Job-search perspectives on migration behaviour

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Abstract. Although considerable empirical work has been undertaken to estimate interregional migration models, there has not been a corresponding attempt to construct more rigorous theoretical models. For over a decade, Sjaastad's (1962) basic analysis has been unsurpassed. The more recent paper by David (1974), however, attempts to lay a firm microeconomic and risk-analytic foundation for migration models by using concepts arising from job-search theory. His analysis is still quite limited in its perspective on migration, and the present paper attempts to derive a more satisfactory theoretical view of migration. In particular, the various aspects of job-search theory as it has been applied to macroeconomic theory are reviewed and the relevance of these to migration behaviour are assessed. The paper emphasizes (1) differences between search models concerned with wage dispersion and those concerned with job finding, (2) the information possessed by job seekers about different labour markets, (3) alternative search strategies including voluntary job quitting and the migration of unemployed job seekers, and (4) different measures of job-finding probabilities. Although several theoretical models are presented, the main purpose of the paper is to provide a systematic overview of the issues in model design in this important new area of migration research.

In the past two decades, we have witnessed an explosion in the amount of research being undertaken in the area of interurban and interregional migration. Most of this research, as recently reviewed by Greenwood (1975), is empirical in nature. It has been broadly concerned with the estimation of migration flows, the identification of migratory propensities by age, sex, or other cohort groupings, the dynamics of multiregional population growth, and the explanation of migration between regions in terms of such causal variables as age structure, income differentials, distance, and intervening opportunities. On the other hand, there has been relatively little research done on the theory of migration behaviour. Some critics would go so far as to argue that nothing new has appeared since the work of Ravenstein in the late nineteenth century. Others might concede that more recent works, such as those of Sjaastad (1962), Wolpert (1965), Todaro (1969), and David (1974), have also made significant contributions. Even allowing all these, there have been relatively few advances made in the theory of migration behaviour.

What has gone on in the past is, however, not always a reasonable prediction of what can be expected in the future. Certainly the work of Todaro and of David, in their use of job-search perspectives on migration, offers a rich new avenue for theoretical exploration. It may well be that we are in fact on the verge of another explosion of research activity on this topic, this time theoretical. Before this happens, however, it is important to assess what kinds of migration questions can be usefully approached using a job-search perspective. That is the primary purpose of this paper. It is hoped that this paper will make clear what is reasonable or not reasonable to expect from future research of this type.

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The foundations of a job-search perspective

Migration has been associated with many epic moments in man’s history, such as the settling of the Americas. The reasons for such migration behaviour are manifold: intolerance or persecution at home, the quest for fortune or a better standard of living, and the imperative of a religious or ideological belief, to name just a few. The theories we now have in order to explain when people will move and where they will move to are much more narrowly focussed than this. With Sjaastad’s (1962) work as the clearest example in mind, it can be seen that a broadly defined economic-betterment motive is the only one to have received substantial attention in the theoretical literature. This economic emphasis is certainly consistent with contemporary North American societies wherein migration attributable to other motives is relatively limited. Nonetheless the limitations placed on this discussion by a solely economic emphasis need to be noted.

The adoption of a job-search perspective represents a slightly broader view of the migration process. Sjaastad and his empirical disciples would argue that migration tends to occur whenever there are differences in the standard of living between regions (whether this be due to wages, regional amenities, or costs of living) that are sufficient in capitalized form to exceed the costs of migration. Implicit in their view is the notion of migration as a spatial adjustment process based on some kind of disequilibrium between regions. There is, however, a curious dissonance in this approach. If migration is a dynamic disequilibrium process, should there not be more emphasis placed on understanding the behaviour of the potential migrant as an information gatherer and decision maker? Is it not unreasonable to assume, as do many researchers in this area, that the potential migrant has perfect information about the disequilibrium among regions, especially if such disequilibria are changing over time? The proponents of job-search theory would argue that their work extends the economic theory of migration specifically in this area.

Job-search theory does not have its origins specifically in the migration literature. It is principally associated with the set of papers in Phelps (1970) and with subsequent research. There it is applied principally to derive a microeconomic theory which could underpin the empirical Phillips-curve relationship of macroeconomics. A rather substantial literature now exists on that topic.

There have been relatively few attempts to link job-search models to migration theory. One of the earliest is the work of Todaro (1969) which appeared about the same time as Phelps’s volume. Although not a rigorous model in microeconomic terms, it nonetheless exemplifies the job-search emphasis on the uncertainty of job finding and rational decisionmaking. The extensions to and corrections of Todaro’s model by Zarembka (1970a) should also be noted. The work by David (1974) is certainly more typical of the job-search approach in its rigorous use of microeconomic principles. Also David emphasizes the dispersion of wage offers as well as the uncertainty of job finding, which is typical of the job-search-theory approach. As indicated earlier, these are among the only pieces of migration literature which use a job-search perspective.

To provide a framework for discussing job-search and migration behaviour, David’s model is examined in section 2. Some major questions are raised about his model and its relevance to contemporary migration. In section 3 some alternative perspectives on job-search theory are drawn from other parts of the literature. These are used to illustrate the kinds of models which might be forthcoming in the future and what kinds of alternative assumptions would have to underlie them. A concluding assessment is presented in section 4.
2 David's model of job search and migration: a critique

David uses an analogy for what he refers to as the prospective migrant's decision problem. This section begins with an outline of that analogy and the parallels drawn. Subsequently consideration is given to the assumptions made and the restrictions this places on migration and job-search behaviour. Here the empirical relevance of some assumptions are considered in two ways: the prospective migrant's state of knowledge and his method of wage sampling. After this is a discussion of David's main findings and the significance these place on his various assumptions.

The analogy used by David is described as follows.

