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Search Capital*

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Abstract

This paper first documents the extent of return employment: workers returning to employers they worked for previously within the same employment spell. Employer returns are typically involuntary and lead to lower earnings. To understand these features, the paper then develops an equilibrium model of worker recall and on-the-job search in which job seekers hold onto information they acquire about job opportunities as insurance in the event of a job destruction shock. Allowing workers to recall contacts increases the probability of a job-to-job transition with the number of jobs previously held during the employment spell while the probability of an job-to-unemployment transition decreases. These transition patterns are consistent with empirical evidence.

Keywords: Search Capital, Job Turnover, Recall.
JEL: J62, J63, J64.

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1 Introduction

Modern labour markets exhibit a large degree of worker churning. In the US, for example, around six percent of employed workers separate from their employers every month. Around half of these workers find another job almost immediately while the other half transit to unemployment. Job ladder models like Burdett and Mortensen (1998) and Postel-Vinay and Robin (2002) provide a natural interpretation for these facts. In these economies, some workers move up the job ladder over time as they search for better paid employment, while others fall from the job ladder after job displacement and must re-climb the ladder from unemployment.

This paper first documents a novel feature of worker job ladders: a notable fraction of job transitions in the National Longitudinal Survey of Youth (NLSY) involve workers returning to employers they worked for previously within the same employment spell. Job transitions involving an employer return are typically involuntary and lead to lower earnings. To understand these features, this paper then develops an equilibrium model of worker recall and on-the-job search in which job seekers hold onto information they acquire about job opportunities as insurance in the event of a job destruction shock.

The mechanism is straightforward. From time to time, workers who engage in on-the-job search encounter firms with job opportunities that are not currently attractive. However, it is in the interest of these workers to establish contacts with such firms. If job matches are subject to destruction shocks, then with positive probability the worker will lose the current job sometime in the future. In the face of such a shock, the worker can approach the accumulated employment contacts (if any) to inquire whether there is still a job available. If so, the worker has the option of taking the job and avoiding unemployment. The crucial insight is that the ability of workers to recall previously met firms allows them to accumulate "search capital", a valuable asset that (partially) insures them against adverse displacement shocks.[1,2]

The framework is similar to the one proposed by Postel-Vinay and Robin (2002) in which all workers search for jobs and sequential auctions determine wages. The key difference is that we allow workers to keep track of the identity of the firms they encounter during their search process. We also allow for search capital depreciation: there is a positive probability that a worker's employment contact might disappear. In this context, it is in the interest of the firm as well as the worker to establish contacts. With recall, a losing firm in the auction knows it will remain in contact with the worker, at least for some period of time. Because employment for the worker at another firm may end, firms that are in contact with the worker might at some time in the future face less competition and hire the worker at more favourable, monopsonistic terms. As a result, with search capital, the option value of losing the worker in a competitive

[1]Insurance here is not against unemployment *per se* but against a type of unemployment. When a laid off worker returns to a previous employer or contact, the worker receives a take-it-or-leave-it which makes the worker indifferent between employment and unemployment *with a contact*. Therefore, contacts insure (in part) against unemployment *without a contact* which has a strictly lower payoff.

[2]The type of recall studied in this paper differs from recall unemployment as investigated by Fernandez-Blanco (2010) and Fujita and Moscarini (2015). Recall unemployment is a by-product of temporary layoffs, where employers layoff workers with the option of employing them again at some point during their unemployment spell. In contrast, employer returns in this paper occur as a result of workers using their employer contacts to avoid spells of unemployment.

auction is no longer zero (as in Postel-Vinay and Robin, 2002), but positive and depends on the extent of search frictions, job destruction and search capital depreciation.

As workers can immediately recall offers following a displacement, job-to-job transitions occur not only when new work is found but also when the current employer lets the worker go. If on-the-job search generates a contact, the new contact and the current employer bid up the wage. If the new contact wins the auction, voluntary job turnover can occur with a pay rise or a pay cut, depending on the productivity of the poaching firm, among other factors. If a displacement shock subsequently hits, the worker takes employment with a previous employer. As a lone bidder, this firm acts monopsonistically and offers a low wage equal to the worker's reservation wage. At this point, the worker experiences an employer return characterised by an involuntary job-to-job transition with a pay cut.

Allowing workers to recall contacts accumulated while searching on the job also implies that the probability of a job-to-job transition increases while the probability of a job-to-unemployment transition decreases with the number of jobs previously held during the employment spell. Workers who have had more jobs during the employment spell are likely to have accumulated more contacts. When a displacement shock occurs, workers with more contacts have a lower probability of transiting into unemployment (and hence making a job-to-job transition) than workers with less contacts.

These transition patterns are consistent with empirical evidence found in the NLSY. As observed elsewhere (see Jolivet et al., 2006, among others), the NLSY dataset contains considerable numbers of voluntary and involuntary job-to-job movements involving pay cuts as well as pay rises. Moreover, the NLSY data also reveal that the number of previously held jobs during an employment spell is positively related to the probability of a job-to-job transition and negatively related to the probability of a job-to-unemployment transition. These findings contrast with standard job ladder models in which workers who have held many jobs during the employment spell are close to the top of the job ladder and hence have a lower probability of another job-to-job transition.[3] In the NLSY, workers with more employer returns or more involuntary job transitions within an employment spell have a higher probability becoming unemployed after a job displacement shock as the search capital model also implies but in contrast with standard job ladder models.

Since investment in on-the-job search creates a productive resource for workers, recall affects aggregate equilibrium output. Contacts accumulated through on-the-job search provide back-up employment opportunities that partially insure against costly unemployment from displacement shocks. Ceteris paribus, output with recall is higher than output without recall. On-the-job search, however, can be inefficient when employed searchers crowd out the unemployed for jobs and discourage job creation. We show that the net effect is in general ambiguous but in a calibrated version of the model with heterogeneous jobs total output increases with on-the-job search.

This paper is closely related to Carrillo-Tudela et al. (2011), which explores the implications

[3]Standard job ladder models assume that job destruction shocks affect all jobs equally and hence the job-to-unemployment transition is independent of the number of jobs held during the employment spell. See, however, recent work by Pinheiro and Visschers (2015) and Jarosh (2015).

of recall by unemployed workers alone. Without on-the-job search, unemployed workers on the equilibrium path are hired with no contacts. If they subsequently experience a displacement, they become unemployed with no contacts once again. Without on-the-job search, it is the threat of continued search while unemployed which increases the workers' reservation wage, raises the wage offered and hence avoids the Diamond (1971) paradox. In contrast, this paper incorporates on-the-job search as well as firm heterogeneity and optimal firm entry. These extensions create search capital accumulation. With on-the-job search, although unemployed workers again do not hold any contacts in equilibrium, employed workers will hold these contacts, thereby generating the rich job-to-job and wage dynamics and the welfare properties described above.[4]

The rest of the paper is as follows. The next section presents new evidence on employer returns based on the NLSY. Section 3 develops the general framework, allowing for firm heterogeneity and recall. Section 4 defines equilibrium and describe its properties. Section 5 characterises the homogeneous firms case to obtain a basic understanding of the model, while Section 6 explores the welfare implications. Section 7 analyses the models' implications for employment dynamics and transition probabilities. Section 8 presents a further discussion and concludes.

2 Motivating Evidence

This section describes the existence and relevance of recall or return employment based on the job-to-job transitions of white workers for the period 1979-2010 observed in the NLSY. The overall picture emerging from this evidence is that workers search on-the-job and find (on average) better, more desirable jobs. From time to time, these workers return to a previous employer but under more adverse circumstances.

Since a worker may have multiple contemporaneous jobs within an employment spell, the analysis focuses on mobility across workers' main jobs.[5] A job-to-job transition is recorded when the worker changes his or her main job *and* stops working for the firm where the main job was located. The latter restriction is important. We observe (and do not want to consider) workers with multiple contemporaneous jobs changing their main job without actually separating from any of their employers.[6] Given these selection criteria, the NLSY sample contains 26,094 spells of uninterrupted employment. A little more than half of these spells (58.8%) involve only one job. Approximately one fifth (18.3%) involve two jobs. Almost a quarter of these spells (22.9%) have three or more jobs in the same continuous spell of employment.[7] The Appendix provides further details of the construction of the sample. Here we present the main results.

[4] Kircher (2009) and Wolthoff (2014) explore related environments with multiple bidders.

[5] The main job is defined as the one in which the worker (sequentially in order of importance) spends more hours, has currently a longer tenure, earns the higher wage and last longer. See the Appendix for details.

[6] For example, consider a worker who performs two job simultaneously. Let job 'A' be the main job and job 'B' the secondary job. There are instances when the worker's main job changes from 'A' to 'B' and back to 'A' within an employment spell, while the secondary job changes from 'B' to 'A' and back to 'B'. These transitions do not involve a separation (the worker never stopped working for either employer), and thus are not included in the analysis.

[7] A continuous employment spell starts and ends with unemployment or non-participation and thus potentially contains multiple job spells. A job spell is the duration of a job at a given employer.

Table 1: The Extent of Return Employment

	№ of spells with 3+ jobs	№ of spells with at least one return	Returns in spell with 2+ jobs	Returns in spell with 3+ jobs
All workers	5,985	1,619	15.0%	27.1%
Gender				
Female	2,779	774	14.8%	27.9%
Male	3,206	845	15.3%	26.4%
Age				
25 or younger	4,460	1,253	16.2%	28.1%
26-35	1,200	287	13.1%	23.9%
36 and above	325	79	9.4%	24.3%
Years of schooling				
Below 12	1,158	312	14.3%	26.9%
12	1,765	423	12.9%	24.0%
13-14	1,306	327	14.3%	25.0%
16	551	127	13.1%	23.1%
17 and above	203	52	13.2%	25.6%

Notes The NLSY sample (see Appendix) contains 26,094 spells of uninterrupted employment. 58.8% of these spells involve only one job, 18.3% have two jobs and 22.9% have three or more jobs in the same continuous spell of employment. The first column reports (for different groups) the number of spells with a potential return and the second column reports the number of these spells with a return. The fourth columns reports the ratio of these two figures. The third column reports the percentile of returns among employment spells with two or more jobs.

