A THEORY OF JOB SHOPPING*

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I. INTRODUCTION

This paper concerns itself with a theoretical model of mobility between jobs based on uncertainty and imperfect information. The model is not intended, by any means, to provide a complete accounting of all the heterogeneous and complex motivations for job mobility, but rather to highlight reasonably simple phenomena that lead to interesting and relevant empirical observations. Although the paper is primarily theoretical, implications of the theory for earnings dispersion and mobility patterns will be compared with existing empirical work at the end of the paper.

It may be helpful at the outset to define job shopping by comparing it with the now familiar notion of job search. Job shopping refers to the period of experimentation with jobs and accompanying high rates of mobility, which typically occurs at the beginning of the working life. While job search is a rationale for unemployment, job shopping is a theory of job mobility. Search theories typically assume that the characteristics of potential offers can be ascertained by the worker by searching, while our assumption is that some characteristics cannot be known without actual employment experience. For example, workers’ tastes and abilities with respect to the job or occupation will likely be apparent only after some experience in the job. Job shopping is the search for a suitable job when workers cannot predict perfectly either their performance in or their liking for a particular job.

There are many motives for job mobility that will not be considered at all by this theory. Changes in demand for labor arising from technological or product demand changes as well as “normal” occupational mobility up well-defined career ladders are both aspects of job mobility that will not be treated by the job shopping model. Other aspects of mobility, which will not be considered, emphasize the acquisition of on-the-job training that allows more complex tasks to be

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performed, or the upward filtering of talented workers as firms discover and promote their most able workers. Instead, job shopping will concentrate on those causes of job mobility, such as workers' ignorance of their own job-specific or general abilities and preferences, or working conditions, which lead them to "try out" jobs.

The paper is organized as follows. Section II presents the basic model of job shopping and derives implications of the theory for job mobility and sequencing decisions. Sections III and IV embellish the basic model by adding costs of mobility and advance knowledge of abilities through education. Section V shows that the results of the basic model are not necessarily altered when workers are risk-averse and working periods are not equally long. Finally, Section VI discusses some empirical applications of the theory.

II. THE BASIC MODEL—RISK NEUTRALITY

The purpose of the model is to analyze the behavior of a worker who seeks to maximize his lifetime returns from working and, because of ignorance of abilities, preferences, and working conditions, faces uncertainty as to the returns available in various jobs. In a general model he must select among many jobs and might move between jobs several times. We simplify drastically by assuming that his choice is narrowed to two jobs, and because the working life has two equal periods, job mobility can occur only at the end of the first period. Four possible working careers can be pursued: Job one followed by job two, job two followed by job one, or each job held for both periods. (To make clear the distinction between jobs and their position in the career sequence, jobs one and two refer to the names of the jobs, while first or second job implies sequence position.) A worker must therefore make two different types of decisions: he must decide the order in which he will try jobs (the sequencing decision) and he must decide, on the basis of earnings in the first job, whether or not to move to the second job at the beginning of the second period (the mobility decision).

Turning to the determination of job returns and a worker's information about them, we assume that workers do not know their values of two of the determinants of job rewards, $\theta_j$ and $u_{ij}$. These two variables represent the worker's general ability or proclivity for all jobs ($\theta_j$) and a worker's job-specific preferences or abilities ($u_{ij}$), which are unknown to him before he enters the job. From the worker's point of view, these variables are causes of his inability to predict job returns—causes that either are general across all jobs, or are specific
to a particular job. A spectrum of unknown abilities, preferences, and working conditions of varying generality across jobs is therefore replaced in the theory by a purely general and a purely job-specific variable. Although workers are ignorant about their values of $\theta_j$ and $u_{ij}$, their expected value of job returns equals $a_{ij}$ for job $i$, and they know that jobs reward general ability differentially ($b_{ij}$). Because the worker also knows the distribution of $\theta$ and $u_i$ in the population from his observations on how other workers fare in various jobs, he views $\theta_j$ and $u_{ij}$ as random variables with the population distribution function.

