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Job Search Strategy, Expected Wages, and Sectoral Movers and Stayers

Jonathan Thomas Dan Bernhardt

Department of Economics
Queen's University
94 University Avenue
Kingston, Ontario, Canada
K7L 3N6

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by

Jonathan Thomas* and Dan Bernhardt**

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*Department of Applied Economics
University of Cambridge
Cambridge, U.K.

**Department of Economics
Queen's University
Kingston, Ontario
Canada K7L 3N6

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Abstract

This paper develops theories of multi-sector search by unemployed workers. The paper then attempts to distinguish empirically whether unemployed workers target their job search efforts exclusively on a particular sector at any point in time, or whether they search in a "non-targetted" fashion across all sectors. We look at two types of sectoral movements -- between occupation and between industry. We employ both a standard probit formulation and a "competing-risk" formulation (to estimate the semiparametric hazard into the pre-unemployment sector and an alternative sector). The common implications of both models are supported by the results, which provide strong support for multi-sector search formulations over single-sector formulations. However, we are unable to distinguish empirically between the alternative models of multi-sector search.

1. Introduction

Standard search theory emphasises the role of the reservation wage and job offer probabilities in determining the duration of unemployment. However, even more fundamental to the observed outcome is where and how the unemployed worker actually searches. This paper investigates the implications of two models of multi-sector search: (i) one where unemployed workers search in a "non-targetted" fashion across all sectors of the labour market for the next match, and (ii) one where they search in a "targetted" manner in which, within a period, a worker searches a selected sector to the exclusion of other sectors of the labour market.

The interesting case is where ex-workers from the high-wage sector (sector A) face a lower job offer probability, but a higher expected offer wage in this sector than the relatively low-wage sector (sector B). Then, with targetted search, workers may first search in a favoured "high-wage" sector and only search in the relatively low-wage sector if initially unsuccessful. We show that the alternative search models of non-targetted and targetted search can generate conflicting predictions on the effect of the expected offer wage from B on the hazard into sector A. Non-targetted search unambiguously predicts a negative correlation between this wage and the conditional probability of leaving unemployment as a stayer. On the other hand, targetted search allows this wage to have a positive effect on the hazard into A. Both models are consistent with the observation that the greater a worker's previous wage (the greater his expected sector A wage), the lower the hazard into employment. Describe a worker who becomes re-employed in his or her former sector of employment (sector A) as a "stayer", and one who is re-employed in a different sector, B, a "mover". We show that both models imply that the duration of the spell of unemployment is positively correlated with the worker leaving unemployment as a mover.

A simple practical example motivates our approach. Consider a highly paid, highly skilled job loser, with many years of job tenure and sector-specific skills which have little value in other occupational or industrial sectors. He or she must decide whether to look for jobs where the return to such skills will be low, or to spend a potentially long spell unemployed searching for a job similar to that lost. In essence, the worker must decide whether or not to trade a long spell of unemployment for a desirable match[1].

Our theoretical findings allow the possibility of empirically testing the consistency of both models with the data (e.g., are workers with longer spells more likely to be observed as movers?). We also attempt to test the search models against each other: do workers with higher expected wages in B have shorter spells of unemployment if they leave via A? We use a sample of unemployed workers drawn from the 1986 wave of the Statistics Canada Labour Market Activity Survey and look at two types of sectoral movements -- between occupation and between industry. Two econometric techniques are employed. First, we use a standard probit formulation with the dependent dummy variable representing whether or not the worker ends the unemployment spell as a mover or stayer. Second, we adopt a "competing-risks" formulation and estimate, using a model developed by Meyer (1990), semiparametric hazards into the pre-unemployment (staying) sector and a different (moving) sector. The common implications of both models are supported by our results, which provide strong support for the multi-sector search formulation. However, we are unable to distinguish empirically between the alternative models of multi-sector search.

The paper is organised as follows: the next section introduces both search models, presents some theoretical results and discusses their empirical implications. Sections 3 and 4 present our empirical results. Section 5 concludes.

2. The Search Models.

2.1 The Search Environment.

This section introduces the fundamental search environment underlying both the non-targetted and targetted search models (NTSM and TSM respectively). In both we assume that unemployed agents are infinitely lived, risk neutral and seek to maximise the lifetime discounted expected value of search[2]. There are two sectors of the economy: A, the pre-unemployment sector, and B, the rest of the labour market. Each has known and independent wage offer distributions which can differ among workers. Wage offers from both

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[1] There is empirical evidence that workers displaced from high-wage sectors of the economy have longer spells than other displaced workers with similar observable characteristics (Summers, 1986; Kruse, 1988).

[2] The predictions of the analysis are robust to perturbations such as risk aversion, finite horizons and multiple unemployment spells.

sectors are drawn from the Pareto distribution, and the worker expects a higher wage offer from a firm in A than from one in B[3].

Job offer probabilities are also known. These are assumed to be generated from time homogeneous independent processes where the offer probability from B exceeds that from A. Sector A can therefore be characterised as the high wage-low job offer probability sector while sector B is the low wage-high job offer probability sector. Differences in the wage offer distributions across workers reflect differences in sector-transferable or sector-specific skills. The greater a worker's sector specific skills, the better the wage distribution he faces in A, but wage offers in B are unaffected. The greater a worker's general or sector-transferable skills, the better the wage offer distributions in both A and B. The length of a period is sufficiently short that the probability of multiple job offers is zero (the analysis extends to longer periods, where there may be multiple within-period job offers). A rejected offer cannot be recalled. If the worker finds a job, it lasts forever. We use the following notation:

p^i - probability of a job offer from sector i per period, i =A,B.

q^i_t - probability a job offer from sector i is acceptable, i=A,B.

b - unemployment compensation per period received throughout the spell.

V_t - expected value of search at t.

w^{i*}_t - reservation wage for a job in sector i in period t, i=A,B.

w^i_{et} - expected wage of a job in sector i conditional on it exceeding the corresponding reservation wage, i=A,B.

r - interest rate.

$f_i(w)$ - the PDF of wage offers in sector i, i=A,B[4], where

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3 The Pareto distribution has been used previously in the empirical literature on single-risk structural search models where researchers have data on reservation wages and it is necessary to explicitly model the distribution of wage offers. (Lancaster and Chesher, 1983; Jones 1989). In the single-risk literature, Sattinger (1985) argues that the Pareto density is a good approximation of the wage offer density facing the worker. Most of our analysis does not rely on the Pareto distribution.

4 We also assume that the wage offer distribution from B has support $[\underline{w},\infty]$ where $\underline{w}>b$. This ensures that the worker always participates in the labour market throughout the unemployment spell, because the value of the minimum

$f_a(w) = \alpha_a(\underline{w}+d)^{\alpha_a} w^{-\alpha_a-1}$ and $f_b(w) = \alpha_b(\underline{w})^{\alpha_b} w^{-\alpha_b-1}$,

$\underline{w}$ and d are positive constants and $\alpha_b > \alpha_a > 2$.[5] The mean wage offers from A and B are then $\alpha_a(\underline{w}+d)/(\alpha_a-1)$ and $\alpha_b(\underline{w})/(\alpha_b-1)$ respectively.

c_t - cost of search which is incurred in t if a job is not obtained at t-1.

We assume that the cost of unemployment increases monotonically as the spell continues so that $c_{t+1}-c_t \geq c_t-c_{t-1}\ldots\geq 0$ $\forall t$. Increasing costs also capture any decreases in unemployment benefits: increased costs and decreased benefits have identical effects on search behavior. The assumption captures an increasing dissatisfaction or impatience with the unemployed state.

Denote by q_t^i, i=A,B, the probability that a given wage offer is acceptable to a worker:

$$q_t^i = \int_{w_t^{i*}}^{\infty} f_i(w)dw. \qquad (1)$$

Denote by w_e^i the worker's expected wage conditional on it exceeding the reservation wage:

$$w_e^i = \frac{1}{q_t^i}\int_{w_t^{i*}}^{\infty} w\, f_i(w)\, dw. \qquad (2)$$

2.2 Non-Targetted Search

We define non-targetted search to be a situation where, rather than focusing on a particular sector, a worker simply searches across all sectors for "a job" which meets some reservation criterion. One non-targetted search technology might be going to a job centre which refers workers to jobs across both sectors.

At time t during the spell, the worker's expected value of search is given by:

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wage offer that the worker can get exceeds the value of taking UIC for the infinite future. The support of the wage offer distribution from A is $[\underline{w}+d,\infty]$.

5 $\alpha_b > \alpha_a > 2$ ensures that the mean and variance of wage offers from A exceeds that from B and that these variances exist.

$$V_t = b + p^a q_t^a (w_{et}^a/r) + p^b q_t^b (w_{et}^b/r) + (1-(p^a q_t^a + p^b q_t^b)) \left[\frac{V_{t+1} - c_{t+1}}{1+r}\right] \quad (3)$$

The first term on the right hand side of (3) is the value of unemployment benefits. The second term is the discounted value of an acceptable offer from A times the probability of the job being offered to the searching worker. The third term is the corresponding expression for an offer from B. The fourth term is the expected value of search in the next period given that no acceptable offer is received net of search/unemployment costs which are incurred in the next period in the event of continued unemployment[6].

The worker sets a reservation wage which maximises the expected value of search. Defining the reservation wage as w_t^*, it can be shown that the worker will set $w_t^* = r[(V_{t+1})/((1+r)-c_{t+1})]$: the worker rejects any job offer lower than w_t^*, and accepts any wage offer which is greater. Note that the worker has the same job acceptance criteria regardless of whether the firm sampled is in A or B. However, the worker is more likely to accept a job offer from A because the wage offer density from this sector stochastically dominates that from B. Since search costs rise over the spell, the value of search and therefore the reservation wage fall as the spell continues. As the reservation wage falls, the worker accepts a greater proportion of job offers from both A and B. Proposition 1 details that the acceptance set in B increases faster (in relative terms) than A as the reservation wage falls, so that with time the worker is more likely to exit as a mover.

