Job Search, Networks, and Labor Market Performance of Immigrants

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Abstract

We develop an on-the-job search model in which immigrants search for jobs through formal channels or networks, and the quality of job offers differs across search methods. The model predicts networks unambiguously lead to a larger share of network jobs in job-to-job transitions, whereas the effect is ambiguous in unemployment-to-job transitions.

JEL codes: J31, J61, J62, J64.

Keywords: On-the-job search, networks, migration.

1 Introduction

Recent empirical literature has provided evidence on the effect of social networks on immigrants' labor market outcomes.[1] However, the evidence is rather mixed. A source of heterogeneity explaining these results is the size of the network: networks might have a positive or negative effect depending on their size and whether they are contemporaneous

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[1] For a survey of the literature refer to Ioannides and Loury (2004).

with the immigrant or they preceded the immigrant's arrival.[2] The theoretical literature also offers a wide range of explanations on the source and sign of the network's effects on labor market outcomes.[3]

In this paper, we examine a different source of heterogeneity that stems from relaxing two assumptions used in previous literature on the effect of networks on job search; namely that there is only unemployment search (Beaman, 2012; Calvó-Armengol and Zenou, 2005; Montgomery, 1992; Patel and Vella, 2007) and that the wage offers from different search methods are drawn from the same wage distribution (Calvó-Armengol and Jackson, 2004; Calvó-Armengol and Zenou, 2005; Patel and Vella, 2007). In our model, we allow for on-the-job search, a direct impact of network size on the arrival rate of wage offers, and two exogenous wage offer distributions for each search method. Relaxing those assumptions will lead to important implications on starting wages, wage growth and occupational choices dependent on the network size and the value of on-the-job search relative to unemployment search, thus reconciling the mixed empirical evidence on the effect of network size. The most important finding is that the share of jobs found through the network increases as the network size increases only in the case of job-to-job transitions, whereas the effect is ambiguous for unemployment-to-job transitions.

The rest of the paper is organized as follows. In Section 2 we develop an on-the-job search model for low-skilled immigrants. Section 3 presents some comparative statics on labor market outcomes. Finally, Section 4 concludes.

2 The Model

This section develops an on-the-job search model[4] in which individuals use two job search methods simultaneously: their network and other formal channels. Our contribution to the

[2] See for instance: Beaman (2012), Munshi (2003), and Wahba and Zenou (2005).

[3] See for example Montgomery (1991 and 1992); Mortensen and Vishwanath (1994); and Koning, van der Berg and Ridder (1997).

[4] Mortensen (1987); and Rogerson, Shimer and Wright (2005) present a survey of the literature on job search.

literature is that we allow for exogenous differences in the distribution of wage offers of the two search methods *and* the arrival rate of job offers from the network depends on the network size. Previous work had only allowed for differences in the distributions of wage offers or for the dependence of the arrival rate on the network size, but not both. There are two only exceptions in the literature. The first exception is Calvó-Armengol and Jackson's (2004) model of information transmission in networks. However their model implicitly assumes that unemployed individuals search for jobs using formal and informal channels, but employed individuals search only through the formal channels. Our model relaxes this assumption by allowing unemployed *and* employed workers to search using formal and informal methods. The other exception is Goel and Lang's (2009) model. However their model is a static one and does not allow us to differentiate between unemployment search and on-the-job search.

Assume we have a utility maximizing individual who is searching for a job. As it is standard, individuals do not posses perfect information about the available vacancies. Thus they invest time searching for a job using two methods: (1) the informal methods, which include obtaining information from the individual's network; and (2) formal methods, such as contacting or visiting employers directly, posting advertisements, and so on. Let n index the informal methods (i.e. the network), and f the formal methods. If the individual uses the network, she will receive a wage offer at rate $\lambda_n^e(N)$ if she is employed, and $\lambda_n^u(N)$ if she is unemployed, where N is the network size. For simplicity, assume that

$$\begin{aligned} \lambda_n^e(N) &= \theta_n^e \lambda(N), \text{ and } \lambda_n^u(N) = \theta_n^u \lambda(N), \\ \text{with } \lambda(0) &= 0, \lambda' > 0; \end{aligned} \tag{1}$$

such that as the network size increases, the arrival of wage offers increases because there may be more information on available jobs. In the case of formal search methods, the arrival rates are going to be given by λ_f^e, and λ_f^u, for the employed and unemployed, respectively. For simplicity, we assume that $\lambda_f^e = \lambda_f^u$.

Wage offers are an $i.i.d.$ draw from a cumulative distribution function $F_n(w_n)$, where w_n is the wage of a "network job". Each wage offer from the formal channel is an $i.i.d.$ draw from a distribution function $F_f(w_f)$, where w_f is the wage of a "formal-channel job". Assume that the support of the distribution functions is upperly bounded by $\bar{w} < \infty$. So $\bar{w}$ is the minimum wage such that $F_j(\bar{w}) = 1$ for $j = n, f$.

