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1983

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MIGRATION DECISION WITH IMPERFECT INFORMATION

I I R - DISCUSSION 16 1983

1.0 INTRODUCTION

It is a well known fact in regional literature that the willingness (or ability) of people to migrate from one place to an other declines with distance between these places. This effect has been observed for a long time span and for economically, culturally and socially very different countries so that it is sometimes claimed to be "one of the few 'constants' observed in behavioral research" (Lewy & Wadycki, 1974, p.199)

This observation has been given different interpretations partly depending on the discipline the researcher comes from. "Economists have suggested that the effect of distance is a cost of moving, and sociologists have suggested that it reflects reluctance to leave familiar surroundings or is a surrogate for intervening opportunities." (Lewy & Wadycki, 1974, p.199)

A more recent interpretation is that the distance effect is mainly caused by uncertainty and lack of information. (Beals, Levy, Moses, 1967, Greenwood, 1969, 1971, 1975) The writers argue that people cannot compare the opportunities in different regions as long as they don't know them, and the probability that people know the opportunities in a specific region declines with the distance to that region.

This hypothesis is quite appealing, but although there is a huge body of literature on decisions under risk and uncertainty and on imperfect information in economics, in migration research only a few attempts have been made, to give this uncertainty hypothesis a more formal basis. (See for example Siebert, 1970, Smith et.al., 1979, MacKinnon and Rogerson, 1980, Rogerson and MacKinnon, 1981, Rogerson, 1982, Gordon and Vickerman, 1982)

Most studies simply refer to this effect and interpret the distance variable as a proxy for it and all the other effects mentioned above without explicitly saying which mechanism the researcher has (or has not) in mind.

It is the aim of this paper to do a step in the direction of clearifying the theoretical connection between the uncertainty hypothesis and distance.

The paper uses job search models developed in economic literature. But it will turn out that the information assumptions drawn in the - so called - "standard search model" (Lippman & McCall, 1979) are too strong to give the distance effect a meaningful interpretation. Therefore the information assumptions are relaxed and a search model with imperfect information on the wage offer distribution is applied. (Rothschild, 1974) So the connection between the uncertainty hypothesis and distance is not as clear as some former studies implicitly assume.

2.0 PRELIMINARY NOTES ON SOME METHODOLOGICAL CONCEPTS

There are a few concepts which are used almost throughout the paper. The first one is a special type of regionalization. I need to assume that all regions are disjoint functional regions. That is commuting and other interactions of everyday life are assumed to occur only within regions. In the migration decision - a decision about regions - individuals therefore have to take into account not only the region's characteristics as a place of living, but also as a place of working, of recreation and so on.

However, it is not assumed that these characteristics are of the same level all over the region. There is variation between places within one region and the individual is assumed to utilize this variety in an optimal manner. He works in a factory or in a downtown bureau, lives on the fringe of the regional center, spends his weekends out in the country, or behaves in some other way that maximizes his utility. The main point is that all these everyday interactions are assumed to occur within the region and that the only type of interaction between regions on an individual level is migration.

The other two assumptions used throughout the paper are well known in the context of decision making in an uncertain environment. The first one is the "expected utility rule" as invented in economic theory by John von Neumann and Oskar Morgenstern (1944). (Hirshleifer, 1974, Hirshleifer and Riley, 1979, Green, 1976)

Assume there are several actions (a), whose consequences (c) not only depend on the action the individual chooses but also on an uncertain state of the world (s). If the states of the world arise with a known probability (p) and if the individual evaluates the consequences along a utility function (v), then the "expected utility rule" assumes that the individual chooses that action which maximizes his expected utility:

$$(1) \qquad E(U_a) = \sum_s v(c_{a,s})\ p(s)$$

The second assumption in this context is on the form of the utility function v. This function is assumed to be linear in the relevant charakteristic; i.e. the individual is risk neutral.

Although there is some consensus in economic literature that risk aversion is kind of a "normal behavior", risk neutrality is a standard assumption in the theory of search. (Lippman and McCall, 1979). The main reason for this is a dramatic ease in mathematics, since under the assumption of risk neutrality maximization of the expected utility is equivalent to the maximization of the expected consequence.

Therefore one can totally ignore the individuals utility function <1> and has only to deal with consequences - in the case of job search with wages.

In the context of this paper the assumption of risk neutrality has a second advantage. Due to this assumption some rather surprising phenomena in part five and six of the paper can be clearly identified as information effects. At the end of the paper a few comments will be made on effects of risk aversion on the presented model. But besides this risk neutrality is assumed throughout the paper.

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1 Therefore some of the symbols used above to illustrate the expected utility rule can be used later on in the paper with different meanings.

3.0 THE STANDARD SEARCH MODEL

During the late sixties and early seventies, following the pioneering papers of Stigler (1961, 1962), the standard job search model was developed.

Assume an individual who knows exactly the wage offer distribution in a labor market but not the wages specific employers will offer him. That is, he is absolutly sure that, say, ten percent of the employers will offer him wages higher than 200.000 Schilling a year, 40 percent wages higher than 150.000 Schilling and so on. Denote this distribution function by F.

What he does not know is, who the employers are, who offer a specific wage level.

Therefore the individual draws wage offers at random. Since he is absolutly sure about his knowledge of F he need not revise his opinion, even if he observes the lowest possible wage offer a hundred times in a row. Therefore this type of search model is termed "with perfect information on the wage offer distribution". Herein lies the main difference to the search model of section 5 of this paper.

It is further assumed that the individual can observe wage offers - random draws from the wage offer distribution - only at costs of c for each observation. Further there is no predefined maximum number of observations and the individual can accept or reject wage offers only when they are drawn. Offers once rejected are not valid any more. <2> As proved by Telser (1973) a sequential strategy is optimal for the individual. He calculates a critical wage level and searches until he observes a wage offer higher than or equal to the critical wage level. This is the wage offer he accepts.

As will be shown, for a specific wage offer distribution and specific search costs there is a specific optimal critical wage level, which maximizes the individual's expected income.

The standard literature on job search does not clearly distinguish between an arbitrary critical wage level and the optimal one. Although usually different mathematical symbols are used, verbally they are both termed "reservation wage".

