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The Industrial Mobility of Displaced Workers

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This article uses a two-industry model of unemployment duration and job search to estimate rates of transition of displaced workers from unemployment to employment, distinguishing between employment in a worker's previous industry and in other industries. The competing-risks model allows inferences about search strategies to be drawn from data concerning employment outcomes and allows tests of some fundamental implications of search theory. There is evidence that improvements in the prospects for employment in their previous industry induce displaced workers to reduce search intensity or increase reservation wages in other industries.

I. Introduction

Between 1981 and 1985, approximately 11 million U.S. workers permanently lost their jobs (see Horvath 1987). Many such job losses stem from structural changes in the demand for labor. These changes may include general and permanent contractions of employment in specific industries, and such contractions may affect a worker's ability to find another job similar to the one that he lost. The ability and willingness of displaced workers to obtain employment and to move between industries in response to the economic incentives engendered by structural change play a major role in determining the economy's ability to adjust smoothly to new circumstances. Changes in market conditions create dissimilar employment

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opportunities across industries. We expect displaced workers to adapt by concentrating their efforts to find jobs in those industries that offer the best prospects, even if this means switching industries. Industry job prospects include both the likelihood of finding a job and the wage levels to be expected in the industry.

Macroeconomic incentives to change industries are, however, tempered by displaced workers' long-term attachments to their industries. Frequently, they will have acquired skills specific to the industry, and the value of those skills at their next job will be crucial to their economic well-being. They may have established credentials in a particular industry or have information that facilitates productive and efficient job search in that industry.[1] In sum, a worker's old industry may offer very different prospects for finding new jobs than other industries. Together with more general economic conditions, a displaced worker may find, for example, that his old industry offers high wages but few jobs, while other industries offer many jobs at lower rates of pay. Taking into account all of these factors, a displaced worker should optimally allocate his search efforts among industries and thereby affect both the duration of his unemployment and the likelihood of changing industries.[2]

As we shall see, a model of job search over multiple labor markets can incorporate both the macroeconomic incentives that may favor changing industries and the more person-specific incentives that make reemployment in the same industry more attractive. In such a model, an unemployed worker's search strategy adjusts to favor finding and taking a job in those industries where more promising conditions prevail. This prediction is a generalization of the implication of single-sector analytical search theory that an improvement in labor market conditions should induce a worker to search more intensively while becoming more particular about which job to take. This is a fundamental prediction of search theory and as such is widely used.[3] Much research depends on the validity of this hypothesis, but it has not been extensively tested. The two-industry model used here greatly facilitates empirical testing of this theoretical prediction. By exploiting a competing-risks structure of unemployment duration, the effect of a change in employment prospects on search behavior can be distin-

[1] Workers displaced from high-wage industries may be especially inclined to allow their past experience to unduly influence their expectations. Of course, "wait unemployment," in which workers accept unemployment in the hope of obtaining a job in a high-wage industry despite the relative scarcity of such jobs, may be a rational response to market conditions. If workers displaced from high-wage industries can expect a better position in the queue for such jobs, then this "displaced worker syndrome" may be reasonable.

[2] The same can obviously be said of other sectoral distinctions, notably, occupations and geographic regions. The current study is confined to industrial shifts.

[3] For examples, see Mortensen (1986, pp. 864–65).

guished from their more obvious direct effects on outcomes. Thus, inferences about search strategies can be drawn from data about reemployment outcomes without data on search behavior itself.

This article also investigates more generally the unemployment and job search experience of a large sample of displaced workers in the United States. I estimate the determinants of the rates of transition of displaced workers from unemployment (i) to new employment in the industry from which they were displaced and (ii) to reemployment in another industry. In addition to being a natural population in which to study issues of multisector search, a sample consisting of only displaced workers avoids econometric problems arising from the endogeneity of voluntary separations.[4] It should be noted, however, that sample selection bias may arise from other sources, such as the exclusion from the survey of those recalled from (ex post) temporary layoffs.[5]

Katz (1986) employed a competing-risks framework to great advantage in studying the effects on job search of the possibility of recall from temporary layoff. He found that several variables that increase the likelihood of recall also increase the hazard rate for taking a new job, implying that workers adjust their search behavior according to their prospects for recall to their old jobs. Another way to infer changes in search behavior without direct measures is by examining the results of variation in an aspect of a worker's economic environment that has no direct effect on duration. The most prominent examples of this are the many studies that examine the relationship between unemployment insurance and unemployment duration.

The studies just mentioned all confirm the predictions of received theory concerning searchers' responses in the context of variations in their individual economic environments. The present work extends this line of research to include searchers' responses to variation in sectoral economic conditions.

In this study I find evidence that displaced workers adjust their search behavior in response to their prospects for new employment in each in-

[4] Voluntary separations are obviously endogenous to the worker. By construction, the Displaced Worker Surveys exclude anyone who quit her job, except that it includes those who quit explicitly in anticipation of an involuntary separation. This article proceeds under the assumption that the advance notice (or other information) that makes such quits possible is provided or withheld exogenously. Similarly, the advance notice variable is treated as uncorrelated with unobserved heterogeneity in duration.