"A man has been presented with a set of labeled urns, each containing many balls. Every ball has a dollar value inscribed upon it, but the value of any ball can only be obtained after it is withdrawn from the urn. Upon the label of each urn appear the parameters of the particular probability distribution to which the values of the balls therein conform. Also written upon every label is the fixed "entry fee" that must be paid just for the right to put one's hand in the urn, and, further, a schedule of "sampling charges" describing the (dollar) costs of withdrawing different numbers of balls therefrom.... He is ... required to choose an action strategy composed of two elements: He must designate (1) the single urn from which (2) a specified number of balls are to be drawn, say, in sequence, replacing each before extracting the next and recording its value. He will then be allowed, without further expense, to retrieve any ball—and obviously he will want it to be the highest valued—among those comprising the (random) sample. How should he proceed in making this strategy decision? If given a fixed budget, how should he divide it between purchasing "entry" and sampling? And how large a sum should he be willing to spend in this game?" (David, 1974, page 24).

The parallels drawn by him with the migration decision problem of an individual are clear.

"In place of "urns" we should then quickly substitute local labor markets: rural districts, towns, cities, or even different countries. And instead of "balls", read job offers. For simplicity's sake a traditional Japanese arrangement may be imagined to prevail—permanent job tenure; the value of a job offer thus becomes the present value of an annual wage annuity received over the remainder of the worker's earning life. To what does "sampling" correspond here? Obviously to local job search, an activity which is presumed to be distinct from employment (job tenure) and can be conducted only at some (scheduled) expense to the individual concerned. Since the contemplated search is to be carried on within the local confines of a single local market, we must suppose that migration thither is a prerequisite for its conduct. Hence the fixed "entry fee" that appeared (along with the schedule of sampling charges) on each urn's label now represents the pure pecuniary and psychic costs of the migration activity necessary to effect entry into the respective local labor markets from some standard-origin place in the system—the "null urn" initially inhabited by the prospective migrant" (David, 1974, page 30).

2.1 The prospective migrant's state of knowledge

The prospective migrant is assumed to be in some local labour market in space. From this point he observes other labour markets elsewhere in space at which he might be employed. For each labour market, including his own, he knows the
probability distribution of wage offers\(^1\). That is, different firms in the same labour market offer different wages for the same employee. The prospective migrant does not know beforehand which firm offers what wage or even if a firm has an opening for which he might be suited\(^2\). He knows only the probability that any given wage offer will turn up next. To find a specific wage offer, the job seeker must ‘sample’ firms.

The prospective migrant is assumed to be able to attach specific values to every job offer. Presumably each city, or local labour market, offers a bundle of net amenities to the migrant who would choose to live or work there. These in part would reflect elements entering into the job seeker’s locational preferences, such as climate and residential environment. Within David’s model, it can be assumed that these are all valued by the migrant and included in the ‘wage offer’ associated with a job opening in a particular local labour market\(^3\).

2.2 The method of sampling

David envisages the process of sampling in the following way. The job seeker searches within a local labour market by collecting a set of \(n\) wage offers\(^4\). How many firms will have to be sampled to come up with these \(n\) offers is dependent on the frequency of occurrence of job vacancies among firms. From this sample, the job seeker is assumed to choose the highest offer\(^5\).

How does the job seeker ‘sample’ firms? David has assumed that the job seeker must migrate to sample firms in any but his own present local labour market\(^6\).

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\(^1\) How does the job seeker form his estimates of the probability distribution of wage offers in a particular local labour market? David does not consider this question. He does not suggest whether these probabilities are exact or subjectively estimated. Further he does not consider these probabilities to be changing over time either because of changes in local-labour-market conditions or because of the changing perceptions of job seekers.

\(^2\) He thus has no information by which to orient or make systematic his search among firms within a given local labour market. The implied randomness of local search is in sharp contrast to his detailed knowledge about the general distribution of wage offers in different local labour markets and his rational search among these markets.

\(^3\) To the extent that the migrant is uncertain about how well his locational preferences might be satisfied in a given urban area, such an approach is oversimplifying his problem.

\(^4\) To what extent can wage offers be accumulated? As David (1974, page 70) admits, there are broad classes of job seekers who face offers which are only of the “take it or leave it” variety. Even for those fortunate enough to get an offer with a nontrivial life, the time is usually so short that the job seeker is hard-pressed to collect more than one or two additional offers. Most job seekers face a decision situation in which job alternatives are too few in number to make David’s model useful.

\(^5\) David’s notion of choosing from a fixed sample is subject to some criticism. Other researchers would argue that uncertainty about the cost of generating an additional wage offer makes this a problem in sequential sampling. After each individual offer, they would argue that the job seeker should and does weigh the costs of continuing the search against the marginal expected gain in a subsequent wage offer.

\(^6\) Since the job seeker must migrate to sample firms in other labour-market areas, David views each local labour market as distinct geographically. In fact more than this is assumed. The usual concept of a labour-market area is a fairly dense cluster of work sites surrounded by a net of residence sites lying within some maximum commuting range. The maximum commuting range is partly defined by the daily journey-to-work cost relative to wages and partly by commuting time relative to total daily disposable time. In practice such a commuting threshold is usually much smaller than the search range of a job seeker. That is, the job seeker is willing to search sporadically further afield than he is willing to commute on a daily basis. Thus David assumes both that local labour markets are nonoverlapping in spatial terms and that they are further separated by more than the maximum range of local job search. Broad-scale urban commuting with interlinked labour-market commuting or search areas cannot be handled under these assumptions. The model is relevant only for a widely separated network of compact cities, and these are increasingly fewer in number with the passing of time.
This implies that sampling requires a physical contact with the firm. In empirical labour-market research, this most closely corresponds to the 'gate-application' strategy which has been found to be commonly used, especially by certain categories of workers. There are, however, also other search methods which do not require migration or physical presence to sample distant labour markets. Letters of inquiry, written responses to regionally advertised job openings, telephone contact, and national or regional job-placement agencies all provide well-recognized substitutes for gate applications. David does not consider these alternative strategies for long-distance job search. This is a critical oversight. In his model, households can express their locational preferences only by the actual act of migrating.

