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AMONG YOUNG MEN

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The Complexity of Job Mobility Among Young Men  
Derek Neal  
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**ABSTRACT**

The model of job search involves both employer matches and career matches and incorporates an asymmetry in the search technology. Workers may change employers without changing careers, but cannot search over possible lines of work while working for one employer. The optimal policy implies a two-stage search strategy in which workers search over types of work first. After finding a good match with a particular line of work, they then concentrate on finding an employer.

The patterns of job changes observed in the NLSY provide considerable support for the two-stage search policy implied by the model. Among male workers who are changing jobs, those who have previously changed employers while working in their current career are much less likely to change careers during the current job change. This result holds even among workers with similar levels of career-specific work experience. Further, the link between experience and the complexity of job changes operates almost entirely through the two-stage mechanism identified in the model. Among those who are in the first stage (no previous intra-career moves) there is little relationship between experience and the complexity of job changes.

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In 1954, Herbert Parnes produced a survey of existing studies of labor mobility. In this survey, he devoted considerable attention to what he called the "complexity" of labor mobility. In Parnes' terminology, simple job shifts occur when workers change employers but continue doing the same type of work. Complex shifts occur when workers not only change employers but also change tasks. Parnes associated changes in occupation and industry with changes in task, and he noted that most job changes are complex changes. He wrote, "large proportions of the job changes made in the labor force as a whole involve a change in industry, occupation, or both."<sup>1</sup> Further, he also noted that as workers age they not only make fewer job changes, but they also make job changes that are less complex.<sup>2</sup>

In more than forty years since Parnes published his survey, little attention has been devoted to the complexity of labor mobility. Few studies explore the types of job changes that workers make or how patterns of mobility change over the life cycle. Empirical studies of labor mobility have focused primarily on quits, layoffs, and total separations at the firm level. Studies of individual work histories focus almost exclusively on firm to firm transitions.<sup>3</sup>

Further, modern theoretical work on labor mobility focuses

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<sup>1</sup> See Parnes (1954), p. 73.

<sup>2</sup> See Parnes (1954), p.104.

<sup>3</sup> Miller (1984), Shaw (1987) and McCall (1990) are exceptions. McCall presents a model similar the one presented here.

almost completely on firm-specific considerations. Various matching models derive optimal rules for terminating the employment relationship between a particular worker and firm. Models of human capital investment illustrate how firm-specific investments reduce separation rates, and models of principal - agent problems between workers and employers illustrate how firms may use rising wage schedules and pensions to reduce both shirking and turnover.<sup>4</sup>

This paper departs from the existing literature's focus on mobility between firms by developing a model that explores both the complexity of mobility and how complexity changes over the worker's life cycle. In this model, a worker receives utility from two types of matches. To begin, a worker is concerned about her match with her current career. Her career match captures how well she is suited to the type of work she does. She is also concerned about her match with her current employer. This match captures how well she works with her colleagues and how well she is suited to the work environment created by her firm.

The key feature of the model is an important asymmetry in the matching technology. I allow workers to change firms without changing careers, but I assume that workers who wish to change careers must also change firms. This assumption is motivated by the observation that most workers who want to change lines of work

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<sup>4</sup> See Parsons (1986) for a review of theoretical and empirical work on employment relationships. Johnson (1978), Jovanovic (1979a), and Jovanovic (1979b) are important theoretical contributions in this area. Lazear (1979) demonstrates how agency problems may lead to rising wage profiles within firms.

have few prospects for new jobs within their current firm. In this analysis, a career change occurs when a person moves from job A to job B and finds that skills specific to job A are of little or no value in job B. Opportunities for such moves within a given firm should be rare since most firms are engaged in producing a set of goods or services that are closely related.

The model yields an optimal job search strategy that involves two stages. Workers search for a career first. Workers do not begin searching over firms alone until they have already found a suitable career match. Thus, complex job changes tend to occur early in a worker's career and simple employer changes tend to occur later. Further, the two-stage search strategy implies that when workers change employers without changing careers we may infer that the worker has found a suitable career match. This means that any additional job changes in the future should involve simple changes of employer and should not involve career changes.

I evaluate the empirical support for the model using work history data from the National Longitudinal Survey of Youth. As expected, the data do not show that simple job changes are never followed by complex job changes. However, a comparison of job changes made by workers who have and have not made previous simple changes demonstrates that complex changes are roughly three times more likely among workers who have not made simple firms changes within their current career.

The empirical results also show that, among workers who change jobs, simple changes are much more common among experienced

workers. Further, this result appears to be driven by behavior that is consistent with the two-stage search strategy derived in the model below. Although the overall effects of experience on the complexity of job changes are quite significant, the effects are small given controls for whether or not previous job changes involved career changes.

The NLSY data indicate that over half of the job changes made by young men involve both movement across sectors of the economy and a change in occupation. These patterns of movement seem incompatible with the view that job matching is simply the process of finding a good employer match given a fixed career choice. Many workers are apparently using on the job experience as a means of gaining information about possible careers. The model developed here provides a framework for thinking about job search in an environment where career concerns are a driving force behind job mobility decisions. This work serves as a first step toward understanding job mobility as a process by which workers learn not only about firms but also about their relative aptitudes for different types of work. Understanding this process should enhance our understanding of how skills and wages evolve over the life cycle and how workers are sorted to various tasks in the economy.

The results presented here complement recent work on wage determination by Neal (1995) and Parent (1995). Previous studies point to the observed correlation between wages and firm seniority as evidence that firm-specific factors are important determinants of wages. However, Neal and Parent both provide evidence that this

correlation is driven in large part by the fact that wages are positively correlated with industry tenure which is both correlated with firm seniority and typically not included in wage regressions. The results from both studies suggest that, contrary to previous claims, truly firm-specific factors contribute little to observed correlations between wages and seniority.

The following section of the paper outlines the model. Two subsequent sections describe the data and the empirical work. Two additional sections discuss related research and conclusions. The discussion specifically addresses how the results inform the design of training programs for youth.