The Extent of Return Employment Returning to an employer within an uninterrupted employment spell (which obviously involves at least two job-to-job transitions) is an important feature of workers' job ladders. In an employment spell, label the first occurrence of a repeated employer J1 and the return spell at the employer J3. Let J2 represent employment experienced between J1 and J3 which may involve more than one job. Table 1 reveals that employer returns occur in 27% of all employment spells with at least three jobs, in 15% of all employment spells with at least two jobs and in 6% of all employment spells. Table 1 also reveals that these proportions are stable across demographic groups with returns being somewhat higher for the young and the less educated.

Voluntary and Involuntary Mobility Return employment (a J2-J3 transition) is more likely to be involuntary than initial moves away (a J1-J2 transition). Table 2, which considers only those employment spells that include a return, shows the proportion of job spells of the J1-J2 type and J2-J3 type in which workers declare that they left the job due to a quit. Suppose a voluntary job-to-job transition occurs when a worker declares he or she quit the job.[8] This table shows that about 7 out of 10 (71%) of J1-J2 transitions to new employers are voluntary. A substantially lower percentage - approximately one half (56%) - return to a previous employer voluntarily via a J2-J3 transition. Returning workers go back less voluntarily than when they

[8]The Appendix provides further details of quit classifications. Note, however, that this classification is only indicative of voluntary/involuntary mobility. It is unclear whether workers who state that they quit their jobs indeed did so voluntarily or were compelled to quit.

left the old firm. This pattern is consistent across all groups, but older and very highly educated workers have the most pronounced proportion of involuntary returns to previous employers.

Table 2: Employment Returns and Voluntary Mobility

	J1-J2 transition	J2-J3 transition
	Quit	Quit
All workers	71.1%	55.9%
Gender		
Female	75.9%	58.6%
Male	67.7%	54.0%
Age		
25 or younger	72.7%	57.3%
26-35	62.8%	50.9%
36 and above	28.6%	17.4%
Years of schooling		
Below 12	67.0%	58.3%
12	70.4%	59.0%
13-14	73.4%	51.7%
16	61.9%	49.1%
17 and above	73.7%	46.3%

Notes The table reports the percentage of voluntary quits (as opposed to involuntary transitions) observed in those uninterrupted employment spells from the NLSY sample (see Appendix) in which the worker returns to a previous employer. A J1-J2 transition corresponds to the job-to-job transition away from the employer which the worker subsequently returns to. A J2-J3 transition is the job-to-job transition occurring when the worker returns to the employer. The employer in job J1 is the same as the employer in job J3. However, the employer in job J2 from the J1-J2 transition is not necessarily the same as the employer in job J2 when returning in a J2-J3 transition. Workers may hold jobs with several different employers during the spell before returning to the J1 employer.

Weekly Earnings and Return Employment Returning to an employer is less financially rewarding than moving to a new one. Table 3, which again considers only those employment spells that include a return, shows that among all workers, transitions to new employers (J1-J2 transitions) raise earnings on average, whereas returns (J2-J3 transitions) involve a drop in earnings.[9] This pattern holds across all demographic groups. The net effect is small compared to the changes observed at each transition. Among all workers, for example, earnings at the old employer after a return (a J1-J3 transition) increase on average by 10% from initial earnings during J1 at that employer, while the earnings change associated with a J1-J2 or a J2-J3 transition is around three times or two times higher, respectively.

[9] To reduce the measurement error typically present earnings data, Table 3 presents earnings changes after trimming both tails of the earnings distribution by 5%. Similar results are obtained when trimming the tails of the earning distribution by 1%.

Table 3: Employer Returns and Weekly Earnings Changes

	Transitions J1-J2			Transitions J2-J3			Transitions J1-J3
	J1	J2	Change	J2	J3	Change	Change
All workers	171.35	232.32	35.58%	235.63	187.79	-20.31%	9.59%
Gender							
Female	136.78	184.31	34.75%	185.29	151.65	-18.15%	10.87%
Male	200.40	272.66	36.06%	277.94	218.15	-21.51%	8.86%
Age							
25 and younger	152.91	218.25	42.73%	220.80	171.29	-22.42%	12.02%
26-35	226.02	262.24	16.03%	269.04	236.65	-12.04%	4.70%
36 and above	208.45	312.52	49.92%	312.02	221.24	-29.09%	6.14%
Years of schooling							
Below 12	136.82	188.03	37.43%	191.44	160.21	-16.31%	17.09%
12	182.35	248.06	36.04%	247.23	199.23	-19.42%	9.26%
13-14	188.70	253.17	34.17%	258.72	204.13	-21.10%	8.17%
16	234.54	260.21	10.94%	269.32	250.85	-6.86%	6.95%
17 and above	251.25	333.78	32.85%	330.23	248.22	-24.83%	-1.20%

Notes The table documents for different groups of workers earnings and earnings changes observed in those employment spells from the NLSY sample (see Appendix) in which the worker returns to a previous employer during that spell of uninterrupted employment. A J1-J2 transition corresponds to the job-to-job transition away from the employer which the worker subsequently returns to. A J2-J3 transition is the job-to-job transition occurring when the worker returns to the employer. The employer in job J1 is the same as the employer in job J3. However, the employer in job J2 from the J1-J2 transition is not necessarily the same as the employer in job J2 when returning in a J2-J3 transition. Workers may hold jobs with several different employers during the spell before returning to the J1 employer.

3 The Economic Environment

Time is continuous and goes on forever. A unit mass of risk neutral workers and a mass of risk neutral firms with a common discount rate $r > 0$ maximize the expected sum of lifetime consumption and profit, respectively.

Firms operate using a constant returns to scale production technology which can accommodate any number of workers. Although many of the basic insights arise with identical workers and firms, the initial specification is more general and allows for differences in productivity per worker across firms. In particular, suppose there are $H \geq 1$ types of firms. Let $\gamma_i > 0$ (where $\sum_{i=1}^{H} \gamma_i = 1$) and $x_i > 0$ (where $x_i > x_j$ for all $i > j$) denote the proportion and productivity respectively of type $i = 1, ..., H$ firms.

Workers are homogeneous and characterized by their employment status and search capital. An unemployed worker obtains and consumes z ($x_1 > z > 0$) units of output. A worker employed in a type i firm at wage w produces x_i and consumes w. The worker's search capital comes from the number, n, and type of each employer contact, excluding the current employer or any firm that the worker might have just met. Workers lose their firm contacts at a Poisson rate of $\phi \geq 0$. The latter can be interpreted as the rate at which search capital depreciates.

Accumulation of employer contact arises as a by-product of job search. Unemployed job seekers meet a randomly drawn firm at rate $\lambda \geq 0$. Employed workers meet a randomly drawn firm at rate $s\lambda$, where $s \geq 0$ denotes the worker's exogenous search intensity. To keep the analysis simple, let $n = 0, 1$.[10] Workers with an existing contact must therefore decide with which firms to continue after a new meeting takes place.

After a meeting and a choice of firms (if any) takes place, a worker decides whether to solicit job offers or simply continue in the current state. If a worker decides to solicit job offers, a complete information auction immediately ensues among the available firms who make wage bids for the worker's service. An employed worker adds the firm that loses the auction to the contacts list. If the worker transits from unemployment to employment, however, the firm becomes an employer and does not count as a contact.[11]

At rate $\delta \geq 0$, an employed worker is exogenously displaced from the current job. When a displacement occurs, the current employer receives a payoff of zero and the worker can call upon any existing contacts. If the worker accepts a job offer from one of the contacts, the worker moves from one employer to the other without an intervening spell of unemployment. If the worker rejects all offers (or if the worker did not have a contact), the worker becomes unemployed.

To focus on the implications of search capital on the worker's own outcomes alone, assume

[10] Carrillo-Tudela et al. (2011) analyze $n > 1$ in this economy without on-the-job search.

[11] The complete information assumption provides an important simplification. If workers were uninformed about productivity at the time of a meeting, then the auction will not necessarily reveal the productivity of the newly met firm to the worker. Firms' wage bids are not necessarily a monotonic function of their productivities. A low wage bid might be associated with a high productivity firm because it offers a steeper wage-tenure profile (see Postel-Vinay and Robin, 2002). In this case workers' beliefs about firms' productivities (and how these beliefs are formed) become crucial in determining their job acceptance strategies and choices of which firm to keep as a contact. In a complete information environment these complications do not arise allowing an investigation of the empirical facts described in Section 2 in a more tractable, albeit less realistic, framework.

that workers do not pass on information about job opportunities to other workers. Further, to simplify the notation and exposition assume the following

A.1 Unemployed workers or workers without a contact do not disregard a newly meet firm.

A.2 Given equal payoffs, the worker chooses employment over unemployment.

A.3 When an employed worker with a contact meets a new contact, the worker chooses to proceed with the highest two productivity firms and breaks any tie in favour of incumbents, that is, the current employer first, the current contact second and the new contact third.[12]

A.4 In an auction in which the two firms make equally attractive wage offers, the worker's tie breaking decision is to choose the higher productivity firm and randomly with equal probability between equally productive firms.[13]

3.1 Workers payoffs

Let U_i be the payoff to an unemployed worker who has a contact with a type i firm, $i = 0, 1, ..., H$, where $i = 0$ corresponds to no contact. Let $E^i_j(w)$ denote the payoff to a worker earning wage w in a type $i \geq 1$ firm with contact $j \geq 0$. The payoff to unemployment can be written as

$$rU_0 = z + \lambda \left[\sum_{i=1}^{H} \gamma_i \max\{E^i_0(w^i_0), U_i\} - U_0 \right],$$

where w^i_0 is the wage offered by a type i firm to an unemployed worker with no contacts; and

$$rU_i = z + \lambda \left[\sum_{j=1}^{H} \gamma_j \max\{E^i_j(w^i_j), E^j_i(w^j_i), U_i, U_j\} - U_i \right] + \phi \left[U_0 - U_i\right], \ i = 1, ..., H,$$

where w^i_j is the wage offered by a type i firm bidding against a type j firm. The max operator contains the possible choices faced by an unemployed worker. For example, upon meeting a new firm j an unemployed worker with a type i contact chooses between employment in either of the two firms and staying unemployed with either firm as a contact. The last term of the Bellman equation for U_i describes the expected loss from search capital depreciation.