David also does not consider the distinction between migration and long-distance search travel. Migration, according to census takers, is a change in the place of permanent residence from one predefined area to another. It usually involves a movement of household effects and dependents as well as the job seeker himself. David presumes that such movement is a prerequisite to job search. However, it is possible for a job seeker to be physically present for search purposes without having to move his household effects and family first. Thus, in addition to being able to search distant markets without having to be physically present, the job seeker also has a choice between migration and search travel if he wants to be physically present. Indeed such search travel may be a more efficient strategy under a wide set of conditions. Migration need only occur if, in the process of search travel, the job seeker finds and accepts a distant job opening.

At first glance this may seem a moot point. After all, one could rename this a 'search-travel' rather than a migration model and the problem could thus be simply avoided. Interest here is primarily in terms of migration and not search behaviour on its own. To examine migration with this model, it must be extended to include the possibility of both migration prior to search (as assumed by David) and migration subsequent to a successful long-distance search. His model is incomplete in failing to specify the conditions under which these alternative search strategies are each preferable.

Further David presumes an 'intensive' sampling strategy in two senses of the word. First, job seekers are assumed to be searching full-time for job offers. During the search period they must be otherwise unemployed. This does not permit, for example, part-time search where a job seeker retains a job while searching for a better position. David supports this argument by suggesting that a large proportion of workers undertake such intensive search. Second, there is no evidence presented about the proportion of total job quits associated with subsequent search unemployment. A more general search model would permit a choice between intensive and part-time search and emphasize the determinants of such choices.

The sampling strategy is also intensive in that only one local labour market is sampled. David does not consider a strategy in which the job seeker samples, either simultaneously or sequentially, a series of markets. He would undoubtedly justify his approach on the assumptions that prior migration is necessary and migration costs are too high to make extensive spatial sampling economic. However, the possibility of sampling several markets in a short period of time exists, especially when sampling is not strictly of the gate-application kind. David's simplistic view of search behaviour thus leads him to disregard another important aspect of a sampling strategy.

(7) David (1974, page 69) himself draws support from the findings of Reynolds (1951, pages 214, 215, and 240). Similar arguments with respect to young job seekers in particular have also been made by Stephenson (1976, page 108).
In conclusion, David considers a very restricted kind of search behaviour. No search occurs without prior unemployment, thus eliminating part-time search. No local-market search occurs without physical presence, thus disregarding other sampling methods. Finally, no change of location is permitted without corresponding migration, thus eliminating long-distance search travel.

2.3 Conclusions from the model

Given these assumptions, however flawed they might be, David is able to derive some interesting mathematical results. Perhaps the most important is an emphasis on the variance of the wage-offer distribution (denoted by \sigma^2 for local labour market \ell).

This variance is important in two respects. First, since the prospective migrant is making a decision under uncertainty, some notion of rational risk-taking behaviour must be specified. David assumes that some degree of risk aversion is rational so that the individual is not indifferent to the variance of the wage distribution. Other things being equal, the risk-averse individual would choose to migrate to the local labour market having the lowest \sigma^2. Second, the variance is important because it helps to define the expected maximum offer in a random sample of size \( n \). The larger the variance, other things being equal, the greater the expected maximum offer. Thus an increase in the variance of a wage distribution has an undetermined effect.

On the one hand it increases the expected maximum offer, whereas on the other hand it increases the risk of having to accept a low wage.

Another contribution of David's is to make simultaneous the decision to migrate and the decision as to how long (or hard) to search in order to get optimal results. His model permits the prospective migrant to consider, in effect, the expected duration of search unemployment as one aspect in his choice of where to locate. This represents one of the first attempts in the formal theory of migration to give consideration to the duration of unemployment\(^{(6)}\).

A simple version of David's model (for two local labour markets) serves to illustrate both of the points raised so far. Consider a prospective migrant who currently resides and works in labour market \( a \). The present value of an earnings stream at \( a \) for this worker is

\[ Y_a = RY_a, \]

where \( Y_a \) is the fixed annual income and \( R \) is the present value of a dollar flow of income over the worker's remaining working life. \( R \) reflects the discount rate and the individual's working-life horizon. Alternatively the worker could choose to migrate to \( b \) (the only other labour market in this example) and search for \( n \) wage offers. His maximum possible annual wage would be the maximum of these,

\[ Y_{b\text{max}} = \max\{y_{b1}, y_{b2}, \ldots, y_{bn}\}, \]

where \( y_{b}\) is wage offer \( f \) in labour market \( b \). His discounted earnings stream here, \( Y_b \), is similar to that at \( a \) except that initial search costs, \( S \), are subtracted out,

\[ Y_b = RY_{b\text{max}} - S. \]

The expected search costs,

\[ S = s_0 + s_1n, \]

include a fixed component \( (s_0) \), corresponding to the migration cost, and a local search cost \( (s_1) \) which varies with the number of offers required, or equivalently with

\(^{(6)}\) Although the Todaro (1969) models, as will be seen shortly, also treat the probability of being unemployed in a time period, they are not formal microeconomic models.
the time required for local search at $b$. Further, the utility, $W_b$, placed by an individual on these discounted earnings streams is

$$W_b = Y_t^g, \quad 0 < \gamma < 1, \quad i = a, b,$$

subject to risk aversion if $Y_t$ is stochastic. Finally, the prospective migrant’s decision problem is to select a local market ($a$ or $b$) and, if $b$, to choose an optimal level of search. This is done to maximize the expected value of $W_b$, to find

$$\max_{i,n}(E(W_i))$$

This completes the formal statement of the model, represented by equations (1) to (5) and function (6).