[5] Both theoretical search models and empirical studies of the duration of unemployment have tended to model search in a single market. Thomas and Bernhardt (1991) is an exception. Several studies of the wage losses of displaced workers (Jacobson 1978; Podgursky and Swaim 1987; Madden 1987, 1988; Addison and Portugal 1989; and Kletzer 1991) recognize that changing industries or occupations matters but do not examine the implications of this fact for search behavior.

dustry and reemployment at their old jobs. Workers who were displaced from industries with smaller aggregate employment growth choose search strategies that contribute to greater mobility between industries. They not only are more likely to end up in a job in a different industry but will more quickly find acceptable jobs there. An additional finding is that the determinants of the rate of reemployment in a worker's previous industry differ from those for reemployment in other industries. Variables representing the cause of displacement and measuring regional economic conditions are more important determinants of the rate of reentry into the worker's previous industry, while education, job tenure, gender, advance notice, and wage premia are more important for entering other industries. Personal characteristics such as the level of family income and heading a household have large effects on both reemployment rates.

II. Theoretical Framework

Consider an individual with characteristics X_i who has been displaced from a job and is unemployed at the beginning of period t. The worker has available an endowment of search "intensity" that he may devote to seeking a job during this period or to other activities. "Intensity" may refer to time, resources, or effort. For simplicity, think of it as the available time that may be devoted to search. The worker may allocate the time he devotes to search between two sectors of the economy: the industry from which he was displaced (which I shall call the "old" industry) and the set of all other industries (which I shall designate the "new" industry).[6]

Let the proportion of available time during period t that the worker devotes to search in industry j be denoted by $s_j(t, X_i)$, where j = old, new. Let the length of the period be sufficiently small that the probability of receiving more than one job offer in a single period can be assumed to be zero. If the worker were to devote all of his available time in period t to searching in industry j, then the (marginal) probability that he would obtain a job offer in period t from industry j is $\alpha_j(t, X_i)$, which may loosely be called the offer-arrival rate. Assume further that in general the (marginal) probability that the worker will receive an offer in period t from industry j is $\alpha_j(t, X_i)\sigma(s_j(t, X_i))$, where σ is an increasing concave function with $\sigma(0) = 0$ and $\sigma(1) = 1$. The rate of current compensation associated with a job offer (which I will denote as w and refer to simply as the wage) is randomly drawn from a (marginal) distribution $F_j(w; X_i)$.

Assume that for each industry j in each period t, the worker has a reservation wage $w_j^r(t, X_i)$ such that the worker will accept a job offer in industry j with wage w if and only if $w \geq w_j^r(t, X_i)$. Reservation wages

[6] Compare the model of Thomas and Bernhardt (1991), wherein a person may search in only one sector at a time.

and search intensities constitute the worker's search strategy. They will be influenced by the α and F in both industries in addition to t and X_i. In this structure, the probability that a worker who was unemployed at the beginning of period t will make a transition from unemployment to employment in industry j during period t (i.e., the hazard function) is

$$h_{i,j}(t) = \alpha_j(t, X_i)\sigma(s_j(t, X_i))[1 - F_j(w_j^r(t, X_i); X_i)]. \quad (1)$$

Equation (1) makes clear how changes in employment prospects (specifically, the offer-arrival rates and wage-offer distributions) would affect the hazard rates, holding search strategies constant, and how changes in the elements of the search strategies would affect the hazard rates, holding the employment prospects constant. If the search strategies were not to change, that is, if s_j and w_j^r were held constant, an increase in the offer-arrival rate α_j or an improvement in the wage-offer distribution F_j would increase the hazard rate $h_{i,j}$ and reduce the duration of unemployment. An increase in α_j or an improvement in F_j can also be expected to increase s_j and w_j^r, but such reactions are not necessary in order to induce a positive relationship between, say, α_j and $h_{i,j}$. For this reason, a one-sector model does not yield testable hypotheses about the influence of industry conditions on search strategies in the absence of information on search behavior itself. In such a model, any observed change in $h_{i,j}$ associated with a change in industry conditions (α_j or F_j) must be attributed jointly to the conditions themselves and to their influence on search behavior, not separately to one or the other.

In contrast, changes in the prospects for employment in the "other" industry, α_k or F_k, where $k \neq j$, would not affect $h_{i,j}$ at all if the search strategies did not change. For example, any relationship between, α_k and $h_{i,j}$ must be due to the way in which search in industry j reacts. I exploit this consideration in order to make inferences about search behavior from data on reemployment outcomes and to disentangle the indirect effect of a change in employment prospects on hazard rates (i.e., the induced change in the search strategy) from the more obvious direct effects. In other words, the two-sector model yields testable hypotheses that its one-sector counterpart cannot.[7]

It is intuitively sensible that any improvement in the prospects for employment in industry k should lead to a reduction in search intensity de-

[7] The class of models that exhibit the property that conditions in one sector affect only behavior (strategies) in the other sector includes many which are not conventionally called search models. They all, however, can be represented by something similar to eq. (1) and have the same essential character. In a rational queuing model, for instance, the offer-arrival rates might be exogenous functions of previous tenure, etc., but the reservation wage for one industry would still react to the prospects in the other.

voted to search in industry j and an increase in the reservation wage for jobs in that industry. Fallick (1992) demonstrates this formally in a model of job search in two sectors. The unambiguous prediction is that $h_{i,j}$ should fall in response to an improvement in conditions in industry k (i.e., an improvement in either α_k or F_k), due to the induced changes in search behavior. In contrast, while an increase in α_j or an improvement in F_j would probably lead to an increase in $h_{i,j}$, the increase in w_j^r that either one would induce precludes a definitive prediction.[8]

A reduced form of the hazard function (1) may be written

$$h_{ij}(t) = g(t, X_i, \text{common components of labor market conditions in the old and in the new industries}), \tag{2}$$

where t is the number of periods of unemployment thus far, and by "common components" I mean that part of the labor market conditions in each industry (such as α and F) that are common to all individuals. Which specific industries make up the "old" and "new" industries depends on the individual's history. I estimate a version of the reduced-form hazard function (2) for each industry.