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We will assume that the formal channel's distribution of wage offers is superior to the low-skilled immigrant's network wage offer distribution. For instance, network jobs may offer lower wages if working with fellow countrymen is regarded as a job amenity. In particular, we will assume that $F_f(w_f)$ is larger than $F_n(w_n)$ in the hazard rate order sense, which formally means that:

$$\frac{dF_n(w)}{\bar{F}_n(w)} \geq \frac{dF_f(w)}{\bar{F}_f(w)} \quad \text{for all } w \geq 0,$$

where $\bar{F}_j(w) = 1 - F_j(w)$, $j = n, o$. The intuition behind this condition would be as follows. Assuming that the arrival rates are the same for network and for formal-channel jobs, and given a wage offer w^o in the common support of $F_f(w)$ and $F_n(w)$, the probability that an immigrant will find a job in the network in an infinitesimal interval to the right of w^o is higher than the probability of finding a job through formal search methods. The hazard rate order is stronger than, and in fact implies, first-order stochastic dominance.

In each labor status the individual's income is equal to:

$$y = \begin{cases} w^* & \text{if employed} \\ z & \text{if unemployed} \end{cases}$$

where w^* is the wage net of search costs when employed, $w^* = w - c^e$, with c^e being the costs of search while employed; and z is the net income in unemployment, $z = b - c^u$, b denotes the gross income from unemployment, and c^u are the search costs when unemployed assumed constant across job search methods in this model. Finally, all types of jobs end at an exogenous rate q.

The individual's objective is to maximize his lifetime wealth. The Bellman equations of this search problem are:

$$rV^u = z + \lambda_n^u (N) \int_{w^r}^{\bar{w}} [V^e (w_n) - V^u] \, dF_n (w_n) + \lambda_f^u \int_{w^r}^{\bar{w}} [V^e (w_f) - V^u] \, dF_f (w_f) \qquad (2)$$

$$\begin{aligned} rV^e (w) &= w^* + q [V^u - V^e (w)] + \lambda_n^e (N) \int_{w}^{\bar{w}} [V^e (w_n) - V^e (w)] \, dF_n (w_n) \\ &+ \lambda_f^e \int_{w}^{\bar{w}} [V^e (w_f) - V^e (w)] \, dF_f (w_f) , \end{aligned} \qquad (3)$$

where V^u is the present discounted value of unemployment, V^e is the employment counterpart, and w^r is the reservation wage.

The solution to the maximization problem defines the optimal strategy to transit from unemployment to employment, and from job to job. In the latter case, we know that individuals will move to a new job if the wage offer is higher than the current wage. The transitions from unemployment to employment are governed by the reservation wage, which is defined as the wage that leaves the immigrant indifferent between work and unemployment. Hence in our context, the reservation wage solves for:

$$V^e (w^r) = V^u \qquad (4)$$

Solving for the reservation wage, and taking into account that we are assuming $\lambda_f^u = \lambda_f^e$, we get the following expression:

$$w^r = b + (c^e - c^u) + [\lambda_n^u(N) - \lambda_n^e(N)] \int_{w^r}^{\bar{w}} \frac{\bar{F}_n(w)\, dw}{r + q + \lambda_n^e(N)\bar{F}_n(w) + \lambda_f^e \bar{F}_f(w)} \qquad (5)$$

Hence the reservation wage is equal to the gross income from unemployment plus the difference in employment and unemployment search costs plus the net value of unemployment search relative to on-the-job search.

3 Implications of the Model: Comparative Statics

One of our objectives in this paper was to establish another source for the heterogeneity in the effect of the network. The following claim establishes that the effect of the network's size on the reservation wages, and hence in the expectation of the observed wages, is ambiguous. The network effect will depend on whether unemployment search is relatively more valuable than on-the-job search or not.

Claim 1 *The effect of the network size on the reservation wage is ambiguous. We have the following three cases:* (1) *if there is no on-the-job search, as it has been assumed in part of the literature or* $\lambda_n^e(N) < \lambda_n^u(N)$, *then* $\frac{\partial w^r}{\partial N} > 0$; (2) *if* $\lambda_n^e(N) > \lambda_n^u(N)$, *then* $\frac{\partial w^r}{\partial N} < 0$; *and finally,* (3) *if* $\lambda_n^e(N) = \lambda_n^u(N)$, *then* $\frac{\partial w^r}{\partial N} = 0$.