When a worker earning wage w in a type $i \geq 1$ firm with contact $j \geq 0$ meets a type $k \geq 1$ firm, the worker also has several choices. There are six potential bilateral auctions among the three firms.[14] In addition, the worker can replace or keep the existing contact j without holding a new auction, thereby still earning wage w at firm i. Allowing the worker to choose unemployment with any of the three potential firms as contacts yields a total of eleven possible

[12] Formally, given an (i, j, k) employer-existing contact-new contact triple, the following sequencing occurs: (1) if $k \leq \min\{i, j\}$ continue with status quo; (2) else if $i \geq j$, proceed with (i, k) and choose $\{Auction, NoAuction\}$ as outlined below and (3) else proceed to (j, k) auction.

[13] In an (i, j) auction in which $E^i_j(w^i_j) = E^j_i(w^j_i)$ as defined below, the worker chooses $\max\{i, j\}$ and i with probability $1/2$ if $i = j$.

[14] To ease notation, ignore the option of opting for a one bidder auction when two are available.

outcomes. The simplifying behavioural assumptions A.1-A.4 rule some of these options so that in this situation, the payoff is given by

$$\begin{aligned} Q(i,j,k,w) &= \max\{E_k^i(w_k^i), E_i^k(w_i^k), E_k^i(w), U_i, U_k\} \quad for\ k > j\ \&\ i \geq j \\ &= \max\{E_k^j(w_k^j), E_j^k(w_j^k), U_j, U_k\} \quad for\ k, j > i \\ &= E_j^i(w) \qquad otherwise \end{aligned}$$

Assuming without loss that following a ϕ shock the worker does not call a one bidder auction with the current employer i, it follows that

$$\begin{aligned} rE_j^i(w) &= w + s\lambda \left[\sum_{k=1}^{H} \gamma_k Q(i,j,k,w) - E_j^i(w)\right] \\ &\quad + \delta\left[\max\left\{E_0^j(w_0^j), U_j\right\} - E_j^i(w)\right] + \phi\left[\max\left\{E_0^i(w), U_i\right\} - E_j^i(w)\right], \end{aligned}$$

for $i = 1, ..., H,\ j = 1, ..., H$. For $j = 0$, there is no contact to lose, hence

$$rE_0^i(w) = w + s\lambda \left[\sum_{k=1}^{H} \gamma_k Q(i,j,k,w) - E_0^i(w)\right] + \delta\left[U_0 - E_0^i(w)\right].$$

Like the value functions of the unemployed, these equations show that the value of employment equals the flow payoff w plus the expected capital gain from accumulating search capital through job search, plus the capital losses from displacement as well as from search capital depreciation.

3.2 Type i firm payoffs

Let $J_j^i(w)$ denote the payoff to a type $i = 1, ..., H$ firm paying a wage w to an employee who currently maintains a contact with a firm of type $j = 0, 1, ..., H$. Likewise let C_j^i denote the value to a type i firm of being the contact for a worker employed at a type j firm. As above, $j = 0$ corresponds to the situation where the worker does not have a current contact and hence is unemployed.

A type i firm's expected payoff as a lone bidder, that is in an auction with a worker with no other contact, is then given by

$$M_0^i = \max_w \{I[E_0^i(w) \geq U_i](J_0^i(w) - C_0^i)\} + C_0^i,$$

where I is an indicator function that takes the value of one if the firm outbids the worker's value of unemployment and zero otherwise.

On the other hand, a type i firm's expected value from engaging in an auction against a type j firm bidding w_i^j is

$$M_j^i = \max_w \left\{ \begin{array}{c} I[E_j^i(w) > \max\{E_i^j(w_i^j), U_i, U_j\}](J_j^i(w) - C_j^i) \\ +I[E_j^i(w) = \max\{E_i^j(w_i^j), U_i, U_j\}]\iota_j^i(J_j^i(w) - C_j^i) \\ +C_j^i \end{array} \right\},$$

where ι_j^i denotes the assumed tie breaking rule between equal payoffs in this auction specified in A.4. Depending on productivity differences, some firms (the high productivity ones) may need to outbid the payoff to unemployment rather than the bid of a weak or comparatively very low productivity opponent in order to obtain the worker's services.

The payoff to firm i of winning the auction and employing the worker, $J_j^i(w)$, depends on the subsequent worker's strategy when meeting a new contact and whether to initiate an auction. Suppose a worker currently being paid wage w at firm i with a type j contact meets a type $k > \min\{i, j\}$ firm. If $i \geq j$, then firm i will ultimately continue with the worker as either the employer or the contact as implied by A.3 and A.4 so that

$$rJ_j^i(w) = x - w + s\lambda\left[\sum_{k=j+1}^{H}\gamma_k[qM_k^i + (1-q)J_k^i(w)] - J_j^i(w)\right] + \phi[J_0^i(w) - J_j^i(w)] - \delta J_j^i(w),$$

where q denotes the worker's decision to initiate an (i, k) auction. That is, $q = 1$ if $\max\{E_k^i(w_k^i), E_i^k(w_i^k)\} > E_k^i(w)$ and $q = 0$ otherwise. If $i < j$, the relationship will end when the contact occurs. Assuming again without loss that following a ϕ shock the worker does not call a one bidder auction with its current employer i or become unemployed with i as the contact, it follows that

$$rJ_j^i(w) = x - w + \phi[J_0^i(w) - J_j^i(w)] - \left(\delta + s\lambda\sum_{k=i+1}^{H}\gamma_k\right)J_j^i(w).$$

Likewise, the payoff to a type $j = 1, ..., H$ firm of being a contact is given by

$$\begin{aligned} rC_i^j &= s\lambda\left[\sum_{k=i+1}^{H}\gamma_k\left(M_k^j - C_i^j\right)\right] + \delta(M_0^j - C_i^j) - \phi C_i^j \qquad i < j, \\ &= -\left[s\lambda\sum_{k=j+1}^{H}\gamma_k + \phi\right]C_i^j + \delta(M_0^j - C_i^j) \qquad i \geq j. \end{aligned}$$

For worker contacts who are unemployed, i.e. $i = 0$, the worker accepts the new contact and initiates an auction between firms j and k.

$$rC_0^j = \lambda\left[\sum_{k=1}^{H}\gamma_k M_k^j - C_0^j\right] - \phi C_0^j.$$

4 Equilibrium

Since the $E_j^i(w)$ are strictly increasing in w, the worker's best response strategy in an auction has the reservation property for each (i, j) pair. Let a firm's auction (pure) strategies or expected bids be given by $\Sigma = \{w_j^i\}$ for $i = 1, ..., H$ and $j = 0, 1, ..., H$, where, as defined in Section 3.1, w_j^i is the offer made by a type i firm bidding against a type j firm and again $j = 0$ corresponds to no other contact or bidder. Denote $\Sigma_{-w_j^i}$ as all bids except the particular paired firm $i's$ bid in an auction involving a type j firm. Given $\Sigma_{-w_j^i}$, define R_j^i as the wage that makes the worker indifferent between accepting firm i's offer and the next best opportunity such that

$$E_j^i(R_j^i) = \max\{E_i^j(w_i^j), U_i, U_j\},\ i = 1, ...H,\ j = 1, ...H \qquad (1)$$
$$E_0^i(R_0^i) = U_i,\ i = 1, ...H.$$

Note that by construction R_j^i is greater or equal to either R_0^i or R_0^j and that reservation wages are not symmetric - R_j^i does not necessarily equal R_i^j.

Given the other firm's bid as summarized in $\Sigma_{-w_j^i}$, the worker's best response function to a bid w from firm i is to accept all $w > R_j^i$. As assumed in A.2-A.4, for $w_j^i = R_j^i$ the worker's tie breaking rule in an auction is to chose (i) employment over unemployment, (ii) the higher productivity firm, that is i if $i > j$, (iii) and with equal probability if $i = j$.

Using the above insights, the bidding problem, M_j^i, for firm i competing against firm j can then be re-written in terms of the reservation wages:

$$M_j^i = \max_w \left\{ I[w > R_j^i](J_j^i(w) - C_j^i) + I[w = R_j^i]\iota_j^i(J_j^i(w) - C_j^i) + C_j^i \right\}. \qquad (2)$$

Also note that since $x_i > x_{i'}$ for all $i > i'$, it follows $J_j^i(w) \geq J_j^{i'}(w)$ and $C_j^i \geq C_j^{i'}$. More productive firms can always replicate the behaviour of less productive firms and earn more profit.

Given the tie breaking rule in an i, j auction, any firm $i \leq j$ will bid more than R_j^i, up to the wage that makes i indifferent between hiring and continuing the relationship with the worker as a contact. That is, the best response strategy is to bid up to where the offer w satisfies $J_j^i(w) = C_j^i \leq C_i^j$. On the other hand, if $i > j$, firm i will win the auction by simply offering R_j^i. In this case, the best response strategy is to offer the reservation bid $w_j^i = R_j^i$ up to where $J_j^i(w_j^i) = C_j^i \geq C_i^j = J_i^j(w_i^j)$. The Bertrand competition just described implies that firm $i \leq j$ increases its bid until $J_j^i(w_j^i) = C_j^i$ whereas firm j bids R_i^j. Since $R_i^j \geq R_0^j$, for all i, it follows that $w_i^j \geq w_0^j = R_0^j$.

The above arguments imply that the optimal wage offered in a one bidder auction is the reservation wage for continuing search with a contact i, $w_0^i = R_0^i$, provided $J_0^i(R_0^i) > C_0^i$ such that

$$J_0^i(w_0^i) = J_0^i(R_0^i) = M_0^i.$$

In a two bidder auction, the less productive firm optimally bids up to the point where it is indifferent between employing and being a contact. The wage offered by firm i in a two bidder auction w_j^i then solves

$$J_j^i(w_j^i) = C_j^i = M_j^i.$$

The more productive firm j optimally matches the payoff to the worker of the less productive firm's wage bid and then the worker chooses firm j and the offer $w_i^j = R_i^j$. Here

$$J_i^j(w_i^j) = J_i^j(R_i^j) = M_i^j \geq C_i^j,$$

with strict inequality for $j > i$. If $j's$ best response makes the worker indifferent between i and

j, by construction $w_j^i = R_j^i$ provided $E_j^i(w_j^i) \geq U_j$ and hence

$$J_j^i(w_j^i) = J(R_j^i) = C_j^i = M_j^i.$$

In this case, $\Sigma = R$. If not, w_j^i solves $J_j^i(w_j^i) = C_j^i$.