III. Data

My sample is drawn from the Bureau of Labor Statistics (BLS) Displaced Worker Survey attached to the Current Population Surveys (CPS) of January 1984 and 1986. The survey was administered only to those individuals in the CPS who were at least 20 years old and lost a job sometime during the 5 years prior to the survey due to a plant closing, a layoff from which

[8] For some classes of improvements, a definitive prediction can be made. See Fallick (1992). In brief, in each period, the unemployed worker chooses the elements of his search strategy. Each of the reservation wages is set so as to equate the expected value of remaining unemployed next period with the value of becoming employed in that industry at that wage next period. Search intensity is allocated so that the marginal value of additional search in each industry is equal to the marginal cost of searching. Any change that raises the value of being unemployed more than it raises the value of being employed in industry j at the reservation wage will induce the worker to raise his reservation wage for jobs in that industry. Any change that increases the marginal "productivity" of search in either industry relative to the marginal cost of searching will induce a worker to increase his search intensity overall, and any change that increases the marginal value of search in industry j relative to that of search in industry k will induce the worker to search more intensively in industry j relative to industry k. Therefore, an improvement in the wage-offer distribution or offer-arrival rate in the old industry should cause reservation wages to rise and search intensity to be reallocated away from the new industry and toward the old industry.

Table 1
Distribution of Independent Variables

Variable	Mean	SD	Variable	Mean	SD
EMPOLD	.0188	.056	SUPPORT	.22	...
EARNOLD	329.08	65.09	CRAFT	.20	...
UNEMPOLD	9.64	3.52	LABORER	.34	...
EMPNEW	.0151	.0263	FARMING	.015	...
EARNNEW	312.73	14.92	SERVICE	.067	...
UNEMPNEW	8.40	1.25	AGE	36.4	11.4
SIZERAT	13.2	15.6	FEMALE	.31	...
NOTIFIED	.53	...	FAMINC	5.91	3.15
SLACK	.47	...	HEAD	.68	...
ABOLISH	.15	...	STUNEMP	8.5	2.4
EDUC	12.2	2.6	WHITE	.87	...
PREMIUM	.11	.65	UI	.62	...
TENURE	5.7	6.1	YEAR86	.48	...
New England	.68	...	MidAtlantic	.13	...
E.N. Central	.15	...	W.N. Central	.10	...
S. Atlantic	.13	...	E.S. Central	.06	...
Mountain	.10	...	Pacific	.14	...

NOTE.—N = 2,090. SD = standard deviation.

they were not recalled, or a similar reason.[9] Call that job the worker's old job. I include in the sample only workers who were employed full-time at their old jobs for at least 1 year, were in the labor force at the time of the survey or reported that they wanted a job, and last worked at their old jobs (i.e., lost their old jobs) in the year prior to the survey. In addition, only workers who reported that their old jobs ended due to a plant closing or relocation, slack work, or the abolition of the position or shift were included.[10] The characteristics of the members of the sample are summarized in table 1.

The duration measure used is the number of weeks in which the individual was without a job during the (at most) 1 year between displacement and the survey. This may include time spent officially out of the labor force rather than unemployed. Therefore, "nonemployment" may be a more accurate term than "unemployment." Moreover, the survey asks only

[9] See Flaim and Sehgal (1985) and Horvath (1987) for descriptions of the data. The involuntary nature of the separations rules out the problems of selectivity that concern much of the literature on voluntary turnover. Ideally, the sample would include only clearly permanent separations, which would also eliminate the possibility of recall to one's old job from influencing search behavior. As noted below, however, while the Displaced Worker Surveys excluded anyone who had been, in fact, recalled, the data do not live up to this ideal.

[10] I also included only those workers who were not missing relevant data, did not report impossible values for important variables, and were not in the armed forces at their old jobs. On these points, and for a further discussion of the sample and problems with the data, see Fallick (1988).

for the number of weeks that an individual has been without a job since becoming displaced, but the current job is not necessarily the first job since displacement. The more time there has been for other jobs to intervene, the less accurate the comparisons of people's inferred nonemployment experiences will be. I have restricted the sample to those displaced no more than 1 year prior to the survey in order to reduce inaccuracies in the measured durations of nonemployment spells. A shorter period prior to the survey also reduces the amount of simple recall error and bias in the data.[11]

For this study, I have defined industries according to the 22 major industry groups defined in the January CPS. They are listed in table 1. The worker's "old" industry is the industry group of his old job. The "new" industry is defined as the other industry groups taken together. Thus, the identity of the old and new industries depends on the individual's history.

In addition to the data provided in the Displaced Worker Survey, I constructed two variables meant to reflect the labor market conditions in each industry: the rate of employment growth and median weekly earnings in each industry during the relevant year for each worker.[12] They were constructed using the full CPS for March 1983–86, each of which comprised approximately 60,000 households. These variables are described in more detail below. Industry unemployment rates are also used.

For the worker's old industry, constructing these variables was straightforward. A worker's new industry, however, comprises several industry groups, each of which may be relevant to his search for a job to a different degree. In particular, the conditions prevailing in those industries that are "close" to his old industry, in the sense that he is likely to find attractive work there or can transfer there much of the human capital that he has acquired in his old industry, are more likely to influence his search behavior and the outcome of his efforts than are conditions in more "distant" industries. Therefore, each of the variables reflecting the market conditions in the new industry is a weighted average of the conditions in each of the major industry groups of which it is composed.