Proposition 1

As the unemployment spell continues the worker is more likely to be observed as a mover.

Proof: See Appendix A.

That is, there is a positive relationship between the duration of unemployment and the likelihood of observing the worker as a mover.

Corollary 1

Consider two workers who face identical wage offer distributions, but one receives greater unemployment benefits or has lower costs of unemployment

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[6] Similar models are developed by Pissarides (1982) and Katz (1986) for workers on layoff unemployment who must decide whether to wait for a recall to a former job or to search for a new one.

so that this worker sets a higher reservation wage throughout the spell. Then this worker expects to have a longer spell of unemployment and is less likely to enter B (i.e. be observed as a mover).

This corollary is useful in deriving various "comparative static" type results for the effects of various exogenous variables on the move/stay outcome and the duration of unemployment.

For econometric analysis of the NTSM it is useful to determine the effects of a shift in the wage offer densities in each sector on the reservation wage, the hazard rates into A and B and the move/stay outcome. These are developed in the following four propositions.

Proposition 2

Consider two individuals, 1 and 2, where the wage offer density facing 1 from A (B) dominates that facing 2 in the first order stochastic dominance sense (FOSD). *Then, ceteris paribus,* $w_t^{*1} > w_t^{*2} \quad \forall t = 1, 2, 3...$

Proof: $V_{t+1}^1 \geq V_{t+1}^2$.

This is a variant of the well-known result that the reservation wage is increasing in the mean offer wage (Kiefer and Neumann, 1979; Mortensen, 1986).

Proposition 3

Consider two workers, 1 and 2, where the wage offer distribution in sector A to worker 2 is a rightward translation of that of worker 1. Then, ceteris paribus,

(a) worker 2 has a greater hazard into sector A.

(b) worker 2 has a smaller hazard into sector B.

(c) worker 2 may have a greater or smaller single-risk or overall hazard out of unemployment.

Proof: See Thomas (1990a)[7].

The intuition behind these results is as follows. As the sector A wage offer distribution shifts to the right the reservation wage rises, decreasing the set of acceptable offers from B for the worker searching both sectors. However, the increase in the reservation wage is less than the shift in the translation, so the set of acceptable offers from A increases. Therefore,

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[7] Parts (b) and (c) hold when a "translation of" is replaced with "FOSD", because the results follow only from the effect on the reservation wage. Part (a) does not, because a FOSD improvement may increase the weight in the tail more than proportionately.

improving the wage offer distribution in A has a positive effect on the hazard into employment in A (the hazard for stayers) and a negative effect on the hazard into B (the hazard for movers). The overall effect on the hazard from unemployment into employment will depend on the relative gain in acceptable offers from A compared to the loss in acceptable offers from B. Since sector B offers are more likely to be received, the net effect is ambiguous. This result can reconcile anomalies found in the single-risk literature concerning the effect of the expected offer wage on the hazard from unemployment to employment. Single sector search theory (e.g. Mortensen 1986) suggests that improving the offer wage distribution will have the effect of increasing the hazard into employment. Empirically however, the expected offer wage, proxied by the pre-unemployment wage has often been found to have a negative effect on this hazard (Ham and Rea, 1987; Kruse, 1988).

Proposition 4

Consider two workers, 1 and 2, where worker 2's sector B wage offer distribution is a rightward translation of worker 1's. Then, ceteris paribus,
(a) worker 2 has a greater hazard into sector B.
(b) worker 2 has a smaller hazard into sector A.
(c) worker 2 may have a greater or smaller single-risk or overall hazard out of unemployment.
Proof: See Thomas (1990a)[8].

Proposition 4 implies that, ceteris paribus, improving the wage offer distribution from B should have a negative effect on the hazard into A (the hazard for stayers) and a positive effect on the hazard into B (the hazard for movers). We can now look at the implications for a shift in the density of wage offers from A and B on the move/stay outcome.

Proposition 5

Consider two individuals, 1 and 2, where the worker 1's wage offer distribution in sector A (B) is a rightward translation of worker 2's. Then, ceteris paribus, worker 1 is less (more) likely to be observed as a mover.
Proof: See the appendix.

A summary of our empirical predictions under the NTSM is as follows:

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[8] Parts (b) and (c) hold when "translation of" is replaced with FOSD.

(1) *As the spell continues the worker is more likely to be observed as a mover (enter sector B).*

(2) An *increase* in the mean offer wage from A (B)

  (a) Increases (decreases) the hazard into A.

  (b) Decreases (increases) the hazard into B.

  (c) Decreases (increases) the probability of the worker being observed as a mover.

2.3 The Targetted Search Model.

2.3.1 Motivation

The basic premise underlying the targetted search model presented is that rather than searching for "a job" as in the model of non-targetted search, the worker targets one particular sector of the labour market and searches that sector exclusively[9]. The worker must choose between searching in the high expected offer wage/low job offer probability sector, A, and searching the low expected offer wage/high job offer probability sector, B. We provide conditions under which the worker first searches in A, and only turns to search in B if he or she has been unsuccessful in finding a job in A for a sufficiently long time.

In this model, the worker switches sectors of job search from A to B because of the increasing costs of unemployment: getting any job becomes increasingly important. As the spell continues and the costs of unemployment rise, the worker becomes more desperate to leave the unemployed state and sector B offers the best chance for escape.

2.3.2 The Model.

The basic assumptions and notation are the same as those in the non-targetted search model. However, now, we distinguish between the values of search in each sector as V_t^a and V_t^b. Define T as the length of time from the start of the spell that the worker will search in A or B without securing a job before switching to search the other sector.

Assume that the worker starts the spell searching in a particular sector. If an offer is received, it is either accepted or rejected according to the

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[9] Salop (1973) develops a job search model where workers successively search at firms where they are most likely to get an acceptable job offer.

usual reservation wage rule. If the offer is rejected (or if none is received), the worker compares the value of searching in that same sector (say A) next period with the value of searching in the other sector (say B), and chooses the sector with the highest return to search in the next period. The value of search to the worker while searching in A at t is

$$V^a_t = b + p^a q^a_t (w^a_{et}/r) + (1-p^a q^a_t)\mathrm{Max}\left[\frac{V^a_{t+1}}{1+r} - c_{t+1}, \frac{V^b_{t+1}}{1+r} - c_{t+1}\right] \tag{6}$$

and that while searching in B is

$$V^b_t = b + p^b q^b_t (w^b_{et}/r) + (1-p^b q^b_t)\mathrm{Max}\left[\frac{V^a_{t+1}}{1+r} - c_{t+1}, \frac{V^b_{t+1}}{1+r} - c_{t+1}\right] \tag{7}$$

Therefore, providing the reservation wage exceeds $\underline{w}$, it satisfies

$$w^*_t = r\left\{\mathrm{Max}\left[\frac{V^a_{t+1}}{1+r} - c_{t+1}, \frac{V^b_{t+1}}{1+r} - c_{t+1}\right]\right\} = r\left[\frac{V^*_{t+1}}{1+r} - c_{t+1}\right], \tag{8}$$

where $V^*_{t+1} = \mathrm{Max}\,(V^a_{t+1}, V^b_{t+1})$.

<u>Proposition 6</u>

(a) If $p^a \geq p^b$ *then the worker searches only in A.*

(b) If $p^a < p^b$, *then* $\exists T^*$ *where for* $0 \leq t < T^*$ *the worker searches in A, and for* $t \geq T^*$ *the worker searches in B.*

Proof: See Appendix A.

Part (a) of the proposition says that if $p^a \geq p^b$, then the worker searches sector A exclusively. This is because sector A is already more attractive due to its higher average offer wage. Part (b) shows, however, that if $p^a < p^b$, the worker starts the spell searching in A but eventually switches into B at T^* if he or she has not found a job in A by this point[10]. Intuitively, at the start of the spell, the higher expected offer wage in A more than offsets its lower offer probability so that sector A has a higher value of search. However, as the spell continues without a successful match in A, sector B becomes more attractive because the costs of unsuccessful search

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[10] T^* may equal zero: if p^a/p^b is too small, the worker never searches sector A.

rise and B offers more prospects of successfully ending the search.

Henceforth, the description of the economy supposes that a worker starts the spell searching in A. If the worker switches sectors of search, the worker switches only once. Again it is possible to obtain comparative static results for the effect of all the exogenous variables on T^* and therefore on the move/stay outcome and the hazards into each sector. Since these are identical to those which obtain for the NTSM, the crucial results for our purposes concern the particular effects of the mean offer wages from A and B. It is to these we now turn.

Proposition 7

Consider two individuals, 1 and 2, where worker 1's wage offer distribution in sector A (B) is a rightward translation of worker 2's. Then, ceteris paribus, $T^{*1} \geq T^{*2}$ ($T^{*1} \leq T^{*2}$).

Proof: See Thomas (1990a).

This proposition tells us that, ceteris paribus, those workers who expect the highest mean offer wage in A will spend a longer time searching in A for a match before switching, while those workers who expect the highest mean offer from B will spend a shorter time searching in A before switching.

Proposition 8

Consider two individuals, 1 and 2, where worker 1's wage offer distribution in sector A is a rightward translation of worker 2's. Then, ceteris paribus,

(a) Worker 1 is less likely to be observed as a mover.

(b) Conditional on exiting as a stayer, worker 1 has a shorter expected spell of unemployment.

(c) Conditional on exiting as a mover, worker 1 has a longer expected spell of unemployment.

Proof: See Thomas (1990a)[11].

Note that these implications also follow from the NTSM. Now we can look at the effects of the expected offer wage in B.

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[11] Parts (a) and (c) hold when a "translation of" is replaced with "FOSD" as well as when instead of an improved wage offer distribution, worker 1 is more likely to receive a job offer from sector A.

Proposition 9

Consider two individuals, 1 and 2, where worker 1's wage offer distribution in sector B is a rightward translation of worker 2's. Then, ceteris paribus,

(a) Worker 1 is more likely to be observed as a mover.