## I. The Model

Here, I present a highly stylized model of job search. The model does not incorporate learning about job matches or investment in matches. However, the model is a useful device for illustrating some important aspects of the search problem facing a worker who must learn about both career matches as well as employer matches. The utility of the model becomes most clear when it is viewed in light of the empirical results presented in section III. The model provides a framework for understanding new results about job mobility that previous models have not addressed.

Consider the maximization problem faced by a worker who is infinitely lived and derives utility from two types of matches, her career match  $\theta$  and her firm match  $\xi$ . The worker draws career

matches from the distribution  $F(\theta)$  and firm matches from the distribution  $G(\xi)$ . There is no learning in this model. The values of all matches are revealed when drawn.

At the beginning of each period, the worker may draw a new firm match,  $\xi$ , or she may draw a new pair of matches  $(\theta, \xi)$ , but she is not allowed to draw a new career match,  $\theta$ , while retaining a firm match,  $\xi$ , from a previous draw. Further, the worker may choose not to draw from either distribution and simply consume the matches enjoyed in the previous period.

The worker's utility in period  $t$  is given by  $u_t = \xi_t + \theta_t$ , where  $\xi_t$  and  $\theta_t$  are the matches chosen at the beginning of period  $t$ . These may be new draws or matches carried over from the previous period. The worker's objective is to maximize the expected value of the present discounted sum of  $u_t$  for  $t = 0, \infty$ . The worker's problem can be characterized by the following Bellman equation.

$$(1) \quad V(\theta, \xi) = \theta + \xi + \beta \max \left[ V(\theta + \xi), \int v(\theta, s) g(s) ds, \iint v(x, s) f(x) g(s) dx ds \right]$$

where  $V(\theta, \xi)$  is the value of having current matches  $(\theta, \xi)$ , and  $\beta$  is a discount factor. Equation (1) illustrates that at the beginning of the next period, the worker has three options: (i) keep both  $\theta$  and  $\xi$ , (ii) keep her career match  $\theta$  and draw a new firm match or (iii) draw a new career match and a new firm match.

Appendix I demonstrates that the worker's optimal policy can be characterized by Figure I.  $\theta^*$  and  $\xi^*$  serve as quasi-reservation values for each type of match, and based on these values, the



figure is divided into three regions. Workers holding a pair  $(\theta, \xi)$  that lies in region A choose to draw a new pair at the beginning of the next period. Workers holding  $(\theta, \xi)$  in region B keep their current career match  $\theta$ , but draw a new firm match at the beginning of the next period. Workers who hold  $(\theta, \xi)$  in region C cease searching.

Given this search strategy, workers never change careers after changing firms within a given career. In this model, workers who make simple firm changes within a career already hold a career match  $\theta > \theta^*$ . They may change firms many times before they draw  $\xi > \xi^*$ , but they will not change careers.

Further, precisely because the optimal policy illustrated in Figure I places restrictions on the sequence of moves that workers make, it also generates predictions concerning the relationship between worker experience and the complexity of job moves. Define two indicator variables,  $I_t^{\theta\xi}$  and  $I_t^\xi$ .  $I_t^{\theta\xi} = 1$  if the worker draws a new pair  $(\theta, \xi)$  at the beginning of period  $t$ .  $I_t^{\theta\xi} = 0$  else.  $I_t^\xi = 1$  if the worker draws a new  $\xi$  at the beginning of period  $t$ .  $I_t^\xi = 0$  else. Thus,  $I_t^\xi = 1$  if any change is made.  $I_t^{\theta\xi} = 1$  if a complex change is made. Note that the probability of a complex change in period  $t$ , given that some change occurs in  $t$  is

$$(2) \quad Pr[I_t^{\theta\xi} = 1 \mid I_t^\xi = 1] = \frac{p(A)^{t-1}}{p(A)^{t-1} + p(A)^{t-2}p(B) + \dots + p(B)G(\xi^*)^{t-2}}$$

It is straightforward to show that this is a strictly decreasing function of  $t$ . Thus, the optimal policy illustrated in Figure I implies that, in a sample of workers who are changing jobs, the complexity of changes should be negatively correlated with worker experience. Further, this result is driven entirely by the fact that workers search in two stages. If we condition on the complexity of past moves, the model indicates that experience and the complexity of current job changes should be unrelated. Let us assume that a worker is changing jobs this period and assume further that she has made no simple job changes in the past. Then, the probability of a complex change this period is just

$$(3) \quad \Pr\{I_t^{\theta\xi} = 1 \mid I_{t-1}^{\theta\xi} = 1\} = \frac{p(A)}{p(A) + p(B)}$$

This is not a function of  $t$ . Further, if we assume that the worker has made a simple change in the past, the two-stage strategy implies that the probability of a complex change in the current period is zero.

The model outlined here could be generalized to include learning about either one or both of the matches. Although I have not been able to characterize explicit solutions for the optimal search policy in these cases, the strict two-stage search strategy outlined above would likely not be optimal in such a model. In a model with learning, workers would occasionally change careers after having made a simple change of employer because they would in

some instances realize that what appeared, at the time of the employer change, to be a good career match was in fact a poor one.

Nonetheless, two-stage search should be the rule and not the exception in any model where career matching is important and workers cannot effectively search over possible careers within a given employer. Under these circumstances, workers have a strong incentive to find a suitable career match first, and then search for an employer. If a worker devotes resources toward finding a better employer match without first locating a suitable career match, she may forfeit the returns from her investment because any subsequent career change necessitates a change of employer.

In section III, I present empirical results concerning the complexity of job changes among young men. The purpose of the empirical work is to determine the extent to which the two-stage search strategy described here is an accurate description of the data. The next section describes the construction of my data set. Before conducting the empirical analyses, I must first construct a data set that provides not only longitudinal information concerning when workers change jobs but also information about the complexity of each job change.

## II. DATA

The National Longitudinal Survey of Youth is a panel data set that covers work, schooling and other experiences of a cohort of young persons who were born between 1957 and 1964. The first

survey was conducted in 1979. At the time of their first interviews, respondents were between 14 and 22 years of age. In this paper, I use data from 14 survey years, 1979-1992.