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2 This assumption is of no importance in the standard search model, since the search strategies with and without recall are the same under the information assumption drawn above. However, in the model of section 5 this will be an important assumption and so it is already noted here.

To distinguish more clearly between these two, I will use the term "reservation wage" (y) for an arbitrary critical wage level only, while the reservation wage which maximizes expected income will be called "optimal reservation wage" (y^*).

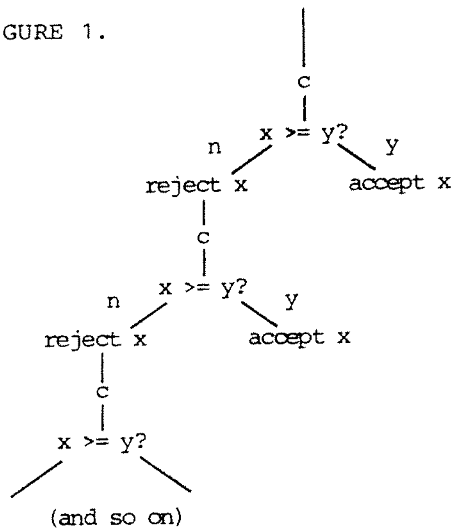
Secondly it should be stated more clearly than usual that both, reservation wage and optimal reservation wage, must be viewed as lifetime incomes. Search costs are kind of an investment, the return of which materializes in payments every week or every month over the individual's period of employment. So the individual has to sum up all the future payments - appropriately discounted - to gain a measure of the same dimension as search or migration costs.

When the individual follows the above sketched strategy and fixes a reservation wage, say, by thumb rule, what will be his expected income?

First of all, before he can observe the value of the first wage offer, he has costs of c to get that offer. Since the distribution function of the wage offer distribution is F, there is a probability of $1-F(y)$ that the wage offer he observes will be higher than or equal to y. If that happens, the individual will accept the wage offer and stop searching.

with probability $F(y)$ the individual will reject the wage offer and be in exactly the same situation as in the beginning (see figure 1).

FIGURE 1.



The expected income of this search sequence is an infinite sum of the following form:

$$(2)\quad E(x^{+}) = -c + \int_{y}^{\infty} x\, dF(x) + F(y)\{-c + \int_{y}^{\infty} x\, dF(x) + F(y)\{-c \ldots\}\}$$

x^{+} .... income net of search costs

this can be transformed to

$$(3)\quad E(x^{+}) = -c/\{1-F(y)\} + \int_{y}^{\infty} x\, dF(x)/\{1-F(y)\}$$

"Where the first term on the right hand side represents the expected cost incurred when the reservation wage is set equal to y and the second term is simply the conditional expected value of an offer given that it is at least y."

(Lippman & McCall, 1979, p.3)

The optimal reservation wage can be extracted from (3) simply by differentiation with respect to y. This results in the following condition for the optimal reservation wage (y^*).

$$(4) \qquad c = \int_{y^*}^{\infty} (x-y^*)\,dF(x)$$

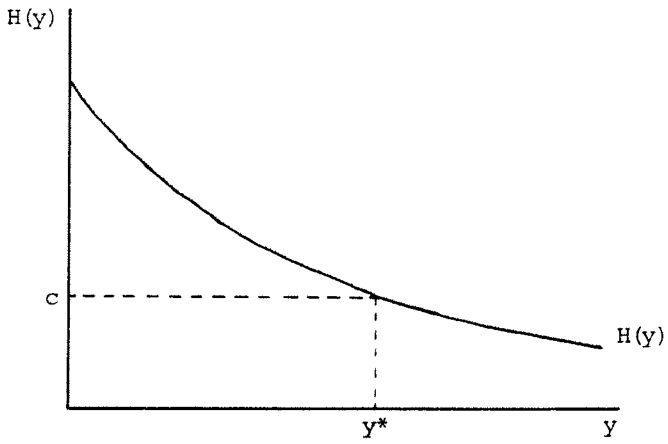
The left hand side is the marginal cost, while the right hand side represents the marginal return of an additional draw from the wage offer distribution.

The expression on the right hand side of (4) is often formulated as a function of y:

$$(5) \qquad H(y) = \int_{y}^{\infty} (x-y)\,dF(x)$$

"H is a convex, nonnegative, strictly decreasing function which approaches zero as y goes to infinity." (Lippman & McCall, 1979, p.4)

FIGURE 2. The graph of H(y)



As can easily be seen from figure 2 there is a reverse relationship between search costs and the optimal reservation wage. If the search costs rise the individual becomes less selective and therefore his expected period of search declines. (For a formal prove of this relationship see McCall, 1970, p.119) As proved by Hall, Lippman & McCall (1979, p.146, Footnote 15) a mean preserving increase in the riskiness of the wage offer distribution leads to an upward shift of function H(y) in all points exept y=0 <3> and therefore to an increase in the optimal reservation wage.

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3 Since there are no negative wages H(0) is equal to the mean of the wage offer distribution.

There is an other important property of the optimal reservation wage. Substituting y^* for y and equation 4 for c in equation 3 reveals that the individual's expected income net of search costs when searching under the optimal reservation wage is equal to the optimal reservation wage.

Since both F and c are fixed and the optimal reservation wage is a function of these two only there is a specific expected income for a given function F and given search costs. Under the assumptions drawn above the optimal reservation wage contains all the information the individual needs for an optimal search strategy.

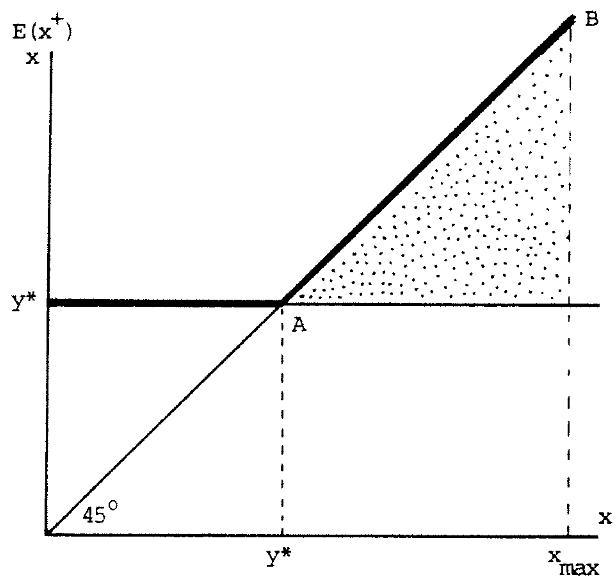
At the end of this section let's take a slightly different look at the search procedure.