The weights were constructed from data on workers' transitions between industries from the March CPS Work History data from 1983 to 1988,

[11] Studies that use the same data sources but concentrate on wage changes often include workers displaced up to 5 years prior to the survey.

[12] For workers displaced during 1983, data from the March 1983 and 1984 CPS were used; for workers displaced during 1985, the March 1985 and 1986 CPS were used. Since search strategies depend on expected industry conditions (both current and future), the question arises of the period to use in constructing industry variables. It may be appropriate to include an industry trend, for example. My thinking was that following a deep recession, and given the tendency for industrial declines to manifest themselves primarily during recessions, current industry conditions would be best.

using the procedure outlined in Shaw (1984, 1987). Essentially, two industries are deemed to be close to each other if workers leaving jobs in those two industries tend to move to the same other industries.[13] Direct flows between the two industries are not emphasized since they are more likely to reflect temporal shifts in demand. Thus, the weights reflect the relevance of an industry to the workers' search for jobs, whether due to some intrinsic similarity between the industries, such as the transferability of knowledge, or a circumstantial connection, such as geographic proximity.

IV. Estimation Procedure

I assume that transitions from nonemployment to employment occur as part of a search process in continuous time. The hazard functions in (1) and (2) should be reinterpreted accordingly. I further assume that the rates of transition follow the proportional hazards model. The hazard rate of individual i for transitions from nonemployment to employment in industry j at duration t is

$$h_{i,j}(t) = h_{0,j}(t)\exp(X_i'\beta_j), \tag{3}$$

where $h_{0,j}$ is a baseline hazard rate that may vary with time, X_i is a vector of individual characteristics and conditions in the old and new industries, and β_j is a vector of coefficients on the X_i for transitions into industry j.

Since the baseline hazard function is not of interest in the present study, a specification that does not require assumptions about the shape or character of the baseline hazard is best. This avoids the biases that such assumptions can impart to the estimates of the rest of the function, at the cost of discarding some of the information in the data. Therefore, I estimated the coefficients β_{old} and β_{new} using a competing-risks version of Cox's partial likelihood model (see Cox and Oakes 1984), which uses information on the order of events only, not the times at which they occur.

Instead of the likelihood that each observation experiences the exit (from unemployment) that we observe at the time we observe, the Cox model deals with the likelihood that the observations exit in the order that we observe, conditional on the observed timing of the exits. For each observed "failure" time t, the likelihood that observation m should exit to industry j given that someone exited to industry j is

$$\frac{h_{0,j}(t)\exp(X_m'\beta_j)}{\sum_{i\in R_t} h_{0,j}(t)\exp(X_i'\beta_j)},$$

[13] Details are available from the author.

where R_t is the set of observations still at risk for "failure" at time t. The baseline hazard rates cancel out, leaving us free to estimate the coefficients β.

The data report the duration of nonemployment in weeks, rather than more specific actual durations. Consequently, there are numerous ties (workers reporting the same number of weeks without a job) in the data, which were handled using the approximation suggested by Breslow (1974). The estimation was performed using BMDP software. The analysis was repeated using both fully parametric and semiparametric specifications.[14] The results reinforced those presented below and are not shown.

A comment is in order about the assumed independence of the hazard rates in the Cox model. The estimation procedure just described does not explicitly take account of possible stochastic dependence between the two hazard rates, h_{old} and h_{new}. Consequently, the estimated hazard rates should be interpreted as the transitions rates conditional on the worker not yet having exited into *either* industry.[15] The alternative interpretation is that each hazard rate is the transition rate conditional only on not having yet exited into that particular industry, as if no other exits were possible.[16] (The two interpretations are equivalent only under the assumption that the latent failure times are independently distributed. See Cox and Oakes 1984, pp. 144–45.)

The search model does not rule out the possibility of stochastic dependence between the two hazard functions given the information available to the worker, so it would seem appropriate to estimate the hazard rates without explicitly accounting for possible correlation and adopt the first interpretation. However, there may be variables known to the worker but unobserved by the researcher that affect both hazard rates and introduce to the empirical model a source of correlation that is not present in the search model. In order to account for such correlation, I have also estimated a sequential multinomial probit model that allows for unrestricted cor-

[14] The semiparametric model was similar to that proposed by Prentice and Gloeckler (1978).

[15] These are sometimes called the "cause-specific" hazard rates and may be expressed as

$$h_{i,j}(t) = \lim_{x \to 0} \frac{\text{pr}(t \leq T_{i,j} \leq t + x \mid T_{i,\text{old}} \geq t,\ T_{i,\text{new}} \geq t)}{x}.$$

[16] These are sometimes called the "counterfactual" hazard rates and may be written as

$$h_{i,j}(t) = \lim_{x \to 0} \frac{\text{pr}(t \leq T_{i,j} \leq t + x \mid T_{i,j} \geq t)}{x}.$$