Proof. Let $\Phi\left(w^r, N, \lambda_f^u, \lambda_f^e, r, q\right)$ be given by:

$$\Phi\left(w^r, N, \lambda_f^u, \lambda_f^e, r, q\right) = w^r - z - c^e - [\lambda_n^u(N) - \lambda_n^e(N)] \int_{w^r}^{\bar{w}} \frac{\bar{F}_n(w)}{\Delta(w)} dw = 0$$

where $\Delta(w) = r + q + \lambda_n^e(N)\bar{F}_n(w) + \lambda_f^e \bar{F}_f(w)$. Then using the implicit function theorem we have that $\frac{\partial w^r}{\partial N} = -\frac{\Phi_N}{\Phi_{w^r}}$. Thus differentiating $\Phi(\cdot)$ with respect to w^r, we get:

$$\Phi_{w^r} = 1 - [\lambda_n^e(N) - \lambda_n^u(N)] \frac{\bar{F}_n(w^r)}{\Delta(w^r)} > 0$$

Differentiating $\Phi(\cdot)$ with respect to N we get:

$$\begin{aligned}\Phi_N &= \left(\lambda_n^{e\prime} - \lambda_n^{u\prime}\right)\int_{w^r}^{\bar{w}} \frac{\bar{F}_n(w)}{\Delta(w)}dw - \lambda_n^{e\prime}\left(\lambda_n^e - \lambda_n^u\right)\int_{w^r}^{\bar{w}} \frac{\bar{F}_n(w)^2}{\Delta(w)^2}dw \\ &= \int_{w^r}^{\bar{w}} \frac{\lambda'\left(\theta_n^e - \theta_n^u\right)\bar{F}_n(w)\Delta(w) - \lambda'\left(\theta_n^e - \theta_n^u\right)\lambda_n^e \bar{F}_n(w)^2}{\Delta(w)^2}dw \\ &= \left(\theta_n^e - \theta_n^u\right)\int_{w^r}^{\bar{w}} \frac{\lambda'\bar{F}_n(w)\left(r + q + \lambda_f^e \bar{F}_f(w)\right)}{\Delta(w)^2}dw \gtreqless 0\end{aligned}$$

where $\lambda' = \frac{d\lambda(N)}{dN}$, and I have omitted the arguments of $\lambda_n^i(N)$,and $\lambda_n^{i\prime}(N)$, $i = e, u$, for notational simplicity. The integral in the last expression is always positive. Hence the sign of Φ_N depends on the sign of $\left(\theta_n^e - \theta_n^u\right)$, which is also the sign of $\lambda_n^e(N) - \lambda_n^u(N)$. So we have that:

$$\frac{\partial w^r}{\partial N} = -\frac{\left(\theta_n^e - \theta_n^u\right)\int_{w^r}^{\bar{w}} \frac{\lambda'\bar{F}_n(w)\left(r+q+\lambda_f^e\bar{F}_f(w)\right)}{\Delta(w)^2}}{1 - \left[\lambda_n^e(N) - \lambda_n^u(N)\right]\frac{\bar{F}_n(w^r)}{\Delta(w^r)}} \lesseqgtr 0.$$

The sign of $\frac{\partial w^r}{\partial N}$ is ambiguous, $\frac{\partial w^r}{\partial N} \lesseqgtr 0$, and it will depend on whether $\lambda_n^e(N) \gtreqless \lambda_n^u(N)$. ■

Hence, the effect of the network size on the reservation wage is ultimately an empirical question. The results on the reservation wage are easily extended to the observed wage, given that the observed distribution of wages is truncated at the lower tail of the distribution by the reservation wage. Hence, a higher reservation wage implies that the mean of the observed wages is also higher.

Our next two results explore the relationship between the concentration on network jobs and the network size.

Claim 2 *The probability of job-to-job transitions increases with the network size, and a larger share of these transitions are due to the network.*

Proof. Let α^e be the proportion of job-to-job transitions due to the network, which is given by:

$$\alpha^e = \frac{\lambda_n^e(N)\bar{F}_n(w)}{\lambda_n^e(N)\bar{F}_n(w) + \lambda_f^e\bar{F}_f(w)},$$

where w is the current wage. The numerator is the probability that an employed individual accepts a network offer, and the denominator is the probability that the individual will change jobs. Differentiating α^e with respect to N, we get:

$$\frac{\partial \alpha^e}{\partial N} = \frac{\lambda_n^{e\prime} \lambda_f^e \bar{F}_n(w) \bar{F}_f(w)}{\left[\lambda_n^e \bar{F}_n(w) + \lambda_f^e \bar{F}_f(w)\right]^2} > 0.$$

Hence as the network size increases more of the job-to-job transitions are going to be due to wage offers coming from the network. ■