The expected income of continued search in an infinite search procedure is constant over the search process, as can easily be seen from equation (2) or (3). Therefore with the optimal reservation wage the individual's expected income of search is

$$(6) \quad E(x^+) = -c + \int_0^\infty \max(x, y^*)\, dF(x)$$

The max-function in (6) can be graphed in the following way:

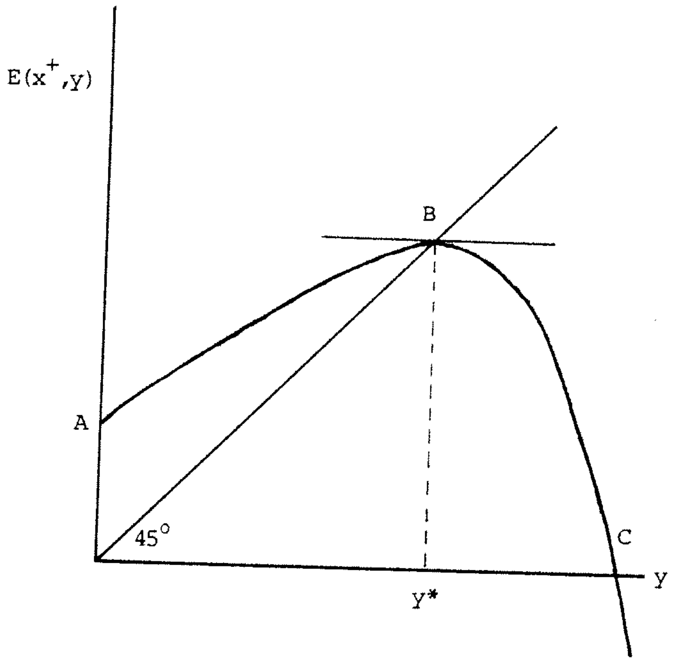
FIGURE 3.



Since y* does not change with the observed wage offer, y* is a line parallel to the x-axis. At point A the observed wage offer is equal to y* and the individual is indifferent between accepting x and continuing the search process. The max-function at different levels of x is indicated by the heavy drawn line y*-A-B. Equation (4) states that the costs of search must be equal to a function of the dotted area in figure 3.

The dependence of the expected income of search on the reservation wage - equation (3) - can be graphed in the following way:

FIGURE 4.



Point B is the optimal point, where the expected income is a maximum and equal to the reservation wage. In point A the individual accepts every possible wage offer and his expected income therefore is the expected value of all wage offers minus search costs. In point C the costs of search are equal to the expected value of acceptable wage offers and therefore the expected income of search is zero.

4.0 THE STANDARD SEARCH MODEL AND MIGRATION

Because of the regionalization and the information assumptions discussed above, the generalization of the standard search model to a multiregional model is straightforward.

Assume there is a system of n regions, with a specific wage offer distribution for every region.

(7) $$F_1, F_2, \dots, F_n$$

and a specific level of search costs

(8) $$c_1, c_2, \dots, c_n$$

Analogous to the standard search model the individual is assumed to know all wage offer distributions and all seach costs and therefore can calculate an optimal reservation wage

(9) $$y_1^*, y_2^*, \dots, y_n^*$$

for every region. This is obtained via the multiregional form of equation (4)

(10) $$c_i = \int_{y_i^*}^{\infty} (x-y^*)\ dF_i(x)$$

Since the optimal reservation wages are equal to the expected income net of search costs in all regions the individual can calculate the expected gain from migration by comparing the optimal reservation wage of his current region with that one of region i minus the costs of migration between these regions.

Without loss of generality we can assume that the individual's present region is region 1. Then there is a vector of migration costs <4>

$$(11) \qquad c_{11}=0, c_{12}, \ldots, c_{1n}$$

the elements of which will be correlated with distance between the relevant regions.

The above mentioned comparison between net-expected-incomes can be formalized in the following way:

$$(12) \quad \text{migrate to } i \text{ if } (y_i^*-c_{1i}) >= (y_k^*-c_{1k}) \qquad k=1, \ldots, n$$

Note that region 1, the individual's present region, is included in this formulation. So there is a migration decisions even if the individual does not move.

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4 In a more general formulation, if the individual is not assumed to live in region 1, there is a full nxn matrix of migration costs.

Since there is no stochastic element involved, condition (12) leads to a deterministic decision. So, if the assumptions of the standard search model are fulfilled for all individuals and the wage level is the only relevant characteristic of regions, all individuals residing in region 1 will either all stay in region 1 or all migrate to the region, which offers the highest optimal reservation wage minus migration costs.

In a multiregional context, it can be said, all individuals residing in a specific region make the same choice. If there are more arguments in the individual's utility function, condition (12) results in perfect separation of individuals over regions depending on the weights of the arguments in their utility function.

However, condition (12) is valid only when there is no other option than search in region 1 or search in some other region. If the individual is already employed in region 1, he receives an income of x, which - because it has to be acceptable - is higher than the optimal reservation wage of region 1. <5> In this case the individual will move only when the optimal reservation wage in region i minus migration costs is higher than his actual income in region

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5 Note that x is gross income, not income net of search costs.

1, which is a realization of a random variable.

So, viewed over the population of region 1, the probability that an individual will migrate from region 1 to region i is equal to the probability that the optimal reservation wage in i minus migration costs exceeds x. This second probability is

$$\text{Prob}(y_i^*-c_{1i}>x) = \frac{F_1(y_i^*-c_{1i}^m)-F_1(y_1^*)}{1-F_1(y_1^*)} \qquad (i\,|\,y_i^*-c_{1i}^m>=y_k^*-c_{1k}) \tag{13}$$

$$k = 1, \ldots ,n$$

So, if the individual is unemployed in his current region, both, the decision whether to change regions or not, and the decision where to migrate are deterministic as expressed by condition (12). If the individual is employed, the decision whether to move or not is stochastic as expressed in the probability statement of (13). On the other hand the decision where to migrate is still deterministic as expressed by the definition for i in (13). <6> Since the individual always chooses the region where the optimal reservation wage minus migration costs is a maximum, provided he moves at all, this second part of the decision is equivalent in the case of employment and unemployment.