The NLSY Work History (NLSYWH) is a file that contains weekly records of each respondent's labor force activities. This longitudinal file is constructed using information provided in the yearly interviews. For each week, the data provide an employment status for each respondent. For those who are working, the data also provide a description of up to five jobs that the respondent may have held during that week. The description of each job usually includes hours worked, hourly wage rates, industry, occupation, and union status for each job.<sup>5</sup>

In this paper, I restrict my attention to data on male workers from the cross section subsample of the NLSY. This sample contains 3,003 cases. Each individual work history covers the time period January 1978 through December 1991.

Further, I only consider respondents with complete work history records. I delete 280 cases because the individual work histories in question do not offer a continuous record of each respondent's weekly activities. This occurs most often because of coding errors, refusals, or related problems.

I use the NLSYWH weekly records of individual activities to construct a monthly history of primary employment for each worker. I define a worker's primary job in a particular month as the job associated with the most hours of work in that month. For each

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<sup>5</sup> Jobs involving self-employment are included.

respondent, I keep a running tally of actual work experience.

My goal is to construct monthly records that will not only allow me to identify job changes, but will also allow me to identify career changes. In the empirical analyses below, I identify career changes by using industry and occupation codes. Given this strategy, two features of the NLSYWH present important problems. First, the occupation and industry codes in the NLSYWH contain many errors that imply false changes in industry or occupation. Second, industry and occupation codes are not provided for all jobs.

In some instances, the industry and occupation codes are missing because workers refused to provide information about the type of work they performed. In others, the codes are missing because errors were made in processing the respondents descriptions of their jobs. These errors create "invalid skips" in the industry and occupation data. Finally, in many cases, the codes are missing because the respondents were never asked about certain characteristics of a particular job. This occurred in some but not all cases where jobs either involved less than ten hours per week or less than nine weeks of actual work. These missing codes are known as "valid skips."

I adopt several strategies to address the problems of coding errors and missing data. In an effort to minimize the number of false transitions implied by the industry codes, I edited codes that imply a change in industry affiliation within a continuous employment spell associated with a single firm. In the edited

data, the first industry code reported for a given employer is always the industry code associated with that employer.

In all cases where a respondent refuses to provide information about a primary job, I eliminate the entire case from the sample. I use a similar rule to deal with invalid skips. In all, I deleted 241 cases for these reasons. I turn to the problem of valid skips below, but first I describe an intervening step.

I merged my data on monthly employment records with data on each respondent's demographic characteristics. These characteristics come from the corresponding waves of the NLSY survey. I use the interview dates to match answers with the appropriate months. In 187 cases, I was able to construct a complete history of monthly work activities but was not able to construct a complete time series of demographic characteristics. I delete these cases.

After the deletions described above, 2,295 of the original 3,003 cases remain. Among these 2,295, there are 1351 cases with at least one month where the respondent is working, but the data do not provide industry and occupation codes for the job in question. On average, this problem of valid skips effects roughly five months of data within each case in question. Most of these months appear early in the respondents' work histories, and they often appear to represent part-time jobs or summer employment. This is likely the case because, as I note above, all of the valid skips involve jobs that either last less than ten weeks or require less than ten hours of work per week.

The model developed above attempts to describe how agents choose jobs. Implicit in the formulation is the assumption that each agent's primary activity is work. Appropriate tests of the model's implications should be based on data taken from periods where agents are firmly attached to the labor force. There is no natural or obvious way to identify these attachments, but I do make an attempt to do so. I examine each respondent's work history to find the first twelve month period that involves at least nine months of full-time work.<sup>6</sup> I designate these episodes as transitions to full-time labor force participation, and I eliminate all monthly observations prior to this period. Further, I restrict the sample to monthly observations following this transition that involve at least thirty hours per week on the primary job.

The transformed data not only contain individual work histories that more closely correspond to periods when individuals are firmly attached to the labor force. The data also contain fewer cases involving valid skips of industry and occupation codes. In the 2,199 cases that remain, 1,460 contain industry and occupation codes for each monthly record. In addition, the remaining 739 cases involve, on average, less than 3 monthly

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<sup>6</sup> I define full-time as 30 hours or more per week. 96 of the 2,295 respondents never record a transition to full-time participation. Approximately 400 respondents both work full-time in January, 1978 when the panel begins and subsequently work at least nine months during 1978. There is no way to know how many months these workers worked before the panel started. Although the oldest cohort in the sample is 20 years old when the panel begins, I have also analyzed job changes using a sample that excludes all workers who turn 18 before January, 1978, and the results are quite similar to those for the full sample.

records with missing codes.

I remove all months with missing codes. This rule causes me to understate the number of job changes made by some workers. However, I cannot determine whether or not a job change involves a career change without information about the industries and occupations associated with both jobs, and the incidence of career changes is the primary focus of the empirical analyses below.

### III. EMPIRICAL RESULTS

The model presented in Section I focuses on the complexity of job changes. It draws a distinction between job changes that involve only a change of employer from job changes that involve both a change of employer and a career change. Obviously, I must develop an empirical definition of a career change before I can test the implications of the model. Conceptually, I define a career change as a change in line of work. Whenever a worker enters a new job and finds that knowledge and skills acquired on his previous job are of little value in his new endeavor, the new job represents a new career.

Although I assume otherwise in the model section, it is possible that such job changes might occur without a change of employer. I do not address such changes for two reasons. First, I argue that there is limited scope for such changes. In most cases where a worker is promoted or transferred from one task in the production process to another, I expect the worker to draw on



existing knowledge of that process in performing his new task.

Second, although one can imagine exceptions to this rule, within firm career changes are hard to identify in the NLSY data because the occupation codes are riddled with measurement error. In an effort to examine the prevalence of within firm career changes, I identified each recorded change of one-digit occupation within a continuous spell of employment with a particular employer. There are 5,231 such episodes in my data, which cover 11,413 employment spells. Thus, at first glance, it appears that within firm occupation changes are quite common. However, careful inspection of the data reveals that many of the changes are one element in a sequence of reported moves between two particular occupations. There are numerous instances where the data indicate that a worker moved from occupation A to occupation B, then moved from occupation B back to occupation A, and then moved from A back to B. In fact, respondent cases that involve this pattern of cycling between two occupations account for almost two thirds of the reported within firm occupation changes. I interpret this pattern as evidence that the occupation codes in the NLSY data are quite noisy. Further, I know of no satisfactory way to clean these data.<sup>7</sup>

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<sup>7</sup> It should be noted that, even if one assumes that the occupation codes in cases without cycling are correct, the vast majority of recorded, intra-firm, occupation changes do not appear to involve changes in line of work. The most common transitions involve movements into management positions. This is especially true among white collar workers. There are also many movements between the one-digit classifications of craftsmen, operative, and laborer.