(b) Conditional on exiting as a stayer, it is ambiguous as to which worker will have the longer expected spell of unemployment.

(c) Conditional on exiting as a mover, worker 1 has the shorter expected spell of unemployment.

Proof: See Appendix A[12].

Note that (a), and (c) also follow from the NTSM. However, the TSM allows greater expected offer wages in B to have a positive effect on the hazard into A which is inconsistent with the NTSM. This follows from the fact that worker 2 can leave as a stayer yet have a longer spell of unemployment than worker 1.

Proposition 10

As the spell continues the worker is more likely to be observed as a mover.

Proof: See Thomas (1990a).

Our empirical predictions under the TSM can be summarised as follows:

(1) *As the spell continues the worker is more likely to be observed as a mover (enter sector B).*

(2) An *increase* in the mean offer wage from A (B)

(a) Has an positive (ambiguous) effect on the the hazard into A.

(b) Has an negative (positive) effect on the hazard into B.

(c) Has an ambiguous effect on the overall hazard.

(d) Decreases (increases) the probability of the worker being observed as a mover.

Note then the possibiliy of empirical conflict between the models. The TSM allows the possibility that an increase in the expected offer wage from B can increase the hazard into A while the NTSM unambiguously predicts the opposite effect. This contrast allows us to test the models against each other

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12 Parts (a) and (b) hold when "translation of" is replaced with "FOSD", as well as when, instead of a better wage offer distribution, worker 1 is more likely to receive a wage offer from sector B. Part (c) is ambiguous, because worker 1 sets a higher reservation wage.

using competing-risks hazards. Both models have identical implications for the effects of the duration of the spell and the expected offer wages from A and B on the probability of observing the worker as a mover. We next determine whether the predictions are consistent with the data.

3 Testing the Implications of The Non-Targetted and Targetted Search Models.

3.1. The Data

We use data drawn from the 1986 wave of the Labour Market Activity Survey collected by Statistics Canada. The LMAS contains retrospective individual-specific information on the work patterns of a representative sample of 66,394 Canadians between the ages of 16 and 69, and the characteristics of up to five jobs they may have held in the 1986 calendar year. This enables the construction of a labour market status profile of each individual for 1986[13].

The sample of individuals used here consists of workers who had at least two jobs in 1986 with at least one week between the jobs in which they were unemployed but searching for work[14] [15]. Students and workers with missing variables were excluded, giving us a sample of 1829 workers.

The next issue is to measure the expected wage offers from A and B respectively. Since these expected wages are not directly observed they must be imputed in some way. Typically, in the single-risk literature, researchers have used the worker's previous wage to proxy the expected offer wage perceived by the worker (Ham and Rea, 1987; Meyer 1990). Katz (1986) uses this to capture the expected offer wage of a worker on layoff should he or she be recalled. In our case then this wage would seem a reasonable proxy for the mean of the wage distribution in the worker's own sector, A. With respect to the expected offer wage from B one possibility is to interpret the pre-unemployment tenure of the worker as an inverse proxy. This would follow if skill level in other sectors were negatively correlated with time spent out of such sectors, and hence with tenure on the pre-unemployment job. Given this, then, the greater such tenure, the lower the wage that the worker can

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[13] Information on some workers is available through to March 1987.

[14] The question asked to determine this variable was "In how many weeks was ... looking for work just before this job?

[15] We look at spells between the first and second jobs. Each worker was permanently separated from his past employer and was not waiting for recall.

expect to earn if he or she changes sector[16]. Admittedly, this measure is rather crude because tenure on the pre-unemployment job may also capture sector transferable general skills. However these will also depend on the educational level and the industrial and occupational affiliation of the worker in the pre-unemployment job. We attempt to control for such differences in our empirical work. A reader uncomfortable with this interpretation can ignore it as it does not otherwise affect the analysis.

3.2 The Probit Model

In this section, we present results from a simple probit model of the factors explaining the move/stay outcome. We separately investigate both inter-occupation and inter-industry movements, so that the dependent variable is 1 if the worker changes, say occupation (a mover) upon re-employment and zero otherwise (a stayer)[17]. The explanatory variables include the standard socio-demographics, regional, industrial, and occupational dummies, and the the duration of the unemployment spell[18]. Of the total sample of 1829 workers, 1131 workers move occupation between jobs and 698 stay in the pre-unemployment occupation upon re-employment. Industry movers and stayers number 1216 and 613 workers respectively[19].

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[16] Addison and Portugal (1989) present evidence that tenure on the pre-unemployment job has a positive effect on post-unemployment earnings. Their estimates also show that workers who move industries or occupations when re-employed suffer significant wage losses: the relative effect of tenure on wage changes for occupational or industrial movers and stayers remains to be investigated.

[17] Industries and occupations are defined at the 2 digit level in the LMAS. Therefore a mover is an individual who changes his or her 2 digit occupation or industry between jobs.

[18] The duration of the spell could conceivably be endogenous with respect to the move/stay outcome, if, for instance, workers who wish to stay in sector A search more intensively and therefore have shorter spells. We attempted to test for potential endogeneity via a Hausman-type test for the endogeneity of regressors in the probit model suggested by Rivers and Vuong (1988) which involves estimating a reduced form equation for the (log) duration of unemployment substituting the OLS residuals into the probit equation and testing for its significance (MacKinnon and Olewiler (1980) and Smith and Blundell (1986) suggest a similar approach for the tobit model). However, this approach requires arbitrary exclusion restrictions since their are no convincing instruments. Using family size and union status did not provide any evidence of endogeneity.

[19] Given that 84% of occupation movers also move industry and 78% of industry movers change occupation one may want to allow the worker four choices, (i)

The inclusion of the observed spell length of the worker as an explanatory variable in the probit equation marks an essential difference between the econometric work presented here and that by Loungani et al. (1989a, 1989b). Loungani et al. do not include the length of the unemployment spell as an explanatory variable in their probit equation for industry movers because they are interested in the spell lengths of movers and stayers conditional on moving or staying. Therefore their model consists of three equations, where, along with a probit equation for the inter-industry move/stay outcome, they estimate reduced form equations for the duration of unemployment of movers and stayers respectively. The probit equation is used to provide the Inverse Mills Ratio to correct for potential sample selection bias in the reduced form equations for industry movers and stayers where the dependent variable is the duration of unemployment[20]. It turns out, from their "second stage" OLS regressions that there is no evidence of sample selection bias. It is important to note that their approach implicitly assumes that workers choose a moving or staying status immediately as the unemployment spell starts, so the move/stay outcome does not depend on the duration of unemployment. However, our theoretical developments suggest that the duration of the spell may itself affect the move/stay outcome and hence our alternative formulation. Further, our competing risks hazard estimates allow us to quantify the effect of various pre-determined variables on the spells of movers and stayers. Therefore, we achieve the same goal as Loungani et al., without the possibility of specification error in the probit equation. Table 1 below shows the average unemployment and wage gain experiences of occupation and industry movers and stayers[21].

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change occupation but stay in the same industry, (ii) move industry but stay in the same occupation, (iii) switch both industry and occupation (iv) stay in same industry and occupation. This is left to future work.

20 Loungani et al. could not include the spell length of a worker as an explanatory variable in the probit equation when this variable was also the dependent variable in the reduced-form regressions and estimate the model allowing for sample selectivity. Maddala (1986) shows that an identification problem ensues to make estimation impossible.

21 Variable definitions and the sample means of all varables are presented in Appendices B and C, respectively.

Table 1

Unemployment and Wage Experiences of Occupational and Industrial Movers and Stayers[1]

	Occupation		Industry	
	Stayers[2]	Movers[3]	Stayers[4]	Movers[5]
Average Weeks[6]	8.84	9.28	8.55	9.39
Average Wage1[7]	925.48	763.15	921.08	776.71
Average Wage2[8]	937.89	729.63	898.80	763.89
Average Wage Gain[9]	12.41	-33.52	-22.28	-12.82

1/ Based on total sample of 1829 workers
2/ 698 workers who get job 2 in the pre-unemployment occupation
3/ 1131 workers who get job 2 in a different occupation to job 1
4/ 613 workers who get job2 in the pre-unemployment industry
5/ 1216 workers who get job 2 in a different industry to job 1
6/ Average completed weeks of unemployment between job1 and job2.
7/ Average hourly wage rate (in cents) in pre-unemployment job (job 1)
8/ Average hourly starting wage rate in post-unemployment job (job 2)
9/ Average change in the hourly wage rate (in cents) between job1 and job2.

Notice that both occupation and industry stayers receive higher pre- and post- unemployment wages than their moving counterparts[22]. In addition, occupation stayers obtain an average wage increase of $0.12 per hour, while occupation movers take a wage cut of $0.33 per hour on average. Both industry movers and stayers take wage cuts on average with stayers taking the largest cuts of $0.22 per hour. Interestingly, among both groups, movers have the longest spells on average[23]. This is consistent with the possibility that workers search according to the NTSM but that few sector B jobs exceed the reservation wage until the reservation wage falls as workers become more desperate with time for any job. Alternatively, workers may be searching according to the TSM, and observed movers are "failed stayers" who endured relatively long spells fruitlessly searching A before switching into sector B.

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[22] In all four cases the difference between wage1 and wage2 for movers and stayers is significant at the 1% level.

[23] This difference is significant for industry movers at the 5% level. Both occupation and industry stayers also have significantly higher levels of pre-unemployment tenure at the 5% level.

3.3 The Probit Results

Table 2 presents the results of our probit estimates for both inter-occupational and inter-industrial transitions. Recall that both the NTSM and the TSM imply that the expected offer wage in A should have a negative effect on the probability of moving sectors, while that from B should have a positive effect. Both models also imply that the duration of unemployment should have a positive effect on this probability.