Table 2
Estimates from the Cox Model

Variable	h_{old}	h_{new}	Variable	h_{old}	h_{new}
EMPOLD	5.4***	−4.7**	SUPPORT	.40***	−.12*
	(2.3)	(−2.0)		(2.5)	(−1.0)
EARNOLD	−.0029*	.0025*	CRAFT	.50***	.27*
	(−1.7)	(1.8)		(3.0)	(−1.9)
UNEMPOLD	.014	−.029	LABORER	.32*	−.23*
	(.4)	(−1.1)		(1.9)	(−1.7)
EMPNEW	32	−44	FARMING	.76*	−.031
	(1.0)	−(1.6)		(1.7)	(.1)
EARNNEW	.14**	.16***	SERVICE	.14	.14
	(−2.2)	(3.3)		(.5)	(.8)
UNEMPNEW	−.49	−.15	AGE	−.016***	−.013***
	(−.7)	(−.3)		(−3.1)	(−2.9)
SIZERAT	−.0093**	.0012	FEMALE	.11	.27***
	(−2.0)	(.4)		(.8)	(2.6)
NOTIFIED	.04	.18**	FAMINC	.11***	.066***
	(.4)	(2.2)		(6.6)	(4.5)
SLACK	−.44***	−.28***	HEAD	−.63***	−.40***
	(−4.2)	(−3.0)		(4.9)	(3.8)
ABOLISH	−.27**	.055	STUNEMP	−.090***	−.021
	(−1.9)	(.5)		(−2.8)	(−.8)
EDUC	.014	.052***	WHITE	−.55***	.70***
	(.6)	(2.8)		(−3.2)	(4.7)
PREMIUM	.066	−.12*	UI	−1.1***	−1.2***
	(.9)	(−1.7)		(−10.9)	(−13.6)
TENURE	−.0014	−.023***	YEAR86	−.14	.010
	(−.1)	(−2.5)		(−1.2)	(.1)
Log likelihood	−3,167	−4,318			

NOTE.—Dummy variables for nine geographic regions were included but are not shown. *t*-statistics for the coefficients appear in parentheses.
* Significantly different from zero at the 10% level.
** Significantly different from zero at the 5% level.
*** Significantly different from zero at the 1% level.

relation across risks. (See Sueyoshi [1991] for a discussion of binary response models as an alternative to the proportional hazards model.) The estimates were qualitatively similar to those presented here.[17]

V. Results

In this section, I describe the explanatory variables and present their estimated effects. The Appendix briefly defines the explanatory variables. Table 2 presents the estimates of the Cox model for the sample.

A. Information and Market Conditions

One of the major themes of the theory of job search is that workers should adjust their search behavior in response to information about their

[17] The estimated correlation coefficient was approximately 0.1. One could not reject the null hypothesis of no correlation using a likelihood ratio test at standard levels of significance. For this reason, and in order to retain greater comparability with the literature, I report the proportional hazard estimates.

prospects for employment in the relevant labor markets. A natural application of this theme is the concern over the rate at which workers displaced from "declining" industries move into employment in other industries, as compared to workers displaced from industries that are doing better. To reiterate, conditions in the old industry will affect the outcomes of the search process by affecting workers' search strategies as well as by affecting the distribution of outcomes which results from any given search strategy. Within a single labor market, these two effects are confounded. When two labor markets are examined, however, $h_{new}(t)$ is unaffected by the conditions in the old industry except through their effect on search strategies. Therefore, for example, if an increase in α_{old} is associated with any change in h_{new} (holding other conditions constant), then we can infer that workers change their search strategies in response to α_{old}.

The industry variables are as follows: The rates of growth over the year of full-time employment in each of the two industries are measured by EMPOLD and EMPNEW. The variable EMPOLD is meant to serve as a proxy for that part of α_{old} which is specific to the old industry rather than to the individual. It is intended to answer questions like the following: Holding the wage-offer distribution constant, do workers displaced from industries characterized by lower offer-arrival rates adjust their search behavior so as to increase h_{new} relative to workers displaced from more forthcoming industries? According to the analysis in Section II, the answer should be yes.

The median weekly earnings of full-time employees in each industry, averaged between the two relevant surveys, are EARNOLD and EARNNEW.[18] EARNOLD is meant to capture that part of the expected wage offer that is common to all workers from an industry, while EARNNEW reflects the expected wage that workers from that industry can expect elsewhere.[19] A better wage-offer distribution in one industry ought to reduce the hazard rate for reemployment in the other industry by making jobs there, and therefore search as well as acceptance of an offer, less attractive.[20]

[18] Using mean weekly earnings rather than the median does not appreciably alter the results. The rate of increase of median full-time earnings in the two industries over the year was also tried, without effect.

[19] Variables meant to reflect the spread of the wage-offer distributions, the variance of weekly earnings, and the quartile range were too highly correlated with mean or median earnings to separately estimate their effects. Only the median was included in the reported results. Since a worker's search strategy truncates $f(w)$ from below at w^r so that only the upper part of the distribution matters, an increase in the standard deviation of $f(w)$ holding the mean constant is in most cases an improvement from the point of view of the worker. Therefore, the median earnings can still be interpreted as a measure of the "goodness" of the distribution.

[20] Warner, Poindexter, and Fearn (1980) found that the predicted expected wage for a worker (based on an estimated earnings function) was positively related to the reservation wage and negatively related to the duration of unemployment spell given the reservation wage.

The variables OLDUNEMP and NEWUNEMP are the industry unemployment rates, as reported by the BLS. They are meant to capture slackness in the industries' labor markets.