To make this model operational, a few additional assumptions and derivations are required. First, since $y_a$ is deterministic (known), $E(W_a) = Ry_a$. On the other hand, $y_{b \max}$ is a stochastic variable. David argues that a good second-order approximation is $E(W_b) = R\bar{y}_{b \max}(1 - \beta \delta) - S$, where $\bar{y}_{b \max} = E(y_{b \max})$, $\rho_s = \sigma_s^2/\bar{y}_{b \max}$, $\sigma_s^2 = \gamma(1 - \gamma)/2$. Function (6) then reduces to

$$\max(Ry_a, R(\bar{y}_{b \max} - \delta \sigma_s^2) - S).$$

To evaluate $\bar{y}_{b \max}$ and $\sigma_s^2$, the mean and variance of the extreme value of a sample, it is necessary to invoke some particular probability distribution for wage offers. David assumes wage offers are $N(\bar{y}_b, \sigma^2)$, that is, normally distributed with mean $\bar{y}_b$ and variance $\sigma^2$. In that case $\bar{y}_{b \max}$ and $\sigma_s^2$ are approximated by

$$\bar{y}_{b \max} = \bar{y}_b + Bsn^\beta, \quad 0 < \beta < 1, \quad B > 0$$

and

$$\sigma_s^2 = A\sigma^2 n^\alpha, \quad \alpha > 0, \quad A > 0,$$

where $\alpha$, $\beta$, $A$, and $B$ are constants. Function (7), equations (8) and (9), together with

$$S = s_0 + s_1 n, \quad s_0, s_1 > 0,$$

form a complete statement of the migrant’s decision problem. $W_b$ can be solved explicitly for an optimal $n$, and the optimized value, $W_b^*$, could be used to solve separately the problem $\max(W_a, W_b^*)$.

Several comments are in order here. First, the model can not be analytically solved for the optimal sample size, $n^*$. Although the economic interpretation of an optimized expression for $E(W_b)$ is clear enough (that is, the marginal cost of increasing sample size, $s_1$, should be equal to the marginal gains from search), the solution is tractable only at a numerical level. Second, the model can be easily extended to include search within labour market $a$ as well. Thus the worker would choose among three strategies: retaining his current job, searching in $a$, and searching in $b$. Last, the model is readily extended to cover more than two local labour markets.

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(9) Let $p_1$ be the probability that a firm has a vacancy. The expected number of firms a job seeker must visit to obtain $n$ offers is $N = n/p_1$. Therefore the expected search cost is $S = s_0 + s_1 n$, where $s_2$ is the marginal search cost per firm. From equation (4) it is seen that $S$ reflects both the cost of search per firm and the likelihood of getting an offer.
3 Alternative perspectives on job search
Given the criticisms of David's (1974) approach, it is instructive to ask how alternative models of job-seeker behaviour might be formulated. Two broad sets of issues are identified. One has to do with the general setting within which job-search behaviour is examined. The other treats questions about the choices open to the job seeker and his optimal choice under different assumptions about rationality.

3.1 The problem setting
The 'problem setting' is made up of a grab bag of different aspects. One of these is the number of different ways in which researchers might treat space, including the number of (and separation among) local labour markets. Another concerns different possible assumptions about the knowledge (or degree of uncertainty) possessed by job seekers. A final aspect considered is the different ways in which the probability of finding a job offer in a unit of time is handled. These are now considered in more detail.

3.1.1 The spatial setting. In the treatment of a spatial setting, David's model is the most ambitious job-search model to date. The only other spatial models, in any sense, have been those of Todaro (1969) and Zarembka (1970a; 1972). Those are concerned with rural-urban migration and assume only two corresponding labour-market areas. David's model, by contrast, allows for any number of local (rural or urban) labour markets.

Does the multimarket aspect of David's model generate any new insights? The answer is negative because of a critical assumption made by him. By assuming spatially distinct labour-market and search areas, he is unable to consider relevant phenomena such as interarea job commuting or search. His spatial setting in this regard is more reminiscent of a nineteenth-century urban system than of a contemporary one. Although his model may be used numerically in interesting applied analyses, it is doubtful that the multimarket aspect is helpful in a theoretical model. To push this attack further, it is not clear that any useful theoretical insights can be formed which would not be available in a two- (or at most a three-) market model. Although future theoretical models should be restricted to such small urban systems, this argument of course does not deny the usefulness of a large-scale multimarket approach in empirical models.

An additional issue here is whether local labour markets should be treated as areawless points in space. Schneider (1975) considers a model which explicitly analyzes areal form in studying search in an urban market. This model emphasizes search by physical contact and the necessity of moving along paths between firms being searched. How relevant this approach is is an open question. Schneider's model does not consider the use of other search tools such as telephones, letter writing, and job vacancies, which alleviate the need for purely physical spatial search. The gains from considering simple point markets seem, in conclusion, to outweigh the restrictive complexity of the areal market models developed so far.

3.1.2 Uncertainty and search. In David's model it has been assumed that the job seeker is uncertain only about the wage offer, if any, of a particular firm. It has also been assumed that he knows the mean and variance of the (normal) wage distribution in each labour market. Further, the worker is assumed to know that any wage offer can be kept open until he finishes collecting his sample. Finally, it is assumed that the job seeker can assess all the additional elements intrinsic to a given job opening (for example, work environment and job stability) and include these in an overall 'wage' measure. Are these realistic assumptions for a broad sector of workers in a contemporary society? Alchian (1970) and others have attacked the assumption that
the parameters of the wage distribution are known. They perceive the employed
labour-force member to be cognizant only of the wage rate he himself has received in
the past and is currently receiving. A less-than-average change in this rate, relative to
past changes, will cause the worker to quit and search for work elsewhere in the
perhaps mistaken belief that his firm is not being competitive. Such behaviour,
because the worker is uninformed about average market wages, leads to a ‘wage
illusion’ in which the worker accepts or rejects a certain wage rate without knowing
how large it is relative to other wages. Parsons (1973), in an empirical study of quit
rates, finds no support for such a wage illusion. His findings are consistent with the
idea that workers are broadly aware of average wages. Thus, although they may not
know much about the other parameters of a wage distribution, they are at least
generally aware of its expected value.