These reservation wages and bidding strategies induce the worker to initiate an auction if and only if it leads to strictly preferred outcomes, that is if $Q(i, j, k, w) > E^i_{max\{j,k\}}(w)$. Using the above arguments we now define an equilibrium.

Definition: An equilibrium is a set of reservation wages and wage offers R, Σ such that under the tie breaking rules described in A.2-A.4

(i) R_j^i satisfies the worker's reservation value in (1) given Σ for $i = 1, ..., H,\ j = 0, 1, ...H$.

(ii) w_j^i solves the firm's problem described by M_j^i in (2) given R, $\Sigma_{-w_j^i}$, for $i = 1, ..., H,\ j = 0, 1, ...H$.

(iii) a worker employed by firm i at wage w initiates an auction if and only if $\max\{E_j^i(R_j^i), E_i^j(R_i^j)\} > E_j^i(w)$.

5 Homogeneous Firms

To highlight the main economic mechanisms of the model in a tractable and transparent way, we analyse the case in which all firms are homogeneous ($H = 1$ and $x_1 = x$). In this case it is not necessary to identify firm types. Superscripts can be suppressed and subscripts for contacts are now $\{0, 1\}$.

The expected payoff for a firm in an auction without a competitor is

$$M_0 = \max_w \{I[w \geq R_0](J_0(w) - C_0)\} + C_0.$$

The firm's expected value from an auction with a worker who is unemployed with one contact or is employed with no contacts is

$$M_1 = \max_w \left\{ I[w > R_1](J_1(w) - C_1) + I[w = R_1] \left(\frac{J_1(w) - C_1}{2} \right) \right\} + C_1,$$

where the other bidding firm offers the worker's reservation wage in this auction, $w_{-1} = R_1$, a wage that makes the firm indifferent ($J_1(R_1) = C_1$) about hiring the worker. In this situation, the best response strategy (w_0, w_1) is to offer the reservation wages (R_0, R_1). Hence, the firm's strategies (w_0, w_1) imply $M_0 = J_0(w_0)$ and $M_1 = J_1(w_1) = C_1$, where $J_0(w_0)$, $J_1(w_1)$, C_1 and C_0 are given by

$$rJ_0(w_0) = x - w_0 + s\lambda[J_1(w_1) - J(w_0)] - \delta J_0(w_0)$$

$$rJ_1(w_1) = x - w_1 - \delta J_1(w_1)$$

$$rC_1 = \delta(M_0 - C_1) - \phi C_1$$

$$rC_0 = \lambda(M_1 - C_0) - \phi C_0.$$

Given these bidding strategies, the expected value of an unemployed worker with a contact and the expected payoff in a two bidder auction simplifies to

$$rU_0 = z + \lambda \left[E_0(w_0) - U_0 \right]$$

$$rU_1 = z + \lambda \left[E_1(w_1) - U_1 \right] + \phi \left[U_0 - U_1 \right],$$

whereas the expected value of employment at any wage w satisfies

$$rE_0(w) = w + s\lambda \left[\max\{E_1(w), E_1(w_1)\} - E_0(w) \right] + \delta \left[U_0 - E_0(w) \right]$$

$$\begin{aligned} rE_1(w) &= w + s\lambda \left[\max\{E_1(w), E_1(w_1)\} - E_1(w) \right] \\ &\quad + \delta \left[E_0(w_0) - E_1(w) \right] + \phi \left[\max\{E_0(w_0), E_0(w)\} - E_1(w) \right]. \end{aligned}$$

For $E_1(w_1)$, the worker does not benefit from on-the-job search. Thus when a worker with a job and a contact meets another firm, the worker receives no capital gain and disregards the new contact.

Using the above value functions and firms' indifference condition in an auction with two bidders gives the following result.

Lemma 1: *If all firms have the same productivity, the wage offered in an auction with two bidders is given by*

$$w_1 = \frac{(r+\phi)(r+\delta+s\lambda)}{(r+\phi)(r+\delta+s\lambda)+\delta(r+\delta)} x + \frac{\delta(r+\delta)}{(r+\phi)(r+\delta+s\lambda)+\delta(r+\delta)} w_0.$$

Relative to sequential auction models without recall (Postel-Vinay and Robin, 2002), the new feature here is that the offered w_1 is strictly below x. With search capital firms have a positive value of holding on to a contact; i.e. $C_1 > 0$. Over time employed workers experience job destruction shocks. Workers will call upon their contact (if any) to avoid unemployment. In such a case, the contacted firm is in the desirable situation where it faces no competition from other firms and hence can extract monopsony rents from the worker by paying w_0.[15] This recall implies a positive weight on w_0 in the above equation as the value to the firm of not hiring the worker (and waiting for a job displacement and a subsequent wage of w_0) is decreasing in w_0.

In an auction with just one bidder, the worker (without a contact) gets offered $w_0 = R_0$ making the worker indifferent between accepting the job and searching with a contact, i.e., $E_0(w_1) = U_1$. This condition leads to Lemma 2.

Lemma 2: *If all firms have the same productivity, the indifference condition faced by unemployed workers with no contacts yields*

$$w_0 = \varphi w_1 + (1-\varphi)z,$$

[15] In the more general case of $n > 1$, the contacted firms will face less competition for the worker than they faced in the last auction and offer the worker a lower wage.

where

$$\varphi = \frac{\lambda[(r+\lambda+\delta) - s(r+\lambda+\phi)]}{(r+\delta+\phi)(r+\lambda+\phi)+\lambda(r+\lambda)} < 1.$$

Note that φ is decreasing with search intensity as there is a "foot-in-the-door" effect at play. Unemployed workers are prepared to accept a wage below z as an investment for the wage growth that arises from engaging their future employers and poaching firms in Bertrand competition. See Postel-Vinay and Robin (2002). With search capital, however, the possibility of accumulating employment contacts tempers this foot-in-the-door effect thereby increasing w_0. Given that unemployed workers have the option to continue searching and increasing their wage when meeting another contact, a firm must compensate workers for giving up this option. The relative importance of these channels pins down the sign of φ and hence whether w_0 is above z or not.

Combining Lemmas 1 and 2 gives the following result.

Proposition 1: *The wages offered in an equilibrium with homogeneous firms are:*

$$w_1 = \alpha x + (1-\alpha)z \quad \text{and} \quad w_0 = \beta x + (1-\beta)z,$$

where

$$\alpha = \frac{(r+\phi)(r+\delta+s\lambda)}{(r+\phi)(r+\delta+s\lambda)+(1-\varphi)\delta(r+\delta)},$$

$\beta = \varphi\alpha$ *and* $w_1 > w_0$.

The above equations reveal the effects on equilibrium wages of an increase in the rate at which workers meet contacts, s, and the rate at which they loose them, ϕ. For example, differentiation implies that $\partial w_1/\partial\phi > 0$. This result is quite intuitive. As search capital depreciates faster, the firm's value of holding on to contact is lower. There is a higher chance that the worker might not recall the firm by the time a job destruction shock hits the worker. Since this also implies that the firm's value of employing a worker is now higher, firms would be willing to bid more to attract workers.

The sign of $\partial w_0/\partial\phi$ is, however, ambiguous. A higher ϕ increases w_0 through its effect on w_1. On the other hand, a higher ϕ reduces w_0 through its effect on φ. As search capital depreciates faster, the option value to continue searching for another contact becomes less important, thereby decreasing φ. The relative strengths of these forces then pins down the net effect of ϕ on w_0.

Differentiation also establishes that $\lambda(\phi-\delta)+\phi(r+\phi) < 0$ is necessary and sufficient to guarantee $\partial w_1/\partial s < 0$, and is sufficient to guarantee $\partial w_0/\partial s < 0$. When workers are able to hold on to their contacts for a relatively long time (i.e ϕ close to zero), a higher s implies a lower w_0 through the foot-in-the-door effect. This effect in turn increases the firm's value of holding a contact and puts downward pressure on w_1. At higher values of ϕ, these effects are weaker and an increase in s leads to stronger competition between firms in the auction, thereby putting upward pressure on w_1 and consequently on w_0.

Further, $J_0(w_0) > C_0 > 0$ implies firms strictly prefer to hire an unemployed worker at the first meeting rather than keeping the worker as a contact. In a two bidder auction, $J_1(w_1) = C_1 > 0$ implies firms are indifferent between hiring the worker and keeping the worker as an employed contact and hence there is no profitable deviation. These arguments establish existence and uniqueness.

Theorem 1: *The reservation strategies* (R_0, R_1) *and the offer strategies* (w_0, w_1) *describe the unique symmetric equilibrium with homogeneous firms. Employed workers without a contact search on-the-job and initiate a two bidder auction when they meet another potential employer.*

6 Unemployment and Output

In conventional job search models with homogeneous agents, employed job seekers are rent seekers who move from job to job for higher pay without an accompanying increase in production. If reshuffling workers across employers is costly in these environments, on-the-job search becomes socially wasteful.[16] This inefficiency does not apply here - there are no search costs. There are, however, other potential consequences associated with job-to-job turnover. In particular, on-the-job search can alter output as (a) employed workers compete with (crowd out) unemployed workers for available employment opportunities and (b) firm entry responds to changes in matching rates, wages and the anticipated duration of employment.

In contrast, on-the-job search in the economy presented here takes on a productive aspect - it generates back-up job opportunities that partially insure workers when they become displaced. Establishing contacts with potential employers through job hunting enables workers to avoid costly unemployment spells when they separate from their current employer. The benefits of this insurance depend on the accumulation and depreciation rates of search capital, so s and ϕ become focal parameters for evaluating the impact of on-the-job search in this framework.