The estimates in table 2 imply that EMPOLD is significantly and positively related to h_{old}, while it is significantly and negatively related to h_{new}. It is no surprise that the rate of growth of employment in the worker's old industry is estimated to increase the rate at which he goes to work there, but this need not be due to any change in search behavior on his part. At the same time, a larger rate of employment growth in his old industry also decreases the rate at which he becomes employed in another (the new) industry, and this does imply something about behavior. It appears that workers do respond to lower offer-arrival rates in the old industry by increasing their search intensity or decreasing their reservation wages in the new industry. The order of magnitude of these effects may be indicated by the predicted average effect of a change in EMPOLD on the expected latent durations of unemployment. For becoming reemployed in the old industry, a 1 percentage point increase in EMPOLD is estimated to decrease the latent duration by approximately 1 week. For becoming reemployed in the new industry, a 1 percentage point increase in EMPOLD is estimated to increase the latent duration by approximately 1 week.[21]

The estimated coefficients on EMPNEW run contrary to expectations, indicating that greater employment growth in the new industry increases

[21] The latent durations (or latent failure times) may not be behaviorally meaningful in this context, but they do provide an easily compared indication of the magnitudes. For grouped duration data, the expected latent duration of unemployment for reemployment in industry j is

$$Et_j = \sum_{t=1}^{\infty} t[S_j(t-1) - S_j(t)],$$

where

$$S_j(t) = \exp\left[-\int_0^t h_j(s)ds\right]$$

is the survival probability for transitions into industry j. For a proportional hazards model,

$$\frac{dEt_j}{dX} = \beta \sum_{t=1}^{\infty} t[S_j(t-1)\ln S_j(t-1) - S_j(t)\ln S_j(t)].$$

The summation was calculated using life-table hazard rates. This quantity, which must be multiplied by the coefficient to yield the derivative, is -19.63 for Et_{old} and -22.32 for Et_{new}.

search in the old industry and reduces the probability of becoming reemployed in the new industry. However, the estimates are surprisingly large, have correspondingly large standard errors, and proved to be very sensitive to changes in the specification.[22] The estimates for EMPOLD, in contrast, were robust to the same changes.

The estimates for EARNOLD are similarly unexpected in sign, while the estimates for EARNNEW have the expected signs but are suspiciously large.[23] For reemployment in the old industry, a $10 increase in weekly earnings in the old industry (EARNOLD) is predicted to increase the expected latent duration by .57 weeks, while a $10 increase in EARNNEW increased the expected latent duration by 27.5 weeks. For reemployment in the new industry, a $10 increase in EARNOLD is predicted to decrease the expected latent duration by .56 weeks, while a $100 increase in EARNNEW decreased expected latent duration by 35.7 weeks. The coefficients on the industry unemployment rates are insignificantly different from zero for both hazard rates.

One possible cause of the counterintuitive and nonrobust estimates for several of the industry conditions variables is that the new industry is defined as the complement of the old industry. For a given year, for example, aggregate employment (the sum for both the old and the new industries) is constant across old industries. By construction, then, there is a strong negative relation (in fact, a one-to-one mapping) between each of the variables for the old industry and its counterpart for the new industry within each year. The estimates may confound their effects. To supplement the results in table 2, I regressed each of the constructed industry variables on its counterpart and a dummy for the year and used the residuals from these equations to reestimate the model. The results appear in table 3. The estimates for the other variables are unchanged and not included in the table. The coefficients on the industry variables' residuals conform to expectations about workers' responses, but the coefficients on the new industry variables remain very large in magnitude. Only the estimates for the growth rate in the old industry (EMPOLD) are robust to this trans-

[22] Conditional on becoming reemployed in the old industry, an increase in EMPNEW of 1 percentage point is predicted to decrease expected duration by 6.3 weeks. Conditional on becoming reemployed in the new industry, the same change in EMPNEW would increase expected duration by 9.8 weeks.

[23] It has been suggested that EARNOLD may reflect the degree of unionization in the industry and therefore be correlated with the worker's union status, for which I cannot control directly. Union status may matter because, in the words of one unemployed worker, "nonunion employers . . . were reluctant to hire a union man, believing he would be unhappy with the lower wage they offer" (Serrin 1986). Controlling for the rate of unionization in the old industry group did not change the results significantly.

Table 3
Residuals for Industry Variables, Cox Model

Variable	h_{old}	h_{new}
EMPOLD	8.8***	−4.8*
	(2.7)	(−1.9)
EARNOLD	−.0006	−.0025*
	(−.4)	(−1.8)
UNEMPOLD	.042	−.040
	(1.0)	(−1.3)
EMPNEW	-119***	38
	(−2.4)	(1.0)
EARNNEW	−.15**	.21***
	(−2.1)	(3.9)
UNEMPNEW	−1.2	.48
	(−1.4)	(.8)
Log likelihood	−3,167	−4,318

NOTE.—*t*-statistics for the coefficients appear in parentheses.
* Significantly different from zero at the 10% level.
** Significantly different from zero at the 5% level.
*** Significantly different from zero at the 1% level.

formation. This was also the one variable that was robust to changes in specification under the original formulation.

These results offer some support for the claim that workers adjust their job-search behavior in response to conditions in the labor markets in which they may search. The one set of coefficients that appears to be robust to changes in the specification and to the transformation, EMPOLD, indicates that workers from relatively declining industries direct their search efforts toward other industries.