Formally, we specify that job rewards are a linear function:

\[ E_{ij} = a_{ij} + b_{ij}\theta_j + u_{ij}, \]

where $E_{ij}$ denotes job returns (both pecuniary and nonpecuniary) for worker $i$ in job $j$; $\theta_j$ is the unknown component of returns to the job, general across all jobs, for worker $j$; and $u_{ij}$ is the unknown dimension of returns to the job, specific to job and worker. The parameters of the function are $a_{ij}$, mean return, and $b_{ij}$, the reward to general ability, which are known to the worker. The distributions of $\theta$ and $u_i$ in the population are assumed normal and independent:

\[ \theta \sim N(0, \sigma_\theta^2) \]
\[ u_i \sim N(0, \sigma_{u_i}^2). \]

A worker has two reasons to move to another job after trying a job and finding out the total return $E_{ij}$ for that job. First, he may feel unlucky in picking a particular job that was either unsuitable or profitable. He may feel he “drew” a particularly low value of $u_i$ and want to try again in a process that might be called “search” mobility. Alternatively, he may feel he knows more about his general ability across jobs ($\theta_j$), and want to move either to a lower $b_i$ job if he thinks his ability is low, or to a higher $b_i$ job if he thinks his ability is relatively high. This process can be termed “learning” mobility.

We shall turn to the behavior of one worker, and can therefore drop the subscript $j$ from variables and parameters. It is also easier to think of $E_{ij}$ as earnings rather than total returns, and $\theta$ and $u_i$ as general and specific abilities, even though the theory to be developed does not hinge on that special interpretation. Only in Section VI, when data on earnings are considered, will $E_{ij}$ necessarily be interpreted solely as pecuniary returns.

**Mobility Theory**

Consider the optimal mobility strategy of a risk-neutral worker
who has tried job one in the first period. He will move at the end of the first period if his expected earnings in job two exceed his current earnings:\(^3\)

\[
E[E_2|E_1] > E_1.
\]

Because of \(\theta, E_1\) and \(E_2\) are not independent, \(E[E_2|E_1] \neq E[E_2]\), and the information gained from the first job helps to predict earnings in the second. The assumption of independence of \(\theta\) and \(u_i\) allows us to write \(E[\theta|E_1]\) in terms of a simple linear equation:\(^4\)

\[
E[\theta|E_1] = \beta(E_1 - a_1),
\]

where

\[
\beta = \frac{b_1 \sigma_\theta^2}{b_1^2 \sigma_\theta^2 + \sigma_{u_1}^2}.
\]

One can easily verify that if \(\sigma_{u_1}^2 = 0\), then information about \(\theta\) given by earnings in job one will be perfect, while if \(b_1 = 0\), no information is given by \(E_1\) that will help to predict general ability, so the best predictor of \(\theta\) will be its mean, zero.

From (1) and (3), predicted earnings in job two are given by

\[
E[E_2|E_1] = b_2 \beta (E_1 - a_1) + a_2.
\]

Thus, combining (2) and (4), a worker will opt to change jobs if and only if

\[
E_1 > \frac{[\beta b_2 a_1 - a_2]}{(b_2 \beta - 1)} \quad \beta b_2 > 1
\]

or

\[
E_1 < \frac{[\beta b_2 a_1 - a_2]}{(b_2 \beta - 1)} \quad \beta b_2 < 1.
\]

If \(b_2 \beta = 1\), then the worker is indifferent about moving.

To simplify as much as possible, we can assume that the worker has already narrowed his choice down to two jobs with the same mean income, \(a_1 = a_2 = a\), which may differ in their reward to general ability \((b_1 \neq b_2)\) and the amount of pure earnings randomness \((\sigma_{u_1}^2 \neq \sigma_{u_2}^2)\). This reduces the mobility decision to move if \(E_1 > a\) and \(b_2 \beta > 1\), or if \(E_1 < a\) and \(b_2 \beta < 1\). The first case \((b_2 \beta > 1)\) can be considered an example of “learning” mobility. That is, \(b_2 \beta\) is large when both \(b_2\), the reward to ability in job two, and \(\beta\), the accuracy of prediction of \(\theta\) with \(E_1\), are large. Thus, when ability can be well predicted by \(E_1\), and is well rewarded in job two, it is rational for the worker to move when the value of \(E_1\) is larger than \(a\).