As indicated earlier, it seems unreasonable that a wage offer can be kept open
until a large \(n > 3\) sample is collected. Several researchers, including McCall
(1970), have constructed models which relax this assumption. They find the optimal
strategy is a sequential one in which, after each wage offer, the job seeker weighs the
relative cost of finding an additional offer against the expected gain which that new
offer would represent. A sequential strategy has been shown by McCall and others
to lead to a ‘reservation wage’. The individual would choose, under this strategy, to
stop searching with the first offer exceeding this reservation wage. The reservation-
union strategy has not yet been integrated into a model of migration behaviour.

There is, however, a more fundamental issue here. Both the fixed-sample and the
reservation-wage strategies emphasize the dispersion of wages in a local labour market
as the prime source of uncertainty underlying the job seeker’s problem. Is such a
dispersion the essential source of uncertainty underlying migration behaviour? Some
researchers, particularly Todaro (1969) and Zarembka (1970a; 1972),
emphasize the uncertainty of job finding alone. In their models they assume that all
jobs carry the same wage, thereby eliminating wage dispersion. The prospective
migrant has a known and fixed probability of finding a job in any period of time and
this constitutes the only uncertainty facing him. Such an approach is quite attractive
because it makes the informational requirements for a migration decision much
smaller. What emphasis should be placed on job finding versus wage dispersion is
still an open empirical question.

As a final issue here, one might ask how the job seeker weighs one important
intrinsic element of a given job: its expected duration. David has assumed that the
job seeker believes that a job opening will last the rest of his lifetime. This, however,
is a polar case. More generally the worker believes a job will have a finite life
although he may be unsure about how long this will be.

A job may terminate for several main reasons: retirement, quitting, and layoff.
The retirement effect has already been considered in David’s model in terms of the
discounted stream factor \(R\). No presently available search model considers future
‘voluntary’ quits (for the purpose of taking or searching for a better job) in the job
seeker’s current decision problem. A simple discounted-earnings-stream approach,
such as that of David, understates the true expected earnings stream by ignoring the
expected income gain from future search. This could call for a drastically different

\(^{(10)}\) The basic search-theory models have often been criticized for their reliance on wage dispersion.
In addition to empirical doubts, Rothschild (1973, page 1288) and others have questioned the
theoretical basis of such dispersion.

\(^{(11)}\) As an example of the fragmented evidence available, Stephenson (1976, page 110) suggests
that about 90% of young job seekers in the United States accept the first job offered to them.

\(^{(12)}\) Stephenson (1976, page 109) also presents evidence suggesting that, among young job seekers
in the United States, the older the job seeker the longer he expects his next job to last.
to the particular job seeker\(^{(16)}\). If a job seeker happens to find a firm with such a vacancy, this position is assumed to be offered to him. Thus, in the David–Barron view, the job seeker who engages in random search has a probability \(p_1\) of getting an offer from a firm. Further, if it takes \(m > 1\) time periods to search one firm, the probability of getting an offer in a unit time is \(p = p_1/m\).

An alternative definition of this probability in the bingo model has been suggested by Todaro (1969). He imagines a labour market where all new job openings are filled within one period of time and that these positions are filled randomly from among the ranks of a large stock of unemployed\(^{(17)}\). Given \(O_i\) openings in the local labour market at time \(i\) and \(U_i\) unemployed job seekers, the probability that a job seeker will get an offer is \(p(i) = O_i/U_i\).

These two definitions of the job-finding probability in a bingo model share certain features. They are both objectively determined by conditions in the local labour market. They both see the hiring of workers as a kind of random choice among the unemployed job seekers. They both require that the job seeker have some idea of the rate of job creation by firms in a given local labour market. Finally neither sees the duration of an individual’s search as affecting \(p\)\(^{(18)}\). In fact if the general labour-market conditions remain constant so does \(p\).

Are there any reasons for preferring either a queueing or a bingo model? In terms of realism, exclusive reliance on the bingo model is unsatisfactory. Firms, to varying degrees, find it helpful to maintain waiting lists of acceptable job seekers, especially where such workers infrequently approach the firm. By maintaining such lists, the firm should be able to fill its openings more quickly (and at a relatively small increase in administrative costs) than by hiring according to a bingo model. Secondly, the queueing model may make more realistic information demands on the part of the job seeker. How would the job seeker get the information required to estimate \(p\) in the bingo model? Newspaper and other reports about the expansion of economic activity in a local labour market might be a common source. The job-hunting experiences of friends who have recently searched in that market might be another frequently used source. It is doubtful in either case that the job seeker could get enough information to have more than a very vague estimate of \(p\).

In a queueing model there are two kinds of information which the individual must acquire. First, he must know \(p_1\), the probability of being a successful applicant. Second, he must have some idea of the expected time until he comes to the top of a waiting list. To estimate \(p_1\), he must rely on his own experiences in job search since this is his only guide to his intrinsic qualities as generally perceived by firms. To estimate waiting times, he might reasonably rely on the personnel officers of the firm

\(^{(16)}\) Barron assumes, more strictly, that no firm has more than one vacancy (of a given type) at a given time.

\(^{(17)}\) This is in contrast to the David–Barron model where an opening is filled in a period only if an appropriate applicant appears.

\(^{(18)}\) Some objections to the basic assumptions of the bingo model raise questions about the effect of search duration on \(p\). Several researchers, including Zarembska (1972, pages 54–58), have suggested that job search involves skills which must be learned. They see the sampling of firms not as a purely random process but as one in which the job seeker becomes increasingly adept at discovering firms with vacancies. Thus the individual job seeker has his own \(p\) which increases with search duration.

