms and their workforce. Contacts' labor market attributes have a significant effect on a variety of job search outcomes. Employed contacts significantly increase the probability of re-employment. They are more effective if they experienced a recent job change and when geographically and technologically closer to the displaced. Stronger ties and lower competition for the available information also speed up re-employment. While largely irrelevant for unemployment duration, contacts' quality is a significant determinant of entry wages and subsequent job stability.

JEL classification: J23, J64.
Keywords: social network, unemployment duration, wages, job stability.

Contents

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1 Introduction[1]

Social contacts are known to be a prominent and effective source of employment for job seekers (Rees (1966), Granovetter (1973), Blau and Robins (1990), Holzer (1988), Holzer (1987)). This simple fact is shown to have powerful implications. Models of job information network detail how differential access to information determined by the characteristics of one's contacts may have significant and long lasting effects not only for the individual, but also for the social network he is embedded in as a whole[2]. Intuitively, an employed acquaintance is likely to be a better source of job-related information than someone who is unemployed. Thus, having more employed contacts improves on the information a job-seeker has access to and, in turn, his outcomes. Similar mechanisms are potentially able to explain stylized facts such as the significant variability in labor market participation, employment rates, unemployment persistence, and earnings observed across geographic or socio-demographic groups, and to qualify part of the more general neighborhood effects found in the empirical literature[3]. Additionally, they have important implications for the

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[2]Calvo-Armengol and Jackson (2004), Bramoullè and Saint-Paul (2004), Montgomery (1991), Bentolila, Michelacci and Suàrez (2004), Fontaine (2004), Arrow and Borzekowski (2004), Calvo-Armengol (2004), Wahba and Zenou (2005). See Ioannides and Datcher Loury (2004) for a detailed survey of the job information networks literature.

[3]The correlation of a number of individual outcomes within residential locations and their large variations across locations is widely documented. A considerable effort is devoted to understanding whether this is the result of certain neighborhood characteristics affecting individuals' behaviors (among others, Case and Katz (1991), Cutler and Glaeser (1997), Ludwig, Duncan and Hirschfield (2001)). This may be due to a number of mechanisms beyond local information sharing: social norms (Akerlof (1997), Akerlof and Kranton (2002)), conformism, access to resource. As concerns labor market outcomes, Weinberg, Reagan and Yankow (2004) show that living in better neighborhoods increases the number of hours worked. However, Katz, Kling and Liebman (2001) provide evidence that neighborhood effects, while

optimal design of policies, suggesting that the informational spillovers may be stronger when interventions can be initially targeted to connected clusters of individuals rather than scattered around; the benefits will then expand to other individuals through the dissemination of information (Calvo-Armengol and Jackson (2004)).

Evidence that contacts' characteristics matter for individual employment performances is limited to few recent studies. Datcher Loury (2006) shows that, while jobs found through contacts are generally not different from jobs found through other methods, when the job is obtained through a prime-age male contact it pays a higher wage and lasts longer. In a different setting, Bayer, Ross and Topa (2005) show that a higher quality of available job referrals at the block level raises employment, wages and hours worked[4]. Similarly, Munshi (2003) shows that new immigrants from Mexican communities with a larger proportion of individuals already settled in the US fare better in terms of employment likelihood and job quality[5]. These works mainly look at network differences along socio-demographic dimensions. While largely unexplored, contacts' current labor market status is arguably a major aspect of job information networks. On the one hand, it certainly is a significant determinant of the job-related information a contact has access to and is willing to share; on the other, it suggests the existence of spillover effects.

significant on measures of well being and health, appear to insignificant on labor market outcomes of heads of households who participated in the Boston MTO program. Similarly, Oreopoulos (2003) uses randomised participation into public housing programs in Toronto to conclude that growing up in poor neighborhoods has no long-lasting effects on labor market performance.

[4]At a more aggregate level, Topa (2001) documents a high correlation in unemployment rates across neighboring Census tracts in Chicago, especially in areas with less skilled workers and larger fractions of minorities. Wahba and Zenou (2005) find that it is more likely to have found a job through contacts in lower unemployment areas in Egypt.

[5]In other contexts, Bertrand, Luttmer and Mullainathan (2000) show that welfare use is correlated within language groups in a given area even after accounting for most sources of omitted variable bias; Grinblatt, Keloharju and Ikaheimo (2004) find similar effects in automobile purchases among close neighbors in Finland.

In this paper we directly address the effects of contacts' labor market attributes on a number of individual job search outcomes[6]. We draw on Social Security records covering the universe of worker-firm matches in a small dense labor market in Italy. We focus on a sample of workers displaced by several firm closures and define an individual's social network as all of his coworkers in the 5 years prior to displacement. The data allow us to investigate the role of job information networks for a number of largely unexplored post-displacement outcomes such as unemployment duration, job stability and subsequent employment probability along with entry wages and other job characteristics. We relate these outcomes to descriptions of contacts' current employment status and job seniority, proximity to the displaced along several metrics, quality, numerousness and to the degree of competition for the available job-related information. Importantly, some of these network features can be explicit policy targets, thereby conveying policy content to our estimates. For example, we quantify the effects on job search outcomes of contacts' tenure on the current job thus providing an additional element for the correct evaluation of the cost-benefit trade-off of active labor market policies aimed at speeding up re-employment.

Unlike previous research, we focus on contacts established on the workplace[7]. We thus explore job information networks among individuals who are connected and have direct experience of each other's skills by having shared the workplace. This is especially true in our setting because of the very small size of firms. In this sense, workplace contacts are likely to be a prominent source of information when searching for a job[8]. An important

[6]By labor market attributes we loosely refer to contacts' employment status, as well as match quality, tenure, and a number of job-related characteristics such as location and industry.

[7]To our knowledge, only Lalive (2003) adopts a definition of network similar to ours to show that a policy change that extended the duration of unemployment benefits for older workers in certain Austrian regions had some effect on slightly younger unaffected members of the same network.

[8]Bayer et al. (2005) find that also the place of residence may be an important source of job information

advantage of focussing on workplace networks is that we make explicit when and why two individuals met. Estimation of social effects is complicated by the possibility that individuals choose to get together, the determinants of this choice being generally unobserved, and this may lead to sorting along relevant unobservables driving the empirical correlation between individual outcomes[9](Manski (1993), Moffitt (2001)). In our setting, outcomes of an individual and of his contacts are spuriously correlated if the labor market sorts workers across firms along relevant dimensions or if workers become similar by working together (e.g. they accumulate the same specific skills). The data allow us to deal with these specific concerns in a number of complementary ways. First, we account for heterogeneity in unobservable workers' characteristics across closing firms with a firm-specific fixed effect. This implies that our results are obtained by comparing subsequent outcomes of workers displaced by the same firm closure. In addition, we exploit within-firm heterogeneity in workers' residential location and pre-displacement sectoral experience to allow for year-specific city and 3-digit industry fixed effects. Finally, the longitudinal dimension of the data allows us to account for potential residual heterogeneity by controlling for a number of pre-displacement realizations of relevant individual outcomes such as wages, wage growth and unemployment as well as for several characteristics of past firms. Identification thus primarily comes from variations in the current labor market attributes of the different sets of contacts co-displaced coworkers have access to at displacement

by showing that people living at the same block are more likely to work at the same location even when most sources of spurious correlation are accounted for; Munshi (2003) provides elements in favour of networks based on origin community among Mexican migrants.

[9]An exception is Weinberg et al. (2004) where the neighborhood choice is explicitly modeled. Other studies of neighborhood and social effects rely on quasi-random neighborhood or peer assignment (among others, Case and Katz (1991), Katz et al. (2001), Sacerdote (2001)) or on exogenous changes in the outcomes or composition of peers (Angrist and Lang (2004), Hoxby (2000), Cipollone and Rosolia (2005)).

date. The main identifying assumption is that this variation is orthogonal to within-firm unobserved individual heterogeneity. We provide indirect tests of this assumption relating current contacts' labor market status to individual pre-displacement outcomes and, more importantly, by showing that post-displacement individual outcomes are unrelated to pre-displacement contacts' labor market status.