From the definition of \(\beta\) in (3), \(b_2 \beta > 1\) implies that \(b_2 b \sigma_\theta^2 >\)
\[ b_2^2\sigma_\theta^2 + \sigma_u^2, \text{ and therefore, for } \sigma_u^2 \neq 0, \text{ a necessary condition for } b_2 > 1 \text{ is that } b_2 > b_1, \text{ or that job two reward ability more than job one. This suggests that "learning" mobility could never occur in both directions of the job sequence. When } b_2 \beta < 1, \text{ the worker moves if } E_1 \text{ is less than } a. \text{ Motives for mobility in this case are either avoidance of a particularly low job-specific factor ("search" mobility) or the desire to find a job that penalizes his low ability less ("learning" mobility). Regardless of the value of } b_2 \beta, \text{ the probability of mobility (and hence the proportion of movers in a population of identical workers) is 0.5 because the mobility wage } a \text{ is the mean of the (normal) distribution of } E_1. \text{ From (1) it is clear that } E_1 \text{ is a linear combination of two normally distributed independent variables and is therefore distributed according to the density function } g(E_1), \text{ with mean } a \text{ and variance, } \sigma_1^2 = b_2^2 \sigma_\theta^2 + \sigma_u^2. \]

**Optimal Sequencing**

Having derived the proper mobility strategy, we now consider the optimal sequence of jobs. The risk-neutral worker seeks to pick the sequence that maximizes his expected lifetime earnings.\(^5\) Letting \( L_1 \) denote expected lifetime earnings if job one is chosen first, the worker will prefer this sequence if and only if \( L_1 > L_2 \). The value of \( L_1 \) depends on \( b_2 \beta \).

1. If \( b_2 \beta > 1 \), and mobility is "learning mobility," then

\[
L_1 = a + \int_{-\infty}^{a} E_1 g(E_1) dE_1 + \frac{1}{2} E[E_2 | E_1 > a].
\]

The second term is expected second-period earnings when \( E_1 < a \) and the worker does not move. The third term is the probability of mobility (\( \frac{1}{2} \)) times expected income if \( E_1 > a \) and the worker moves. It is easily confirmed that, since \( E_1 \) is normally distributed, with variance \( \sigma_1^2 \)

\[
\int_{-\infty}^{a} E_1 g(E_1) dE_1 = \frac{1}{2} a - \frac{\sigma_1}{\sqrt{2\pi}}.
\]

Also,

\[
E[E_2 | E_1 > a] = E[a + b_2 \theta + u_2 | E_1 > a]
\]

\[
= a + b_2 E[\theta | E_1 > a]
\]

\[
= a + (2b_2 \beta \sigma_1) / \sqrt{2\pi}.
\]
So,

\[ L_1 = 2a + (b_2 \beta - 1) \sigma_1 / \sqrt{2\pi}. \]

Note that, since \( b_2 \beta > 1 \), \( L_1 \) is definitely greater than \( 2a \), expected earnings without the possibility of mobility, and therefore, as expected, allowing workers to move makes them better off.

In order to compare sequences, we must derive \( L_2 \), expected earnings when job two is tried first. By exactly analogous reasoning,

\[ L_2 = 2a + \sigma_2 (1 - b_1 \gamma) / \sqrt{2\pi}, \]

where

\[ \sigma_2^2 = b_2 \sigma_\theta^2 + \sigma_{u_2}^2 \]

and

\[ \gamma = b_2 \sigma_\theta^2 / \sigma_2^2. \]

From (8) and (9)

\[ L_1 - L_2 = \frac{1}{\sqrt{2\pi}} \left[ (b_2 \beta - 1) \sigma_1 + (b_1 \gamma - 1) \sigma_2 \right]. \]

Recalling that \( b_2 \beta > 1 \) implies \( b_2 > b_1 \), we see it also follows that, from the definition of \( \gamma \), \( b_1 \gamma < 1 \). Furthermore, \( b_2 \beta > 1 \) implies \( b_1 \gamma < 1 \). Thus, risk-neutral workers will pick the sequence that begins with job two, the riskiest job in terms of overall earnings variance.

2. If \( b_1 \gamma > 1 \), and the analysis is exactly parallel to that above in (6)–(10). In this case the 1,2 sequence will be preferred because \( \sigma_1^2 > \sigma_2^2 \).