An alternative argument has been developed by Salop (1973) to suggest that job seekers are relatively good at picking out high-wage and likely employers. In systematic searching, the job seeker will search these firms first and will only subsequently search low-wage, less-likely employers. In this contrasting view, \(p\) will decrease with the duration of search. It is improbable that search learning and systematic search effects exactly cancel each other out, but the net effect on \(p\) of search duration is an empirical issue if one accepts the bingo model as a realistic approximation.
choice from the one dictated by David's model. Layoffs or 'involuntary' quits (that is, not quitting to search for or take up a better job) are not generally considered in the literature either. These too may have a significant effect on the prospective migrant's decision by making a simple discounted earnings stream overstate the expected true stream of earnings.

To incorporate the possibility of these last two kinds of job termination, more information is required by the prospective migrant. He needs to have some idea about the probability of layoff in each of the local labour markets. In addition, for each labour market, he needs to evaluate the likelihood that future search will become profitable. The latter might include, for example, an expectation about temporal shifts in the wage distribution of a local market relative to current conditions. It is unclear as yet just what sources the prospective migrant tends to use in estimating such information.

A small example illustrates the role of uncertainty about layoff on the prospective migrant's choice. Suppose that a job seeker is considering searching some particular local labour market. Assume that he knows the only wage, \( w \), which can be obtained there. It remains fixed in real terms over the worker's life. Further assume he knows the probability \( p \) of finding a job opening and the probability \( q \) of being laid off involuntarily during a period. These are also assumed to be fixed over time. Given that the job seeker is unemployed at the outset \( (t = 0) \), can one find the probability \( e_t \) that he is employed at time \( t \)? Let \( u_t \) be the probability that he is unemployed and let \( u_t = (u_t, e_t) \), where, of course, \( u_t + e_t = 1 \). The earlier assumptions help to define a Markov model of the form \(^{(13)}\)

\[
v_t = v_{t-1} P, \quad \text{where} \quad P = \begin{pmatrix} 1 - p & p \\ q & 1 - q \end{pmatrix}.
\]

From this,

\[
u_t = u_0 P^t.
\]

As Howard (1971, pages 63–64) indicates, \( P^t \) has a closed-form solution,

\[
P^t = \begin{pmatrix} q & p \\ p + q & p + q \end{pmatrix} + (1 - p - q)^t \begin{pmatrix} p & -p \\ p + q & p + q \end{pmatrix} - q \\ p + q & p + q \end{pmatrix} \begin{pmatrix} q & -p \\ p + q & p + q \end{pmatrix} - q \\ p + q & p + q \end{pmatrix}.
\]

Given the prior assumption that \( u_0 = 1 \), it is now easily seen that

\[
e_t = \frac{p}{p + q} (1 - (1 - p - q)^t).
\]

The expected value of the discounted flow of future earnings can now be calculated. Assume a discount rate of \( r \) and assume that there are no unemployment benefits. The expected discounted earnings stream, \( E \), is given by \(^{(14)}\)

\[
E = \sum_{t=0}^{\infty} \frac{e_t w}{(1 + r)^{t+1}}.
\]

\(^{(13)}\) Note that the Markov model also assumes one state change per unit time (that is, from unemployed to employed or vice versa).

\(^{(14)}\) Note that \( E \) is defined solely in terms of \( e_t \) and ignores the duration of unemployment. Thus the job seeker is indifferent between several short periods of unemployment or a few longer periods.
Substituting from equation (14) and letting the worker's time horizon, $T$, be large, one gets as an approximation

$$E = \frac{p}{r(p+q+r)}w.$$  \hfill (16)

Equation (16) can be expressed in a number of ways. Let us assume that the worker has a fixed level of $E$, say $E_0$, in mind. A rearrangement of equation (16) in this case yields

$$q = -r + p \left[ \frac{w}{rE_0} - 1 \right].$$  \hfill (17)

This equation ties together the three local-market variables: $q$, $p$, and $w$. Given that the job seeker wants to maximize $E$, equation (17) indicates indifference curves among these three variables\textsuperscript{(15)}. For example, the job seeker is indifferent to a higher quit rate provided that it is accompanied by a higher wage or higher job-finding probability.

3.1.3 The probability of job finding. Whatever the emphasis on wage dispersion, some attention must be focussed on uncertainty in the search for job openings. This may be summarized by thinking of the probability that a job seeker will locate any opening either while searching a firm or during a given time period. How would one measure this probability? What are its determinants?

There are several ways in which one could measure the probability of getting a job offer during a period. These may be broadly classified according to how one would view the hiring behaviour of firms. One possibility is that firms maintain waiting lists of acceptable job applicants. In an extreme version, the firm would make available a job opening only to the first person on this list and the person's name would be dropped from the list subsequently regardless of whether he accepts or rejects the offer. An opposite view of the hiring process would be that no waiting lists are maintained. In this case, a job opening is offered to the next applicant who appears. These two polar views of the hiring process result in different kinds of job-finding probability measures.

Let us look more carefully at the 'waiting-list' or queueing model of job hiring. Suppose that a job seeker randomly visits $N$ firms during a period of which $n$ on average find him an acceptable applicant. Then $p_1 = n/N$ is the probability that a firm will make him a job offer at some time. This offer may come immediately but generally will come substantially after the application. The probability $p(t)$ that he gets an offer during a time interval $t$ is dependent on $p_1$, on the magnitudes of the waiting lists of firms, and on the rate of occurrence of job vacancies. In general $p(t)$ will be near zero when the job seeker initially begins searching but will increase, at least to some level, with his duration of search. No application of this approach has been found in the job-search literature although this queueing model seems to be a realistic representation of some job-search problems.