To assess these effects we extend the model with homogeneous firms described in the previous section by first endogenising the arrival rate through a matching technology and then by allowing firm entry and exit. Let u denote the number of unemployed job seekers, e_0 the number of employed workers without a contact and e_1 the number of employed workers with a contact so that $u + e_0 + e_1 = 1$. In a steady state, flows across these three states balance such that $(\delta + \phi)e_1 = s\lambda e_0$ and $\delta e_0 = \lambda u$ leading to the steady state measures

$$u = \frac{\delta(\delta+\phi)}{(\delta+\phi)(\delta+\lambda)+s\lambda^2}, \quad e_0 = \frac{\lambda(\delta+\phi)}{(\delta+\phi)(\delta+\lambda)+s\lambda^2}, \quad e_1 = \frac{s\lambda^2}{(\delta+\phi)(\delta+\lambda)+s\lambda^2}. \qquad (3)$$

The $1-u$ employed workers produce x whereas the unemployed contribute z. Define gross output as $p = x(1-u) + zu$. Let f denote the number of firms producing as well as recruiting workers. Firms in this framework are a collection of jobs that can be either vacant or occupied and producing. To be economically active and recruit workers, firms must pay a fixed flow cost k each period. Steady state net output y - the standard measure of welfare in matching models - is then $y = p - kf$.

[16] Models with on-the-job search may be more efficient than the competitive outcome without on-the-job search. For example, adding on-the-job search as in Burdett and Mortensen (1998) relieves the outcome of the Diamond paradox (Diamond, 1971).

6.1 Crowding Out

Employed workers searching for another job opportunity, the e_0 and e_1 workers, can interfere with the search outcomes of unemployed job seekers, the u jobless workers.[17] To allow for this behavior, assume search is undirected with random encounters between workers and firms so that unemployed and employed workers are substitutes in the search process.[18] Following conventional specifications, suppose a Cobb Douglas technology with constant returns to scale governs the way in which job seekers meet potential job opportunities so that the number of work-firm meetings is:

$$\mathcal{M}(u + se_0 + se_1, f) = \mathcal{M}(u + s(1-u), f) = Af^{1/\sigma}(u + s(1-u))^{(1-1/\sigma)},$$

where A is an efficiency parameter and $1/\sigma \in [0,1]$ is the elasticity of the job finding rate. In this environment, the number of meetings occurring between firms and job seekers of both types depends on the extent of on-the-job search captured by s. Employed workers compete with unemployed job seekers in the matching process slowing the escape rate out of unemployment.

Assume for now that the number of firms f is fixed, a specification that aligns with the conventional notion of the short run. Fixing f is not equivalent to fixing the number of jobs or vacancies as firms can maintain contacts as they hire other workers. If a firm meets a worker with a job and becomes the contact of the worker, this relationship does not impede the firm's capacity to hire other workers at any point. The value functions are consistent with this set up as is the exogenous specification for the decay of search capital ϕ which is independent of firm matching and hiring rates.[19]

The corresponding arrival rate is

$$\lambda = \mathcal{M}(u + s(1-u), f)/(u + s(1-u)) = A[f/(u + s(1-u))]^{1/\sigma}. \tag{4}$$

Implicit differentiation and manipulation gives

$$\frac{\partial \lambda}{\partial s} = \frac{-\lambda^2[\delta + \phi + s\lambda - (1-s)\lambda u]}{\sigma[(\delta+\phi)(\delta+s\lambda) + s^2\lambda^2] - (1-s)(\delta+\phi+2s\lambda)\lambda u},$$

which is negative as both the denominator and the numerator term in brackets are positive. Total differentiation of unemployment above gives

$$\begin{aligned} \frac{\partial u}{\partial s} &= \frac{-u}{(\delta+\phi)(\delta+\lambda) + s\lambda^2}\left[\lambda^2 + (\delta+\phi+2s\lambda)\frac{\partial \lambda}{\partial s}\right] \\ &= \frac{-\lambda^2 u}{(\delta+\phi)(\delta+\lambda) + s\lambda^2}\left[\frac{(\sigma-1)[(\delta+\phi)(\delta+s\lambda) + s^2\lambda^2] - (\delta+\phi)(\phi+2s\lambda) - s^2\lambda^2}{\sigma[(\delta+\phi)(\delta+s\lambda) + s^2\lambda^2] - (1-s)(\delta+\phi+2s\lambda)\lambda u}\right]. \end{aligned}$$

[17] The model specifies that all employed workers search including those with a contact. This specification eases exposition in the general case but does not alter the basic results derived here. Restricting on-the-job search to those without contacts does not materially affect outcomes.

[18] In directed search models with on-the-job search (Delacroix and Shi, 2006, for example), employed and unemployed workers search for jobs in different submarkets and any crowing out effect between these workers disappears.

[19] Although specifying a fixed number of jobs is conceptually awkward given recall, naive specifications with $u = v$ yield similar results to those found here.

As u governs output for a fixed f, the term

$$\sigma - 2 + \frac{(\delta + \phi)(\delta - \phi - s\lambda)}{(\delta + \phi)(\delta + s\lambda) + s^2\lambda^2} \tag{5}$$

determines the impact of on-the-job search on unemployment and output. For sufficiently small ϕ and small s, allowing workers to increase the extent of on-the-job search with recall via s lowers unemployment. Since the number of firms is fixed, p and y rise with s. On the other hand, if employed workers do not hold onto their contacts sufficiently well (for ϕ large), crowding out outweighs backstopping from recall. As $\phi \to \infty$ recall disappears, the model converges to the homogeneous version of the Postel-Vinay and Robin (2002) model in which on-the-job search reduces p and y. It is worth noting that given (i) symmetric matching ($\sigma = 2$) coupled with (ii) a contact destruction rate weakly greater than the job destruction rates ($\phi \geq \delta$), unemployment increases for all $s > 0$. The parameter values in Table 5 below satisfy these two conditions implying that in the calibrated model without entry, unemployment rises and output (both p and y) fall as s increases.

A similar but simpler exercise establishes that $\partial p/\partial \phi = \partial y/\partial \phi < 0$. This result is quite natural. A decline in the insurance component from an increased ϕ lowers output.

6.2 Job Creation

With a fixed number of agents, workers and firms have limited opportunities to adjust behavior in response to matching rates or wage changes as s or ϕ vary. Allowing a participation response through entry and exit enables firms to react to wages and matching thereby further altering unemployment and output. This response, which aligns with conventional notions of the long run, causes the interactions among the endogenous variables λ, u, e_0, e_1, w and now f to become more complex.[20]

With contacts and hired workers present, the zero profit condition in this model differs from the familiar expression relating to the value of a vacancy. See Pissarides (2001). Recall that firms use a constant returns to scale production technology that enables them to acquire and maintain contacts independently of the number of workers currently working with the firm. As such, entry and exit become tied to the payoffs of employing a given worker and of holding contacts. In a steady state of this economy, there are $e_0 + e_1$ workers at any point in time evenly allocated across f firms each paying operating costs k. Steady state profit flow at each firm is thus given by

$$\pi = (x - w_0)e_0/f + (x - w_1)e_1/f - k. \tag{6}$$

Participation through entry or exit drives flow profits to zero, $\pi = 0$, and determines the

[20]It is possible but conceptually less transparent and meaningful to fix λ and let f be endogenous. Doing so restricts matching to be independent of unemployment, employment and the number of firms. Moreover, as wages are now allocating resources, the impact of parameter changes works through wages as well as employment.

amount of job creation in the economy.[21] Substitution and manipulation then gives

$$\frac{kf}{x-z} = \frac{\lambda(1-\varphi(1/\sigma))(\delta+\phi) + s\lambda^2(1-1/\sigma)}{(\delta+\lambda)(\delta+\phi)+s\lambda^2}. \tag{7}$$

A free entry equilibrium further includes a (λ, f) pair solving equations (4) and (7). Wages follow from Proposition 1 whereas employment and unemployment levels follow from equations (3). Gross and net output are given by the same expressions as above.

Analytic solutions and hence comparative static results are elusive for any free entry equilibria. We therefore calibrate the model to analyse the effects of search capital on unemployment and output with endogenous entry. Let the time period to be a month and $r = 0.0041$, corresponding to a 5% annual interest rate. Following Shimer (2005), normalize the common firm productivity $x = 1$ and set the flow payoff of unemployment and the flow cost of posting a vacancy to be 40% and 20% of firm productivity, respectively. Following Pissarides and Petrongolo (2001), set $\sigma = 2$ so that the elasticity of the job finding rate equals 0.5.

Minimizing the percentage squared difference between the simulated and empirical moments described in Table 4 recovers the remaining four parameters $\Omega = \{\delta, A, s, \phi\}$. Following Hornstein et al. (2011), the monthly UE transition target rate is 0.43, whereas the EE and EU transition target rates are 0.033 and 0.03, respectively. The NLSY provides the final two targets - (i) the ratio of self reported voluntary and involuntary EE transitions and (ii) the proportion of spells with at least one return (1,619) divided by the total number of employment spells (26,094) - which correspond to the relative number of moves from new contacts relative to job destruction moves and the probability of an employer return following a job loss (see Table 1). The estimated results and their implications are discussed below.

6.3 Firm Heterogeneity

The effect of search capital on output and unemployment expand under firm heterogeneity. On-the-job search increases match productivity as workers improve the "quality" of their contacts in terms of future wage and productivity growth. To gauge this impact, let $H = 2$.[22] With two types of firms there are four different bids in competitive two firm auctions and an equilibrium corresponds to the solution of 36 linear equations in 36 unknowns.[23]

[21] The requirement that free-entry flow profits equal zero is purely to keep the analysis tractable. This condition can be derived when interpreting r as a "death" shock for firms instead of an interest rate.