Our findings show that network effects are sizeable. In our preferred specification a one standard deviation increase in the share of employed contacts shortens unemployment duration by 7 per cent, about 3 weeks at the average spell. This effect is considerably stronger if contacts recently changed job, separating from those firms where they overlapped with the displaced. According to our estimates, increasing the employment rate by raising the share of recent job switchers reduces the average unemployment spell by about 5 weeks, as opposed to 15 days if the increase is due to contacts who did not switch job. These results suggest employed job switchers increase the available job-related information in the network. In fact, exploring network effects during unemployment reveals that the advantages of being endowed with larger shares of recent job switchers are strongest at short durations. We also find that competition for the available information matters. A higher number of displaced individuals connected to a given contact significantly delays re-employment. On the other hand, stronger ties with employed contacts increase the probability of finding a job. Finally, our estimates show that contacts' quality, at best only a weak determinant of unemployment duration, significantly contributes to the quality of the new job. In particular a one standard deviation increase in contacts' wage premium raises average weekly wages in the entry year by about 2 percent and the probability of holding the same job after 12 months by 2.5 percentage points. These findings

suggest that workplace networks are a relevant channel of information diffusion thereby significantly improving the allocation process of workers to jobs.

The paper proceeds as follows. In the next section we present the data, discuss the main identification issues and motivate the empirical strategy. Next, we turn to the results. We first thoroughly discuss the strength of our identification strategy focussing on unemployment duration and then move on to the analysis of network effects on other relevant outcomes. Section (5) discusses the results and offers additional evidence in favor of the main identifying assumptions. Section (6) concludes.

2 Data and identification.

We draw on three National Social Security Service (INPS) archives providing information on any work episode occurred over the period 1975-1997 in two Italian provinces[10]. As concerns firms, we have information on their geographic location at the town level and 3-digit industry affiliation, starting and, if applies, ceasing dates; as to the workers, the data provide a whole set of demographic characteristics (gender, date and town of birth, town of residence); as to the specific match, we know its starting and ending dates, the number of weeks worked each year, the corresponding yearly wage, the employment status at monthly frequency. Individuals have also been tracked so that the same information is available whenever they were employed at a firm in other areas of the country.

[10]A province is an administrative unit composed of smaller towns. The two provinces we focus upon are Treviso and Vicenza, located in the northern region of Veneto, and contain, respectively, 121 and 95 towns, each with an average working-age population of about 5,000.

2.1 Networks and network characteristics.

We study job information networks among workplace contacts by assessing the influence of past coworkers' current labor market status on individual job search outcomes. Workplace contacts are a natural set of people to look at. Previous coworkers are likely to be a main source of information and referrals when searching for a job for the simple fact that they have shared the same workplace, thereby being reasonably aware of the unemployed skills and possibly more likely to be exposed to information relevant to him. The features of the labor market we focus upon are supportive of the assumption that coworkers can be actual contacts. First, it is concentrated in a small geographical area, about 5,000 square km, the maximum distance between two towns being 110 km. Second, it is characterized by small firms: the median size is 6 while the 75th percentile is 13. Third, the density of economic activity is significantly higher than in the rest of Italy: in 1991 there were about 23 manufacturing firms and 345 manufacturing employees per square km as opposed to an Italian average of, respectively, 8 firms and 117 employees. Finally, the area is a highly self-contained labor market: in 1991 more than 80 percent of manufacturing workers in the area were also residents.

We focus on a sample of about 9,000 working-age individuals displaced by more than 1,000 firm closures occurred over the period 1980-95[11]. In practice, we define the specific network of social contacts tracking each displaced over the five years prior to his displace-

[11] As most administrative sources, our data do not report the reason why a given job ended. This is particularly relevant in our setting, since the (unobserved) decision of quitting may, among other things, depend on the characteristics of one's network. For example, an individual could decide to quit because his network allows him to quickly find a new job. Focussing on exogenously displaced workers controls for this and other sources of endogeneity. An additional shortcoming of administrative records is the lack of information on whether, when and how workers actively search for a new job. Throughout the paper we will thus follow the common practice of analyzing non-employment spells rather than unemployment ones as defined by ILO's guidelines.

ment, a convenient time interval we call the *network building* period (henceforth NB), and recovering the pool of individuals he has been working with for at least one month. This group of individuals lays at the basis of all our analysis[12]. We use the information available for each coworker - the same available for the displaced - to describe several characteristics of the network: its employment rate, the sectoral and geographical distribution of contacts, their wages and tenure elapsed in the current firm, their number, the intensity of the tie they have with the displaced and the degree of competition for the information they carry. Throughout the paper we measure network characteristics as of displacement date.

Table (1) reports some descriptive statistics of the closing firms and the individual networks. Rows represent variables for which we have computed means at the closing firm (panel A) or workplace network (panel B) level; columns report statistics on the sample distribution of these means. Co-displaced workers are relatively young, the median closing firm with an average age of about 27, and typically blue collar workers. They tend to live in the same city (LLS) where their employer is located, although not in the same smaller town[13].

As concerns workplace networks, their size appears to be reasonable, a consequence of the limited firm size in the underlying labor market. The number of contacts ranges from 8 persons (10th percentile) to 150 (90th percentile), with a mean of 32. The average share of contacts who are employed at displacement is around 67 percent, with a standard

[12]We neglect co-displaced workers who are more likely to be competitors than useful acquaintances.

[13]A city is defined as a cluster of smaller towns characterized by a self-contained labor market, as determined by the Italian National Statistical Institute (INSI) on the basis of the degree of workday commuting by the resident population. Using 1991 census data, the INSI procedure identified 19 such cities in the two provinces under analysis.

deviation of about 20 percentage points. Contacts' live nearby the displaced, the median network displaying an average distance of 5.5 km, and generally in the same city. However, as for co-displaced workers, within cities contacts do not appear to be clustered in the same (smaller) towns. Contacts' are slightly more likely to be males, reflecting the higher participation rates of men; average age differences range from 4 to 15 years, with a grand mean of about 9 years.

2.2 Identification of network effects

Throughout the paper we will focus on linear estimating equations of the form:

$$y_{ijt_0} = \gamma NET_{ijt_0} + X_{ijt_0}\beta + W_{ijt_0}\delta + \nu_{ijt_0} \tag{1}$$

where the variable of interest y for individual i displaced at time t_0 from firm j is related to (a set of) characteristics of the network NET_{ijt_0}, accounting for a number of individual and firm controls X_{ijt_0} and a set of local labour market conditions W_{ijt_0} measured at the date of displacement.

The usual criticism to causal interpretations of least squares estimates of γ in equations like (1) is that the empirical correlation between individual outcomes and network characteristics may rather be due to group members sharing some attributes, to their being exposed to the same environment or subject to the same shocks (Manski (1993), Moffitt (2001)). In our setting network members are past coworkers who could share the same unobservables if the labor market sorted them along these dimensions. For example, the displaced and his contacts' probability of employment may be correlated simply because more able individuals tend to work together and ability also implies higher employment

rates. Likewise, the displaced and his contacts may acquire specific skills while in the same firm thereby being exposed to the same skill-specific labor market shocks.

We address these crucial issues in a number of complementary ways. First, since the pool of contacts is accumulated through time and varies across co-displaced workers, in estimating (1) we can account for a closing-firm fixed-effect (CFFE). This implies that identification of the coefficients of interest is based on comparisons of workers displaced by the same firm. By absorbing their average unobservable characteristics, the CFFE mitigates the concerns that the estimated network effects reflect omitted-variable biases, the more so the more similar co-displaced workers are along the dimensions of selection. If individuals endowed with the same skills always work together the CFFE completely absorbs the spurious correlation between the displaced and his contacts' current labor market outcomes. While in the absence of sorting CFFE would be irrelevant, it would be insufficient if sorting did not lead to full segregation of skills across firms. In such case, the sorting variable would display residual variability among co-displaced workers. To be a source of concern in our exercise, however, market-driven sorting must reflect into specific individual labor market outcomes (as wages or employment status) and coworkers characteristics (as their employment rate or average compensation). This implies that past realizations of the relevant variables represent reliable proxies for the unobserved dimensions of sorting. The econometric specification will include, among others, the unemployed pre-displacement wage and employment profiles along with a number of past firms characteristics including their average size and the average wages paid to network members.