Equations 1 and 2 present the results from the occupation mover/stayer probit. In equation 2 duration is excluded from the model but this barely changes any of the other coefficients. As predicted, both the pre-unemployment wage (Wage1) which proxies the expected offer wage in A, and the duration of the unemployment spell (Durn) have negative and positive effects respectively on the probability of a worker moving occupation. Tenure in the pre-unemployment job (Ten/10) has a negative effect on this outcome[24]. If this variable is negatively correlated with the unobserved expected offer wage in B, then this implies that workers who expect higher wages in B are more likely to be occupation movers which is also consistent with both models[25].

Notice also that occupational groups such as managers, who have skills which are relatively transferable across occupations are significantly more likely to be observed as movers, as theory would predict. Where one would believe skills are relatively non-transferable, such as for construction workers, the converse obtains[26]. Older workers are also far less likely to change occupations, presumably for the same reason.

Equations 3 and 4 show the corresponding results for the inter-industry move/stay outcome. Again the effects of pre-unemployment wage and unemployment duration are consistent with the theory. The effects of tenure on the

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24 All three effects are significant at conventional levels.

25 All the probit models presented are tested for non-normality using LM tests based on the formulation suggested by Davidson and MacKinnon (1984). The test for non-normality is analagous to the standard Reset test and is distributed as $\chi^2(2)$ under the null (Thomas 1990b). The results are shown at the bottom of Table 2.

26 The default occupational group are operatives.

pre-unemployment job and tenure squared are quite small and insignificant[27].

Given these inter-occupation and industry estimates, a more revealing assessment of the effect of the central explanatory variables on the likelihood of a standard person moving occupation or industry is shown in Table 3. A standard person is taken as a married male between 20-34 with a high school education who is the head of household in a family of three (to the nearest integer) living in Manitoba, Alberta or Saskatchewan. He works in the transportation industry in a clerical or services position for 87.212 weeks before becoming unemployed[28]. He is not a union member in this job and his hourly wage was 825.10 cents. He receives UI benefits during 1986 and his completed unemployment spell was 9.11 weeks. Given the estimates from equations 1 and 3 in Table 2 the probability this individual switches occupation or industry is 0.72 and 0.67, respectively. Notice that the effect of duration on the probability of moving actually starts to fall for workers with relatively long spells. This may reflect the search outcomes of those workers who "hold out" for a job in A. Pre-unemployment wages have a larger effect on movement between industries than occupations, while in both cases the effect of tenure is quite dramatic. A worker with 20 years tenure in the pre-unemployment job is more than 20% (14%) more likely to move occupation (industry) than the standard person. As expected the effects of pre-unemployment occupational status are striking: construction workers are 46% less likely to switch occupations than managers. Although tenure has the "wrong" sign in the probit equations, workers with sufficiently long tenure are still less likely to move industry due to the negative effect of tenure squared, as predicted.

4. The Competing-Risks Approach

In this section of the paper we examine the implications of the NTSM and

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[27] Preliminary results in models where the dependent variable is 1 if the worker moves industry and occupation are similar to those in equations 1 and 2. For workers who move occupation but stay in the same industry, wage1, duration and tenure have insignificant positive, positive and negative effects, respectively. For workers who move industry but stay in the same occupation these effects are positive, positive and positive (significant) respectively. Obviously in moving such workers are not forfeiting any sector specific skills. These results are available upon request and a full analysis is left for future work.

[28] Tenure squared and duration squared are 38530 and 154.2 respectively for the standard person.

the TSM using a competing-risk hazard model. Such models have been found useful in examining the role of the route of re-employment of the individual in accounting for unemployment differences, and in particular the differing effects that various covariates can have on the hazards of unemployment exit via alternative routes. Katz (1986), Katz and Meyer (1990), and Han and Hausman (1989) examine recall to the previous job and the taking of a new job as alternative routes by which a laid off worker can become re-employed. They find that tenure in the pre-layoff job has a positive effect on the recall hazard, but a negative effect on the new job hazard. Also there is a sharp downward trend in the recall hazard, while the new job hazard rises, as suggested by standard search theory[29].

We present semiparametric estimates of the single-risk hazard from unemployment to employment and competing-risk hazards into A and B for inter-occupation and inter-industry transitions. We use the semiparametric estimation procedure developed by Meyer (1988, 1990) which allows the estimation of the baseline hazard non-parametrically for each individual week of unemployment in the sample[30]. The approach developed by Meyer allows for both parametric and non-parametric specifications of the distribution for unobservables, although, as is typical in the literature, the gamma distribution is employed here[31]. Table 4 shows the empirical Kaplan-Meier hazards for the single-and competing-risk hazards of occupation movers and stayers based on the unemployment spells censored at 39 weeks. These competing-risk hazards are depicted in figure 1. Notice that apart from weeks 7, 29, 32, 34 and 36-38, the hazard for movers dominates that for stayers, and each hazard has a slightly upward trend over the spell[32]. Figure 2 shows the

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[29] Katz and Meyer (1990) also find that pre-layoff wage has a negative effect on the recall hazard. This suggests that it may be pre-layoff tenure which truly captures the quality of a match from the employer's point of view. The pre-layoff wage has a positive effect on the new job hazard. Both effects are insignificant.

[30] The estimator is based on Cox's proportional hazards model. Han and Hausman (1990) develop a similar, though differently motivated, approach.

[31] Estimates from a Weibull specification of the baseline hazard are similar to those presented and are available upon request. The estimated σ^2 in the results below is the estimated variance of this gamma distributed heterogeneity. See Meyer (1990) for further details.

[32] The sparseness of spells above 20 weeks makes it difficult to estimate semiparametrically precisely the baseline hazards for such spells. Therefore, the estimated hazards are based on spells censored at 21 weeks. Less

corresponding single-risk hazard out of unemployment.

4.1 The Competing-Risks Results

The single-risk, and occupational/industrial competing-risk estimates are presented in Table 5. Our main interest is in the effect of the expected offer wages on the competing risk hazards for stayers and movers. Recall that both models predict that the expected offer wage from A should have a positive effect on the staying hazard and negative effect on the moving hazard. Both models also imply that the expected offer wage from B should have a positive effect on the hazard into B (i.e. a negative effect of tenure). However, a positive effect of this wage on the staying hazard (i.e. a negative effect of tenure) while consistent with the TSM, is inconsistent with the NTSM.

Equation 1 shows the single-risk or total hazard estimates from unemployment to employment which do not distinguish between the routes of re-employment. Equations 2 and 3 show the estimates for the inter-occupation stayers and movers respectively while equations 4 and 5 show the results for the corresponding inter-industry hazards.

Consider first the estimates for occupational stayers. Both the pre-unemployment wage and tenure have positive effects on their conditional escape rate. The former finding is of course consistent with the NTSM and the TSM. Given that tenure is an appropriate inverse proxy for expected offer wage in another occupation, the second finding implies a negative relationship between this wage and the hazard for stayers which also follows from both theoretical models. Indeed, tenure in the pre-unemployment job is likely to be positively correlated with the probability of a job offer from a firm in the pre-unemployment sector and negatively correlated with the probability of a job offer from a firm in sector B. Thomas (1990a) shows that under both the NTSM and TSM, an increase in the job offer probability from A has an ambiguous effect on the hazard into A, while an increase in the job offer probability from B has a negative effect on the hazard into A under the NTSM, but an ambiguous effect under the TSM. With this interpretation the positive effect of tenure is again consistent with both models.

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restrictive censorings and corresponding Weibull estimates on uncensored data did not change any of the effects of the explanatory variables. Katz and Meyer (1990) adopt a similar approach. To save space we do not present the Kaplan-Meier industry mover/stayer hazards. These follow the same pattern as those in table 4.

In sharp contrast, the pre-unemployment wage and tenure have significantly negative effects on the hazard for occupational movers (equation 3).[33] Again, if we believe that pre-unemployment tenure has a positive effect on the job offer probability from A and a negative effect on that from B, then this result is consistent with both of the multi-sector search theories.

Looking at the inter-industry hazards we see that the results with respect to the pre-unemployment wage and tenure mimic those of their inter-occupational counterparts although less conclusively. Both sets of estimates suggest that the degree of sectoral portability of a worker's skills varies greatly with the occupation. For instance, notice that managers and construction workers have relatively shorter and longer unemployment spells, respectively, conditional on changing occupations compared to the default group of operatives. Recalling the results from our probit regressions, it is clear that not only are construction workers less likely to be observed as movers, but conditional on moving they have long spells of unemployment. Skill portability may also explain the different unemployment experiences of older workers conditional on moving or staying, since the single-risk result of older workers having relatively longer spells of unemployment is driven by their relatively long spells conditional on switching industry or occupation.

From our competing-risk results, it is possible to compute the weekly probability that a standard person in the sample will leave unemployment as a mover or a stayer conditional on the spell of joblessness. This is simply the estimated hazard of either moving or staying divided by the sum of both competing-risk hazards. Table 6 presents the effects of pre-unemployment wage, tenure, and occupational status on the average weekly probability of a standard worker leaving unemployment as an occupation mover and stayer. Each week the standard worker is almost 1.8 times more likely to leave unemployment as an occupation stayer rather than a mover. However, workers with 20 years tenure on the pre-unemployment job are almost four times more likely to exit as stayers. The effects of pre-unemployment wage are relatively small: those who earned $20 per hour are only about 6% more likely to leave as a stayer than those who earned $5 per hour. Construction workers are three times more

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33 The estimation program had difficulty converging in estimating the hazard for occupational movers with gamma heterogeneity because the likelihood function was very flat in the region of the maximum. Hence the non-heterogeneity "corrected" estimates are presented.

likely to leave as stayers, a figure which is reversed for managers. Together with our probit results, these findings indicate that many workers who have relatively more sector A specific skills who leave unemployment as stayers have quite short spells, but a substantial fraction who leave as movers have relatively low hazard rates. Whether this finding is due to "choice" (they are failed stayers) or "chance" (they have low job offer probabilities) cannot be determined from our reduced form analysis.