3. The only other possible case is if both \( b_1 \gamma < 1 \) and \( b_2 \beta < 1 \), then

\[ L_1 - L_2 = \frac{1}{\sqrt{2\pi}} \left[ (1 - b_2 \beta) \sigma_1 - (1 - b_1 \gamma) \sigma_2 \right]. \]

After further manipulation, it can be seen that the sign of the left-hand side of (11) depends on the sign of \( (\sigma_1 - \sigma_2) \), and again the riskiest job will be selected first in the sequence. The results of the three possible cases can be summarized in the following proposition:

**PROPOSITION 1.** In a two-period model, a risk-neutral worker will always select first the riskiest (highest \( \sigma \)) job among jobs with the
same mean earnings \((a_1 = a_2)\) as long as \(\sigma^2_{u_i} \neq 0\) for some \(i\), regardless of the values of \(b_i\).

Several consequences of Proposition 1 suggest themselves. First, workers will always move from jobs in which they get low earnings. Moving when earnings are high in job one \((E_1 > a)\) requires that \(b_2 \beta > 1, b_1 \gamma < 1, \) and therefore \(\sigma_1 < \sigma_2\). But then the optimal sequence begins with job two, and the mobility condition is that \(E_2 < a\). Second, the dispersion of earnings in a cross section of identical workers will be greater in the first working period than in the second. Observations of earnings variance should show declining earnings variance with experience during the process of job shopping. Third, the mix of pure random variance \((\sigma^2_{u_i})\) and variance due to ability \((b_2^2 \sigma^2_{\beta})\) does not affect either the sequencing decision or the mobility decisions. In all cases workers choose the job with the greatest overall earnings variance for the first job in their career and move only if their earnings are less than average. In fact, although we do not prove it, workers may select jobs with both lower mean earnings and higher earnings variance first. In no case will a worker pick a low \(b_i\) job in order to safely discover his general ability and then move to a higher \(b_i\) job if his ability is high. The failure of this type of learning phenomenon to explain mobility or sequencing patterns may be attributable to either the assumptions of risk neutrality or equal period length. Both assumptions are relaxed in Section V.

We examine now, briefly, two extremes of the model, first where earnings variance is all job-specific \((b_i = 0)\), and second, where earnings variance is all due to general ability \((\sigma^2_{u_i} = 0)\). In the first case the gain from mobility comes from being able to “play the game” again if one has had bad luck the first time. The gain from mobility over a no-mobility working life is directly proportional to the standard deviation of the first job’s earnings. On the other hand, when earnings dispersion is entirely due to \(b_i\) and ability variance, then the two sequences are exactly equivalent because ability will be learned precisely in the first job, and both jobs have the same average earnings. This rather surprising result arises from the lack of risk aversion in the model and the fact that the worker has no prior idea of his ability. There is, in this case, no particular advantage in starting with one job rather than another.

To summarize the results of the basic model: (1) When at least one job has randomness \((\sigma^2_{u_i} \neq 0)\), then a worker will choose first the job with the higher earnings variance and move only if his income is below the average. The probability of job mobility will be 0.5, and earnings dispersion will be observed to fall with work experience. (2)
When neither job has any random element ($\sigma_u^2 = 0$), then sequencing is irrelevant, but mobility probability will still be 0.5.

III. MOBILITY COST

One way to make the model a bit more realistic is to impose a mobility cost $C$ on the worker as he changes jobs. This cost could represent specific training costs for the new job as well as the value of the loss of experience at the old job. Clearly, the effect of the mobility cost is to make mobility less likely by changing the optimal mobility decision. For example, when $\beta b_2 < 1$, and the worker begins with job one, he will move if and only if

$$E_1 < a + C/(b_2\beta - 1).$$

The probability of mobility is a decreasing function of $C$.

A more interesting, and difficult, issue is the optimal job sequence with a mobility cost. In effect, we want to derive $L_1 - L_2$ as a function of $C$. We know two extreme points of this function. First, if $C = 0$, then the results derived in Section II hold true, and the sign of $L_1 - L_2$ is the sign of $(\sigma_1^2 - \sigma_2^2)$. At the other extreme, as $C$ gets very large, the probability of mobility becomes very small, and $L_1$ approaches $L_2$ because both jobs have equal expected incomes ($a$) taken alone. The more difficult question is whether there are values of $C$ for which the sequence beginning with the least risky job is preferred; that is, whether mobility cost can alter sequence preferences.