Finally, we account for the possibility that displaced individuals and their contacts

are exposed to asymmetric labor market shocks. Closing-firm fixed effects already absorb shocks common to co-displaced workers, over and above those induced by the specific date, location and industry of the closing firm. However, within-firm heterogeneity in residential location implies that co-displaced workers (and possibly their contacts) may be exposed to time-varying location-specific shocks to their employment opportunities; we account for this possibility by inclusion of a full set of city-year fixed effects. Similarly, year-industry (at 3-digit level) fixed effects account for the possibility that within-firm heterogeneity in pre-displacement sectoral experience exposes different networks to different industry shocks[14].

Our main identifying assumption is that, conditional on this set of controls, variation in contacts labor market status at displacement date is orthogonal to individual heterogeneity within closing firms. The assumption would fail if our controls missed individual fixed characteristics that, while shared by past coworkers in pre-displacement firms, are not shared by the co-displaced and, while not affecting a number of pre-displacement outcomes and firm characteristics (wages, employment, location, etc.), do affect them after displacement; also, it would fail due to labor market shocks not captured by the closing firm fixed effect, the city-year fixed effect or the industry-year fixed effect. While conclusive evidence on the causal effect of workplace network characteristics can only be obtained in a pseudo-experimental framework, we think the most plausible sources of omitted variable bias are accounted for in our setting. Our interpretation is that variation in contacts' current labor market status generates exogenous changes the information available in the network and potentially transmitted to the displaced. In section (5) we

[14]We define sectoral skill dummies by looking at the sector where the displaced spent most of his tenure in the pre-displacement period. More details will be given in the next section.

will present a set of exercises in support of the main identifying assumptions. We now turn to the main results.

3 Networks and Unemployment Duration.

Because it affects both the amount of available information on existing job opportunities and the willingness to share it, contacts' labor market status represents the main characteristic of job information networks. We start our empirical analysis relating individual unemployment duration to the share of employed contacts available in each network at the date of displacement, a measure of their current average wage premium and the (log of the) number of contacts[15]. Contacts' wage premium captures either the fact that high wage acquaintances share more information or the fact that, a higher wage premium signaling a higher quality, they are able to provide more credible referrals (e.g. Calvo-Armengol (2004), Mortensen and Vishwanath (1994), Montgomery (1991)).

Estimates reported in the first column of (2) only account for a limited set of individual characteristics (age, sex, tenure and qualification at closure), and the CFFE. Unemployment duration appears to be significantly and negatively correlated with the network employment rate and, to a lesser extent, with the contacts' wage premium, while we do not find any effect of network size. In this simple specification all unobserved heterogeneity potentially correlated with network characteristics is assumed to be captured by the CFFE. To account for the possibility that, while correlated with own networks, individual unobserved characteristics differ among co-displaced workers, in column 2 we include the

[15]The contacts' average wage premium is obtained as the network average of the residuals from a wage equation estimated on all individuals belonging to some network and employed at displacement date, controlling for a quadratic in age, sex qualification and time dummies.

displaced earnings profile over the 5 pre-displacement years (captured combining average wage at closure and average wage growth) and the average length of his unemployment spells in the same period[16]. If, as most theories suggest, sorting occurs along characteristics that, though not directly observable, reflect into wages or employment likelihood over time (e.g. ability), accounting for past individual realizations of these outcomes absorbs the (potential) residual correlation between unemployment duration and network characteristics. In fact, while both indicators are significantly related with unemployment duration, attracting the expected sign, the coefficient on the network employment rate is largely unaffected.

We next address the possibility that the relevant unobservables, while not reflected into individual pre-displacement outcomes such as wages and unemployment, are correlated with characteristics or the number of past firms. Compensating wage theory suggests that workers might sort across firms on the basis of their preferences for the combination of wage and non-wage benefits offered by the firm (Rosen (1986)). Thus, for example, large firms may be able to attract better workers by offering fringe benefits such as day care, health insurance, meals (Woodbury (1983), Oyer (2005)). Similarly, they are shown to be more likely to provide training opportunities to their employees (Oi and Idson (1999)). Alternatively, workers may be attracted to certain firms by the quality of its workforce, for example because this generates learning opportunities, a better working environment or other amenities the individual values positively. As to the number of job switches, it may be associated with changes in the working environment[17]. Results in column 3

[16]Results are unchanged if we allow for a considerably more flexible specification that considers the whole pre-displacement wage and employment history in the estimating equation.

[17]Our data do not allow to distinguish the causes of job separations. The number of visited firms could therefore either capture voluntary job-switching, plausibly associated with improved working conditions

account for a measure of peer quality at past firms - the average wage paid to coworkers - along with the average size and the number of firms the unemployed visited in the pre-displacement period. Notice that these two last controls imply, in particular, that variation in the measure of network extension is induced by coworkers turnover at each past firm. Accounting for these controls yields a larger and more precisely estimated effect of the network employment rate.

Finally, we address the possibility that our results are driven by shocks common to network members and not captured by the CFFE. This would be the case if, for example, contacts have accumulated the same specific skills - but co-displaced workers differ in the skills they accumulated in the past - so that different networks could be subject to different industry-specific shocks. Similarly, if individuals mostly work locally - but not while in the closing firm - they would be largely subject to the same local shocks as their contacts. In column 4 we augment the specification with a full set of city-year fixed effects for the displaced city of residence and a full set of 3-digit industry-year fixed effects corresponding to the sector where the displaced accumulated the longest tenure over the NB period[18]. Inclusion of these controls amounts to assuming that the displaced is directly exposed to city- and industry-specific shocks, that is he learns about the randomly arising opportunities in his local labor market and in the industry where he accumulated most of his experience independently from his contacts. Allowing for these additional controls does not change the basic result that a larger share of employed contacts leads to a

(including the quality of co-workers), or involuntary separations due to firing, plausibly signalling poor worker quality.

[18]We have experimented with other plausible definitions of sector experience and results were unaffected. For example, we have used dummies for the most recent visited sector excluding the closing firm, which is captured by the CFFE.

shorter unemployment spell; the weak effect of contacts' quality detected in some of the previous specifications disappears altogether. Results are also largely robust to using a very flexible specification that allows for a quadratic in all control variables and all their cross-products, together with the set of dummies considered so far (col. 5).

Consistently with theoretical predictions, the evidence reported in table (2) thus points to a negative effect of the share of employed contacts on unemployment duration, a result that proves to be robust to controls for the most plausible omitted-variable hypotheses. The estimated coefficient in column 4 implies that a one standard deviation increase in network employment rate (corresponding to about 20 percentage points) reduces unemployment duration by about 7 percent, almost 3 weeks for the average unemployment spell. As a benchmark, increasing individual wage by one standard deviation would imply a reduction in unemployment duration of about 10 percent, 1 month at the average duration.