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6 Note that there is a positive probability in (13) only when condition (12) is fulfilled.

However, the only distance variable terms in (12) and (13) are migration costs. So if one believes this model to be fairly correct, the whole distance effect as observed in empirical studies can only be caused by migration costs. This is a rather uncomfortable conclusion of this model type, especially if one takes into account that this is of no fundamental difference to a simple model with fixed regional characteristics, where no search is needed at all. As mentioned above, all income and wage variables must be viewed as lifetime incomes, while migration costs are only payed once. So migration costs are rather small compared to optimal reservation wages of different regions or to the actual income in region 1. This makes the above mentioned conclusion of the model rather implausible.

There is an other unrealistic implication of this type of model. Since by assumption the individual cannot improve his knowledge about the wage offer distribution in a region, he will always migrate to the optimal region before starting a search procedure. Strategies, where the individual stays in region 1 while searching for a job in an other region are suboptimal, since they only incur higher costs but no higher returns. (For a formal proof see Maier, 1983).

Obviously this result is contrary to empirical evidence.

In principle these results hold for the risk averse individual, too. If he has perfect knowledge about all the wage offer distributions he can calculate his expected utility of income for every region. This measure takes into account the riskiness of the relevant wage offer distribution and the individual's preference towards risk, but is unaffected by distance (For a search model with risk aversion see Hall, Lippman and McCall, 1979). In the migration context this assumption causes no change in the migration model presented above besides substitution of expected utilities of income for the optimal reservation wages.

The crucial assumption of the standard search model is perfect knowledge about all the wage offer distributions. This assumption is the main reason for the unappealing theoretical results of this model. So in the next section I will drop this assumption and refer a job search model with imperfect knowledge on the wage offer distribution. In section 6 this model will be analysed for its implications on the migration decision.

5.0 JOB SEARCH WITH IMPERFECT INFORMATION ABOUT F

Contrary to the preceeding chapters and following a paper of Michael Rothschild (1974) in this section a discrete formulation for the wage offer distribution is used, instead of a continuous one. In the single region we are dealing with here, there are m descrete wage offers

(14) $x_1, x_2, \ldots, x_m$

in the wage offer distribution.

Other than before, the individual does not know this distribution exactly, but has some subjective knowledge. His knowledge is characterized by the vector N,

(15) $N_1, N_2, \ldots, N_m$

where N_k can be termed "the number of times, wage level x_k was observed by the individual". These observations are not necessarily taken by the individual personally, but can also be experienced by friends and relatives, gained by updating earlier observations or submitted by the media or other information distributing institutions.

The vector N is a measure for the individuals experiences and informations and can be transformed to an equivalent measure, more convenient in this context.

Let

$$(16)\quad u_k = N_k/\sum_j N_j \quad \text{and} \quad v = 1/\sum_j N_j \ ; \qquad u=(u_1,u_2, \ldots ,u_m)$$

then the vector u and the scalar v contain exactly the same information as N. "This parameterization permits a distinction between the content of this information represented by u, and its precision, represented by v." (Rothschild, 1974, p.695) In a more statistical sense u is the vector of relative frequencies, while v is the inverse of the sample size.

If the individual's state of information is (u,v), one can ask the question, how additional information will be incorporated into that knowledge. In the formulation of equation (15), when the individual observes a wage offer x_k, he updates his believes simply by adding 1 to the corresponding element N_k of the vector N, while leaving all other elements unchanged. Using the definitions of (16) it is easily seen that this updating rule is equal to

$$(17)\quad h_k(u,v) = \{\frac{u_1}{(v+1)}, \ldots ,\frac{(u_k+v)}{(v+1)} , \ldots ,\frac{u_m}{(v+1)} ;\frac{v}{(v+1)} \}$$

where $h_k(u,v)$ symbolizes the updated (u,v), when x_k is observed.

This updating function is equivalent to Bayes' theorem and the additional information is therefore used in an optimal manner. <7>

Some inspection of (17) reveals the following characteristics of the updating function:

- If the individual has only little information about the wage offer distribution - i.e. v is relatively high - , he revises the vector u much more than when he has much information - v is close to zero.

- Perfect information about the wage offer distribution, as assumed in sections 3 and 4, is represented by v=0 and so a special case of this formulation.

Besides updating his state of information the indiviual has to decide about accepting or rejecting the wage offer drawn. In principle there is the same situation as in section 3. The individual has costs of c for each draw from the wage offer distribution and he has to decide if the expected out-

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7 Additional information is of the same weight as information already at hand. If the individual uses equation (17) to incorporate a whole set of information into his believes (u,v), the result is always the same independently from the sequence in which the information comes up.

come of an additional draw <8> is worth these costs. If not he better accepts the actual wage offer. Other than in section 3 the individual's opinion of the wage offer distribution now changes through the updating mechanism discussed above. Therefore the probability with which the individual expects an acceptable wage offer to come up at the next draw depends on the wage offers already observed. So there is no simple formulation for the expected income of search as in equation (2).

Instead one has to go through an induction argument of the following way:

Suppose that the individual's state of information is (u;v) and he is allowed to take just one more draw from the wage offer distribution after the actual one. <9> Then the expected income from the very last draw is:

$$(18) \qquad V^1(u;v) = -c + \sum_k u_k x_k$$

where V indicates expected income, (u;v) the individual's state of information and the superscript 1 symbolizes that just one more draw is allowed. Since the individual will accept this last draw in any case, the expected income of

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8 As before only the actual wage offer can be accepted.

9 The information gained from the actual wage offer is already included in (u;v).

this last draw is simply the expected value of the wage offer drawn, minus the costs of search.