Closer to home, the prospects for continuing at the old job may affect search behavior before the job ends. The variable NOTIFIED in table 2 indicates that workers who knew or expected in advance that their jobs would end had significantly higher hazard rates for reemployment in the new industry than those who did not know, all else being equal.[24]

Similarly, a worker whose job was lost due to a plant closing or moving (the omitted job loss category) will have little or no hope of being recalled or rehired to his old job. A person whose job was lost due to the abolition of his position or shift (ABOLISH = 1) may have some hopes, while a person's whose reason was "slack work" (SLACK = 1) may have some

[24] Note, however, that work by Ehrenberg and Jakubson (1989) and Addison and Portugal (1987) indicate that the primary effect of advance notice is to increase the probability of zero unemployment, with little effect on the hazard rate once unemployment is experienced. Moreover, Fallick (1991) and Ruhm (1992) find that advance notice is endogenously determined.

reason for optimism (although no one in this sample had in fact been recalled), and his prospective employers may fear the same possibility.[25]

Alternatively, workers may be more likely to know in advance that the plant is scheduled to close than that a position is scheduled to be abolished and more likely to expect either of those events than a layoff due to slack work. The coefficients on SLACK and ABOLISH are consistent with either of these views. The value h_{old} is significantly lower for those laid off due to slack work than for those whose position or shift was abolished, which in turn is lower than h_{old} for those whose plant closed or moved. The value h_{new} is similar, but there is no significant difference indicated between plant closing and abolition of shift.

B. Human Capital

Human capital considerations clearly have the potential to advance or retard industrial mobility, depending on whether or not it is specific to the old industry.[26] The variable EDUC measures the number of grades of schooling completed. It is significantly positive for h_{new} and insignificantly different from zero for h_{old}.[27] The difference between these coefficients is not statistically significant, but it suggests that education may do more to improve prospects in the new industry than in the old. Education may be a less informative indicator of a prospective worker's productivity in the old industry, where superior indicators such as the worker's work history, recommendations, and so forth from that industry are available. Alternatively, education may increase or signal the worker's ability to learn, which would be more important in the new industry than in the old.

The variable PREMIUM is the percentage by which the worker's earnings in his or her old job exceeded the industry average, which is intended to capture industry-specific human capital or match quality. The coefficient on PREMIUM is significantly negative for h_{new} while insignificantly positive for h_{old}. This suggests that the effect of the wage premium, possibly the

[25] Barron and Mellow (1979) found that better prospects for recall reduced the amount of time devoted to search.

[26] For reemployment in general, Mincer and Ofek (1982), among others, have also argued that at higher levels of education human capital depreciates more rapidly, so that individuals with more education have more incentive to keep the duration of nonemployment short. Kiefer and Neumann (1979) found that more education increases the reservation wage, while Barron and Mellow (1979) found that it increases the amount of available time devoted to search.

[27] The coefficients on the education variables were sensitive to specification of the hazard function, especially to the inclusion or exclusion of an AGE. I report what I consider to be the most reliable estimates. The results are similar if dummy variables for less than 12, 12, 13–15, and at least 16 years of schooling are used instead of the continuous variable EDUC.

premium itself, will not carry over into a new industry, although it may carry over into a new job in the old industry.[28]

Job tenure is another proxy for firm-specific human capital, and in the absence of data on industry tenure may represent industry-specific human capital as well. If so, then we would then expect tenure to increase h_{old} and decrease h_{new}.[29] The variable TENURE is significantly negative in the equation for h_{new}, while insignificantly different from zero in the equation for h_{old}. For reemployment in the new industry, 1 more year of tenure is estimated to increase the expected latent duration by about ½ week.

The discussion of this section relies, of course, on the assumption that different jobs within an industry are sufficiently similar that the human capital acquired at one job will likely carry over to another job in the same industry to a greater extent than it will carry over to a job in another industry.[30] While a finer level of aggregation of industries than the 22 industry groups used here would lend more credence to this assumption, considerations of sample size led me to use the broader definition. If, however, the old industry is defined by the two-digit Standard Industrial Classification (SIC) code of the old job, the coefficient on tenure at the old job and on the intraindustrial wage premium do increase in magnitude in the hazard function for employment in the old industry. They exhibit no noticeable change in the other hazard function, and the coefficients on the education variable change little in either function.

C. Occupations

To the extent that occupation-specific human capital is important and that particular occupations tend to be employed in particular industries, a worker's occupation may affect the two hazard rates differently. A set of dummy variables controlled for the occupation of the worker. The coefficients on a set of dummy variables for the worker's occupation at his old job (by census major occupation code) indicate that the omitted category of managerial and professional occupations have lower h_{old} than

[28] Together with EARNOLD, PREMOLD makes the inclusion of the worker's weekly earnings at the old job redundant. Using those earnings instead of PREMOLD only complicates interpretation.

[29] Also, permanent job loss may come as more of a surprise to workers with more seniority at a firm, and they may be more optimistic about the possibility of being recalled. Therefore, they may begin to search later and with lesser intensity than their less tenured co-workers. See Leighton and Mincer (1982). Tenure and age are highly correlated, so one may wish to interpret the coefficients cautiously.

[30] The discussion of industry conditions, in contrast, requires only that the industries define identifiable sectors of the economy that a worker may see as differing in job prospects and among which one may allocate search effort. We can confidently assume that a worker coming from a job in, say, durable manufacturing will see that sector as distinct from, say, retail trade.

other occupations (excepting service occupations) and higher h_{new} than production occupations. More detailed analysis (not shown in the tables) indicated that within that group it is the executive, administrative, and managerial occupations, as opposed to professional specialties, that differ when it comes to reemployment in the old industry. For the new industry, salespeople and production occupations appear to have lower hazard rates than other occupations. These occupations may involve a significant amount of industry-specific human capital. Managers and executives, however, appear to have less industry-specific or more general skills and knowledge.