A puzzling feature of the results in table (2) is the absence of any scale effect. However, this may be a consequence of the measurement error induced by defining the extension of the network as the simple count of pre-displacement coworkers. In particular, we may be assigning too many contacts to some individuals. For example, if an individual cannot maintain more that Z contacts the measurement error would be zero whenever the number of contacts does not exceed the threshold and $\epsilon_i = C_i - Z$ otherwise, where C_i is the measured extension. Under these assumptions the measurement error would display a mechanical and positive correlation with the underlying true network, C_i^*, generating the standard attenuation bias. We attempt to shed light on this issue and develop a way to correct the measurement error. More specifically, we take seriously the assumption

that, above a certain threshold Z, the individual meets a coworker only with some probability. Let us assume we can rank coworkers in a given firm of size $N > Z$ with some distance metric from the displaced (say, because they work in different units), and that the probability of meeting farther individuals decays with distance at rate γ. Let the $P^n = e^{-\gamma \max\{0, n-Z\}}$ the probability of meeting coworker who is in position $n = \{1, ..., N\}$. Now we have to deal with the fact that the true ranking within a firm is unknown. Let $P(n_i = n) = 1/N$ the probability that coworker i is in position n of the ranking[19]. Therefore, the probability that the displaced actually meets coworker i is given by $P_i = \sum_{n=1}^{N} P(n_i = n) * P^n = \sum_{n=1}^{N} P^n/N$. Making use of the definition of P^n, after some algebra, we obtain $P_i = \left(Z + (e^{-\gamma}/(1 - e^{-\gamma}))(1 - e^{-\gamma(N-Z)})\right)/N$. Knowing Z and γ we can thus weight each assigned coworker and redefine network measures accordingly. In table (3) we use the corrected network measures and present results under alternative assumptions on Z and γ. Results suggest that measurement issues may explain the absence of scale effects in previous specifications. Even assuming a slow decay of the probability of meeting additional workers we detect some negative effect of scale consistently with theoretical predictions. The effect loses significance as we increase the threshold or lower the decay rate, thereby going back to the original error-ridden measure. Reassuringly, the results on the effects of the network employment rate are largely unaffected: we detect a higher precision and larger point estimates in line with an attenuation bias also on this variable.

Overall, these results suggest that contacts' current employment status favours re-entry into employment, possibly because it shapes the information they are able or willing to

[19]This probability is obtained noticing that in firm of size N there are $N!$ possible rankings of the workers and $(N-1)!$ rankings such that a given position is occupied by a specific coworker.

disseminate in the network. Before moving on to a deeper qualification of contacts' attributes a point may be worth emphasizing. In a standard search model, the rate at which the unemployed finds a suitable job is given by $\lambda F(w_R)$, where λ is the job offer arrival rate, w_R is the reservation wage, itself a function of λ, and $F(.)$ the distribution offers are drawn from. Therefore, while theory suggests reasons why network characteristics can affect both λ and $F(.)$, it is in general hard to disentangle the two channels. This is so even if we allow for on-the-job search so that the probability of finding a job is simply $\lambda F(b)$, with b being the unemployment benefit[20]. However, the Italian institutional setting lacks a proper unemployment insurance scheme. Therefore, if one is willing to make the above assumptions, the probability of finding a job would be $\lambda F(0) = \lambda$, suggesting that we can plausibly interpret the estimates as direct effects on the arrival rate.

3.1 Information flows and contacts' characteristics.

A contacts' propensity and ability to disseminate information depend on characteristics of the tie he has with the displaced and on his access to information valuable to him. Intuitively, a stronger tie is more likely to share information; similarly, a succesful job seeker may be more informed on current employment opportunities. Differences in these characteristics yield important qualifications on the role of employed contacts and shed further light on the workings of job information networks.

The intensity of ties is arguably the major determinant of the willingness to share information. In our setting a natural definition of intensity is the time the displaced

[20]This obtains if the arrival rate of job offers when unemployed and when employed are the same, so that all offers above b are accepted.

spent in the same workplace with a certain contact; average exposure thus provides a synthetic plausible measure of the strength of ties the displaced has with his workplace contacts. Conditional on the time he spent on average in each firm, variation in intensity is induced by the timing of contacts' turnover at past firms. Insofar as the determinants of past turnover are independent of the displaced current unobserved characteristics, we are able to identify the effects of tighter ties on unemployment duration. In column 2 of table (4) we augment the main specification (whose results are reported in column 1) with our intensity measures. Results show that longer exposure to currently employed contacts shortens unemployment duration. More specifically, a one standard deviation increase in average exposure (corresponding to slightly less than 10 months) reduces unemployment duration by 9 percent. Interestingly, lower exposure to future unemployed coworkers turns out to have a similar effect, suggesting the presence of congestion effects at the firm level. A longer presence in the firm of coworkers who will not be useful sources of information at the future displacement date relative to those who will may in fact reduce the net exposure to each contact, thus weakening the strength of the tie with a currently employed contact.

Information diffusion within the network is also likely to be shaped by the degree of competition for the available information. As shown by Calvo-Armengol (2004) and Wahba and Zenou (2005) the advantages of being connected to an employed individual decrease with the number of other job seekers he is in contact with. In this sense, the previous results on the effects of a higher employment rate could reflect both the fact that more information is generated in a network with a higher number of employed contacts and, at the same time, the lower competition for the available information signalled by a lower unemployment rate. To single out these two effects we develop an intuitive measure of

competition for the available information held by a given contact, namely the number of contemporaneously displaced individuals he is connected to. Variation across codisplaced workers is induced by differences in the number of contemporaneously displaced individuals (by a different firm closure) their contacts are linked to[21]. In this sense, it provides an exogenous shift in the degree of competition for a given information source. Augmenting the basic specification with the average number of competitors shows that a higher degree of competition significantly slows down re-employment (col. 3). Specifically, increasing the number of competitors by 8 units (corresponding to a shift from the 1st to the 3rd quartile in our sample) raises unemployment duration by about 6 percent.

The above results show that, given the available information, tighter ties and lower competition for it increase the probability of leaving unemployment. We now turn to an analysis of factors that determine the amount of valuable information a contact can share. The first distinction we draw is between employed contacts who have recently changed job (movers) and those who still keep the one where they met the displaced (stayers). By the same fact they are no longer employed in a firm the displaced already visited, movers are in fact relatively more likely to be endowed with relevant information, the more so if switching job plausibly requires some search and collecting information which can then be spread through the network. In column 5 we split the share of employed contacts into contacts who still maintain the job where they met the displaced and those who meanwhile changed employer. Results show this distinction is highly relevant. The effect of an increase in the network employment rate on duration more than doubles when stemming from a higher share of movers as opposed to a higher share of stayers. More

[21]Note that if a contact is connected only to workers displaced by the same firm the degree of competition does not vary across codisplaced workers.

specifically, according to our estimates a one standard deviation increase in employment rate due to a higher share of movers reduces unemployment duration by around 11 percent, corresponding to about 5 weeks for the average unemployment spell; the reduction would be around 15 days if the increase in the employment rate was due to a larger share of stayers[22].

The same distinction is carried through to columns 6 and 7 where we address two additional aspects that plausibly signal access to more relevant information, namely technological and geographical proximity. In either case, the basic intuition is simple. Contacts employed in sectors the displaced is more familiar with likely play a more relevant role when locating attractive job opportunities; the same holds true for contacts employed in the local market if workers have a preference for working close to their own residence[23]. Results confirm the intuition, further stressing the importance of recent job switchers. For example, a mover employed in the displacing sector is twice more effective, in terms of the unemployed chances of getting a job, than one employed in a different industry; the same qualitative result is true when we look at the geographic location of movers, although the additional effect is lower. On the other hand, only the sectoral distribution of stayers seems to matter[24].

[22]We also find that the more recent the job switch the stronger the effect of a given share of movers, in line with the intuition that they carry more up-to-date and thus valuable information. Results are available upon request.

[23]For example, if offers from farther locations involve a commuting cost, the worker will set a higher reservation wage for jobs at those locations. Additionally, if the arrival rate of offers also depends of search effort (say, acquaintances must be contacted) the lower expected wage of an offer from those locations would lead to put less effort into search for these jobs. Note this would be the case even if the support of the wage distributions was the same at both locations and always above the commuting cost.

[24]As a natural consequence of these findings, increasing network proximity should induce the displaced to re-enter in geographically or technologically closer firms. Results not reported here (available upon request) show that this is the case: a higher share of contacts in the displacing sector increases the chances of being re-employed in that sector and the new job is also closer to the displaced hometown the more movers are employed around it.

Finally, results in columns 8 and 9, obtained using specifications that include all network characteristics, largely confirm the above discussion.