The alternative view of the hiring process, in which no waiting lists are maintained, might be referred to as the 'bingo' model. Here there are at least two different measures of the probability of finding a job. One is the measure used, for example, by David (1974) and by Barron (1975). During a small interval of time, only a certain proportion of firms, say $p_1$, have one or more job openings of a type suitable

\textsuperscript{(15)} Note that the coefficient of $p$ in equation (17) is positive: from equation (16)

$$w = \frac{p+q+r}{rE_0}p \quad \Rightarrow \quad p > 1.$$
who might say, for example, “you are an acceptable applicant. At current turnover
and expansion rates, we would be able to hire you in six to twelve weeks.” As his
search gets underway, the job seeker thus has a built-in process by which to estimate
and update \( p(t) \) with his market experiences.

Finally, the queueing model may have an advantage in terms of its relatively
subjective nature. The David–Barron and Todaro (1969) approaches assume that \( p \) is
objective and known before the job seeker makes his migration decision. The
queueing model, however, suggests that \( p \) is subjective. The migrant may enter a
labour market with some notion about \( p \) that undergoes changes with his own job
search experiences. In this case \( p \) is combined with search (sample) information to
yield a posterior estimate of \( p \).

3.2 The choice problem
In this subsection, the specifics of the choice problem facing the job seeker are
discussed. What are the choice alternatives? Initially a general discussion of these
questions is undertaken here. Subsequently a simple model illustrating some of the
issues raised is presented.

Up to this point, simple models of job search have been presented. The job seeker
looks at different local labour markets, makes a choice among them, migrates, and
then searches for work. His choice was merely where (if at all) to migrate and how
long to search. Several objections are possible about this paradigm. As indicated
earlier, several researchers might criticize the notion that migration and unemployment
prior to search is the only strategy open to the job seeker. The choice alternatives
should be expanded to include long-distance search travel with migration only
consequent to successful job finding.

Other researchers, such as Mortensen (1970), have emphasized the choice between
full- and part-time search. They see the possibility, in other words, of employed
workers undertaking limited search for new work while maintaining their present jobs.
The presence of such part-time search in reality is quite extensive and cannot be
ignored. In fact several researchers, such as Aichian (1970, page 29), are quick to
point out that full-time search is justifiable only if it enables more efficient and
productive search. A job seeker might engage in limited search while maintaining a
job, change jobs to permit the move to search on a part-time basis with more
extensive search activity, or quit to search full-time. A more realistic model of the
job seeker would make the intensity of search part of his choice problem.

Finally, in treating the problem of rational choice, most researchers have assumed
that the job seeker maximizes the expected value of his discounted future-earnings
stream. This implies risk neutrality. David (1974) is one of the few to consider risk
aversion as a basis for rational decisionmaking under uncertainty. Just what the gains
are in moving from simple risk neutrality to other rationality assumptions is an open
question. Although David's model, for example, places an emphasis on the variance
of the wage distribution, it is unclear whether a job seeker would ever have enough
information about this to behave properly. Unless alternative models of rationality
can be developed which generate realistic data requirements on the part of job
seekers, there would be little to gain from considering them here.

3.2.1 Migration and search travel. Consider the following model as an example of what
can be done with the first issues raised: the choice of search strategies. Imagine two
local labour markets, \( a \) and \( b \), in which there are fixed wages, \( y_a \) and \( y_b \), and fixed
probabilities of job-finding, \( p_a \) and \( p_b \), respectively. Assume that there is no possibility
of layoff, that is, \( q = 0 \). The cost of migration from \( a \) to \( b \) is \( c_m \), the cost of a round-
trip search trip is \( c_s \), and the discount rate is \( r \). Of course, \( c_m > c_s \). Finally assume
risk neutrality on the part of the job seeker.
There are three actors whose decision might be evaluated. The employed worker at a who is considering quitting to search at b, the unemployed job seeker at a who is considering which market to search, and the unemployed job seeker at b who is considering a similar question\(^{(19)}\). Here attention is focussed on the first two, although the third can be handled in a similar manner.

Several earnings streams can be calculated. The person presently working at a (or b) has a discounted earnings stream of \(E_{ea}\) (or \(E_{eb}\)), where, from equations (12), (13), and (15), with \(q = 0\) and \(e_a = 1\), and a subsequent approximation for large \(T\),

\[
E_{ei} = \frac{y_i}{r}, \quad i = a, b. \tag{18}
\]

Here working-life horizons have been ignored again. The unemployed job seeker at a (or b) has a similar discounted earnings stream, \(E_{ei}\), where, from equation (16) with \(q = 0\),

\[
E_{ei} = \frac{p_i}{(p_i + r)^q} y_i, \quad i = a, b. \tag{19}
\]

Given that a person makes a migration or search decision so as to maximize \(E_i\), equations (18) and (19) can be used to identify an optimal choice. For the moment, disregard direct costs of search and migration (\(c_s\) and \(c_m\)). The minimum condition for an employed person at a to seek work at b is \(E_{ub} > E_{ea}\) or\(^{(20)}\)

\[
\frac{y_b}{y_a} > 1 + \frac{r}{p_b}. \tag{20}
\]

This asserts a simple relationship between the relative wage rate at b, the likelihood of finding a job there, and the discount rate. The similar minimum condition for an unemployed worker at a to search at b is \(E_{ub} > E_{ea}\) or

\[
\frac{y_b}{y_a} > 1 + \frac{r}{p_b}. \tag{21}
\]

This is similar to equation (20) except it also includes \(p_a\).

What about the choice of search strategy? If a job seeker at a migrates to b and then searches, his direct search cost, \(S_m\), is an immediate outlay,

\[
S_m = c_m. \tag{22}
\]

If he undertakes search travel first and migrates only if a job is found, the expected search cost, \(S_s\), when properly discounted, is

\[
S_s = c_s + \left( \frac{p_b}{1 + r} \right) c_m + \left( \frac{p_b}{1 + r} \right)^2 c_m + \left( \frac{p_b}{1 + r} \right)^3 c_m + \ldots
\]

\[
= c_s + \frac{p_b}{r + p_b} c_m, \tag{23}
\]

where \(c_s\) is the cost of the initial search travel. The advantage of this second strategy is that it allows the job seeker to defer \(c_m\) until a job is found. The disadvantage is the initial outlay \(c_s\) required. The job seeker will choose the smaller of \(S_m\) and \(S_s\).