Claim 3 *The probability of unemployment-to-job transitions increases with the network size, and a larger share of these transitions is due to the network if* $\frac{\partial w^r}{\partial N} < 0$ *and* $F_f(w_f)$ *is larger than* $F_n(w_n)$ *in the hazard rate order sense.*

Proof. Let α^u be the fraction of transitions from unemployment to employment due to the network, which is given by:

$$\alpha^u = \frac{\lambda_n^u(N) \bar{F}_n(w^r)}{\lambda_n^u(N) \bar{F}_n(w^r) + \lambda_f^u \bar{F}_f(w^r)},$$

where the numerator is the probability that an unemployed migrant finds a job through the network, and the denominator is the probability that he finds a job using either search method. Differentiating α^u with respect to N, we get:

$$\frac{\partial \alpha^u}{\partial N} = \frac{\lambda_f^u \lambda_n^{u\prime} \bar{F}_n(w^r) \bar{F}_f(w^r) + \lambda_f^u \lambda_n^u \frac{\partial w^r}{\partial N}\left[\bar{F}_n(w^r) dF_f(w^r) - \bar{F}_f(w^r) dF_n(w^r)\right]}{\left[\lambda_n^u \bar{F}_n(w) + \lambda_f^u \bar{F}_f(w)\right]^2}$$

In order to determine the sign of $\frac{\partial \alpha^u}{\partial N}$, we need to find the sign of the numerator in the expression above. Dividing the numerator by $\lambda_f^u \bar{F}_n(w^r) \bar{F}_f(w^r)$,we get the following expression:

$$\lambda_n^{u\prime} + \lambda_n^u \frac{\partial w^r}{\partial N}\left[\frac{dF_f(w^r)}{\bar{F}_f(w^r)} - \frac{dF_n(w^r)}{\bar{F}_n(w^r)}\right]$$

The expression above will be strictly positive if $F_f(w)$ is larger than $F_n(w)$ in the hazard rate order sense, and hence we will have that:

$$\frac{\partial \alpha^u}{\partial N} = \frac{\lambda_f^u \lambda_n^{u\prime} \bar{F}_n(w^r)\bar{F}_f(w^r) + \lambda_f^u \lambda_n^u \frac{\partial w^r}{\partial N}\left[\bar{F}_n(w^r)\,dF_f(w^r) - \bar{F}_f(w^r)\,dF_n(w^r)\right]}{\left[\lambda_n^u \bar{F}_n(w) + \lambda_f^u \bar{F}_f(w)\right]^2} > 0$$

Thus unemployed individuals will tend to concentrate on network jobs as the network size increases. ■

Hence, the model predicts that the effect of the network size is unambiguous for job-to-job transitions: there is going to be more clustering in network jobs as the network size increases. However, the result only holds under certain conditions for unemployment-to-job transitions, where in addition to the superiority of formal jobs, we also need that the reservation wage is a decreasing function of the network size, or that the arrival rate from network jobs is higher when employed than when unemployed (following Claim 1). In the case of low-skilled immigrants, especially those who recently arrived, it seems sensible to assume that the job offer arrival rate from networks when employed is higher than the offer arrival rate from networks when unemployed. The intuition behind this assumption is that when immigrants start working both their knowledge on the host country's labor market and their network expand, so that overall, they receive more valuable information per connection than an unemployed worker. Hence, in the case of low-skilled workers, our model reaches a result consistent with one of the findings in Patel and Vella (2007). They find that recent immigrants locate in the same occupations as their countrymen within regional labor markets, which is consistent with Claim 3. Their other finding states that recent immigrants enjoy higher wages in common network jobs. We would only be able to explain concurrent higher wages and occupational clustering if $\lambda_n^e(N) < \lambda_n^u(N)$ (Claim 1), and if the occupational clustering is a result of job-to-job transitions (Claim 2).

4 Conclusions

This paper developed an on-the-job search model in which individuals are allowed to search for a job using formal and informal methods simultaneously. The model allows for the network size to have a direct effect on the arrival rate of job offers both while employed and while unemployed; and that the distribution of wage offers from the network is different than the distribution of offers from formal channels. We find that the effect of the network size on the reservation wages, and hence on observed wages, is ambiguous. The heterogeneity of the effect arises from the difference in the employment-offer arrival rate relative to the unemployment-offer arrival rate. Our model is consistent with previous literature in the sense that when there is no on-the-job search (Beaman, 2012; Calvó-Armengol and Zenou, 2005) or when the unemployment-offer arrival rate is higher than the employment-offer arrival rate (Calvó-Armengol and Jackson, 2004), the reservation wage increases when the network is larger. We also find that the proportion of job-to-job transitions due to the network is increasing on the network size. In contrast, the relationship between the network size and the proportion of unemployment-to-employment transitions requires some rather restrictive assumptions for it to be positive.

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