D. Demographic Characteristics

The demographic characteristics included do not appear to greatly influence industrial mobility, although they do have large effects on the overall rate of reemployment. While the coefficient on FEMALE indicates greater mobility for women, on further analysis this turns out to be entirely attributable to differences in the occupational distributions of men and women. An exception may be "usual" family income (represented by FAMINC), which has a positive effect on both hazard rates but a significantly larger effect on h_{old} than on h_{new}. Considering that the worker's earnings on the old job are controlled for by EARNOLD and PREMIUM (the result remains if the worker's earnings are entered directly), I interpret FAMINC as representing income from other family members or assets. The availability of these resources makes any direct costs of search less onerous and so may increase search intensity. At the same time, such "nonlabor" income may reduce time spent in search activities by increasing the marginal utility of leisure.[31] The variable FAMINC may also represent the household's social status. If so, then higher FAMINC implies more contacts with people likely to be of assistance in finding a new job and a greater stigma on remaining unemployed.

E. A Higher-tenured Subsample

The definition of a displaced worker has varied in the literature. The present study focuses on the distinction between old and new industries because of an interest in displaced workers who are likely to have formed some attachment to the industries of their old jobs. Therefore, the sample was restricted to those whose tenure at that job was at least 1 year. A more stringent definition is sometimes used. Accordingly, I restricted a subsample to those whose tenure at their old jobs was at least 3 years. The cost of this restriction was to reduce the size of the sample from 2,090 to 1,266,

[31] Barron and Mellow (1979) found that higher nonwage income leads to less time devoted to search but for some individuals leads to larger financial expenditures on search.

and the number of uncensored observations from 954 (54% of the sample) to 573 (45% of the subsample). Other than the consequent increase in the standard errors of estimates, the results (not shown, in the interests of space) are consistent with the above discussion.

VI. Conclusion

Search-theoretic models and empirical studies of the duration of unemployment generally treat all jobs as belonging to a single homogeneous labor market. Recognizing that a worker may search simultaneously in more than one market allows one to test a fundamental class of implications of job-search models and investigate their importance to the mobility of labor across sectors of the economy. In particular, judging from the results presented here, distinguishing between industries when analyzing the reemployment of displaced workers is important because labor market conditions vary across industries. Coming from an industry with a greater rate of employment growth appears to induce workers to reduce their search intensity and increase their reservation wages in other industries, in accordance with models of job search. Other measures of industry conditions are more problematic.

The distinction between the industry in which a person used to work and all other industries is useful also in that factors such as education, job tenure, and intraindustrial wage premia affect the hazard rates associated with these two sectors differently. For example, at least through graduating from high school, education increases the rate of reemployment into jobs in a new industry but not the rate into jobs in the old industry. Studies of displaced workers should take account of the distinctions between the different industries in which a worker may find a job.

The evidence that displaced workers respond to macroeconomic incentives concerning industrial mobility highlights society's interest in providing job seekers with good and timely information about labor market conditions in the various sectors of the economy. The effect of job tenure and wage premia on mobility suggests that programs to assist displaced workers in finding new jobs might profitably emphasize, in addition to prompt and accurate information, locating matches that allow the greatest amount of human capital to be transferred to the new job.

Appendix

Definitions of Explanatory Variables

ABOLISH = 1 if left job due to the elimination of shift or position,
= 0 otherwise;
AGE = age in years;
CRAFT = 1 if occupation at the old job was precision production, craft, and repair,
= 0 otherwise;

EARNNEW = the analog of EARNOLD for the weighted aggregate of all major industries except the old industry;
EARNOLD = median weekly earnings of full-time employees in the old major industry, averaged between the March 1983 and 1984 CPS, or 1985 and 1986 (as appropriate);
EDUC = the number of grades of schooling completed;
EMPNEW = the analog of EMPOLD for the weighted aggregate of all major industries except the old industry;
EMPOLD = fraction increase in the number of full-time employees in the old major industry in the January Current Population Survey between 1983 and 1984, or 1985 and 1986 (as appropriate);
FAMINC = usual family annual income, by category;
FARMING = 1 if occupation at the old job was farming, forestry, or fisheries,
= 0 otherwise;
FEMALE = 1 if female,
= 0 if male;
HEAD = 1 if head of household,
= 0 otherwise;
LABORER = 1 if occupation at the old job was operator, fabricator, or laborer,
= 0 otherwise;
NOTIFIED = 1 if expected in advance the loss of one's job,
= 0 if did not expect;
PREMIUM = the proportional difference between weekly earnings on the old job and median weekly earnings for the industry;
SERVICE = 1 if occupation at the old job was services,
= 0 otherwise;
SIZERAT = ratio of employment in the new industry to employment in the old;
SLACK = 1 if left job due to slack work,
= 0 otherwise;
STUNEMP = the state unemployment rate for 1983 or 1985;
SUPPORT = 1 if occupation at the old job was technical, sales, or administrative support,
= 0 otherwise;
TENURE = number of years working at the old job;
UI = 1 if unemployment insurance benefits were received,
= 0 otherwise;
UNEMPNEW = unemployment rate for the new industry;
UNEMPOLD = unemployment rate for the old industry;
WHITE = 1 if white,
= 0 if nonwhite;
YEAR86 = 1 if the observation came from the 1986 survey,
= 0 otherwise.

Dummy variables for geographic divisions are also used.

If SUPPORT = SERVICE = CRAFT = LABORER = FARMING = 0, then the occupation at the old job was managerial or professional.

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