3.2 Network effects during unemployment.

Our evidence so far points to the existence of significant network effects on the expected duration of unemployment. We also showed, however, that the information provided by contacts proves more effective when more plausibly recent. This section further characterizes our findings exploring whether the movers-stayers composition of networks - which captures the recentness of available information - has different effects on the probability of leaving unemployment at different horizons.

In table (5) we report estimates for a set of linear models of the probability of being still unemployed at different points in time: for example, the dependent variables in column 1 is a dummy equal to 1 if the displaced is still unemployed one month after the closure. Network characteristics are measured, as above, as of displacement date[25]. A larger share of employed contacts lowers the probability of leaving unemployment at all horizons. However, different subsets of contacts drive the result at different durations. This can be seen clearly in figure (1). At each month after displacement we plot the ratio between the probability of being still unemployed implied by an increase of one standard deviation in the network employment rate and the average probability of unemployment. The lines correspond to two alternative experiments, where the increase in the employment rate is due to a) a higher share of movers, b) a higher share of stayers.

[25]In principle, our data allows us to update the description of one's network as unemployment proceeds. However, we would no longer be able to control for common shocks affecting both the displaced probability of leaving unemployment and the employment status of his contacts.

Several facts are worth noticing. First, and consistently with our previous discussion, the advantages of being connected to a network with a higher share of recent job-switchers materialize immediately after displacement. For example, after three months the probability of being unemployed is 8 percent lower than the baseline if the higher employment rate is induced by a higher share of movers; in the case of stayers the difference is only 1 percent, and not statistically significant. On the contrary, the probability of unemployment at longer horizons is the same, irrespective of the source of the higher employment rate. Importantly, the fact that at longer horizons both experiments imply a roughly constant ratio with the baseline probability means that the structure of the network at displacement date does not affect the corresponding conditional probabilities of leaving unemployment[26]. As a whole, these results suggest that differences in the relevance of information diffused by networks with different composition are subject to relatively fast rates of decay over time[27].

4 Networks, Entry Wages and Job Stability.

The previous section has shown that being connected to a larger share of employed contacts significantly contributes to speeding up reentry into employment, the more so the more recently the contact changed job. However, the role of contacts for job characteristics

[26]This can be seen easily by noticing that the lines plotted are the ratios between the survival probabilities. Let T, unemployment duration, be distributed according to a distribution function $\bar{F}(t) = Pr(T \leq t)$ if the network has the average characteristics, and $F^X(t)$ if we increase the network employment rate by increasing $X = \{movers, stayer\}$. Then the figure plots the ratios $R(t) = \frac{1-F^X(t)}{1-\bar{F}(t)}$. The sign of the derivative of $R(t)$ with respect to t is therefore equal to the sign of the quantity $\Gamma(t) = \frac{f^X(t)}{1-F^X(t)} - \frac{\bar{f}(t)}{1-\bar{F}(t)}$ which is the difference between the hazards of leaving unemployment at time t implied by the two distributions, $\bar{F}, F^X$.

[27]These results hold unaffected when we also control for the intensity of ties and the degree of competition in the network. Results are available upon request.

is less clearcut, their attributes potentially affecting the features of the new job in several ways. For example, high earning contacts may generate a higher expected wage because they pass on offers they do not find profitable (among others, Calvo-Armengol (2004), Mortensen and Vishwanath (1994)) or because better contacts provide a prospective employer with superior information on the applicant (Montgomery (1991). Additionally, by reducing the uncertainty on the new hire, contacts' referrals may also lead to a longer expected tenure in the new job (Jovanovic (1979)). On the other hand, certain contacts' characteristics may also lead to lower wages. For example, if the provided information concerns jobs somehow unsuited to the unemployed (for example, by involving new tasks), he may nonetheless decide to accept trading off the lower quality with a shorter unemployment spell (Bentolila et al. (2004)); this in turn may also lead to a shorter tenure on the new job.

While the above mechanisms point to reasons why contacts' characteristics affect the distribution of job attributes, from the empirical point of view identifying such effects may be complicated by the fact that, following a reservation wage policy, the observed distribution of job attributes is censored. As pointed out before, Italy has no proper unemployment insurance scheme. To the extent that this implies displaced workers would accept all job offers they receive, the following results can be interpreted as direct effects of contacts' characteristics on the underlying distribution of offers. Table (6) reports estimates from our preferred specification for a number of post-entry outcomes. Results in column 1 show a positive effect of contacts' wage premium on post-displacement wages, compatibly with either high wage contacts passing on high wage offers or their providing more valuable referrals. Increasing contacts' current wage premium by one standard

deviation increases entry wages by 1.7 percent, corresponding to 4.2 percent of their standard deviation. As a benchmark, increasing own wage at displacement by one standard deviation, raises entry wages by 5.7 percent (13.6 percent of the entry wage standard deviation). On the other hand, while relevant in terms of unemployment duration the share of employed contacts does not affect entry wages. These findings are consistent with the idea that, whatever the arrival rate of offers, the option value of turning them down is close to zero. In this case, although they will re-enter at a considerably faster pace, displaced individuals endowed with high employment rate networks would still earn a starting wage which is a random draw from a common distribution[28].

These results largely carry through to job stability. Column 2 looks at the probability of still holding the entry job 12 months after re-entry. Contacts' wage premium has a positive and significant effect on subsequent job tenure. Again, increased stability might follow from better contacts' referrals substantially reducing uncertainty on the quality of the new match, or their sharing information on better jobs, those below their reservation wage. According to our estimates, a one standard deviation increase in contacts' wage premium increases the probability of holding the same job after one year by 2.7 percentage points, corresponding to 4.5 percent of the average probability. Somewhat strikingly, individuals endowed with a larger share of employed among their contacts are also less likely to keep the entry job, a result entirely driven by the share of stayers (col. 3). Possibly, by being more dated, information conveyed by stayers involves less desirable non-wage job attributes, which are however traded off against a significantly shorter unemployment duration. In fact, consistently with the idea that all job offers are accepted and job

[28]Note however, that their lifetime earnings are still higher because of the shorter unemployment spell.

search continues on the job, the last column of the table shows that the probability of employment at the same horizon, regardless of the employer identity, is unaffected by network characteristics (col. 4). This suggests that those who initially ended up in less favourable matches because of their contacts' attributes, look for better opportunities and eventually switch job. Note, however, that this does not imply there are no differences between displaced one year after reentry. For one thing, those with higher quality contacts are more likely to be in a better paying job.

The intensity of the ties with employed contacts, while irrelevant for entry wages, turns out to increase job stability. Plausibly, stronger ties are more successful in supplying a given employer with reliable information, thus leading to less separations. We also find evidence that a larger number of potential competitors reduces expected tenure in the current job.

All in all, our findings confirm that a thorough characterization of contacts' labor market attributes is crucial to unveil the mechanisms underlying the workings of job information networks. As the above evidence shows, network characteristics that significantly affect the duration of unemployment, do not play a major role in determining the features of the new job. Conversely, while largely irrelevant in determining the speed of re-entry, contacts' quality turns out to improve the initial wage and the stability of the subsequent job. Recalling that absence of an unemployment scheme allow us to plausibly interpret the estimates as direct effects of network characteristics on the arrival rate of job offers (previous section) and on the distribution of job characteristics (this section), the findings suggest that contacts' current employment status is crucial in channelling information on available opportunities to job seekers. Thus, as theory suggests, even temporary shocks

to the network employment rate may have long lasting effects via their altering the overall availability of information, the more so the more segregated the network. On the other hand, contacts' quality turns out to be the only determinant of important characteristics of the subsequent job, thereby suggesting that employers may face serious screening problems in hirings and additional information provided by referrals may significantly reduce the uncertainty involved in a new match. Another possible interpretation of the finding is that contacts' in better matches, by earning higher wages, are willing to share more information. In both cases, insofar as our measure of contacts' quality reflects somehow the quality of the match they are in, policies favouring an efficient allocation of workers to jobs may have important spillovers either by increasing the amount of information passed on to untargeted job seekers by their contacts or by complementing, via the referral effect, the information on new hires[29].