Finally, note that the effects of both tenure and pre-unemployment wage on the total hazard into employment are numerically small and insignificant[34]. Not only are the theories of multi-sector search which underlie this analysis strongly supported, but they also provide convincing explanations for a common empirical finding that the pre-unemployment wage has a negative effect on the single-risk hazard into employment[35] [36]. However, our results are inconclusive as to the relative empirical validity of the two models.

5 Conclusions

This paper develops and tests theories of multi-sector search. We derive the empirical implications that follow from employing a "non-targetted" search strategy where a worker searches across the whole labour market for "a job", as well as those that follow from "targetted" job search in which workers focus their search exclusively upon a single sector at any point in time. Empirically, this paper seeks to explain the job search outcomes of workers displaced from a high wage/low job offer probability sector.

Using a sample drawn from the 1986 wave of the Labour Market Activity Survey for Canada, our estimates for inter-occupation and inter-industry job transitions are consistent with the common implications of both models and suggest that expected wages in a worker's pre-unemployment sector, as well as

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34 The likelihood ratio test statistics of the single-risk against the occupational and industrial competing-risk hazards are 1888.1524 and 2067.611 with 53 and 54 degrees of freedom respectively, providing conclusive evidence that the competing-risk hazards fit the data better.

35 Wolpin (1987) finds similar results when simulating the effect of an increase in the mean offer wage on the hazard of school-leavers into their first job.

36 The semi-parametric baseline hazards also imply that the hazards trend upwards non-monotonically over the spell. To get some idea of this trend note the corresponding weibull estimates imply that the total, occupation stayer and occupation mover hazards rise with asymptotic t-statistics of 4.5, 1.5and 3.7 respectively.

those in the alternative sector, play a substantial role in accounting for differences in the unemployment experiences of workers. Although in principle it is possible to test between the NTSM and the TSM, our results do not allow us to distinguish their relative empirical validity.

The ability to test between the models is hampered by the inability to obtain good measures of the expected offer wage from the alternative sector. We tried taking samples of workers from the primary/manufacturing (p/m) sector and imputing expected service sector offer wages using the parameters from a wage equation estimated from workers in the service sector. This wage was then used as a regressor in the competing risk hazards for movers and stayers from the p/m to the service sector. We also ran standard (log) wage regressions to try to identify separately the wage returns to general skills (e.g. education) and sector specific skills (tenure, occupaton/industry affiliation). While the results were consistent with the analysis here, both approaches were abandoned due to insufficient variation in the components; conclusive results required substantially larger sample sizes. Using predicted (log) wage instead of pre-unemployment wage did not change the results, and interacting either wage with occupational dummies showed that high wage construction workers (high wage blue collar workers in general) were less likely to move than high wage managers (white collar workers) as suggested by tables 2 and 3.

Still, the common implications of both models are borne out by the data and provide strong support for our underlying sectoral view of the labour market. The results strongly support the multi-sector, competing-risks formuation over the standard "single-sector" search model. The analysis also enables us to re-interpret previous single-sector analyses of unemployment durations that have found differing implications for the effects of the pre-unemployment wage on the hazard from unemployment into employment. One simple reason could be the relative proportions of movers and stayers in the sample[37].

Finally, our results suggest that recent structural search models that simulate the effects of shifts in the wage offer distribution and changes in the job offer probability on the expected duration of unemployment (Wolpin, 1987; Gonul, 1989) may provide deeper insights if generalized to allow for sectoral moving and staying behaviour. This is an area for future research.

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[37] Note from Table 5 that the negative effect of pre-unemployment wage on the single-risk hazard is driven by its negative effect on the hazards of movers. In a sample with a low proportion of movers, this result could be reversed.

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Table 2

Probit Regressions for Occupational and Industrial Mover/Stayer Outcome

(Standard Errors in Parentheses)

Dep Var : Dummy for worker being a Mover/Stayer (1=Mover)

	Move Occupation		Move Industry	
	(1)	(2)	(3)	(4)
Intercept	1.3163**	1.3963**	1.0788**	1.1417**
	(0.2795)	(0.2770)	(0.2850)	(0.2824)
Durn	0.02088*	-	0.01584	-
	(0.01027)		(0.01029)	
Durn2/100	-0.04627	-	-0.02266	-
	(0.02979)		(0.02995)	
Wage1	-0.00009*	-0.00009*	-0.00032**	-0.00032**
	(0.00003)	(0.00004)	(0.00009)	(0.00009)
Ten/10	-0.00876*	-0.00887*	0.00172	0.00177
	(0.00387)	(0.00386)	(0.00399)	(0.00400)
Ten2/100	0.00002	0.00003	-0.00005	-0.00005
	(0.00003)	(0.00004)	(0.00004)	(0.00004)
Marrd	-0.09977	-0.10450	0.01931	0.01321
	(0.07312)	(0.07299)	(0.07353)	(0.07342)
Fem	-0.33768**	-0.34809**	-0.36121**	-0.36708**
	(0.08588)	(0.08564)	(0.08689)	(0.08664)
Famsze	-0.06506+	-0.06447*	-0.02679	-0.02599
	(0.03455)	(0.03452)	(0.03450)	(0.03447)
Head	-0.25844**	-0.26265**	-0.15998*	-0.16167*
	(0.07908)	(0.07894)	(0.07947)	(0.07933)
UI	-0.09079	-0.06581	-0.00479	0.02501
	(0.07172)	(0.07054)	(0.07191)	(0.07065)
Union	-0.18606*	-0.17996*	-0.05268	-0.45886
	(0.08247)	(0.08232)	(0.08752)	(0.08739)
Age Dummies				
20-34	-0.08634	-0.07866	-0.36805**	-0.35584**
	(0.12667)	(0.12663)	(0.07947)	(0.13184)

Table 2 (cont)

35-44	-0.00413	-0.02333	-0.33534*	-0.32953*
	(0.14990)	(0.14979)	(0.15495)	(0.15457)
45-69	-0.50176**	-0.48030**	-0.51620**	-0.49337**
	(0.16012)	(0.15980)	(0.16532)	(0.16468)
Education Dummies				
High	-0.10098	-0.09550	-0.02803	-0.02535
	(0.10759)	(0.10726)	(0.10846)	(0.10815)
Spsec	-0.18674	-0.18993	0.06990	0.06945
	(0.14954)	(0.14993)	(0.15216)	(0.15214)
Psecq	-0.35544**	-0.36215**	-0.06678	0.05793
	(0.13687)	(0.13666)	(0.13869)	(0.13841)
Univ	-0.39421*	-0.38845*	0.00189	-0.00122
	(0.18172)	(0.18114)	(0.18228)	(0.18178)
Regional Dummies				
Atla	-0.00110	-0.01487	0.17940+	0.19710*
	(0.09927)	(0.09887)	(0.10079)	(0.10036)
Queb	-0.09965	-0.10282	0.02545	0.02348
	(0.11180)	(0.11158)	(0.11249)	(0.11226)
MSasAl	-0.01980	-0.01041	0.00577	0.01828
	(0.09463)	(0.09444)	(0.09479)	(0.09455)
BC	-0.17788	-0.16311	-0.22378+	-0.20136+
	(0.12114)	(0.12062)	(0.12083	(0.12025)
Industry Dummies				
Ming	-0.04627	-0.02458	0.38753+	0.40749+
	(0.20461)	(0.20433)	(0.20920)	(0.20896)
Dbles	0.29279	0.28109	0.95088**	0.96382**
	(0.18899)	(0.18878)	(0.23655)	(0.23562)
Ndbles	0.20431	0.21504	0.50160*	0.48512*
	(0.21732)	(0.21619)	(0.19475)	(0.19411)
Trans	0.02316	0.01817	0.23177	0.22193
	(0.17369)	(0.17358)	(0.17625)	(0.17580)
Trade	-0.00853	-0.01048	0.12845	0.12583
	(0.17871)	(0.17856)	(0.17998)	(0.17953)

Table 2 (cont)

Fincl	-0.10917	-0.10395	0.40071^{+}	0.39990^{+}
	(0.20933)	(0.20904)	(0.21208)	(0.21156)
Publ	0.16505	0.17326	0.46060*	0.46562*
	(0.18066)	(0.18039)	(0.18365)	(0.18321)
Othserv	-0.25392	-0.25615	0.14620	0.14211
	(0.18056)	(0.18036)	(0.18295)	(0.18242)
Occupation dummies				
Mang	1.1145**	1.1429**	0.13995	0.15823
	(0.2398)	(0.2404)	(0.20622)	(0.20667)
Prf/Tch	-0.08216	-0.07032*	-0.44818*	-0.43394*
	(0.16744)	(0.16693)	(0.16948)	(0.16917)
Cler	0.10979	0.12444	-0.09385	-0.08537
	(0.13464)	(0.13423)	(0.13629)	(0.13612)
Prim	-0.16896	-0.16627	-0.09039	-0.09699
	(0.16979)	(0.16949)	(0.17560)	(0.17535)
Crft	-0.25090^{+}	-0.23403	-0.08332	-0.07463
	(0.14980)	(0.14935)	(0.15523)	(0.15502)
Constr	-0.52854**	-0.52147**	-0.21451^{+}	-0.21395^{+}
	(0.12480)	(0.12449)	(0.12917)	(0.12905)
LogL	-1112.3	-1114.8	-1099.0	-1101.8
LogL(Constant)[1]	-1216.0	-1216.0	-1166.5	-1166.5
Zero Slopes test[2]	207.498**	202.460**	135.007**	129.419
LM Normality Test[3]	4.6214	3.7956	0.3578	0.9221
Sample Size	1829	1829	1829	1829

+ Significant at 10% level.
* Significant at 5% level.
** Significant at 1% level.
1/Log-likelihood when the constant is the only explanatory variable. 2/ LR test of the explanatory power of the covariates. Equivalent to the standard F-test in the linear model where the null is that all the covariates (except the constant) have a zero coefficient. Test has 36,34,36 and 34 df in (1),(2),(3) and (4) respectively. 3/ Test is distributed as Chi-Squared with 2 degrees of freedom under the null.