In the empirical work below, I rely primarily on industry codes to identify career changes. As I note earlier, the industry codes, like the occupation codes, report numerous intra-firm changes that are apparently false. However, this problem is easier to address because it seems reasonable to assume that almost all of the implied intra-firm industry transitions are false. Here, I classify industries at approximately the one-digit level, and it is hard to imagine situations where a worker actually changes industrial sector without leaving his employer. Therefore, I edit the industry codes to ensure that one industry classification is assigned to each spell of employment. Table I describes the industry coding scheme.

In many instances, it might be safe to assume that someone who moves between two of these broad industrial sectors is changing careers. A worker who makes such a change is not only moving to a new employer, he is moving to an employer that produces goods or services that differ greatly from those produced by his previous employer. Therefore, it is natural to expect the worker to be engaged in tasks that, in large measure, require knowledge and skills that were not important for his previous job. Further, through experience in his new job, he will learn how well he matches with his new employer and his new tasks.

However, a rule that associates sector changes directly with career changes may overstate the complexity of some job changes. A worker is not always involved directly in tasks that are specific to the good or service that his employer produces. Rather, a

worker may engage in activities that are common to production processes in many or all industrial sectors. Accountants, computer programmers, and truck drivers are a few examples of three-digit occupations that are common in many one-digit industries. It would be fallacious to say that a truck driver who moves from driving a truck for a manufacturing company to driving a truck for a large retail store is changing lines of work. In both cases, he is driving a truck, and it seems reasonable to assert that his career-specific knowledge and skills involve the operation of trucks and have little to do with the particular contents of their cargo.

Using data described in Section II, I construct, for each respondent, a record of employer changes. I document each change of employer that occurs after a respondent makes a transition to full-time labor force participation. I note whether the job represents entry into a new industrial sector, and whether it represents entry into a new occupation, defined at roughly the three-digit level.<sup>8</sup> If the new job falls in a new sector and occupation, the event is labeled a career change, and the job change is described as a complex move. If both of these criteria are not satisfied, the job change is described as a simple move.<sup>9</sup>

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<sup>8</sup> In some instances, I combine three-digit occupations that belong to a fairly homogenous category of workers. For example, I combine various types of mechanics and repair personnel in order to avoid drawing fine distinctions between mechanics that are based on types of machines.

<sup>9</sup> I have also conducted the analyses of job changes using occupation codes as the key identifier of career changes. In this scheme, career changes occur when workers change both one-digit occupation and two-digit industry. The results provide strong support for the model's predictions. In particular, the

The task of measuring career changes is central to this analysis, and it is important to realize that measurement error remains an important concern even if one accepts the conceptual strategy described above. Errors in the NLSY industry and occupation codes may lead to false inferences concerning whether or not a particular job change involves an industrial sector change or a change in three-digit occupation. After presenting the results, I discuss how the presence of measurement error affects the conclusions I draw.

Table II provides descriptive statistics concerning my sample. On average, respondents make 4.2 job changes following their transition to full-time participation. Just over 55 percent of these changes involve career changes. The average age at the beginning of a transition period is 20. 61% percent have graduated high school. 6% percent are college graduates.<sup>10</sup>

The optimal search strategy described in Figure I implies that job histories follow one of four patterns. Some workers stay with their first job throughout their careers. Others make a series of complex job changes that end in a stable attachment to one job. Some make complex changes until they find a suitable career match and then make a series of simple changes that involve only a change

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presence of previous simple job changes dramatically reduces the probability that current job changes involve career changes. However, the overall frequency of career changes is lower given this definition. It is .39.

<sup>10</sup> It is important to remember that these educational attainment measures are for the first month of post-transition work. They do not reflect final attainment, which is significantly higher.

of employer, and finally some find a suitable career match on their first job and then make employers changes until they find a satisfactory firm match. In all four scenarios, complex job changes never follow simple job changes. Workers do not make simple changes of employer unless they have already drawn a career match  $\theta > \theta^*$ .

Table III provides information concerning search patterns in the NLSYWH data. The rows in Table III group workers according to their total number of job changes during the sample period. The first column displays the number of workers in each group that never report a complex change preceded by a simple change. The second column presents the expected value of this number under the null hypothesis that each job change is an independent event involving a constant probability of a complex change.<sup>11</sup>

It is obvious that the two-stage search strategy illustrated in Figure I is not an accurate characterization of the job histories in the NLSYWH data. Numerous cases involve violations of the two-stage search rule. For example, among workers who change jobs six times, 70 percent of the records involve at least one complex job change that is preceded by a simple change of employer. However, job histories that satisfy the two-stage search rule are much more common than expected under the null hypothesis that the probability of a complex job change is constant across consecutive job changes. Among histories involving five employer changes, the

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<sup>11</sup> The probability of a complex change is assumed to be .55, which is the fraction of complex moves in the full sample of job changes.

number of cases that satisfy the two-stage search rule is more than twice the expected number under this null. For histories involving more than four changes, such cases are at least three times more common than expected.

Table IV provides more information about the tendency for workers to search in two-stages. Here, the unit of observation is not an entire job history but a particular job change. There are 9,209 job changes recorded in my data set. 3,001 occur among persons who have not graduated from high school. 5,256 occur among high school graduates, and 952 occur among college graduates. For each of these three educational categories, Table IV presents information about the relationship between the complexity of current and previous job changes.

The entries in the Table IV give the fraction of job changes in each category that involve career changes,<sup>12</sup> and the results are consistent with the proposition that workers tend to search in two-stages. If a worker without a college degree is leaving the only job he has held in his current career, there is roughly a 70 percent chance that the new job will involve a new career. If on the other hand, the worker is leaving the second job he has held in his current career, there is less than a 25 percent chance that the new job will involve a career change.