Therefore the individual will accept the actual wage offer, if it is at least equal to the expected income of the last draw:

(19) Accept x if $x >= V^1(u;v)$

If the individual is allowed to take two more draws from the wage offer distribution, equation (19) has to be changed to

(20) Accept x if $x >= V^2(u;v)$

where

(21) $$V^2(u;v) = -c + \sum_k u_k \max\{x_k, V^1(h_k(u;v))\}$$

and the expected return of the very last draw, now pushed one step back, with u', v' substituted for $h_k(u;v)$ of equation (21) is

(22) $$V^1(u';v') = -c + \sum_k u_k x_k$$

So the expected return in one step of the search procedure always depends on the expected return of the next step in the following way: <10>.

$$(23)\quad V^n(u;v) = -c + \sum_k u_k\{\max x_k, V^{n-1}(h_k(u;v))\}$$

When the actual wage offer is still unknown, the individual's decision rule is:

$$(24)\quad \text{Accept } x \text{ if } \quad x >= V^{n-1}(h_k(u;v))$$

Let

$$V(u;v) = \lim_{n\to\infty} V^n(u;v)$$

Then (23) and (24) can be reformulated for the unlimited search procedure <11> in the following way

$$(25)\quad V(u;v) = -c + \sum_k u_k \max\{x_k, V(h_k(u;v))\}$$

If there are more than two possible wage offers, the question arises, whether the reservation wage property of the standard search model is valid or not. With this property there is a single wage offer, which divides the set of all possible wage offers into two convex sets. The set of

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10 This definition includes (18), (21) and (22) since $V^0(u;v)$ is equal to zero.

11 Strictly speaking, there is no external limit to the number of possible draws from the wage offer distribution. As will be seen later, there is an internal limitation through the updating mechanism for the individual's believes.

acceptable (A) and the set of unacceptable wage offers (U). (see figure 5)

So, if the reservation wage property is valid, every wage offer higher than - or equal to - that critical value is acceptable and every wage offer lower than the critical value is unacceptable.

Under the assumptions drawn above, one can construct examples, where the reservation wage property is not valid. (Rothschild, 1974, p.701; Lippman & McCall, 1976, p.174) But as proved by Rothschild, the reservation wage property is valid in this model, when the distribution of the individual's believes about the parameters of the wage offer distribution is Dirichlet. Since the Dirichlet distribution is

1. the conjugate prior to the multinomial distribution and

2. the likelihood function of the parameters of a sample out of a multinomial distribution (De Groot, 1970; Fabius, 1973)

Rothschild's result is more general than it seems to be at first look. Whenever the individual's believes about the wage offer distribution are based on observations rationally combined, the parameters of his wage offer distribution are distributed dirichlet and the reservation wage property is valid.

Troughout the rest of the paper I will assume that the individual's knowledge about the wage offer distribution is based on observations and therefore the reservation wage property is valid. So the two sets of acceptable and of unacceptable wage offers always form convex sets.

Since the expected income of continued search in this model type not only depends on the individual's state of information, but also on the value of the actual wage offer, the optimal reservation wage in a specific state of the search procedure ($y^*(u;v)$) is defined by:

$$(26) \quad y^*(u;v) = \min\{V(h_k(u;v)) \mid x_k >= V(h_k(u;v))\}$$

This search procedure has some important properties:

1. There is a maximum number of draws, even if the search procedure is unlimited.

2. "As the costs of search increase, search decreases" (Rothschild, 1974, p.700)

3. $V(h_k(u;v))$ is a nondecreasing function of x_k. (proved by

Rothschild, 1974, p.703)

4. $y^*(u;v)$ cannot increase during the search procedure.

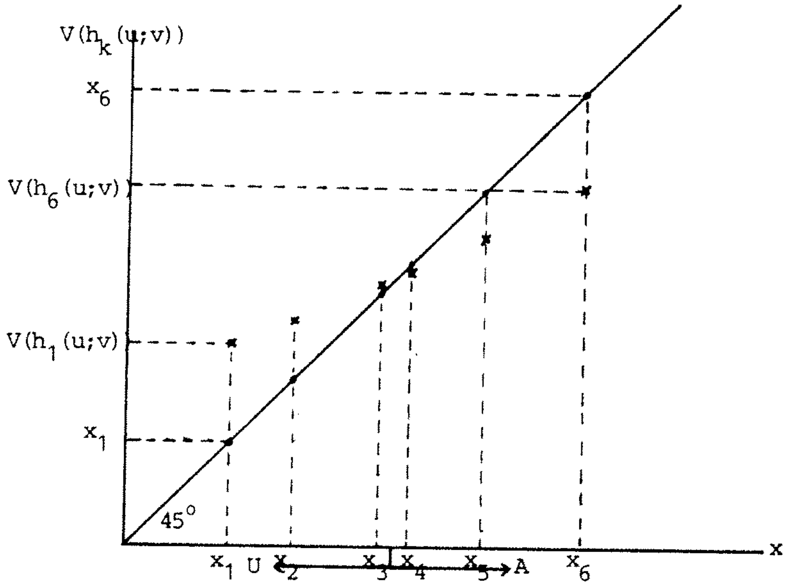
5. For a given vector u, expected income of search increases as v decreases.

Properties one and four result from the reservation wage property and updating function (17). The individual will continue search only when the actual wage offer is lower than the optimal reservation wage. Therefore he reduces the subjective probabilities for all wage offers acceptable in this stage, i.e. the probability of the set of acceptable wage offers. In the next step, the optimal reservation wage will be lower (Property 4) and the set of acceptable wage offers eventually increased. Through this mechanism repeated unsuccessful draws must lead to a point, when the set of acceptable wage offers contains the entire set of wage offers, and the search procedure terminates at the next draw, irrespective of the wage offer drawn. (Property 1)

Property 5 states that more precise information on the wage offer distribution - i.e. lower v - leads to a higher level of expected income. Compared to a search procedure with perfect information - v=0 - , the optimal reservation wage calculated with imperfect information will be somewhere above or below the "correct" optimal reservation wage. For a low level of v, the actual optimal reservation wage will more likely be close to the "correct" one than for a large value of v. Since deviations in both directions lead to lower incomes (see figure 4), in a situation with less precise information on the wage offer distribution, the individual's expected income must be lower. Note that this result holds, although we assumed the individual to be risk neutral.

Figure 5 summarizes the search problem graphically:

FIGURE 5.