5 Discussion and Robustness Checks.

The main identifying assumption required to interpret the previous estimates as effects of the information conveyed by a given network is that, conditional on the set of controls, variation in contacts' attributes at displacement date is orthogonal to individual unobserved characteristics. As we discussed above, the source of this correlation lies in the possibility that the labor market brings together workers with similar unobserved characteristics or that, by having shared the workplace, contacts are subject to the same shocks (for example, they acquire the same skills). In this section we provide indirect evidence

[29]Of course, there are no policy implications if our measure of contacts' quality only reflects their innate ability, rather than match specific quality by which the employer could trust a referral. However, since results are conditional also on contacts' past wage premia, this possibility is plausibly ruled out.

in favor of our identifying assumption addressing three major concerns.

The first source of concern is that our controls are not able to pick up unobserved fixed characteristics shared by the displaced and his contacts. If this was the case, however, we should detect significant empirical correlations when relating contacts' attributes to individual outcomes *prior* to displacement. In columns 1 to 4 of table (7) we relate network characteristics to the weekly wage earned by the displaced 3 to 5 years before displacement and to the time spent in employment in the same years[30]. Network characteristics have no predictive power for these two outcomes, suggesting that results in the previous sections are unlikely to be explained by omitted individual fixed characteristics correlated with network ones.

Second, we address the possibility that our results reflect a causal effect of contacts' fixed unobserved characteristics rather than of their current labor market attributes. While still of interest, our estimates would quantify the effects of exposure to contacts' characteristics rather than their disseminating information obtained on the basis of their current labor market status. However, if this was the case we should be able to detect some significant correlation between individual post-displacement outcomes and his contacts' labor market conditions at some point prior to displacement. In columns 5 to 10 we report results for unemployment duration, entry wages and the probability of holding the same job 12 months from re-entry using network characteristics as measured 4 years before the individual was displaced[31]. Results show that past labor market contacts' attributes are

[30]The only difference with respect to the main specification is that, having pooled wage observations for different years, we also include year dummies to capture common cyclical variation in individual wages and employment status.

[31]Specifically, we track each contact and recover his employment status and wage 4 years before displacement. Since we cannot precisely pin down a month when to measure contacts' attributes we proceed as follows. As concerns employment, we weight every contact for the time he spent employed in the first

unable to predict any post-displacement outcomes. We read this as supportive of the interpretation that the source of identification is random variation in contacts' current conditions. This leads us to a third concern. In particular, we must be sure that random variation in contacts' current labor market attributes is not due to shocks that also affect the displaced. Our empirical strategy accounts for shocks that affect equally co-displaced workers and their contacts via the CFFE; also, the city-year and the 3-digit industry-year dummies absorb all city-wide and industry-wide labor market shocks[32]. Identification thus hinges on variation in contacts' labor market status among co-displaced workers within city and within industry. We may however fail to capture industry-city specific shocks. For example, a new plant requiring a specific skill in a given city would plausibly affect workers endowed with that skill and living in the city differently from co-residents with different skills or individuals with similar skills from other cities[33]. This would be a concern if co-displaced workers (and their networks) were different in terms of city-skills combinations. We deal with this possibility in table (8). We re-ran the main regressions allowing for a full set of 2-digit industry-city-year dummies; we also include town and 3-digit industry fixed effects to absorb permanent differences among towns in the same city (e.g. distances) and among sub-industries belonging to the same 2-digit sector (e.g. skills). Results are unaffected by this extension: we still find that contacts employment status and tenure are the main factors affecting unemployment duration while contacts'

semester of the relevant year; a mover is defined as a contact who in the first semester was in a job other than the one he held the previous year. Results are robust to alternative assumptions of employment status as well as to alternative choices of the relevant pre-displacement year.

[32]Industry dummies are defined on the basis of the 3-digit industry where the displaced accumulated the longest tenure over the pre-displacement period.

[33]City-industry shocks may of course also be events taking place in other industries or cities that affect in the same way people with the same skills and in a given city. For example, a plant closing in a given city-industry would possibly have effects on neighboring cities and sectors through general equilibrium effects.

wage premium is a significant determinant of the entry wage and the degree of stability of the subsequent job.

6 Conclusions

Local and non-market interactions have received a lot of attention as potential causes of persistent segregation and differential behaviors along a number of dimensions. While the sources of these effects can be manifold (social norms, peer pressure, conformism), our findings show that differential access to job-related information determined by different current labor market attributes of the network may be an important factor in shaping them. Unemployment spells are significantly shorter when a larger share of contacts are currently employed, the effect becoming stronger when contacts recently changed job and are employed in markets plausibly more relevant to the displaced. Stronger ties enhance network effectiveness as a source of valuable information, while a higher degree of competition for the information a given contact may share significantly delays re-employment. Contacts' wage premium, at best a weak determinant of the probability of re-employment, turns out to be an important determinant of subsequent wages and job stability, consistently with the idea that contacts in better jobs disseminate superior information.

The findings of this paper complement existing literature in several ways. First, we explicitly focus on contacts' labor market characteristics. While usually maintained as important determinants of job-related information generated in a given network, these aspects have received little empirical attention. Importantly, by looking at individual

and his reference group labor market outcomes the analysis unveils significant sources of spillovers which should be taken into account when evaluating the cost-benefit trade-off of labor market policies. Second, by describing the effects of several network characteristics on a number of individual job search outcomes in a unified framework, we provide a comprehensive assessment of the workings of job information networks. Finally, unlike existing studies, we focus on workplace contacts, arguably a major source of information and referrals for job seekers. Requiring contacts to have previously been coworkers makes explicit why two individuals met and allows us to clarify the sources of potential omitted variable bias. In particular, if contacts are to systematically share some unobserved characteristics that affect their labor market outcomes then it must be that the labor market sorts workers along this dimension. We develop a number of controls for plausible dimensions of sorting and show that our findings are largely robust to alternative specifications of the information set. As a whole, while evidence based on pseudo-experimental data would certainly be more conclusive, we believe the analysis accounts for the most plausible and threatening sources of bias.

By not relying on specific policy interventions or on experimental studies our strategy can be easily extended to other contexts. In particular, given the increased availability of administrative worker-firm matched records, this approach makes it easy to perform cross-country comparisons to assess the relative importance of informal hiring channels and, possibly, their impact on the workings of aggregate labor markets. Additionally, one could address the pervasiveness of workplace networks extending the analysis to alternative, possibly non-labor, outcomes by linking standard administrative records as ours to other data sources.

Table 1: Descriptive statistics.

	(1)	(2)	(3)	(4)	(5)
	Percentile			Mean	Standard Deviation
	10th	50th	90th		
A. Codisplaced Workers.					
Codisplaced	1	5	15	7.6	10.2
Average Age	20.2	26.7	37.8	28	7
Share Males	0	0.667	1	0.571	0.398
Share Blue Collar	0	1	1	0.82	0.328
Share Same LLS as CF	0.143	0.889	1	0.76	0.318
Share Same town as CF	0	0.333	1	0.382	0.332
B. Workplace Networks.					
Total Contacts	8	32	150	60.3	81.1
Share Employed Contacts	0.428	0.68	0.901	0.668	0.193
Average Distance (km)	2.1	5.5	17.6	10.2	28.4
Share Same LLS as Displaced	0.119	0.772	0.947	0.66	0.296
Share Same Town as Displaced	0	0.2	0.593	0.254	0.233
Average Age Difference	4.3	8.2	15.1	9.1	4.6
Share Males	0.083	0.6	1	0.576	0.333

Table entries are the corresponding column statistic computed on the sample distribution of the closing-firm level (panel A) and workplace network level (panel B) means of the row variable.

Table 2: Unemployment duration and network characteristics.