[22] In this setting, workers who meet a potential employer continue with the contact if and only if the new option strictly improves payoffs. They do not replace existing contacts with similar ones. Workers with a type 1 employer and a type 1 contact do not change arrangements when they meet another type 1 firm. This assumption does not affect the individual worker's payoff, but it does alter the firm's return to job creation as this behavior by the worker alters the likelihood of the firm separating from an existing contact or worker as well as the likelihood of being asked to bid after a meeting takes place. Workers might want to collectively commit to swapping contacts around and thereby lowering the firm's payoff to holding a contact. It is uncertain if subsequent firm exit offsets these gains. In any case, an ϵ small switching cost rules out this behavior.

[23] Firms offer reservation wages $R^i_j,\ i = 1, 2,\ j = 1, 2$. There are also two wages offered in a monopsonistic auction, R^1_0 and R^2_0. Because the worker's contacts can come and go without a wage change from an auction, some of these R^i_j wages will appear in non (i, j) employment states. Accounting for all the possible observed contact changes without auctions as well as the off-the-equilibrium path payoffs to $E^1_2(R^1_2), U_1, U_2$ yields fifteen Bellman equations. For firms, the same accounting exercise yields a corresponding twelve $J^i_j(w)$ equations - three of which are off the equilibrium path, along with C^1_1, C^1_2 and C^2_2. In addition there are six equilibrium restrictions

To solve for this equilibrium, set $x_1 = 1$ and let $\gamma_1 = 0.75$ ($\gamma_2 = 0.25$) capture the decreasing right tail typically found in firm productivity distributions (Lentz and Mortensen, 2008, Postel-Vinay and Robin, 2002, and Bartelsman and Doms, 2000). Matching the Hornstein et al. (2011) measure of frictional wage dispersion, a mean-min or Mm ratio of 1.7, recovers x_2. The rest of the parameters $\Omega = \{\delta, A, s, \phi\}$ are obtained using the same moments as in the homogeneous case.[24]

Table 4: Target Moments

		Model	
Moments	**Data**	**Homogenous**	**Heterogenous**
UE	0.43	0.430	0.428
EU	0.030	0.030	0.031
EE	0.033	0.035	0.033
Vol/Inv EE	1.5	1.492	1.583
Prob. Return	0.062	0.061	0.066
Mm ratio*	1.71	1.111	1.710

*This moment is not targeted in the homogeneous case.

6.4 Calibration

Table 4 shows that both the homogeneous and heterogeneous models fit their respective target moments very well. Table 5 shows the corresponding parameter values. Note that firm heterogeneity allows the model to match the observed wage dispersion with minimal impact on the estimated values of δ, ϕ or s. The higher value of A (higher matching efficiency) is required to match the job finding rate of the unemployed under firm heterogeneity.

Table 5: Parameters

Model	δ	A	s	ϕ	x_2
Homogenous	0.0442	0.4137	0.1722	0.1124	1.0000
Heterogeneous	0.0439	0.5360	0.1567	0.1102	4.0865

Now consider the impact of search capital on output given these parameters. Figure 1 shows the effect of increasing search intensity s and hence the rate of search capital accumulation on unemployment and net output ($y = p - kf$). In the calibrated models, an increase in s decreases the EU rate as more workers are able to call upon a contact to avoid unemployment. Although the crowding out effect decreases λ when firms are homogeneous, this effect is not sufficiently strong and unemployment falls.[25] This implies that gross output p also increases with search intensity s in both cases.

$U_0^i = E_0^i(R_0^i)$ for $i = 1, 2$; $J_i^i(R_i^i) = C_i^i$ for $i = 1, 2$; $J_2^1(R_2^1) = C_2^1$ and $E_2^1(R_2^1) = E_1^2(R_1^2)$, which are also linear in R_j^i.

[24] Equilibrium outcomes are found by first suitably adapting (4) and (7) to endogenise λ and f for heterogenous firms and then by again following an iterative procedure. For any (s, ϕ) pair, solve the 36 linear equations for an arbitrary matching rate λ. The corresponding steady state employment levels imply a new arrival rate. Iterating until a fixed point emerges finds the equilibrium.

[25] The crowding out effect does not reduce λ when firms are heterogeneous because firm entry is much stronger in this case.

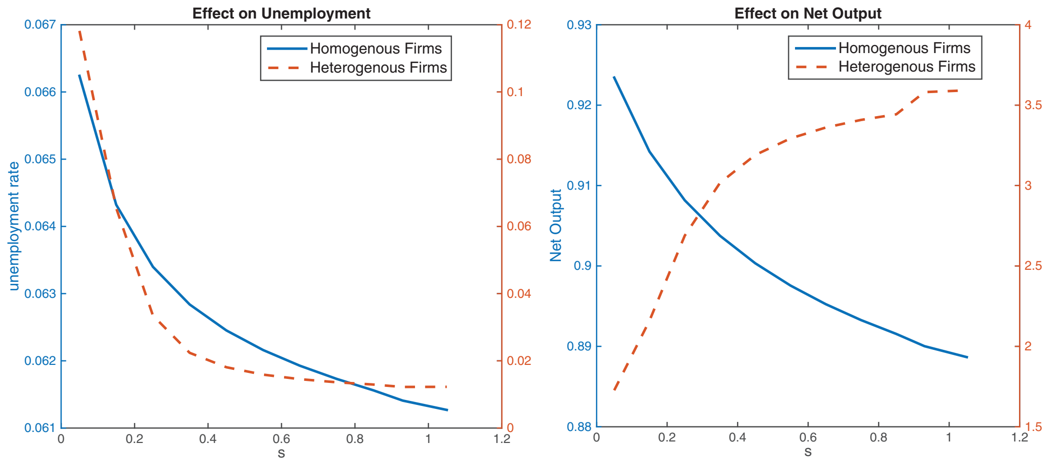

Figure 1: Changes in u and y as s increases

The critical factor driving the decline in net output given homogeneous firms is the behaviour of operating costs kf relative to gross production p. Since firm entry also increases with s, so does the total cost they pay to be economically active, kf. Under firm heterogeneity, the extent to which workers avoid unemployment and become employed in high productive firms generate increases in p that outweigh the increases in kf, making p and y more responsive to changes in s when firms are heterogeneous.

7 Implications for Employment Transitions

Search capital generates worker mobility consistent with the patterns observed in the NLSY, as described in Section 2. Employer returns observed in the model and in the data occur within the same employment spell as shown in Table 4. In the model, workers who experience a job destruction shock call upon their existing employment contacts to avoid unemployment. This generates involuntary job-to-job transitions. Since the new auction has a lower number of bidders than the auction that gave them their last wage, these workers start their new jobs at a lower wage. These involuntary employer returns accompanied by earnings losses are consistent with the evidence on J1-J2 and J2-J3 transitions presented in Tables 2 and 3.[26]

Search capital also creates differentials in the probability of a job-to-job transition and in the probability of a job-to-unemployment transition. Workers who accumulate more search capital (due to more time spent in on-the-job search), have a lower probability of experiencing

[26]Table 3 also shows that relatively small but positive earnings changes occur when comparing J1 earnings with J3 earnings. This feature is also qualitatively consistent with the predictions of an extended model with $n > 1$. Consider the case when $n = H = 2$. Let w_0^L denote the wage paid by a low productivity firm to a worker just hired out of unemployment. If this worker then meets a high productivity firm, Bertrand competition implies the worker will earn $w_L^H > w_0^L$ and keep the L firm as a contact. Conditional on keeping such a contact and adding to the contact list another L firm, Bertrand competition implies this worker will earn a wage $w_L^L > w_0^L$ following a job destruction shock at the H firm. If the job destruction event involved an employer return, the wage pattern shown is consistent with the evidence presented in Table 3. For this result to hold it is necessary to have $n > 1$ as with $n = 1$ the J1 and J3 earnings are the same.

unemployment and a higher probability of experiencing a job-to-job transition than workers with less search capital.

As search capital is unobservable in the data, we use the cumulative number of job transitions during an uninterrupted employment spell as a measure of search capital accumulation. The model predicts that workers with more jobs during an employment spell will have accumulated more search capital. Given this proxy measure, the probability of becoming unemployed (an EU event) is lower for workers with more jobs during the spell, while the probability of a job-to-job transition (an EE event) increases with the number of jobs accumulated prior to the event during the spell.

To see these relationships formally, consider the case in which all firms are homogeneous as described in Section 5. Let $m_{i,j}$ denote the measure of workers with $i = 1, 2$ jobs and $j = 0, 1$ contacts. Steady state turnover implies that the measure of workers with one job is given by $m_1 = m_{1,0} + m_{1,1}$, where $m_{1,0}$ and $m_{1,1}$ solve the system

$$m_{1,0} = \frac{\lambda u + \phi m_{1,1}}{s\lambda + \delta} \quad \text{and} \quad m_{1,1} = \frac{s\lambda m_{1,0}}{2(\phi + \delta)},$$

given an unemployment rate $u > 0$. The measure of workers with two jobs is given by $m_2 = m_{2,0} + m_{2,1}$, where $m_{2,0}$ and $m_{2,1}$ solve the system

$$m_{2,0} = \frac{\delta m_{1,1} + \phi m_{2,1}}{s\lambda + \delta} \quad \text{and} \quad m_{2,1} = \frac{s\lambda(m_{2,0} + m_{1,1})}{2(\phi + \delta)},$$

given $m_{1,1} > 0$. Using the parameter values in Table 5 and noting that in the calibrated model $u = 0.065$, $m_{1,1}/m_1 = 0.18 < m_{2,1}/m_2 = 0.44$. The share of workers holding one contact among those that are in their first job is lower than among those who are in their second job.

The job-to-job transition probability for those workers who have had $i = 1, 2$ jobs during the employment spell is then given by

$$Pr(EE|i) = \frac{(s\lambda/2)m_{i,0} + \delta m_{i,1}}{m_i},$$

while the employment to unemployment transition probability for those who have had $i = 1, 2$ jobs is given by

$$Pr(EU|i) = \frac{\delta m_{i,0}}{m_i}.$$

Given the parameter values above, the monthly probabilities are $Pr(EE|1) = 0.034 < Pr(EE|2) = 0.037$ and $Pr(EU|1) = 0.035 > Pr(EU|2) = 0.024$.[27] A similar result obtains in the model with firm heterogeneity.