The expected return of continued search is an increasing function of the possible actual wage offers. Decision rule (25) is fulfilled for wage offer 4, 5 and 6. The expected return of continued search at wage offer 4 is the optimal reservation wage as defined by (26). So if wage offer 4, 5 or 6 is observed, the actual wage offer is higher than the expected income of continued search, starting with the revised wage offer distribution. Therefore the individual will accept the wage offer, and stop searching.

If an unacceptable wage offer (1,2 or 3) is observed, the probability of each of the acceptable wage offers will be lowered by the factor $1/(1+v)$, and so in the next step the individual will believe the wage offers 4, 5 and 6 to be less probable by this factor. Therefore the individual will become less selective, i.e. in the continuous case his set of acceptable wage offers will increase, while in the discrete case the set of acceptable wage offers eventually will increase, if the highest unacceptable wage offer is close enough to the optimal reservation wage. If the individual observes a whole sequence of unacceptable wage offers, one by one the ever highest unacceptable wage offer will become acceptable.

On the other hand, the individual gains more and more information about the wage offer distribution. Therefore the influence of the actual wage offer on the individual's believes about the wage offer distribution will become less later on in the search procedure. So the graph of the function $V(h_k(u;v))$ becomes less steep, as v comes closer to zero. When v is zero, i.e. when information about the wage offer distribution is perfect <12>, the graph of $V(h_k(u;v))$

is parallel to the x-axis. (see figure 3)

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12 This state of knowledge cannot be obtained with a search procedure, starting with imperfect knowledge about the wage offer distribution.

6.0 IMPERFECT INFORMATION ABOUT F AND MIGRATION

In this section I want to analyse the migration decision based on the search model presented above. In the case of perfect information about the wage offer distribution, the migration decision turned out to be rather simple. The individual had to compare the optimal reservation wages in the different regions net of migration costs <13> and to choose the region with the highest net value.

Because of the perfect information, the individual was assumed to have about all the wage offer distributions, it was always optimal for him, to migrate first, and then to start searching for a job.

As will be seen later on, with imperfect information about the wage offer distribution, more strategies can be optimal. Three strategies will be analysed in this chapter.

1. Search after migration

   This is the strategy that was found to be optimal in

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13 For his present region, he either had to choose the optimal reservation wage or his present wage level, when he is unemployed or employed, respectively.

section 4. The individual first makes his migration decision, migrates to the region chosen and starts to search for a job there. But other than in section 4, with imperfect information about the wage offer distribution, return migration may turn out to be optimal during the search procedure.

2. Buy information

In this strategy an additional option is offered to the individual. Before making his migration decision, he is allowed to buy additional information about the wage offer distribution of a region possibly chosen. Besides the migration decision, the individual has to decide, whether to make the migration decision now, or first to buy additional information.

3. Search before migration.

In this strategy the individual is allowed, first to find a job in an other than his present region, and then to migrate to that region. For interregional search, of course, search costs are higher than for search after migration.

To keep things tractabe, most of the presentation will be in a two regions system, only. Region 1 is the individual's present region, region j a region possibly chosen. For region 1, let's assume, the individual has perfect information about the wage offer distribution.

So, for region 1 there are a wage offer distribution $F_1(y)$, search costs c_1^s. and following from these an optimal reservation wage y_1^*. <14> Region j is characterized by the individual's believes about the wage offer distribution (u;v) and search costs c_j^s. Based on this, the individual can calculate the expected income of search in region j - $V_j^s(u;v)$ - as defined by (25), by backward induction. As in section 4, migration from 1 to j is only possible on migration costs c_{1j}^m.

6.1 SEARCH AFTER MIGRATION

This strategy seems to be analogous to the model discussed in chapter 4. The individual compares the optimal reservation wage of region 1 with the expected income of search in region j minus migration costs from 1 to j, and chooses the region with the highest net value.

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14 If possible without causing confusion, the index for the region is dropped. The superscript s denotes search.

(28) migrate to j if $V_j^s(u;v) - c_{1j}^m > Y_1^*$

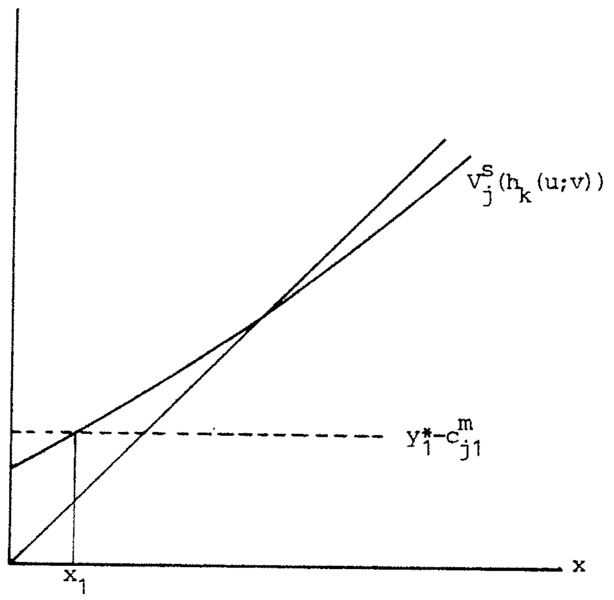
Superscript s indicating a search strategy

A search strategy of this type can be generalized for n regions straightforwardly.

In this model type, the influence of distance is not only via migration costs, but also via $V_j^s(u;v)$. Since less precise knowledge about the wage offer distribution reduces the expected income of search, and the precision of knowledge will very likely decrease with distance. In the average there is a negative relationship between $V_j^s(u;v)$ and distance.

Assume the individual has used the criterion mentioned above and decided to migrate to region j. So, his situation at the beginning of the search procedure could be as described in the following figure:

FIGURE 6.



The individual had only little information about the wage offer distribution in region j, and so the graph of the function $V_j^s(h_k(u;v))$ is relatively steep. However, his information indicated that there are some great possibilities in that region, and so $V_j^s(u;v)-c_{1j}^m$ turned out to be larger than y_1^*.

But, if on his first draw the individual observes a wage offer lower than x_1 (see figure 6), he has to revise his believes that much, that now migration back to region 1 and search with y_1^* offers higher income expectations than continued search in region j. So $y_1^*-c_{j1}^m$ is kind of a lower barrier for tolerable revisions of expected income, and it acts as insurance against heavy frustrations of the individual's expectations. This insurance, of course, is relevant only when there are wage offers lower than $y_1^* - c_{j1}^m$ possible in region j.