	(1)	(2)	(3)	(4)	(5)
Network Characteristics:					
–Extension	-0.022	0.026	-0.020	-0.047	-0.046
	(0.018)	(0.020)	(0.038)	(0.044)	(0.047)
–Employment Rate	-0.284*	-0.306*	-0.402**	-0.365*	-0.286†
	(0.120)	(0.120)	(0.126)	(0.148)	(0.151)
–Wage Premium	-0.242†	-0.191	-0.251†	-0.220	-0.287
	(0.127)	(0.128)	(0.146)	(0.174)	(0.174)
Wage at displacement		-0.227**	-0.232**	-0.242**	
		(0.060)	(0.060)	(0.067)	
Wage Growth n NB		0.122	0.140	0.088	
		(0.109)	(0.111)	(0.123)	
Average unemp. in NB		0.393**	0.513**	0.444**	
		(0.083)	(0.105)	(0.119)	
Number of firms visited in NB:					
–1			-0.270**	-0.344**	
			(0.092)	(0.105)	
–2			-0.186**	-0.242**	
			(0.066)	(0.078)	
–3			-0.073	-0.107	
			(0.062)	(0.074)	
Average firm size in NB			0.032	0.054	
			(0.049)	(0.057)	
Average Cowkrs. Wage in NB			0.167	0.242	
			(0.144)	(0.171)	
Commuting in NB				0.055	
				(0.124)	
Closing firm FE	YES	YES	YES	YES	YES
Year*City of Residence	NO	NO	NO	YES	YES
Year*Sector Experience	NO	NO	NO	YES	YES
Flex. Spec.	NO	NO	NO	NO	YES
Obs.	9121	9121	9121	9121	9121
Adj. R^2	0.23	0.24	0.24	0.25	0.25

Robust standard errors in parentheses.
(†) significant at 10%; (*) significant at 5%; (**) significant at 1%.
Dependent variable is the (log of) months spent unemployed after displacement. All regressions also include controls for gender, a quadratic in age and tenure in the closing firm and four qualification dummies. Flexible specification is a quadratic of all previous controls and their cross-products. Sector experience dummies are defined on the basis of the longest pre-displacement sector tenure of the displaced.

Table 3: Measurement error corrections.

	(1)	(2)	(3)	(4)
Z:	5	10	15	20
		$\gamma = 0.25$		
Extension	-0.139†	-0.100†	-0.087†	-0.079
Employment Rate	-0.430**	-0.423**	-0.413**	-0.403**
Wage Premium	-0.212	-0.211	-0.211	-0.212
		$\gamma = 0.75$		
Extension	-0.162*	-0.105†	-0.090†	-0.081
Employment Rate	-0.431**	-0.425**	-0.416**	-0.406**
Wage Premium	-0.213	-0.212	-0.211	-0.212
		$\gamma = 1.25$		
Extension	-0.169*	-0.106†	-0.090†	-0.081
Employment Rate	-0.431**	-0.426**	-0.416**	-0.406**
Wage Premium	-0.213	-0.212	-0.211	-0.212

Robust standard errors in parentheses.
(†) significant at 10%; (*) significant at 5%; (**) significant at 1%.
Econometric model is as in col. 4 of table (2). Network characteristics are computed weighting each contact acquired in a firm of size N by $P_i = \left(Z + (e^{-\gamma}/(1-e^{-\gamma}))(1-e^{-\gamma(N-Z)})\right)/N$ if $N > Z$ and $P_i = 1$ otherwise.

Table 4: Unemployment duration and employed contacts.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Information diffusion			Information relevance				
Extension	-0.047	-0.054	-0.008	-0.014	-0.072	-0.076†	-0.075†	-0.038	-0.046
	(0.044)	(0.045)	(0.047)	(0.048)	(0.045)	(0.045)	(0.045)	(0.048)	(0.048)
Wage Premium	-0.220	-0.219	-0.205	-0.205	-0.198	-0.186	-0.216	-0.180	-0.186
	(0.174)	(0.175)	(0.174)	(0.174)	(0.174)	(0.173)	(0.173)	(0.174)	(0.172)
Employment Rate	-0.365*	-0.373*	-0.299*	-0.305*					
	(0.148)	(0.148)	(0.150)	(0.151)					
Intensity:									
- with Employed		-0.009*		-0.010*				-0.009*	-0.009*
		(0.004)		(0.004)				(0.004)	(0.004)
- with Unemployed		0.010*		0.010**				0.010**	0.010**
		(0.004)		(0.004)				(0.004)	(0.004)
Competition			0.007*	0.007*				0.008*	0.007*
			(0.003)	(0.003)				(0.003)	(0.003)
Share of Stayers					-0.281†	-0.064	-0.426*	-0.210	-0.129
					(0.149)	(0.176)	(0.178)	(0.152)	(0.201)
Share of Movers					-0.602**	-0.335†	-0.395*	-0.549**	-0.142
					(0.173)	(0.203)	(0.191)	(0.175)	(0.216)
Technological Distance:									
Share Stayers in Displacing Sector						-0.300*			-0.324*
						(0.139)			(0.140)
Share Movers in Displacing Sector						-0.454*			-0.374*
						(0.177)			(0.179)
Geographic Distance:									
Share Nearby Stayers							0.214		0.216
							(0.141)		(0.142)
Share Nearby Movers							-0.277*		-0.253*
							(0.111)		(0.111)
Obs.	9121	9121	9121	9121	9121	9121	9121	9121	9121
Adj. R^2	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25

Robust standard errors in parentheses. (†) significant at 10%; (*) significant at 5%; (**) significant at 1%.
All regressions include controls for gender, a quadratic in age and tenure in the closing firm, four qualification dummies, wage at displacement, wage growth and average unemployment over the NB period, dummies for the number of firms visited over the NB period, their average size, commuted distance, a closing firm FE, year-city of residence and year-3-digit sectoral experience fixed effects. Nearby contacts are defined as those living in towns whose distance from the displaced residence is less than the median distance between displaced and contacts in the sample.

Table 5: Unemployment duration and network characteristics at different horizons.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. var.				Unemployed after:			
	1 month	3 months	6 months	9 months	12 months	15 months	18 months
Extension	-0.043*	-0.037†	-0.021	-0.001	-0.019	-0.004	-0.003
	(0.018)	(0.020)	(0.020)	(0.018)	(0.017)	(0.016)	(0.014)
Share of Stayers	0.021	-0.007	-0.110	-0.329**	-0.244**	-0.213**	-0.176**
	(0.059)	(0.068)	(0.067)	(0.063)	(0.057)	(0.053)	(0.049)
Share of Movers	-0.184**	-0.152†	-0.195*	-0.291**	-0.206**	-0.198**	-0.179**
	(0.068)	(0.078)	(0.077)	(0.073)	(0.067)	(0.063)	(0.058)
Wage premium	-0.173*	-0.089	0.025	0.048	0.049	0.037	0.036
	(0.071)	(0.082)	(0.081)	(0.072)	(0.065)	(0.062)	(0.057)
Obs.	9121	9121	9121	9121	9121	9121	9121
F(Stayer=Mover)	20.93	8.12	3.02	0.51	0.69	0.07	0.03
p-value	0.00	0.00	0.08	0.47	0.40	0.79	0.85

Robust standard errors in parentheses. (†) significant at 10%; (*) significant at 5%; (**) significant at 1%.
All regressions include controls for gender, a quadratic in age and tenure in the closing firm, four qualification dummies, wage at displacement, wage growth and average unemployment over the NB period, dummies for the number of firms visited over the NB period, their average size, commuted distance, a closing firm FE, year-city of residence and year-3-digit sectoral experience interactions.

Table 6: Network characteristics, entry wages and job stability.