Table 3

Predicted Probabilities of Moving Occupation or Industry

Characteristics	Occupation	Industry
Standard Person	0.7175	0.6665
Duration of Spell		
1 Week	0.6832	0.6318
4 Weeks	0.7028	0.6483
8 Weeks	0.7237	0.6676
16 Weeks	0.7494	0.6927
32 Weeks	0.7433	0.7244
40 Weeks	0.7108	0.7232
Wage1		
500 Cents	0.7274	0.7033
600 Cents	0.7244	0.6923
1000 Cents	0.7120	0.6461
1400 Cents	0.6995	0.5976
1800 Cents	0.6867	0.5476
2000 Cents	0.6802	0.5222
Tenure		
26 weeks	0.7321	0.6698
260 weeks	0.6670	0.6720
520 weeks	0.6013	0.6502
1040 weeks	0.5047	0.5233
Occupation		
Manager	0.9430	0.7467
Construction	0.4750	0.6216

Table 4

Kaplan-Meier Single-and Competing Risk Empirical Hazards for Inter-Occupation Transitions

Weeks Unemployed	Risk Set	Number of Spells that End: Total	Stayers	Movers	Empirical Hazards: Total	Stayers	Movers
1	1829	138	57	81	0.0755	0.0312	0.0443
2	1691	278	111	167	0.1644	0.0656	0.0988
3	1413	132	59	73	0.0934	0.0417	0.0517
4	1281	237	84	153	0.1850	0.0646	0.1194
5	1044	48	22	26	0.0460	0.0211	0.0249
6	996	114	42	72	0.1145	0.0422	0.0723
7	882	40	22	18	0.0454	0.0250	0.0204
8	842	150	52	98	0.1781	0.0618	0.1165
9	692	35	13	22	0.0506	0.0188	0.0318
10	657	72	24	48	0.1096	0.0365	0.0731
11	585	38	8	30	0.0650	0.0137	0.0513
12	547	97	39	58	0.1773	0.0713	0.1060
13	450	34	14	20	0.0755	0.0311	0.0444
14	416	42	15	27	0.1010	0.0361	0.0649
15	374	30	14	16	0.0802	0.0374	0.0428
16	344	48	18	30	0.1395	0.0523	0.0872
17	296	19	8	11	0.0642	0.0270	0.0372
18	277	23	8	15	0.0830	0.0289	0.0541
19	254	16	5	11	0.0630	0.0197	0.0433
20	238	52	21	31	0.2185	0.0882	0.1303
21	186	9	3	6	0.0484	0.0161	0.0323
22	177	21	3	18	0.1186	0.0169	0.1017
23	156	8	3	5	0.0513	0.0192	0.0321
24	148	27	7	20	0.1824	0.0473	0.1351
25	121	12	3	9	0.0992	0.0248	0.0744
26	109	16	4	12	0.1468	0.0367	0.1101
27	93	11	4	7	0.1183	0.0430	0.0753

Table 4 (cont)

28	82	12	3	9	0.1463	0.0366	0.1097
29	70	6	4	2	0.0857	0.0571	0.0286
30	64	11	5	6	0.1719	0.0781	0.0938
31	53	2	0	2	0.0377	0.0000	0.0377
32	51	13	7	6	0.2549	0.1373	0.1176
33	38	5	0	5	0.1316	0.0000	0.1316
34	33	5	5	0	0.1515	0.1515	0.0000
35	27	2	0	2	0.0741	0.0000	0.0741
36	25	4	2	2	0.1600	0.0800	0.0800
37	21	2	1	1	0.0952	0.0476	0.0476
38	19	4	2	2	0.2105	0.1052	0.1052
39	15	1	0	1	0.0667	0.0000	0.0667

Table 5

Single and Competing-Risk Semiparametric Hazards[1]

	(1)	(2)	(3)	(4)	(5)
		Occupation		Industry	
Variable	Total	Stayers	Movers	Stayers	Movers
Wage1	-0.00003	0.00015**	-0.00011**	0.00013	-0.00027*
	(0.00009)	(0.00005)	(0.00004)	(0.00010)	(0.00013)
Ten/10	-0.00052	0.00521*	-0.00654**	0.00539	-0.00296
	(0.00227)	(0.00250)	(0.00246)	(0.00345)	(0.00259)
Marrd	0.16026+	0.24929*	0.09618	0.12911	0.21845*
	(0.09238)	(0.11699)	(0.07774)	(0.14985)	(0.09810)
Fem	0.18634+	0.58695**	-0.08760	0.66700**	-0.10882
	(0.10635)	(0.14994)	(0.08299)	(0.18728)	(0.10929)
Famsze	-0.01126	0.05209	-0.05102	-0.00750	-0.02164
	(0.04270)	(0.05436)	(0.03565)	(0.07148)	(0.04379)
Head	0.08630	0.33084**	-0.10505	0.23314	0.00022
	(0.09987)	(0.12523)	(0.08219)	(0.16411)	(0.10197)
UI	-0.62289**	-0.47713**	-0.41242**	-0.79183**	-0.47760**
	(0.10258)	(0.12170)	(0.06898)	(0.16427)	(0.10498)
Union	-0.15283	-0.04783	-0.12693	-0.03851	-0.10279
	(0.10773)	(0.12690)	(0.09249)	(0.17603)	(0.11236)
Age Dummies					
20-34	-0.20295	-0.02441	-0.22611+	0.32734	-0.37658*
	(0.15641)	(0.21244)	(0.11666)	(0.27003)	(0.15753)
35-44	-0.12085	0.03676	-0.12083	0.46371	-0.29243
	(0.18156)	(0.24409)	(0.14451)	(0.31759)	(0.18895)
45-69	-0.48211*	0.17368	-0.66660**	0.30592	-0.70789**
	(0.20773)	(0.25926)	(0.17124)	(0.34152)	(0.21666)
Education Dummies					
High	-0.02554	0.08658	0.00006	0.02875	0.03746
	(0.12594)	(0.16342)	(0.11097)	(0.22394)	(0.13047)

Table 5 (cont)

Spsec	0.13989	0.30962	0.04232	-0.04183	0.25849
	(0.17919)	(0.22610)	(0.15435)	(0.31369)	(0.18382)
Psecq	0.16981	0.53277*	-0.01612	0.23770	0.22632
	(0.16675)	(0.21017)	(0.14699)	(0.28627)	(0.17121)
Univ	0.08014	0.70386*	-0.07989	0.12602	0.22176
	(0.23352)	(0.39166)	(0.19533)	(0.39880)	(0.23404)
Regional Dummies					
Atla	-0.39378**	-0.38276*	-0.23019*	-0.72865**	-0.20648
	(0.12834)	(0.15687)	(0.10025)	(0.22337)	(0.12595)
Queb	0.02594	0.08321	-0.08593	0.01841	0.01692
	(0.13917)	(0.16799)	(0.11487)	(0.22587)	(0.14368)
MSasAl	-0.24888*	-0.29593*	-0.13523	-0.39374*	-0.15530
	(0.11939)	(0.14919)	(0.09444)	(0.20065)	(0.11942)
BC	-0.45919**	-0.23253	-0.40577**	-0.13860	-0.56372**
	(0.15719)	(0.18248)	(0.13439)	(0.24226)	(0.17472)
Industry Dummies					
Ming	-0.52197*	-0.29816	-0.39806+	-1.01357*	-0.13671
	(0.26016)	(0.32532)	(0.21860)	(0.43403)	(0.26905)
Dbles	-0.48087+	-0.42730	-0.25834	-1.88810**	0.11128
	(0.27402)	(0.35936)	(0.22366)	(0.56179)	(0.26786)
Ndbles	0.25025	-0.01988	0.19232	-0.38930	0.44465+
	(0.23216)	(0.29956)	(0.18039)	(0.41935)	(0.23992)
Trans	0.10244	0.22399	0.00243	-0.12611	0.23885
	(0.21056)	(0.27994)	(0.16660)	(0.38499)	(0.21675)
Trade	-0.01795	0.03670	-0.05765	-0.32805	0.10236
	(0.21842)	(0.29029)	(0.17077)	(0.40491)	(0.22086)
Fincl	-0.16351	0.19187	-0.14364	-0.65258	0.14630
	(0.26349)	(0.33875)	(0.21393)	(0.46692)	(0.26793)
Publ	-0.26813	-0.20251	-0.18075	-1.06886*	0.08569
	(0.21965)	(0.29449)	(0.17230)	(0.44005)	(0.21789)
Othserv	0.03142	0.42588	-0.20605	-0.19709	0.04856
	(0.22099)	(0.29345)	(0.17506)	(0.40838)	(0.22526)

Table 5 (cont)

Occupation dummies					
Mang	-0.36827	-2.22078**	0.36611*	-0.76166	-0.07587
	(0.24710)	(0.55937)	(0.18011)	(0.47744)	(0.23579)
Prf/Tch	-0.30884	-0.36227+	-0.13838	0.45572	-0.54351*
	(0.20782)	(0.26673)	(0.17536)	(0.36603)	(0.22036)
Cler	-0.19439	-0.47017*	0.02534	0.00470	-0.18707
	(0.15899)	(0.22253)	(0.12741)	(0.29088)	(0.15870)
Prim	0.04588	0.18727	0.06751	0.26632	0.05877
	(0.20342)	(0.27741)	(0.15883)	(0.39219)	(0.20075)
Crft	-0.28514	0.00952	-0.21487	0.08194	-0.23967
	(0.18539)	(0.23386)	(0.15527)	(0.33021)	(0.18216)
Constr	-0.05090	0.38241+	-0.30181*	0.42825	-0.19625
	(0.15028)	(0.19488)	(0.12976)	(0.28316)	(0.14884)
σ^2	0.77302**	0.57466	-	1.86228**	0.51477+
	(0.23460)	(0.40163)		(0.69502)	(0.29368)
LogL	-4932.2751	-2442.2054	-3434.1459	-2230.0635	-3636.0171
Sample size	1829	698	1131	613	1216

1/ Individual baseline hazard parameters are estimated for weeks 1 to 20. Spells longer than 20 weeks are censored at 21.