On the other hand, this insurance should be taken into account in the migration decision. V(u;v), as defined by (25), is the correct indicator only when no return mirgation is allowed. The expected income of search, with return migration allowed, $V_j^r(u;v)$, is

$$(29) \qquad V_j^r(u;v) = -c_j^s + \sum_k u_k \max\{x_k, V_j^r(h_k(u;v), y_1^* - c_{j1}^m\}$$

Since return migration is simply an additional option to the options considered in $V^s(u;v)$, it can be said that

$$(30) \qquad V_j^r(u;v) >= V_j^s(u;v)$$

with strict equality only when there are no possible wage offers lower than $y_1^* - c_{j1}^m$. So $V_j^s(u;v)$ is a lower bound for $V_j^r(u;v)$ and (28) is a sufficient but not necassary condition for migration to j to be optimal.

Necessary and sufficient in this strategy is

$$(31) \qquad \text{migrate to j if } \ V_j^r(u;v) - c_{1j}^m > y_1^*$$

In a multiregional model, the expected income of search net of migration costs in all other regions could serve as insurance. So in all steps of the search procedure, the expected incomes of all other regions should be considered, and a strict generalization for n regions turns out to be rather complicated.

6.2 BUY INFORMATION

If the individual uses the strategy described above and is unlucky, he ends up back in region 1, with migration costs payed twice. This unsatisfactory result is more probable, when the individual has only little information about the wage offer distribution in region j. So one can ask, whether the individual can avoid this by gathering more information prior to the migration decision. Or, more general, are there situations, where postponing the migration decision for buying additional information is an optimal strategy? Information the individual can buy is assumed to be of exactly the same quality as the information connected with search activities. It is a random draw from the wage offer distribution, but when purchasing information the individual can only observe the value of the wage offer and utilize it for updating his believes about the wage offer distribution and he cannot accept the observed wage offer. For an individual in region 1, observation of one wage offer in region j is assumed to cost c^{i}_{1j}, where the superscript i indicates the information strategy.

To answer the question, whether buying information will be worth the costs, the individual has to calculate his expected return from information. This expected return depends on the different choices, the individual can make. If there are no other options than going to region j, the individual has to go anyways, and information would be worthless. So the returns from information and from search are interrelated. (Mag, 1977)

In our model there are three options:

1. stay in region 1 and search for a job there,

2. go to region j and search for a job there

3. postpone the migration decision and buy more information about the wage offer distribution in region j.

Therefore, the expected return from information is:

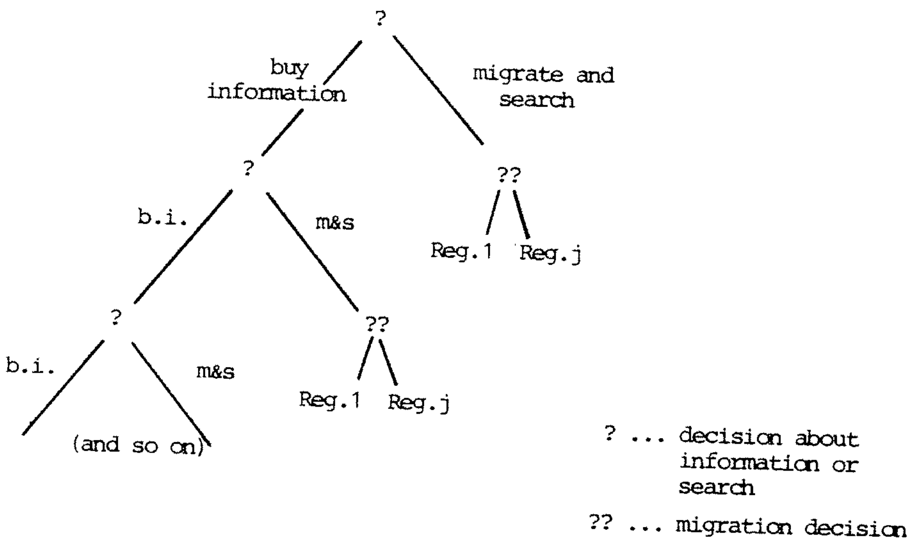
$$(32)\quad V_j^i(u;v) = -c_{1j}^i + \sum_k u_k \max\{y_1^*, V_j^r(h_k(u;v)) - c_{1j}^m, V_j^i(h_k(u;v))\}$$

The three elements of the max-function in (32) are the expected returns of the three options listed above.

In general there are two sequential strategies combined: An information strategy and a job search strategy. The information strategy is used to improve the basis for the migration decision and the job search strategy and therefore always precedes these two. So in the beginning and in every possible step of the information procedure the individual has to decide, whether he will buy information or make his migration decision and start searching for a job in the region chosen. If he decides to stop, or even not to begin the information strategy, he has to make his migration decision on basis of the state of knowledge about the wage offer distribution accumulated up to this point in time. So, basis for the migration decision are still the optimal reservation wage in region 1 and the expected income of search net of migration costs in region j. But the expected income of search now varies through the information process, depending on the wage offers observed through this process.

The general process is sketched in figure 7.

FIGURE 7.



To simplify the presentation, let's drop the last element of the max-function in (32), i.e. assume the individual is allowed to buy only one unit of information.