	(1)	(2)	(3)	(4)
		1 year after entry:		
	Entry Wage	Same Job		Employed
Extension	0.006	-0.039†	-0.015	0.003
	(0.018)	(0.022)	(0.022)	(0.017)
Wage Premium	0.122*	0.193*	0.167*	-0.078
	(0.059)	(0.086)	(0.085)	(0.063)
Employment Rate	-0.052	-0.324**		-0.009
	(0.051)	(0.071)		(0.055)
Competition	-0.000	-0.003*	-0.004*	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)
Intensity:				
- with Employed	0.000	0.008**	0.008**	0.001
	(0.001)	(0.002)	(0.002)	(0.001)
- with Unemployed	-0.000	-0.010**	-0.010**	0.000
	(0.001)	(0.002)	(0.002)	(0.001)
Share Stayers			-0.421**	
			(0.073)	
Share Movers			-0.075	
			(0.081)	
Obs.	9121	8531	8531	8531

Robust standard errors in parentheses. (*) significant at 5%; (**) significant at 1%.
Columns (2-4): linear probability models. Dependent variable: $Y = 1$ if still in entry job after 1 year (cols. 2 and 3); $Y = 1$ if employed after 1 year from re-entry, irrespective of employer's identity (col. 4).
All regressions include controls for gender, a quadratic in age and tenure in the closing firm, four qualification dummies, wage at displacement, wage growth and average unemployment over the NB period, dummies for the number of firms visited over the NB period, their average size, commuted distance, a closing firm FE, year-city of residence and year-3-digit sectoral experience fixed effects.

Table 7: Robustness checks.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Individual Pre-Displacement				Past Contacts Characteristics					
	Current Weekly Wage		% Sem. Unemployed		Unemployment Duration		Entry Weekly Wage		Same Job after 12m	
Extension	0.005	0.006	0.011	0.014	-0.061	-0.061	0.013	0.014	-0.038†	-0.037†
	(0.008)	(0.008)	(0.012)	(0.012)	(0.045)	(0.045)	(0.015)	(0.015)	(0.021)	(0.021)
Employment Rate	-0.024		0.027		-0.035	-0.035	-0.010	-0.011	0.105	0.103
	(0.028)		(0.037)		(0.158)	(0.158)	(0.050)	(0.050)	(0.074)	(0.074)
Share of Stayers		-0.026		0.024						
		(0.029)		(0.037)						
Share of Movers		-0.016		0.047		0.003		0.095		0.136
		(0.030)		(0.045)		(0.239)		(0.074)		(0.110)
Wage Premium	0.048	0.048	-0.063	-0.064	0.072	0.072	0.000	0.002	0.083	0.085
	(0.049)	(0.049)	(0.046)	(0.045)	(0.180)	(0.180)	(0.058)	(0.058)	(0.084)	(0.084)

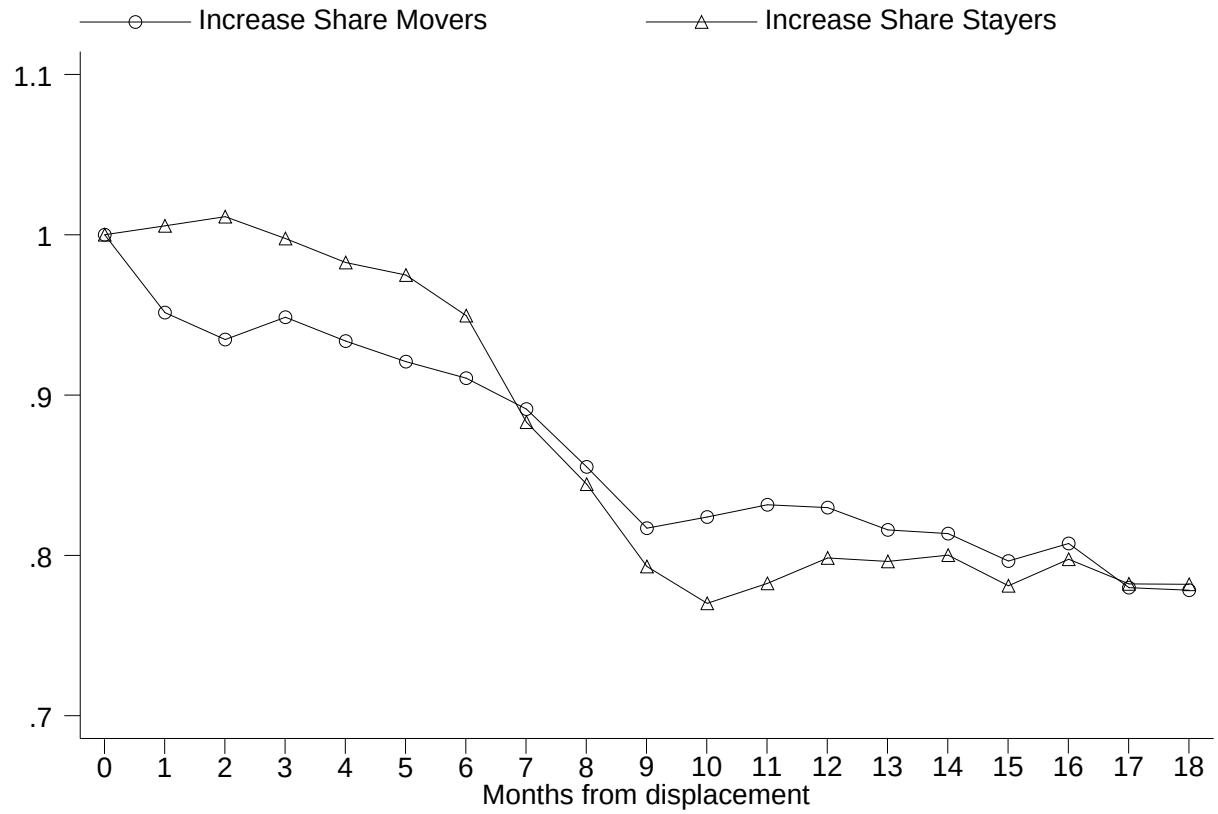
Robust standard errors in parentheses. (†) significant at 10%; (*) significant at 5%; (**) significant at 1%.
Columns (1)-(2): dependent variable is weekly wage 3 to 5 years before displacement. Columns (3)-(4): dependent variable is share of 1st semester spent unemployed 3 to 5 years before displacement. Columns (5)-(10): contacs characteristics are determned 4 years before displacement: employment rate is computed weighting each contact for the share of the 1st semester he spent employed; a mover is a contact who in the first semester of the year was in a job other than the one held the previous year.
All regressions include controls for gender, a quadratic in age and tenure in the closing firm, four qualification dummies, wage at displacement, wage growth and average unemployment over the NB period, dummies for the number of firms visited over the NB period, their average size, commuted distance, a closing firm FE, year-city of residence and year-3-digit sectoral experience interactions.

Table 8: Robustness to city-industry shocks.

	(1)	(2)	(3)	(4)	(5)	(6)
	Unemployment Duration		Entry Weekly Wage		1 Year Job Stability	
Extension	-0.058	-0.086†	-0.001	-0.001	-0.025	0.006
	(0.048)	(0.049)	(0.017)	(0.017)	(0.023)	(0.023)
Employment rate	-0.372*		-0.063		-0.323**	
	(0.163)		(0.055)		(0.078)	
Share of Stayers		-0.282†		-0.063		-0.427**
		(0.164)		(0.057)		(0.079)
Share of Movers		-0.627**		-0.064		-0.034
		(0.191)		(0.060)		(0.089)
Wage Premium	-0.147	-0.122	0.156*	0.156*	0.212*	0.183*
Obs.	9121	9121	8528	8528	8531	8531
Adj. R^2	0.25	0.25	0.91	0.91	0.09	0.10

Robust standard errors in parentheses.
(†) significant at 10%: (*) significant at 5%; (**) significant at 1%.
All regressions include controls for gender, a quadratic in age and tenure in the closing firm, four qualification dummies, wage at displacement, wage growth and average unemployment over the NB period, dummies for the number of firms visited over the NB period, their average size, commuted distance, a closing firm FE, dummies for town of residence and 3-digit sectoral experience and interactions 2-digit industry-city-year.

Figure 1: Network effects at various horizons.



Ratios between implied and average probability of still being unemployed at a given horizon. Implied probabilities are computed increasing, respectively, the share of movers and the share of stayers by one standard deviation of the overall employment rate.

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