To assess these implications and estimate the probability of ending a job spell in the NLSY sample, consider the following competing risks model for EE and EU events:

$$\text{Pr}(Event_t) = \theta_1'(\text{Cumulative number of jobs in spell up to } t) + \Theta'(\text{Controls}) + \epsilon, \quad (8)$$

[27] Conditional on a job separation the job-to-job transition probability is then given by $Pr(EE|i, sep) = \frac{(s\lambda/2)m_{i,0}+\delta m_{i,1}}{m_i(s\lambda m_{i,0}/2m_i+\delta)}$, such that $Pr(EE|1, sep) = 0.518 < Pr(EE|2, sep) = 0.624$.

where the date t is measured in months and the reference category is no EE or EU transition.

Table 6: Probability that a job spell ends

	EE		EU	
	(1)	(2)	(3)	(4)
Jobs in spell				
1	0.006***	0.005***	0.030***	0.025***
2	0.036***	0.031***	0.021***	0.017***
3	0.040***	0.035***	0.017***	0.015***
4	0.042***	0.039***	0.015***	0.014***
5	0.041***	0.042***	0.015***	0.014***
6 or more	0.042***	0.052***	0.013***	0.014***
N	1,163,346	954,467	1,163,346	954,467

*** $p < 0.01$

Notes The table reports the fitted probabilities of job loss (based on Mlogit regressions using the NLSY sample) given the previous number of jobs in the employment spell. Columns (1) and (3) are estimated simultaneously controlling only for job tenure, whereas columns (2) and (4) use additional controls. See Appendix for details. In the left two columns, the job loss does not end the employment spell. In the right two columns, the spell ends in unemployment.

Table 6 reports the fitted probabilities based on the estimated coefficients and setting all the covariate values equal to their corresponding means. Columns (1) and (3) are estimated simultaneously controlling only for job tenure, while columns (2) and (4) are the simultaneous estimates with additional controls for workers' experience, education, gender, union membership, marital status, public sector employment, industrial sector, part time work, urban residence and region. The Appendix provides further details of the specification used and the full set of estimated parameters for the controls.

The left two columns present the results from the estimation of the probability of observing a job separation which does not end the employment spell. In the right two columns, the spell ends in unemployment. The pattern of the fitted probabilities conform with the predictions of the search capital model. Workers with more previously held jobs during an employment spell have progressively higher (lower) probabilities of experiencing an EE (EU) transition.[28]

The search capital model further implies that the probability of ending an employment spell is positively correlated with the number of employer returns and with the number of involuntary transitions during an employment spell. These transitions depreciate workers' search capital and hence increase the probability of ending the employment spell after a δ shock. To empirically evaluate these implications, we estimate the probability of an EU transition once again using the NLSY sample.

Table 7 reports the estimated marginal effects.[29] Columns (1) and (2) show that the probability of ending an employment spell is increasing in the number of returns and in the number of involuntary transitions the worker has had during the employment spell, respectively, after con-

[28]The EE probability for those workers with one job is much lower than the EE probabilities for those workers with more than one job. Since most of the individuals in the NLSY sample did not experience an EE transition during an employment spell (see Table 1), this composition effect dampens the estimated value of $Pr(EE|1)$.

[29]Table 7 presents marginal effects based on estimating a linear probability model (LPM). These estimates are very similar to the ones obtained using a probit or a clog-log model.

Table 7: Probability that an employment spell ends

	(1)	(2)	(3)	(4)
Employer returns				
1	0.0011***		0.0002	
2	0.0021**		0.0021*	
3 or more	0.0008		-0.0007	
Involuntary job transitions				
1		0.0029***		0.0017***
2		0.0045***		0.0025***
3		0.0033***		0.0009
4 or more		0.0029***		0.0018
Constant	0.0613***	0.0611***	0.0654***	0.0653***
N		954,467		

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Notes The table reports the marginal effects of the number of prior employer returns and of the number of involuntary transitions on the probability of a job loss into unemployment from a linear probability model using the NLSY sample. Columns (1) and (2) control for job tenure and the number of jobs in the spell. Columns (3) and (4) control for experience, education, gender, union membership, marital status, public sector employment, industrial sector, part time work, urban residence and region.

trolling for job tenure and the number of jobs in the spell (as suggested by Table 6). Columns (3) and (4) show that although weaker, these results also hold after controlling for workers' experience, education, gender, union membership, marital status, public sector employment, industrial sector, part time work, urban residence and region.[30]

The proposed explanation for the estimates presented in Tables 6 and 7 is that workers accumulate and depreciate search capital during an employment spell. In contrast, standard job ladder models like Burdett and Mortensen (1998) or Postel-Vinay and Robin (2002) are inconsistent with the evidence on employer returns presented in Section 2 and the results of Table 6. In these models, the more jobs that workers have within an employment spell indicate that they are closer to the top of the job ladder and hence have a lower probability of finding a better job to move up into. That is, in these models the probability of experiencing an EE transition *decreases* with the number of previous jobs held during an employment spell. Further, since job destruction shocks affect all matches equally, the probability of an EU transition is independent of the number of jobs the worker has had during the employment spell.

Pinheiro and Visschers (2015) and Jarosh (2015) propose extensions to the Burdett and Mortensen (1998) and Postel-Vinay and Robin (2002) models, respectively, in which moving to more and more stable jobs through on-the-job search decreases the probability of an EU transition. Although these models generate a negative relationship between the number of previous jobs held within and employment spell and the probability of an EU transition, they do not account for the positive relationship between the number of previous jobs in the employment spell and the probability of an EE transition.

[30] Alternative specifications find that the positive correlation between the probability of an EU transition and the number of returns or the number of involuntary transitions remains after controlling simultaneously for the number of returns and the number of involuntary transitions (with and without additional controls). In addition, we find that the probability of an EE transition decreases with the number of involuntary transitions.

Moreover, none of these models provides an explanation for why the probability of an *EU* transition increases with the number of involuntary job transitions or the number of returns workers have had during the employment spell. Search capital depreciation, however, provides a natural interpretation. Involuntary job losses compel workers to use their contacts to avoid unemployment. Workers who consume more search capital become more likely to make transitions to unemployment thereby accounting for these findings.

8 Conclusion

This paper puts forward the concept of search capital to provide an endogenous explanation of return employment as documented in Section 2. Workers who experience a job destruction shock can call upon their existing employment contacts and avoid unemployment. Return employment occurs when the worker chooses one of his or her previous employers after a job destruction shock. Since the new auction has a lower number of bidders than the auction that gave these workers their last wage, these workers start their new job at the old employer with lower earnings.

Given that the amount of search capital is correlated with the number of jobs held during an employment spell, the model predicts that the probability of a job-to-job transition is positively correlated with the number of jobs previously held during an employment spell whereas the probability of a job-to-unemployment transition is negatively correlated. The model also predicts that the probability of a job-to-unemployment transition is positively correlated with the number of involuntary transitions and with the number of returns a worker experiences during the employment spell. Evidence from the NLSY supports all of these predictions and stands in contrast with standard job ladder models like Burdett and Mortensen (1998) and Postel-Vinay and Robin (2002).

The search capital framework is also related to the large empirical literature demonstrating that informal employment contacts based on individuals' social or professional networks have a strong influence on their labour market outcomes. Holzer (1988), for example, finds that 66 percent of young workers who accepted a job used informal search channels. Capellari and Tatsiramos (2011) show that informal employment contacts have positive effects on workers' job finding rates, while Brown et al. (2013) show that such contacts lead to better job matches. Theoretical frameworks that followed on from these findings formalise the idea that contacts help alleviate search frictions that arise from imperfect information about the location of jobs and workers and the idea that contacts help mitigate asymmetric information about the quality of applicants in the hiring process. See Topa (2001), Montgomery (1991) and Galenianos (2013), among others.

Information flows among the members of a given network lie at the heart of most of these theories. In particular, a prominent assumption made in models that consider employed and unemployed workers' job search is that individuals will always pass along information about job opportunities to their contacts (see Calvó-Armengol, 2004, Calvó-Armengol and Jackson, 2004, Fontaine, 2008, among others) or will pass along such information if the job opportunity is less attractive than the current job (see Mortensen and Vishwanath, 1994, Calvó-Armengol and Jackson, 2007, among others). The search capital framework considers an alternative, complementary environment in which job seekers keep and hold the information they acquire about job opportunities as insurance in the event of a job destruction shock.

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Appendix: Data and Estimation

NLSY Data

Following Light and McGarry (1998) and Carrillo-Tudela and Kaas (2015), the National Longitudinal Survey of Youth 1979 (NLSY) sample of white male and female workers used throughout the paper drops workers

- with indeterminate entry dates,
- with entry dates that preceded their 16th birthday or the earliest date included in the time frame of the regressions (January 1st, 1978)
- who stayed in school throughout 1979-1993,
- who were observed for less than 8 years after their entry date
- without employment data during the 1979-1993 period.

The start of the first non-enrollment (in education) spell lasting more than 12 months determines the sample selection entry date. From 1981 onwards, the NLSY provides a dummy variable for each month since the last interview which equals one if the respondent was enrolled in that month and zero otherwise. The first 12 month non-enrolled streak identifies entry into employment and the first month of that streak as the entry month. The 1979-1980 survey years require a different method for determining entry as the NLSY only provides information on the date last enrolled. For these two survey years, the number of months between the date last enrolled and the interview date identifies the entry date for those who had 12 months in between.

An important characteristic of the NLSY is job identifiers that reveal transitions to previous jobs. A "main job" dummy variable for a particular month is constructed to compute job transitions. In particular, instead of using all of the overlapping jobs the worker could have held in the same month, the following tie-breaking rules were adopted for months where more than one job was held:

1. The job that had the most hours worked per week is taken to be the main job.
2. If there were two or more jobs with the same maximum hours, the job that began earlier (earlier "jobstart") is chosen as the main job.
3. If two or more jobs that month had the same maximum hours and "jobstart", then the one with higher wages is chosen as the main job.
4. If two or more jobs had the same hours, start and wages, then the one which lasted longer (later "jobstop") is considered the main job.
5. If there were still two jobs that had the same hours, start, stop and wages, these are assumed to be exactly the same jobs, in which case the one with a smaller job id is selected arbitrarily.