A direct attack on the sequence question, by calculating $L_1 - L_2$, leads to no definite conclusions about sequencing. The result is ambiguous because the inherent advantage of beginning with the riskiest job may be offset by the higher expected mobility cost caused by the greater probability of mobility from the riskier job. An alternative approach to an analytic solution is to derive the slope of $L_1 - L_2$ with respect to $C$. If this curve is monotonic, then $L_1 - L_2$ must always be positive for $\sigma_1^2 > \sigma_2^2$. In Figure I curve I is monotonically downward sloping, and $L_1 - L_2$ is always positive. Therefore, if we can show monotonicity, we can show that the sequence chosen is invariant to mobility costs.

If $L_1 - L_2$ is differentiated with respect to $C$, the resulting expression (which is too complicated to write here) has three terms. Two of these terms are unambiguously negative if $\sigma_1 > \sigma_2$, while the third
Fig. 1
Effect of Mobility Cost \( C \) on the Optimal Job Sequence \( (\sigma_1^2 > \sigma_2^2) \)

The term is

\[
(13) \quad - C \left[ \frac{1}{b_2 \beta - 1} F_1 \left( a + \frac{C}{b_2 \beta - 1}, \sigma_1^2 \right) - \frac{1}{b_1 \gamma - 1} F_1 \left( a + \frac{C}{b_1 \gamma - 1}, \sigma_2^2 \right) \right],
\]

where \( F_1(x,y) \) represents the derivative of the normal distribution function (mean \( a \), variance \( \gamma \)) taken with respect to, and evaluated at, \( x \). In short, \( F_1 \) is the change in the probability of mobility as the mobility wage changes. Assuming that \( \sigma_1 > \sigma_2 \) implies that

\[
1/(b_2 \beta - 1) > 1/(b_1 \gamma - 1),
\]

and that (13) is negative when \( C \) is very low but may become positive when \( C \) rises. In any event, the slope of \( L_1 - L_2 \) is ambiguous, although it is clearly negative when \( C = 0 \). Curve II in Figure I is therefore a possible configuration, and the sequence preference at zero mobility cost does not necessarily hold for all values of \( C \). For low enough values of \( C \), however, the risky job will still be chosen first.
IV. Education

Another question of interest concerns the effect of education on the sequencing and mobility decision in the basic risk-neutral model and its effect on the observed dispersion of incomes. The answer depends greatly on the assumed effect of education on earnings in the two jobs. If education merely shifts the average earnings of both jobs equally, sequence preference and mobility behavior are unchanged. We focus instead on another characteristic of education that may be important in the job shopping model, namely the function of education in giving workers information about their abilities. While we have so far assumed total ignorance about abilities on the part of workers (aside from knowing the distribution function), it is plausible to assume that education acts, much like a first job, to narrow the uncertainty a worker feels about his own abilities, which in turn should reduce the role of learning about abilities on the job.

We therefore consider the effect of perfect knowledge of $\theta$ (conferred by education) on the mobility and sequencing decisions analyzed in Section II.\textsuperscript{6} It is intuitive and easy to show that a worker with above average ability ($\theta > 0$) should begin his career with the job that rewards ability the most. (Again, mean earnings $a$ are the same in both jobs.) Thus, high-ability workers will pick first the job with the highest $b_i$, and vice versa for low-ability workers. Because incomes are random to some extent, however, uncertainty still surrounds actual earnings, and mobility is still possible. For example, if $\theta > 0$ and $b_1 > b_2$, then the 1,2 sequence is preferred, and the worker will move at the end of the first period if and only if $u_1 < \theta(b_2 - b_1).$ Because the probability of mobility is therefore less than 0.5, education reduces job mobility by reducing its role in acquiring information. Less job mobility, in turn, means that the decline in earnings dispersion over the working life will be smaller for educated workers.

A more difficult issue is the effect of education on aggregate earnings variance observed over many workers. Education separates high- and low-ability individuals and sends them off to different jobs at the outset of their careers. While it is clear that average earnings in the first job will be higher with education than without (because workers are not picking jobs blindly), the effect on observed dispersion of earnings in the population is not clear. We must consider the first-period earnings ($y$) of both above and below average ability workers:

\[
y = \begin{cases} 
  a + b_1\theta + u_1 & \text{for } \theta \geq 0 \\
  a + b_2\theta + u_2 & \text{for } \theta < 0,
\end{cases}
\]
where \( b_2 > b_2 \). Remembering that \( \theta \) is distributed normally, we see that mean first-period earnings for all workers are

\[
E[y] = \bar{y} = a + (b_1 - b_2) \sigma_\theta/\sqrt{2\pi}.
\]

The second term of the right-hand side of (15) constitutes the average income gain attributable to education's role in revealing to workers their abilities. It is quite naturally an increasing function of the difference in ability rewards in the two jobs, and the dispersion of abilities.