The same pattern is observed among college graduates, but the

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<sup>12</sup> In the model, workers never return to previous careers. However, in these data, 8.5% of the 9,209 job changes represent a return to a previous career, where careers are defined by industry-occupation pairs.

incidence of complex changes is generally lower among the college educated. To the extent that college provides an opportunity for pre-market search over potential careers, this result is to be expected.<sup>13</sup> The results are consistent with the proposition that college students, in part, find out how well they may match with various careers by trying different majors, while less educated students search for a career by working many different kinds of jobs.

Sections II points out that the two-stage search strategy implied by the model generates clear predictions about the relationship between the complexity of job changes and worker experience. Tables V and VI address these predictions of the model. Table V shows that, for all three education categories, job changes tend to be less complex among more experienced workers. The most dramatic contrast appears among high school graduates. For this group, 64 percent of job changes involve career changes if the job changes occur during the first year of a worker's career. For job changes occurring after seven years of work experience, the corresponding figure is 45 percent.

However, the model not only predicts that the complexity of changes should decline with experience. Equation (3)<sup>14</sup> highlights the additional prediction that the complexity of changes should not be a function of worker experience in a group of workers who are leaving the first job they have held in a particular career. Table

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<sup>13</sup> Johnson (1978) addresses the role of education as pre-market search.

VI addresses this prediction. It demonstrates that across all the three education groups, the relationship between experience and the complexity of job changes is either weak or nonexistent among workers who are leaving their first job in a particular career.

Table IV shows that, among high school dropouts leaving their first job in a given career, roughly 70 percent change careers. The first row of Table VI shows that this result holds for workers at all levels of work experience. The primary reason that Table V reports a negative overall correlation between work experience and the complexity of job changes is because experienced workers are more likely to be in the second stage of search. To see this, compare the first two rows of Table VI. As these workers become more experienced, a larger fraction of the job changers in the high school dropout sample falls in the category "Prior Simple Changes > 0." This category includes workers who are not leaving their first job in a particular career. Their last job change and maybe their last several job changes involved only a change of employer, and they are not likely to change careers during this job change either.

The results are similar but not quite as stark for high school graduates. Among high school graduates who are leaving their first job in a given career, the probability of a changing careers is roughly 70 percent for all workers with less than seven years of experience, and over this range of experience, there is no systematic relationship between experience and the frequency of career changes. However, career changes are slightly less common



among workers with more than seven years of work experience. The results, in row five, for college graduates follow a pattern similar to those for high school graduates, but the frequency of career changes is lower in all experience groups.

In sum, Table VI shows that the experience effects documented in Table V are primarily a reflection of the fact that, among workers who are changing jobs, experienced workers are more likely to be in the second stage of search. It is more likely that they have found a suitable career and are in the process of searching over possible employers.

Taken together, the results in Tables IV, V, and VI provide considerable support for the search model presented in section II. However, one can imagine alternative explanations for these results. To begin, individual specific heterogeneity is a natural explanation for the results in Table IV. Consider a model with two types of workers. One type begins work with a definite career choice. Workers of this type only change jobs when better opportunities arise at another firm in the same field. A second type changes careers periodically because she enjoys doing different things. In such a model, the complexity of previous job changes would provide information about the expected complexity of future job changes. However, such a model would not generate the prediction that the complexity of changes declines with worker experience, and Table V clearly shows that complexity does decline

with experience.<sup>14</sup>

Nonetheless, unobserved heterogeneity is not the only possible alternative explanation for the results presented here. Because career specific investments deter inter-career mobility, one might conjecture that prior simple moves are negatively correlated with career changes because workers who have made prior simple moves are most likely to have significant experience in their current career. To address this possibility, I constructed Table VII. This table has the same structure as Table VI except the columns control for career experience rather than total work experience.

Look down the columns of Table VII. Across all education groups and all career experience categories, there is a strong negative relationship between the presence of prior simple changes and the complexity of current job changes. This is a striking result. Consider two workers who are changing jobs this period. These workers have been in their current careers the same amount of time, but one worker has changed employers since entering his current career and the other has not. The results in Table VII tell us that the latter worker is roughly two to three times more likely to change careers than the former. Thus, when we observe a

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<sup>14</sup> In fact, the overall complexity of job changes would rise with worker experience in a model driven by this type of unobserved heterogeneity. The fraction of job changers who are type two agents should rise with cohort experience because standard models predict that the hazard rate of firm changes should decline for type one workers as they get better firm matches. Further, the experience effects in Table V do not reflect a pattern of filtering into a few sectors where complex changes are uncommon. Regardless of sector, a large fraction of job changes are complex.

worker changing employers without changing careers, we may interpret this event as new evidence that the worker is well matched with his current career, and this is true regardless of how long the worker has been in his current career.<sup>15</sup>

While Table III demonstrates that many workers do not follow a strict two-stage search strategy that involves career changes followed by simple moves across firms within a career, the results taken as a whole do provide support for the model developed in section II. The results in Table IV document a strong tendency toward two-stage search. Further, Tables V, VI, and VII provide additional results that are, in large measure, consistent with the implications of a two-stage search strategy.

I noted earlier that the measurement error in the industry and occupation codes likely contaminates my identification of simple versus complex job changes. This contamination makes it harder not easier to produce evidence that workers search in two stages. Under the assumption that workers do search in two stages, the prevalence of work histories that satisfy the two-stage rule is inversely related to the frequency of coding errors. Thus, the existence of measurement problems strengthens the argument that the results presented here provide support for the model.

While I cannot rule out the possibility that more complicated

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<sup>15</sup> Further, these large effects are evident given simultaneous controls for both total work experience and career work experience. I estimated linear probability models and found that, across all the education groups, the presence of at least one prior simple job change reduced the probability that a current job change involves a career change by roughly 50 percentage points.

alternative models provide other explanations for these results, my empirical findings do support the hypothesis that, among young workers, mobility is often an attempt to gain more information about potential matches with various careers. Further, the results are consistent with the hypothesis that job mobility is not driven by firm-specific considerations unless workers are fairly confident that they have found a good career match.