As mentioned in the text, job-to-job transitions are computed by identifying the months for which the main job changed such that the time gap between these jobs is less than a month *and* the worker stops working for the firm where the main job was located. Non-employment spells are identified when the main job variable is either missing or zero.

Further, job-to-job transitions are labeled as a quit (voluntary transition) when workers declare that they left the previous employer because they either: (i) quit to take another job; (ii) quit to look for another job; (iii) quit because of employment conditions (didn't like work, hours, working conditions, or location, didn't get along with other employees or boss); (iv) quit because interfered with school; (v) quit because of ill health, disability, or medical problems; (vi) quit for pregnancy or family reasons; (vii) quit to enter armed forces or (viii) quit for other reasons.

To complement the analysis presented in Section 2, the table below shows the distribution of employment spells by demographic characteristics and the number of jobs they contain. There are 26,094 employment spells in the sample, where 40% contain at least two job spells (at least one job-to-job transition). Males, young workers and the more educated have a higher proportion of employment spells with at least two job spells. Since employer returns can only occur in employment spells with at least three jobs spells, the analysis in Section 2 focuses on these types of spell, which account 23% of all employment spells. From those employment spells with at least 3 jobs the distribution of job spells is as follows: 37% have exactly 3 jobs, 22% have 4 jobs, 14% have 5 jobs, 8% have 6 jobs and the reminder 19% have 7 or more job spells.

Table 8: Distribution of Employment Spells

		Jobs in employment spell		
	N	1 job	2 jobs	3+ jobs
All employment spells	26,094	0.5875	0.1831	0.2294
Gender				
Female	13,391	0.6084	0.1841	0.2075
Male	12,703	0.5655	0.1821	0.2524
Age				
25 or younger	18,464	0.5816	0.1769	0.2416
26-35	4,939	0.556	0.2011	0.243
36 and above	2,691	0.6864	0.1929	0.1208
Years of schooling				
Below 12	6,213	0.6488	0.1648	0.1864
12	7,880	0.5831	0.1929	0.224
13-14	5,376	0.5746	0.1825	0.2429
16	2,040	0.526	0.2039	0.2701
17 and above	954	0.587	0.2002	0.2128

Notes The table reports the distribution of employment spells in the NLSY sample by demographic characteristics and the number of jobs during the spell.

The next table presents the full set of estimated coefficients from the multinomial logit in Section 7, columns 2 and 4 from Table 6. The regression of equation (8) uses three categories for

Table 9: Multinomial Logit Coefficient Estimates

	EE		EU	
	Coefficients	Std. Error	Coefficients	Std. Error
Number of jobs in spell				
2	1.849	0.028	-0.302	0.020
3	1.978	0.028	-0.458	0.026
4	2.083	0.031	-0.507	0.034
5	2.139	0.034	-0.489	0.041
6+	2.277	0.030	-0.557	0.033
Job tenure (categorical)				
2	-0.600	0.024	0.037	0.023
3	-0.822	0.028	-0.252	0.028
4	-0.889	0.032	-0.353	0.033
5	-1.055	0.034	-0.447	0.035
6	-1.154	0.039	-0.606	0.042
7	-1.190	0.042	-0.653	0.046
8	-1.215	0.046	-0.677	0.051
9	-1.322	0.037	-0.745	0.041
10	-1.416	0.043	-0.837	0.049
11	-1.575	0.047	-1.026	0.056
12	-1.641	0.055	-0.980	0.061
13	-1.742	0.038	-1.146	0.043
14	-1.868	0.061	-1.272	0.071
15	-2.031	0.072	-1.286	0.079
16	-2.082	0.083	-1.249	0.085
17	-2.044	0.089	-1.378	0.099
18	-2.062	0.079	-1.293	0.079
19	-2.111	0.081	-1.391	0.080
20	-2.408	0.084	-1.384	0.063
Experience	-0.056	0.005	-0.088	0.008
Experience^2	0.001	0.0001	0.002	0.0003
Years of Schooling				
12	-0.096	0.021	-0.184	0.025
13-14	-0.121	0.024	-0.154	0.029
16	-0.215	0.029	-0.525	0.035
17 and above	-0.164	0.037	-0.526	0.043
Part-time contract	-0.627	0.021	-0.059	0.020
Male	-0.004	0.014	-0.066	0.018
Married	-0.210	0.017	-0.111	0.021
Divorced	0.033	0.027	0.118	0.033
Work in Government	-0.093	0.033	-0.024	0.033
Union	-0.114	0.025	-0.188	0.028
Lives in a city	-0.028	0.014	-0.118	0.018
Lives in the South	0.010	0.014	0.000	0.018
Industry (categorical)				
Mining	-0.176	0.105	0.088	0.101
Construction	-0.080	0.054	0.156	0.063
Manufacturing	-0.346	0.052	-0.118	0.059
Transportation	-0.286	0.060	-0.121	0.069
Wholesale	-0.076	0.051	-0.086	0.057
Retail Trade	-0.393	0.057	-0.274	0.065
Services	-0.165	0.050	-0.048	0.057
Public Admin.	-0.320	0.069	-0.079	0.077
Constant	-3.180	0.130	-0.572	0.168
N	954,467			

Notes The table reports the estimated coefficients for the controls in the multinomial logit presented in columns 2 and 4 in Table 6. The dependent variable has three categories. Category 0 (baseline) represents no transition, category 1 represents a job-to-job transition and category 2 represents a job-to-unemployment transition.

the dependent variable. Category 0 (baseline) represents no transition occurring during month t, category 1 represents a job-to-job transition occurring during month t and category 2 represents a job-to-unemployment transition occurring during month t.

In addition to the positive (negative) relationship between the probability of an EE (EU) transition and the cumulative number of jobs held during the employment spell, (as expected) a negative relationship obtains between EE or a EU transitions and job tenure, labour market experience and years of schooling, where the reference category for the latter is $<$ 12 years of schooling. Further, there is variation across industrial sectors in the probability of an EE or a EU transition relative to the agriculture sector (the reference category).

The last set of tables present the full set of marginal effects from the linear probability model in Section 7, columns 3 and 4 from Table 7. These marginal effects present a very similar picture about the probability of an EU transition as the one obtained from the multinomial logit coefficients.

Table 10: Linear Probability Model - Marginal Effects

	EU (3)		EU (4)	
	Coefficients	Std. Error	Coefficients	Std. Error
Number of returns in spell				
1	0.00019	0.00051		
2	0.00209	0.00120		
3+	-0.00067	0.00127		
Number of involuntary transitions in spell				
1			0.00166	0.00040
2			0.00250	0.00070
3			0.00089	0.00096
4			0.00177	0.00130
Number of jobs in spell				
2	-0.00865	0.00045	-0.00888	0.00045
3	-0.01074	0.00047	-0.01125	0.00047
4	-0.01106	0.00050	-0.01168	0.00050
5	-0.01112	0.00056	-0.01184	0.00057
6+	-0.01171	0.00049	-0.01266	0.00050
Job tenure (categorical)				
2	0.00068	0.00088	0.00069	0.00088
3	-0.00915	0.00087	-0.00913	0.00087
4	-0.01178	0.00092	-0.01174	0.00092
5	-0.01373	0.00088	-0.01369	0.00088
6	-0.01660	0.00090	-0.01656	0.00090
7	-0.01717	0.00092	-0.01713	0.00092
8	-0.01746	0.00096	-0.01742	0.00096
9	-0.01816	0.00080	-0.01811	0.00080
10	-0.01887	0.00083	-0.01882	0.00083
11	-0.01993	0.00082	-0.01987	0.00082
12	-0.01926	0.00085	-0.01919	0.00085
13	-0.02036	0.00071	-0.02029	0.00071
14	-0.02099	0.00078	-0.02090	0.00078
15	-0.02090	0.00081	-0.02081	0.00080
16	-0.02059	0.00083	-0.02049	0.00083
17	-0.02127	0.00086	-0.02118	0.00086
18	-0.02079	0.00082	-0.02070	0.00081
19	-0.02144	0.00080	-0.02136	0.00080
20	-0.02152	0.00082	-0.02142	0.00082

Notes The table reports the first set of marginal effects from the linear probability model in Table 7, columns 3 and 4.

Table 11: Linear Probability Model - Marginal Effects - continued

	EU (3)		EU (4)	
	Coefficients	Std. Error	Coefficients	Std. Error
Experience (categorical)				
$(3, 9]$	-0.01131	0.00062	-0.01129	0.00062
$(9, 17]$	-0.01158	0.00077	-0.01153	0.00077
> 17	-0.01096	0.00091	-0.01092	0.00091
Years of Schooling				
12	-0.01171	0.00086	-0.01171	0.00086
13-14	-0.01218	0.00089	-0.01215	0.00089
16	-0.01656	0.00088	-0.01652	0.00088
17 and above	-0.01575	0.00092	-0.01575	0.00092
Part-time contract	0.00251	0.00052	0.00249	0.00052
Male	-0.00122	0.00034	-0.00134	0.00034
Married	-0.00204	0.00037	-0.00201	0.00037
Divorced	0.00112	0.00058	0.00113	0.00058
Work in Government	0.00015	0.00063	0.00011	0.00063
Union	-0.00369	0.00049	-0.00367	0.00049
Lives in a city	-0.00232	0.00033	-0.00231	0.00033
Lives in the South	-0.00015	0.00034	-0.00011	0.00034
Industry (categorical)				
Mining	0.00062	0.00219	0.00055	0.00219
Construction	0.00140	0.00154	0.00136	0.00154
Manufacturing	-0.00252	0.00141	-0.00250	0.00141
Transportation	-0.00234	0.00149	-0.00224	0.00149
Wholesale	-0.00188	0.00143	-0.00182	0.00142
Retail Trade	-0.00408	0.00146	-0.00401	0.00145
Services	-0.00091	0.00141	-0.00086	0.00141
Public Admin.	-0.00082	0.00162	-0.00075	0.00162
Constant	0.06536	0.00173	0.06526	0.00172
N	954,467			

Notes The table reports the second set of marginal effects from the linear probability model in Table 7, columns 3 and 4.