To calculate the variance of first-period earnings, we must integrate the variance of earnings given \( \theta \) over all values of \( \theta \):

\[
(16) \quad \text{var}(y) = \int_{0}^{\infty} \left[ \int_{-\infty}^{\infty} \left[ a + b_1 \theta + u_1 - \bar{y} \right]^2 f(u_1)du_1 \right] j(\theta)d\theta
+ \int_{-\infty}^{0} \left[ \int_{-\infty}^{\infty} \left[ a + b_2 \theta + u_2 - \bar{y} \right]^2 h(u_2)du_2 \right] j(\theta)d\theta,
\]

where \( f, h, \) and \( j \) are the normal probability density functions, with mean zero and variances, \( \sigma_{u_1}^2, \sigma_{u_2}^2, \sigma_\theta^2 \), for \( u_1, u_2, \) and \( \theta \), respectively. The first term on the right-hand side of (16) becomes

\[
(17) \quad \int_{0}^{\infty} \left[ \int_{-\infty}^{\infty} \left[ b_1 \theta + u_1 - (b_1 - b_2) \frac{\sigma_\theta}{\sqrt{2\pi}} \right]^2 h(u_1)du_1 \right] j(\theta)d\theta
= \int_{0}^{\infty} \left[ b_1 \theta^2 + \sigma_{u_1}^2 + (b_1 - b_2)^2 \left( \frac{\sigma_\theta^2}{2\pi} \right) - b_1(b_1 - b_2) \frac{\sigma_\theta}{\sqrt{2\pi}} \right]
\times j(\theta)d\theta
= \frac{1}{2} \left[ b_1^2 \sigma_\theta^2 + \sigma_{u_1}^2 - \frac{\sigma_{u_1}^2}{2\pi} (b_2(b_1 - b_2)) \right].
\]

By similar argument, the second term on the right-hand side of (16) can be derived to yield

\[
(18) \quad \text{var}(y) = \frac{1}{2} \sigma_1^2 + \frac{1}{2} \sigma_2^2 + \frac{\sigma_\theta^2}{2\pi} (b_1 - b_2)^2.
\]

Thus, the variance of first-period earnings is greater than earnings variance averaged over both jobs and may exceed the variance of either job alone. Therefore, education will lead to higher variances of earnings in the first job than would be observed if workers were randomly placed in first jobs, but not necessarily more than when workers choose the optimal sequence. For instance, if \( \sigma_1 = \sigma_2 \), so that workers without education would have no sequence preference, then education would raise the variance of first-period earnings.
V. Extensions of the Basic Model

Some of the results that we have derived so far clearly depend on the crucial assumptions of the model. Learning has not played a significant role in occupational sequencing for two reasons. First, risk-neutral workers have no interest in reducing income uncertainty. Second, the assumption of two equal working periods also tends to decrease the role of learning in mobility and sequencing decisions by making the "payoff" period small relative to the investment period. This section attempts to show how the results of Section II are changed if risk aversion on the part of workers is assumed and work periods are not equal.  

To introduce risk aversion in a tractable yet realistic way, we assume first that there is no borrowing or saving, so that expected utility over the lifetime is equal to the weighted average of the expected utility of each period's income, where the weights are the share of each work period in the total working lifetime. While the most natural maximand would be the expected utility of lifetime income, the analysis is impossible with such an assumption. In addition, for analytical ease we formulate the within-period expected utility as a general function of the mean and variance of the distribution of that period's earnings, \( V(\mu, \sigma^2) \). A higher degree of risk aversion implies that the partial derivative of \( V \) with respect to \( \sigma^2 \) is more negative. We also introduce the notion of different working period lengths by letting the parameter \( k \) refer to the proportion of the lifetime spent at the first working period. We do not allow the worker to change \( k \). Under these assumptions, expected lifetime utility \( L \) is the weighted average, the weights being \( k \) and \( 1 - k \), of expected utility in each period.