+,*,** see notes to Table 2

Table 6

Average Weekly Probability of Leaving Unemployment as an Occupation Mover/Stayer

Characteristics	Mover	Stayer
Standard Person	0.3623	0.6377
Wage1		
500 Cents	0.3756	0.6244
600 Cents	0.3715	0.6285
1000 Cents	0.3553	0.6447
1400 Cents	0.3396	0.6604
1800 Cents	0.3245	0.6755
2000 Cents	0.3172	0.6828
Tenure		
26 weeks	0.3741	0.6359
260 weeks	0.3302	0.6698
520 weeks	0.2851	0.7149
1040 weeks	0.2083	0.7917
Occupation		
Manager	0.7450	0.2550
Construction	0.2325	0.7675

Appendix A

Proof of Proposition 1

Given the assumed wage offer densities from A and B we can write $q_t^b=(\underline{w}/w_t^*)^{\alpha_b}$ and $q_t^a=((\underline{w}+d)/w_t^*)^{\alpha_a}$. Define $R = q_t^a/q_t^b$. If $\partial R/\partial w_t^*<0$, then as the unemployment spell continues and the reservation wage falls the worker is more likely to enter B. Since the reservation wage can lie in two regions (i) $\underline{w}\le w_t^*\le\underline{w}+d$ and (ii) $\underline{w}+d<w_t^*<\infty$, we must show that $\partial R/\partial w_t^*<0$ holds in both cases.

Case (i). In this case $q_t^a = (\underline{w}+d/w_t^*)^{\alpha_a} = 1$ and $\partial R/\partial w_t^* = \partial q_t^b/\partial w_t^*$ which is negative by inspection. *Case (ii)* $\partial R/\partial w_t^* = (\alpha_a-\alpha_b)(\underline{w})^{\alpha_b}(\underline{w}+d)^{-\alpha_a}(w_t^*)^{\alpha_a-\alpha_b-1}< 0$, since $\alpha_a<\alpha_b$.

Proof of Proposition 5

Consider first the case where worker 1 expects a higher offer wage from A than worker 2. From proposition 3, although he or she sets a higher reservation wage, worker 1 is more likely to accept a given wage offer from A and less likely to accept a given offer from B compared to worker 2. It also follows from proposition 1 that (for the same unemployment spell length) worker 1 is less likely to leave via B.

Now consider the case where worker 1 expects a higher offer wage from B. Worker 1 sets a higher reservation wage but is more likely to accept a given wage offer from B and less likely to accept a given offer from A. However, although worker 1 sets a higher reservation wage it can be shown that he or she is still more likely to leave unemployment via B given that the increase in the reservation wage is less than the translation. Denote the translation in the density of wage offers from B as z. The acceptance probability of offers from B can be written as $[\underline{w}/(w_t^*(z)-z)]^{\alpha_b}$. Therefore, conditional on z, the ratio of the probability of accepting a job from B to that from A, R(z), for worker 1 can be written as

$$R(z) = q_t^a(z)/q_t^b(z)= [\underline{w}/(w_t^*(z)-z)]^{\alpha_b}/[(\underline{w}+d)/w_t^*(z)]^{\alpha_a}.$$

This can be rewritten as

$$R(z) = [(\underline{w})^{\alpha_b}/(\underline{w}+d)^{\alpha_a}](w_t^*(z))^{\alpha_a}(w_t^*(z)-z)^{-\alpha_b}.$$

Differentiating R(z) with respect to z and using the fact that $\partial w_t^*(z)/\partial z<1$ we see that $\partial R(z)/\partial z>0$. Therefore even though a shift to the right in the wage offer density from B increases the reservation wage the worker is still more likely to leave via sector B.

Proof of Proposition 6

We can write

$$V_t^a - V_t^b = (p^a q_t^a/r)(w_{et}^a - w_t^*) - (p^b q_t^b/r)(w_{et}^b - w_t^*) \tag{A1}$$

Now if $w_{et}^a > w_{et}^b$, then a necessary condition for a worker to switch sectors of search is $(p^a q_t^a/r) < (p^b q_t^b/r)$. However, since $q_t^a > q_t^b$, this cannot hold if $p^a \geq p^b$, so the worker prefers to search in A throughout the unemployment spell.

(ii) We know there exists a $\bar{T}$ such that for $t \geq \bar{T}$, $p^a/p^b < q_t^b/q_t^a$. We then need to ensure that $\partial(V_t^a - V_t^b)/\partial w_t^* > 0$ around 0 so that the worker only switches sectors once. Substitute for $q_t^b = (\underline{w}/w_t^*)^{\alpha_b}$ and $q_t^a = ((\underline{w}+d)/w_t^*)^{\alpha_a}$, as well as $w_{et}^i = \alpha_i w_t^*/(\alpha_i - 1)$, $i = a,b$ into (A1), multiply by r and rearrange to obtain:

$$w_t^* \left[p^a((\underline{w}+d)/w_t^*)^{\alpha_a}/(\alpha_a - 1) - p^b(\underline{w}/w_t^*)^{\alpha_b}/(\alpha_b - 1) \right]. \tag{A2}$$

Differentiating (A2) with respect to w_t^* and simplifying yields

$$-p^a(\underline{w}+d)^{\alpha_a}/(w_t^*)^{\alpha_a+1}\alpha_a/(\alpha_a - 1) \quad + \quad p^b(\underline{w})^{\alpha_b}/(w_t^*)^{\alpha_b+1}(\alpha_b/(\alpha_b - 1) \quad > \quad 0, \tag{A3}$$

since $\alpha_b > \alpha_a$.

Proof of Proposition 9

(i) From proposition 7, worker 1 searches unsuccessfully for a shorter period in A than worker 2. Therefore worker 1 has a lower probability of finding a match in A relative to worker 2. However, this effect only operates for $T_1 \leq t \leq T_2$ (the time that worker 1 is searching B while worker is still searching A). Consider the time that both workers are simulataneously searching A ($t < T_1$). Worker 1 sets a higher reservation wage than worker 2 since he or she expects a higher paying job in B (if forced to switch), and so is more choosy about the jobs he or she will accept in A.[38] Therefore worker 1 has a lower hazard out of unemployment via A. Both effects then reinforce each other. Worker 1 is less likely to escape via A and also searches this sector for a shorter period before switching into B.

(ii) Worker 2 searches unsuccessfully A for a longer period than worker 1. Therefore, worker 2 may leave as a stayer with a longer accumulated spell of unemployment then worker 1. However, while both workers are searching in A, worker 1 is less likely to leave unemployent since he or she sets the higher reservation wage. Therefore if both workers leave unemployment before $t=T_1$,

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[38] Consider the time period just before worker 1 would switch into B. Clearly the value of search next period (in B) for worker 1 exceeds that for worker 2 (in A). Backward induction shows that worker 1 also sets a higher reservation wage than worker 2 while searching in A.

then worker 2 should have the shorter spell. However, if worker 2 leaves after $t=T_1$, worker 2 will have the longer spell. Hence the outcome is indeterminate.

(c) Worker 1 is prepared to search for a shorter period in A before searching B than worker 2. Therefore, worker 1 may search B while worker 2 still searches unsuccessfully in A and accumulating unemployment before (certainly) switching into B. It follows that if both leave as movers then worker 1 should have the shortest unemployment spell. Further, as both search B, worker 1 is more likely to leave unemployment because the higher reservation wage set by worker 1 is more than offset by the higher expected offer wage. Hence worker 1 has the higher hazard out of unemployment via B.

Appendix B

This appendix describes the variables used in the empirical analysis.

Durn	Duration of unemployment between job1 and job2 (in weeks).
Wage1	Hourly wage rate (in cents) of the pre-unemployment job.
Marrd	Dummy Variable: 1 if worker is married; 0 otherwise.
Head	Dummy variable: 1 if worker is head of household; 0 otherwise
Age Dummies	
16-19	1 if worker is between the ages of 16-19 (inclusive); 0 otherwise. This age group was taken as the default group.
20-34	1 if worker is between the ages of 20-34 (inclusive); 0 otherwise.
35-44	1 if worker is between the ages of 35-44 (inclusive); 0 otherwise.
45-69	1 if worker is between the ages of 45-69 (inclusive); 0 otherwise.
Education Dummies	
None	1 if worker has at most elementary schooling; 0 otherwise. This educational group was taken as the default group.
High	1 if worker has completed high school; 0 otherwise.
Spsec	1 if worker has some post-secondary education or diploma; 0 otherwise.
PsecQ	1 if the worker has some post-secondary education and a post-secondary certificate or diploma; 0 otherwise.
Univ	1 if the worker has a university education; 0 otherwise.
Regional Dummies	
Atla	1 if worker is located in Newfoundland, PEI, Nova Scotia or New Brunswick; 0 otherwise.
Queb	1 if worker is located in Quebec; 0 otherwise.
Ont	1 if worker is located in Ontario; 0 otherwise. This was the default group.
MSasAl	1 if worker is located in Manitoba, Saskatchewan or Alberta; 0 otherwise.
BC	1 if worker is located in British Columbia; 0 otherwise.
Union	1 if worker was a member of a union or group which bargained collectively with employer in pre-unemployment job; 0 otherwise.
Ten	Number of weeks worked on the pre-unemployment job.
Ten2	Ten squared
Famsze	Size of worker's family up to a maximum of 4 members.
Fem	1 if worker was female and 0 if male.

UI 1 if worker received Unemployment benefit in 1986; 0 otherwise.

Industry Dummies[1] (pre-unemployment job).

Ag/Fr 1 if worker was employed in agriculture, forestry or fishing, and trapping; 0 otherwise. This was the default group.

Ming 1 if worker was employed in metal mines, mineral fuels, non-metal mines, quarries and sandpits, or services incidental to mining; 0 otherwise.