#### IV. RELATED WORK

McCall (1990) presents a model of job search that is similar to the one described in section II above. McCall's model focuses on occupation choices rather than the more broad concept of career choice, but it resembles the model presented here because the technology requires that workers who want to change occupations must also change firms. Because McCall's model allows information about occupation matches and firm matches to arrive at different times, the characterization of the optimal search policy is much more complicated. Consequently, McCall focuses on one clear prediction taken from his model. His model implies that, if a worker is working his second job and if the worker did not change occupations when he moved from his first job to his second job, the hazard rate of leaving that job should be a decreasing function of tenure on the previous job.

This result is of particular interest here because it is closely related to the two-stage search strategy described above.

In the model presented in section II, workers do not make simple changes of employer unless they have learned that their career match is a good one, in the sense that  $\theta > \theta^*$ . McCall's result is similar in spirit because it is driven by the fact that workers do not change firms within an occupation if they have already learned that their existing occupation match is poor. In his model, a worker holding her second job within an occupation either has received no information about her occupation match or has received good information about her occupation match, and the probability that the worker knows she has a good occupation match is an increasing function of tenure on the first job:

#### V. CONCLUSIONS AND FUTURE RESEARCH

The model outlined here highlights one insight concerning job search. To the extent workers use job experience to determine both how they match with possible careers as well as how they match with specific firms, workers have an incentive to postpone search over firms until they are fairly confident that their career match is a good one. Workers who search over employers without knowing that they match well with their current career may ultimately forfeit the returns to this activity because any future career changes will likely require a change of employer.

This insight has several implications for future research on job mobility. Topel and Ward (1992) document that young men make more than two thirds of their lifetime job changes during their

first ten years of work experience. Further, Topel and Ward note that roughly one third of wage growth during these first ten years can be attributed to wage changes associated with job changes. The results presented here illustrate that many job changes among young workers, especially those without college degrees, involve career changes. This raises the possibility that the process of finding a good career match contributes significantly to the wage growth of many young workers. Future work on the relationship between wage growth and the complexity of job changes is needed to address this issue.

Further, additional work on the complexity of job changes may inform recent debates about government training programs and the school to work transition. In an evaluation of the German apprenticeship system, Harhoff and Kane (1995) point out that although German apprentices appear to invest much more heavily in training than United States high school graduates, both groups, on average, experience similar life cycle wage growth. Harhoff and Kane argue that U.S. workers may enjoy greater returns from job search because institutional features of the German labor market compress wages and restrict mobility.

These institutional features make apprenticeship systems attractive to employers because they reduce the likelihood that firms will suffer losses on investments in general worker training. However, these features may severely reduce allocative efficiency. The results presented here suggest that workers devote considerable effort toward discovering more than just employer specific

information. It appears that finding what one does well is a primary objective of job search. Institutions that limit returns from search may lead not only to an inefficient assignment of workers to firms but also an inefficient assignment of workers to tasks in the economy.

## Appendix I

The worker's problem is characterized by

$$(A1) \quad V(\theta, \xi) = \theta + \xi + \beta \max \left[ V(\theta + \xi), \iint v(x, s) f(x) g(s) dx ds, \int v(\theta, s) g(s) ds \right]$$

where  $f(-), g(-)$  are density functions associated with the distribution functions  $F(\theta), G(\xi)$ . Both distributions are assumed to have bounded support.<sup>1</sup>  $\theta \in [0, \theta^u]$ .  $\xi \in [0, \xi^u]$ .  $\theta$  and  $\xi$  are assumed to be statistically independent. I conjecture that  $\exists \theta^*, \xi^*$  s.t. the optimal policy is given by

- (i) If  $\theta \leq \theta^*$  and  $\theta + \xi \leq \theta^* + \xi^*$ , then draw a new pair of matches  $(\theta, \xi)$
- (ii) If  $\xi \leq \xi^*$  and  $\theta \geq \theta^*$  then hold  $\theta$  but draw a new  $\xi$ .
- (iii) If  $\xi \geq \xi^*$  and  $\theta + \xi \geq \theta^* + \xi^*$ , then cease search and consume  $(\theta, \xi)$

See Figure I.

If this conjecture is correct, the indifference relationships at the boundaries in Figure I imply that

$$V(\theta, \xi) = \hat{V}(\theta, \xi)$$

$$(A2) \quad \hat{V}(\theta, \xi) = \left\{ \begin{array}{ll} \theta + \xi + \frac{\beta}{1-\beta} (\theta^* + \xi^*) & \text{if } (\theta, \xi) \in A \\ \frac{\theta}{1-\beta} + \xi + \frac{\beta}{1-\beta} \xi^* & \text{if } (\theta, \xi) \in B \\ \frac{\theta + \xi}{1-\beta} & \text{if } (\theta, \xi) \in C \end{array} \right.$$

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<sup>1</sup> The assumption of bounded support is not necessary for the result, but it does make the proof much easier to present. I thank Francis Kramarz and Sebastien Roux for providing me with a proof for the unbounded support case.



Define

$$(A3) \quad V^*(\theta, \xi) = \theta + \xi + \beta \max \left\{ \iint \hat{V}(x, s) f(x) g(s) dx ds, \int \hat{V}(\theta, s) g(s) ds, \frac{\theta + \xi}{1 - \beta} \right\}$$

If  $\exists \theta^*, \xi^*$  s.t.

$$(A4) \quad \iint \hat{V}(x, s) f(x) g(s) dx ds = \frac{\theta^* + \xi^*}{1 - \beta}$$

$$(A5) \quad \int \hat{V}(\theta, s) g(s) ds = \frac{\theta}{1 - \beta} + \frac{\xi^*}{1 - \beta} \quad \forall \theta \geq \theta^*$$

$$(A6) \quad \int \hat{V}(\theta, s) g(s) ds \leq \frac{\theta^* + \xi^*}{1 - \beta} \quad \forall \theta < \theta^*$$

then  $V^*(\theta, \xi) = \hat{V}(\theta, \xi)$ , and  $\hat{V}(\theta, \xi)$  solves (A1).

It is straightforward to show that  $\exists \theta^*, \xi^*$  that satisfy (A4) - (A6).