Since we are interested specifically in the effect of differential learning on the sequencing of the two jobs, we can pose the following question: If two jobs have the same overall variance \( \sigma_1^2 = \sigma_2^2 \) and mean \( a_1 = a_2 \), so that they would be ranked identically without mobility, how do differential learning \( b_1 \neq b_2 \), and unequal period lengths \( k \neq 1 - k \), affect the mobility and sequencing decision? The surprising result is that mobility and sequencing are unaffected by these changes.

First, consider the mobility decision. In the 1,2 sequence, the worker will move to job two if expected utility is greater than actual utility in job 1, or if

\[
V(E_{1},0) < V(E[E_2|E_1], \text{var}[E_2|E_1]).
\]

The left-hand side of (19) reflects the fact that the variance of earnings is zero if the worker stays in his present job. Consider first the
\( E[E_2|E_1] \) and \( \text{var}[E_2|E_1] \):

\begin{align}
(20) \quad E[(E_2|E_1)] &= b_2 \beta (E_1 - a_1) + a_2 \\
(21) \quad \text{var}[E_2|E_1] &= b_2^2 \sigma_\theta^2 (1 - b_1 \beta) + \sigma_{u_2}^2.
\end{align}

Note that \( b_1 \beta \) measures the "variance explained" by \( \theta \) in the first job.

It can be easily shown that, since \( \sigma_1^2 = \sigma_2^2, a_1 = a_2 \), and therefore \( b_2 \beta = b_1 \gamma \),

\[ E[E_2|E_1] = E[E_1|E_2], \]

and

\[ \text{var}[E_2|E_1] = \text{var}[E_1|E_2]. \]

In other words, given a value of earnings attained in the first period's job, the mean and variance of earnings in the other job are identical, regardless of the occupational sequence. Since the total distribution of earnings in the two jobs is assumed to be identical (\( \sigma_1^2 = \sigma_2^2, a_1 = a_2 \)), the mobility wage and probability of mobility will be invariant to sequencing. This result can be intuited by realizing that while a high \( b \) job imparts a lot of information about \( \theta \) for use in predicting earnings in the other job, by construction the other job does not rely on \( \theta \) as much. So the more accurate prediction of \( \theta \) is precisely offset by the greater random term in the other job. Thus, the mobility wage, call it \( x^* \), will be the same regardless of sequence.

We now consider the expected lifetime utility \( L \) of both sequences in order to derive the optimal sequence. By assumption,

\begin{align}
(22) \quad L_1 &= k V(a_1, \sigma_1^2) + (1 - k) \int_{-\infty}^{x^*} V(E[E_2|E_1], \text{var}[E_2|E_1]) \\
& \quad \times g(E_1)dE_1 + (1 - k) \int_{x^*}^{\infty} V(E_1,0)g(E_1)dE_1,
\end{align}

while

\begin{align}
(23) \quad L_2 &= k V(a_2, \sigma_2^2) + (1 - k) \int_{-\infty}^{x^*} V(E[E_1|E_2], \text{var}[E_1|E_2]) \\
& \quad \times g(E_2)dE_2 + (1 - k) \int_{x^*}^{\infty} V(E_2,0)g(E_2)dE_2.
\end{align}

Since \( E_1 \) and \( E_2 \) are distributed identically, and \( a_1 = a_2 \), it is easy to see that \( L_1 = L_2 \). We may restate more formally:
PROPOSITION 2. In a model of two variable periods and two jobs, with the same mean earnings and period separable risk aversion, equality of earnings variance \( \sigma_1^2 = \sigma_2^2 \) implies equality of sequence preferences \( L_1 = L_2 \).

The upshot of this proposition is that risk aversion and variable period length are not enough to generate "learning" mobility. Thus, changing the simple model to include these factors would not necessarily alter the sequence preferences of the simple model. It should be emphasized again that the model is still so simple that it may be obscuring important facets of the real world. A three-job or three-period model may be appropriate, but the analysis would be raised to another order of magnitude of difficulty. It should also be pointed out that we have not proved here that higher variance jobs will necessarily be chosen first in the career, as was true in Section II.