Ndbles 1 if worker was employed in food and bevarages, tobacco products, rubber and plastics products, leather industries, textile industries, knitting mills, clothing, wood, furniture and fixtures, paper and allied industries or printing and publishing; 0 otherwise.

Dbles 1 if worker was employed in Primary Metals, Metal Fabricating Machinery, Transportation Equipment, Electrical Products, Non-Metallic Mineral Products, Petroleum & Coal ProductsChemical & Chemical Products, or Miscellaneous Manufacturing; 0 otherwise.

Trans 1 if worker was employed in general contracting, special-trades contracting, transportation, storage communication, or electrical power, gas and water utilities; 0 otherwise.

Trade 1 if worker was employed in wholesale or retail industry; 0 otherwise.

Fincl 1 if worker was employed in finance industries, insurance, real estate, or services to business management; 0 otherwise.

Publ 1 if worker was employed in education and related services, health and welfare services, federal administration, local administration or other government offices; 0 otherwise.

Othserv 1 if worker was employed in religious organisations, amusement and recreation industries, personal services, accomodation and food services or miscellaneous services; 0 otherwise.

Occupation Dummies[2] (Pre-unemployment job).

Mang 1 if worker was employed in a managerial or administrative position; 0 otherwise.

Prf/Tch 1 if worker was employed in a scientific, mathematic, medicine, architectural, engineering, teaching or artistic position; 0 otherwise.

Cler 1 if worker was employed in a clerical or service position; 0 otherwise.

Prim	1 if worker was employed in a farming, fishing or hunting, forestry or logging, or mining and quarrying position; 0 otherwise.
Crft	1 if worker was employed in a food or other processing, metal shaping and forming, machining, electrical and electronics, textiles, fur or leather goods position; 0 otherwise.
Constr	1 if worker was employed as a mechanic or repairperson (except electrical) in wood or rubber (not processing), excavation, electrical power, lighting or wire communications; 0 otherwise.
Oper	1 if worker was employed in motor transport operating, material handling, or other equipment handling; 0 otherwise. This is the default category.
Wage2	Hourly starting wage rate (in cents) of the post-unemployment job.
Average wage gain	Average difference in the hourly wage (cents per hour) on pre-and post-unemployment job.

1/ These dummies for the pre-unemployment industrial affiliation of the worker are defined from the 2 digit classifications given in the LMAS.

2/ These dummies for the pre-unemployment occupational affiliation of the worker are defined in terms of the 2 digit classifications given in the LMAS.

Appendix C

Descriptive Statistics of the Sample

Variable	Mean All (Std. Dev)	Occupation Stayers	Occupation Movers	Industry Stayers	Industry Movers
Durn	9.1154	8.8438	9.2829	8.5546	9.3980
	(8.3220)	(8.5268)	(8.3777)	(8.1563)	(8.5618)
Marrd	0.56807	0.63610	0.52608	0.59706	0.55345
Head	0.52050	0.47480	0.59456	0.56770	0.49671
16-19	0.08475	0.05731	0.10168	0.05220	0.10115
20-34	0.61618	0.57880	0.63926	0.60196	0.62336
35-44	0.18207	0.18911	0.17772	0.19250	0.17681
45-69	0.11700	0.17479	0.08134	0.15334	0.09868
None	0.11318	0.11175	0.11406	0.10930	0.11513
High	0.61837	0.58883	0.63660	0.61175	0.62171
Spsec	0.08474	0.08453	0.08488	0.08157	0.08635
Psecq	0.12630	0.15330	0.10964	0.13051	0.12418
Univ	0.05741	0.06161	0.05482	0.06688	0.05263
Atla	0.26955	0.25501	0.27851	0.21860	0.29523
Onta	0.18753	0.17908	0.19275	0.18760	0.18750
Queb	0.14106	0.15473	0.13263	0.14682	0.13816
MSasAl	0.29415	0.28223	0.30150	0.30016	0.29112
BC	0.10771	0.12894	0.09401	0.14682	0.08799
Union	0.21432	0.27077	0.17949	0.24144	0.20066
Ten	87.212	109.86	73.237	102.48	79.513
	(175.9)	(214.20)	(145.75)	(209.61)	(155.71)
Ten2	38539	57884	26586	54365	30548
Famsze	2.8726	2.9011	2.8550	2.8254	2.8964
UI	0.67031	0.70344	0.64987	0.66884	0.67105
Female	0.39694	0.39828	0.39611	0.44046	0.37500
Wage1	825.10	925.48	763.15	921.08	776.71
	(780.50)	(481.04)	(912.51)	(1202.7)	(425.35)
LWage1	6.5706	6.6960	6.4931	6.6443	6.5334

	(0.5135)	(0.5301)	(0.4873)	(0.55065)	(0.48969)
Wage2	809.11	937.89	729.63	898.80	763.89
	(433.73)	(501.15)	(364.48)	(513.91)	(379.35)
Ag/Fr	0.07490	0.07163	0.07692	0.08320	0.07072
Ming	0.03882	0.04012	0.03802	0.03752	0.03947
Dbles	0.04921	0.04728	0.05040	0.02284	0.06250
Ndbles	0.07983	0.06304	0.09019	0.05710	0.09128
Trans	0.19683	0.23782	0.17153	0.21533	0.18750
Trade	0.17387	0.15473	0.18568	0.18760	0.16694
Fincl	0.05796	0.05587	0.05924	0.05220	0.06086
Publ	0.14926	0.14327	0.15296	0.15008	0.14885
Othserv	0.17933	0.18625	0.17507	0.19413	0.17188
Mang	0.03991	0.01289	0.05659	0.03426	0.04276
Prf/Tch	0.09131	0.10602	0.08223	0.12398	0.07484
Cler	0.38546	0.34384	0.41114	0.38662	0.38487
Prim	0.10169	0.09312	0.10698	0.09788	0.10362
Crft	0.09185	0.09885	0.08753	0.07341	0.10115
Constr	0.18644	0.26218	0.13970	0.20228	0.17845
Oper	0.10334	0.08309	0.11583	0.08157	0.11431
Sample size	1829	698	1131	613	1216

FIGURE 1: COMPETING-RISK HAZARDS

INTER-OCCUPATION TRANSITIONS

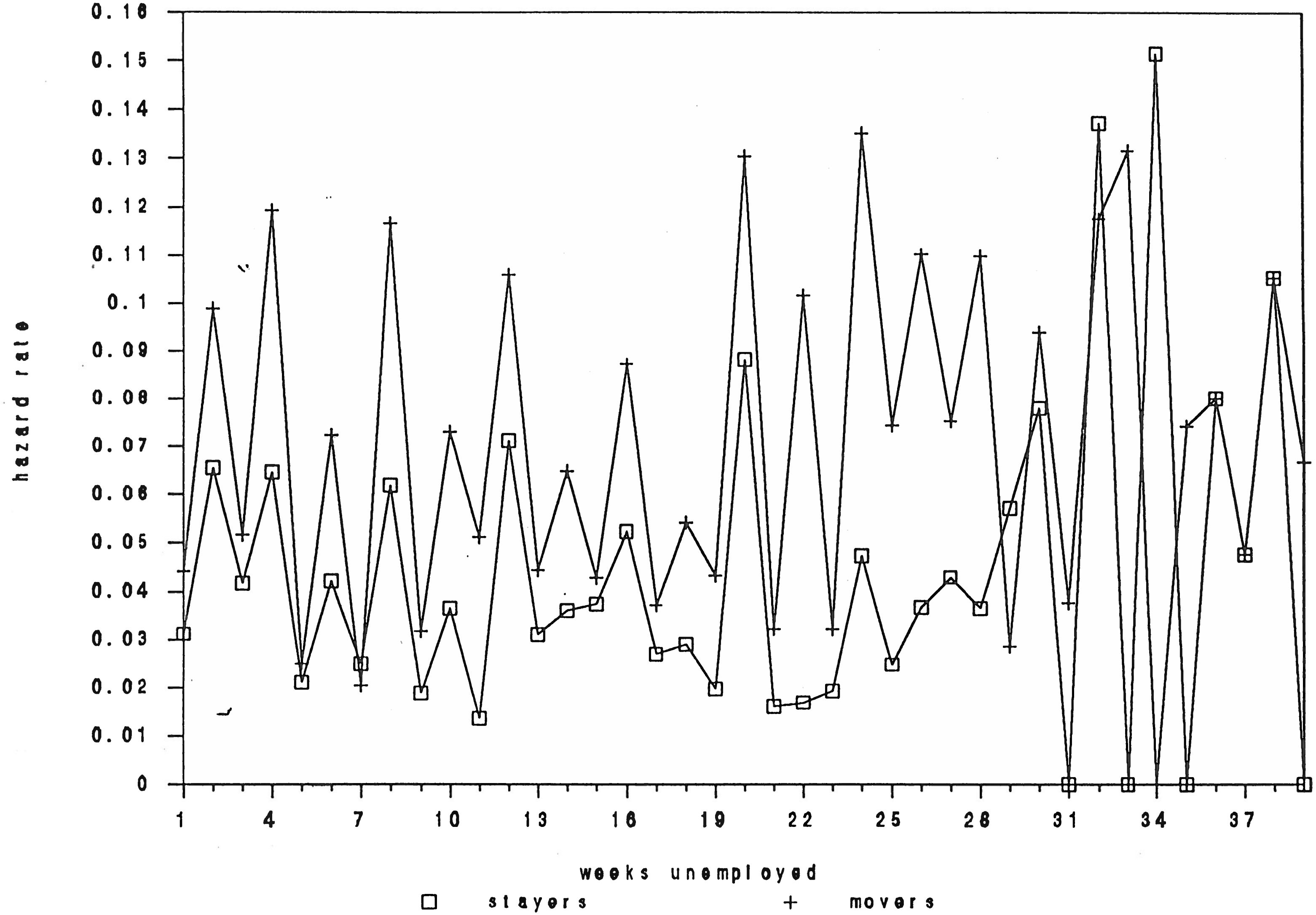

FIGURE 2: TOTAL HAZARD