Begin with condition (A5). Substitution of  $\hat{V}(\theta, \xi)$  into (A5) and same manipulation of terms yields

$$(A7) \quad \xi^* = \mu_\xi + \beta \int_0^{\xi^*} (\xi^* - s) g(s) ds$$

It is easy to show that there exists a unique  $\xi^*$  that satisfies (A7). Given this definition of  $\xi^*$ , it is also straightforward to show that condition (A6) is satisfied. All that remains is to show that given the definition of  $\hat{V}(\theta, \xi)$  and given the definition of  $\xi^*$  in (A7),  $\exists \theta^*$  that satisfies (A4). Substitution of  $\hat{V}(\theta, \xi)$  into (A4) yields

$$(A8) \quad \begin{aligned} & \mu_\theta + \mu_\xi + \beta \theta \Pr(A) + \beta \xi^* [\Pr(A) + \Pr(B)] \\ & - \beta E(\theta|A) \Pr(A) - \beta E(\xi|A) \Pr(A) - \\ & \beta E(\xi|\beta) \Pr(B) = \theta^* + \xi^* \end{aligned}$$

If we evaluate (A8) at  $\theta^* = 0$ , it is easy to show that the left-hand side of the (A8) is greater than  $\xi^*$ . If we evaluate (A8) at  $\theta^u$ , the left-hand side of (A8) is less than  $\theta^u + \xi^*$ . (This can be shown easily because (A7) implies that  $\xi^* > \mu_\xi$ .) Thus,  $\exists \theta^*$  that satisfies (A4) given the definition of  $\xi^*$  in (A7), which implies  $\exists \theta^*, \xi^*$  that satisfy (A4)-(A6).

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FIGURE I

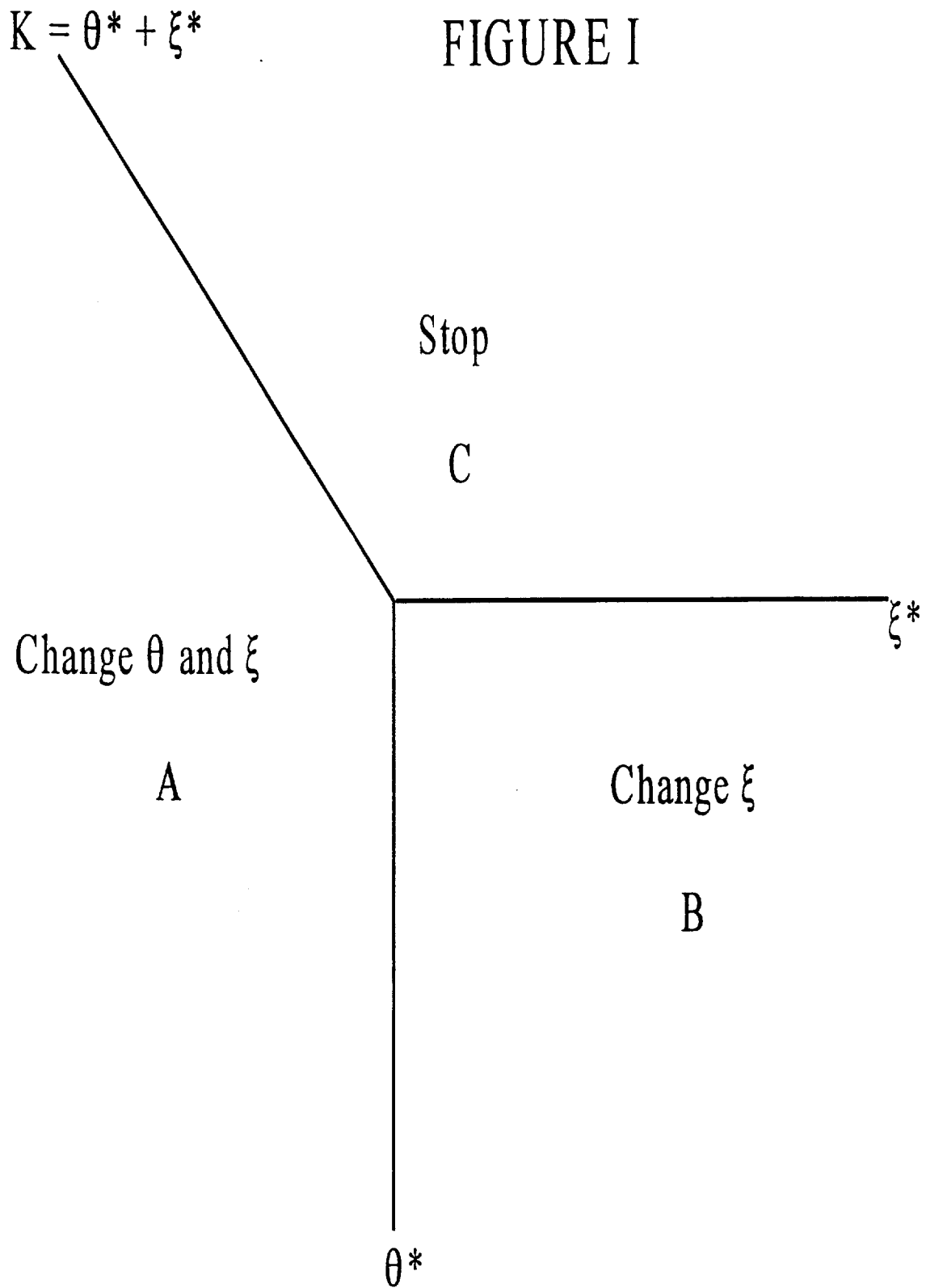


TABLE I  
MAJOR INDUSTRIES

Agriculture  
Mining  
Construction  
Durables  
Non-Durables  
Transportation  
Communications  
Public Utilities  
Trade  
Health Services  
Other Services  
Public Administration and Education

Descriptive Statistics

. Table II .