VI. EMPIRICAL APPLICATIONS

How well does the job shopping theory conform to reality? Three important pieces of empirical evidence could be adduced to confirm the results derived in this paper: (1) the behavior of earnings dispersion at the outset of the working life; (2) the relation between education, earnings dispersion, and job mobility; and (3) the rapid decrease in job mobility at the beginning of the working life.

Human capital theorists have cited the decrease in relative earnings variance for the first seven or so years of work experience as strong evidence of differential acquisition of training on the job. Seven years marks the famous "overtaking point" at which workers receiving training will surpass their nontraining colleagues in observed net earnings. The evidence from Mincer (1974, p. 105) shows declines in the variance of the log of earnings of year-round workers during the first six to eight years of work experience, but only for noncollege graduates. (The use of logs can be justified as a correction for the general upward trend of earnings with experience due to learning, which raises productivity at a constant rate over the life cycle.) The theory of job shopping suggests that an alternative explanation of the same empirical phenomena is successive employment experimentation starting with the "riskiest" jobs first. As the job shopping theory showed, the observed dispersion of earnings will decrease with experience during the highly mobile, job shopping beginning of the working life. Ornstein (1976) finds that mobility among recent entrants is highest for those whose first job was especially low-ranking, given worker characteristics. The subsequent rise in earnings dis-
persion, after six years, could easily be accounted for by the upward filtering process proposed by Taubman and Wales (1973) or, indeed, the effects of on-the-job training. The job shopping theory is, then, not so much a replacement for human capital theory as an elaboration of it, because human capital is acquired, in the early years, as much by learning about jobs as by learning on the job.

Our theoretical results with regard to education indicate that, if schooling substitutes for job shopping, highly educated workers should experience less job mobility and therefore have smaller decreases in earnings dispersion than less educated workers. The theory could not tell whether earnings dispersion itself would be positively related to the level of education. Table I presents some evidence that education is negatively associated with job mobility at the outset of the working life, although these findings have not been duplicated in other studies. However, as Mincer showed, the pre-overtaking point decline in relative earnings dispersion is much smaller for high schooling groups (in fact, there is no decline for college graduates). Hence, while the relation between declines in earnings dispersion and education conform to the job shopping theory, the relation between mobility and education is not clear.

The third and most obvious empirical application of the job shopping theory is the explanation of very high rates of job change among workers with low amounts of experience. Table I shows that job mobility rates are much higher for inexperienced workers. While conventional human capital theory would predict falling mobility rates as the number of years to recoup the investment falls, the decline is much more precipitous than could be explained on that basis alone.
The job shopping theory, combining "learning" with "search" mobility, provides a more complete picture of the way the labor market works.

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NOTES

1. The first use of the term "job shopping" was apparently by Lloyd Reynolds (1951).
2. The on-the-job training theory has been most forcefully stated by Mincer (1974), while the upward filtering theory has been proposed by Taubman and Wales (1973) and supported by Wise (1975).
3. The expectations operator $E \mid \cdot \mid$ will be used with curved brackets to avoid confusion with earnings $E$.
4. $\theta$ is really a regression coefficient equal to $\text{cov}(E, \theta)/\text{var}(E)$.
5. We have not introduced time discounting in order to avoid unnecessarily complicating the analysis.
6. Education is not presumed to reduce the length of the working life.
7. Although a many-job model was also attempted, the results were intractable and are therefore not presented here. There is some evidence (see Burdett, 1975) that a many-job model could be quite different from a two-job model.
8. See Hause (1974) for a criticism of the use of period separable utility functions.
9. It is well-known that von Neumann-Morgenstern expected utility can be written in this form only if density functions are normal or if utility is quadratic. See Feldstein (1969).
10. Similar evidence presented by the author (1977) confirms that high education groups experience lower rates of occupational mobility at the beginning of their careers. This conclusion is based on 1970 Census information on mobility between major occupation groups between 1965 and 1970. However, Parsons (1972), using aggregate industry data, finds education not significantly related to the quit rate. Ornstein (1976), with individual data, finds that among recent labor force entrants job changing is more frequent among high school graduates than among workers with either less or more education. Hence, the evidence on this point is far from clear.
11. See, for example, the Parnes longitudinal data on young workers for a detailed description of job changing (U. S. Department of Labor, 1971, Ch. 3).

REFERENCES

Mincer, J., Schooling, Experience and Earnings (New York: NBER, 1974).