\(^{(19)}\) Given the structure of the assumptions, there is no incentive for the employed person at b to want a job at a. This actor is therefore ignored.

\(^{(20)}\) This is a minimum condition because the existence of nonzero \(c_m\) and \(c_s\) will generally require a larger \(y_b/y_a\) ratio.
He will undertake prior search if \( S_a < S_m \) or
\[
\frac{c_m}{c_a} > \frac{r + p_b}{r},
\]
and prior migration otherwise. The decision problem facing the job seeker at \( a \) is thus separable into two parts. First, how should \( b \) be searched by a job seeker at \( a \). His optimal decision is to incur a search cost, \( S_{\star} \), where
\[
S_{\star} = \min\{S_a, S_m\}.
\]
Based on this the second problem is to decide whether to search \( b \) at all. The job seeker will do this if
\[
E_{ab} - S_{\star} > E_{ka}, \quad k = u, e,
\]
depending of course on his current employment status. Thus it is possible to develop relatively simple models which make endogenous interesting aspects of the job seeker's decision problem.

3.2.2 Full- and part-time search. Although several authors, including Alchian (1970), have examined the trade-off between full- and part-time search at an aspatial scale, there has been no treatment of this problem in reference to migration.

A simple model serves to illustrate some of the issues involved. Let us consider a person at location \( a \) considering a costless move to a higher-wage location \( b \). Suppose further that this person is currently employed at \( a \) although he is engaged in part-time search for work at \( b \). Further assume that the probability of success in such part-time search is \( p_p \) per unit time. If \( e_a \) is the probability of being employed at location \( t \) at time \( t \), the expected utility from part-time search for this person currently employed at \( a \) is
\[
E_{oa} = \sum_{t=1}^{T} e_a y_a + \sum_{t=1}^{T} e_b y_b, \quad (27)
\]
where
\[
e_a = (1 - p_p)^{t-1} \quad \text{and} \quad e_b = (1 - p_p)^{t-1}.
\]
By use of equations (28) in equation (27), it can now be shown that
\[
\lim_{T \to \infty} E_{oa} = \frac{y_b - y_a}{r + p_p}. \quad (29)
\]
Alternatively the person who quits a job at \( a \) to search full-time at \( b \) has a utility level given by equation (19),
\[
\lim_{T \to \infty} E_{ua} = \frac{p_f}{(p_f + r)^{y_b}}.
\]
Here \( p_f \) is the probability of success in full-time search and it is presumed that \( p_f > p_p \). The job seeker is indifferent between full- and part-time search when \( E_{ua} = E_{ea} \) or when
\[
\frac{y_b}{y_a} = \frac{r + p_f}{p_f - p_p}. \quad (31)
\]
If the ratio \( y_b/y_a \) is larger than in equation (31), full-time search is preferable. If it is smaller, part-time search is more desirable. Thus equation (31) describes a simple relationship between the probabilities of job finding in full- versus part-time search, the discount rate, the relative wage to be earned at \( b \), and the most desirable search strategy.
4 Priorities in future modelling of job search and migration

Throughout this paper several issues have been raised about alternative ways to model or represent job-search behaviour. In concluding this paper the most important of these need to be reidentified and suggestions made about future modelling.

The most important controversy in job-search theory is over the relative roles of wage versus job-finding uncertainty. Most models, including that of David (1974), assign a central role to the dispersion of wages within a labour market in the job-search process. Is it reasonable to assume, however, that wage dispersion is so important to prospective in-migrants? Even if it is, are not the informational requirements of a model such as David's too excessive on the migrant's part to be realistic? Finally is it realistic to think of the wage sampling that inevitably accompanies wage dispersion as a common experience of job seekers. For all these arguments, Todaro's (1969) model of wage rates which are fixed within each labour market but vary from one local market to the next seems to be an attractive alternative. His emphasis on uncertainty about finding a job seems preferable because it is more in agreement with everyday experience as well as being simpler.

The second important controversy surrounds the treatment of search behaviour over long distances. David's model is the only one to consider this and his emphasis on migration and unemployment as prior conditions for searching are objectionable. Some work must be done toward the modelling of long-distance search behaviour without prior migration. Even though certain areas are very attractive places to live or work, many prospective migrants are unwilling to take the chance of giving up a current livelihood, moving lock, stock, and barrel, and hoping for a new job upon arrival. Many of these same prospective migrants, however, are willing to engage actively from a distance in trying to find job openings in these areas. The impact of this behaviour is not lost on firms in these favoured areas, who observe constant flows of applicants or applications for job openings. The models described in this paper are only a first small step toward a better treatment of the alternative search strategies open to such prospective migrants.

References


Corley-Hayes M, 1975 "Migration and the dynamics of multiregional population systems" Environment and Planning A 7 793-814


Gronau R, 1971 "Information and frictional unemployment" American Economic Review 61 290-301

Hartley M J, Revankar N S, 1974 "Labour supply under uncertainty and the rate of unemployment" American Economic Review 64 170-175

Holmes J, 1972 "Linkages between external commuting and out-migration" Economic Geography 48 406-420


McCall J J, 1970 "Economics of information and job search" Quarterly Journal of Economics 84 113-126
Maze W F, Chang J, 1972 “The chicken or egg fowl-up in migration: comment” *Southern Economic Journal* 38 133–139


Schneider C H P, 1975 “Models of space searching in urban areas” *Geographical Analysis* 7 173–185


Wolpert J, 1965 “Behavioural aspects of the decision to migrate” *Papers of the Regional Science Association* 15 159–169


Note: references marked • are not specifically referred to in the text but are useful background reading.