Worker Characteristics at Time of Transition to Full-Time Participation	
Age	20.18 (2.57)
High School Graduate	.61
College Graduate	.06
Married	.08
Black	.11
Hispanic	.07
N	2199
Description of Post-Transition Job Changes	
Total Changes	9209
Changes per Worker	4.19
Career Changes	5113 (55.5%)

THE PREVALENCE OF TWO-STAGE SEARCH

TABLE III

Number of Employer Changes in the Job History	Percentage of Actual Job Histories That Satisfy Two-Stage Search	Percentage of Job Histories That Satisfy Two-Stage Search Given Random Behavior
2	83.6% (318)	75.3%
3	63.3% (283)	50.5%
4	52.8% (235)	31.8%
5	42.1% (209)	19.4%
6	30.7% (163)	11.4%
7	27.5% (120)	7%
8	16.1% (93)	3.8%
9	22% (59)	2.2%
10	12.5% (48)	1.2%

The numbers in parantheses give the number of cases in each category. The percentage entries in the second column give the fraction of job histories, involving a fixed number of job changes, that do not violate the two-stage search rule. A violation occurs whenever a simple change of employer is followed by a career change.

The third column gives the expected value of the percentages in the second column under the assumption that each job change is an independent event involving a constant probability of a career change. The probability is set to .55, the overall sample average.



THE FREQUENCY OF CAREER CHANGES AMONG WORKERS WHO ARE CHANGING EMPLOYERS

TABLE IV

	Dropout	High School Graduate	College Graduate
Leaving first job in a given career	70.9% (2270)	68.5% (3942)	54.0% (658)
Prior employer changes while working in current career = 1	23.8% (361)	22.1% (700)	16.5% (176)
Prior employer changes while working in current career = 2	22.5% (178)	15.6% (283)	10.5% (67)
Prior employer changes while working in current career > 2	14.6% (192)	16.0% (331)	7.8% (51)

The numbers in parentheses give the number of cases in each category. The percentages give the fraction of job changes in each category that involve a career change. A career change occurs when a worker changes industrial sectors and changes occupation. Occupations are measured at approximately the three-digit level. Table I describes the industry classifications.

THE FREQUENCY OF CAREER CHANGES AS A FUNCTION OF WORK EXPERIENCE

TABLE V

MONTHS OF WORK EXPERIENCE	EDUCATION LEVEL		
	Dropout	High School Graduate	College Graduate
exp ≤ 12	64.2% (509)	64.0% (888)	49.5% (99)
12 < exp ≤ 24	63.4% (535)	64.5% (965)	52.3% (172)
24 < exp ≤ 36	59.4% (441)	56.8% (759)	44.7% (141)
36 < exp ≤ 60	56.5% (616)	55.4% (1038)	36.8% (242)
60 < exp ≤ 84	56.5% (455)	50.3% (737)	36.4% (154)
exp > 84	51.9% (445)	44.5% (869)	33.3% (144)

The numbers in parentheses give the number of job changes in each category. The percentages give the fraction of job changes in each category that involve a career change. Work experience is measured in months beginning with the worker's transition to full-time employment. For all education groups, the data clearly reject the null hypothesis that the probability of a career change is identical across experience categories. The test statistics are distributed  $\chi^2(5)$ , and the smallest one equals 19.35.

THE FREQUENCY OF CAREER CHANGES:  
THE ROLES OF WORK EXPERIENCE AND PRIOR EMPLOYER CHANGES WITHIN CAREER

TABLE VI

		MONTHS OF WORK EXPERIENCE					
		e ≤ 12	12 ≤ e < 24	24 ≤ e < 36	36 ≤ e < 60	60 ≤ e < 84	e ≥ 84
Dropouts	Prior Simple Changes = 0	69.1% (469)	72.7% (440)	68.5% (352)	73.0% (414)	71.9% (306)	70.2% (289)
	Prior Simple Changes > 0	7.5% (40)	20.0% (95)	23.6% (89)	22.8% (202)	24.8% (149)	18.0% (156)
High School Graduates	Prior Simple Changes = 0	67.7% (838)	73.4% (812)	66.6% (571)	70.5% (748)	68.3% (457)	62.0% (516)
	Prior Simple Changes > 0	2.0% (50)	17.0% (153)	27.1% (188)	16.6% (290)	21.1% (280)	19.0% (353)
College Graduates	Prior Simple Changes = 0	53.9% (91)	56.3% (151)	54.6% (108)	52.0% (152)	56.3% (80)	50.0% (76)
	Prior Simple Changes > 0	0.0% (8)	23.8% (21)	12.1% (33)	11.1% (90)	14.9% (74)	14.7% (68)

The numbers in parentheses give the number of job changes in each category. The percentages give the fraction of job changes that involve a career change. For all education categories, I test the null hypothesis that conditional on no prior simple changes the probability of a career change is constant across experience categories. For high school graduates, the data easily reject this null at a significance level of .001. But, for dropouts and college graduates, the test statistics, which are distributed  $\chi^2(5)$ , are only 3.52 and 1.24.

THE FREQUENCY OF CAREER CHANGES:  
THE ROLES OF CAREER SPECIFIC EXPERIENCE AND PRIOR EMPLOYER CHANGES WITHIN CAREER

TABLE VII

		MONTHS OF EXPERIENCE IN CURRENT CAREER					
		e ≤ 12	12 < e < 24	24 ≤ e < 36	36 ≤ e < 60	60 ≤ e < 84	e ≥ 84
Dropouts	Prior Simple Changes = 0	71.5% (1491)	71.8% (454)	68.1% (163)	65.4% (104)	62.2% (37)	76.2% (21)
	Prior Simple Changes > 0	8.8% (114)	21.0% (200)	29.0% (124)	19.0% (174)	32.9% (70)	20.4% (49)
High School Graduates	Prior Simple Changes = 0	71.3% (2369)	65.8% (783)	65.2% (302)	63.0% (292)	67.7% (102)	51.1% (94)
	Prior Simple Changes > 0	6.9% (159)	19.1% (299)	24.6% (252)	20.3% (291)	21.6% (176)	18.3% (137)
College Graduates	Prior Simple Changes = 0	62.0% (295)	49.4% (166)	50.0% (64)	42.4% (85)	53.1% (32)	31.3% (16)
	Prior Simple Changes > 0	4.8% (21)	14.0% (50)	8.6% (58)	13.7% (95)	29.0% (38)	9.4% (32)

The numbers in parentheses give the number of job changes in each category. The percentages give the fraction of job changes that involve a career change. Career specific experience is defined as the months of work experience in the career associated with the job that the worker is leaving.