Then, for an information strategy to be optimal, the expected return of information must be higher than both, the expected return of search in j minus migration costs, and the optimal reservation wage in 1.

$$(33) \quad V_j^i(u;v) > V_j^r(u;v) - c_{1j}^m$$

$$(34) \quad V_j^i(u;v) > Y_1^*$$

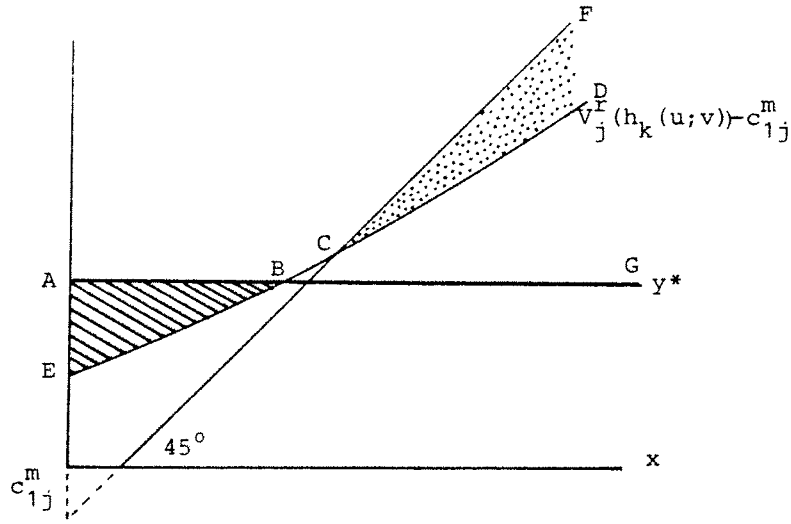
Substituting (29) and the simplified form of (32) into (33) and (34) yields the following conditions, both sufficient for an information strategy to be optimal.

$$(35)\quad \sum_k u_k\{\max(y_1^*, V_j^r(h_k(u;v)-c_{1j}^m)-\max(x_k-c_{1j}^m, V_j^r(h_k(u;v))-c_{1j}^m)\} > c_{1j}^i-c_j^s$$

$$(36)\quad \sum_k u_k\{\max(y_1^*, V_j^r(h_k(u;v))-c_{1j}^m)-y_1^*\} > c_{1j}^i$$

Graphically the max functions in (35) can be presented in the following way.

FIGURE 8.



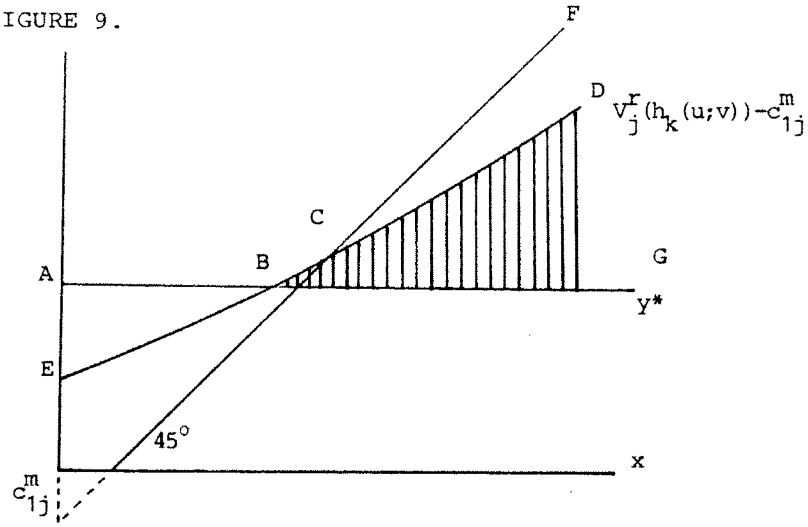
The first max-function of (35) is pictured by the line A-B-C-D, the second max-function by E-B-C-F

So the difference between these two functions is positive in the shaded area of figure 8, and negative in the dotted one. Since the left hand side of (35) is a weighted sum of the difference between the two functions, the size of these two areas is important for condition (35) to be fulfilled.

It is the main difference between a search and an information strategy, that the observation of high wage offers does not necessarily terminate the information process. Therefore function $V_j^i(h_k(u;v))$ can shift up or down, when knowledge is accumulated. However, more information leads to a less steep function $V_j^i(h_k(u;v))$.

Now let's turn to condition (36). The max-function and y_1^* can be graphed in the following way:

FIGURE 9.



The max-function in (36) is exactly the same as the first max-function in (35) and therefore represented by line A-B-C-D. y* is invariant with x and therefore represented by line A-B-G, parallel to the x-axis. The difference between these two functions is indicated by the shaded area in figure 9. The right hand side of (36) is positive.

Before we go to analyse the effects of parameter changes on conditions (35) and (36), recall our assumption that the individual can buy information only once. By dropping this assumption, we introduce an additional option in the first max-function of (35) and the max function of (36) (see figure (7)). This eventually enlarges these functions, while leaving the functions to be substracted from them unchanged. Therefore this additional option can only enlarge, never reduce the left hand sides of (35) and (36). It follows that in the more general formulation (32) conditions (35) and (36) are sufficient, but not necessary for an information strategy to be optimal. So, whenever the purchase of just one unit of information is worth the costs, buying information must be optimal. But buying information can be optimal, although the purchase of a single unit of information is not worth the costs.

For the analysis of parameter changes, let's return to figure 8 and figure 9.

As already noted above, additional information leads to a less steep graph of V. <15> If the new graph is reached by, say, turning V in point B - i.e. by observing about average wage offers - , the size of the positive (shaded) area in

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15 If possible without causing confusion let's use V as a short term for $V^s_j(h_k(u;v))$.

both, figure 8 and figure 9, are reduced, while the negative (dotted) area in figure 9 is enlarged. So both, condition (35) and (36), are less likely fulfilled, when the individual has better knowledge of this kind.

If the graph of V becomes less steep and shifts downwards- i.e. the individual observes low wage offers through the information process - , the main effect will be a reduction of the shaded area in figure 9. In figure 8 the negative area will be enlarged, while the positive area will roughly remain of the same size. So most likely condition (36) will fail for the next step, i.e. the individual will stay in region 1 and search for a job there.

An upward shifted and less steep graph of V caused by the observation of high wage offers in the information process reduces the positive (shaded) area in figure 8, while the negative (dotted) area in figure 8 and the positive (shaded) area in figure 9 will remain roughly of the same size. So, in this case condition (35) is the critical one in the next step, i.e. the individual will most likely migrate to region j and search for a job there.

Since the information strategy as defined in (32) and as sketched in figure 7 is not limited by definition, the question arises, whether the information sequence always must terminate or can it be the optimal choice forever.

If the individual accumulates more and more information his state of knowledge comes close to the state of perfect information about the wage offer distribution. So the migration model discussed in section 4 can be viewed as a limiting situation to the information strategy. Graphically this is expressed in decreasing steepness of V. In the case of perfect information the graph of V will be parallel to y* and the expected income of search net of migration costs in region j will either be above or below the optimal reservation wage in region 1.

It is easy to see from (32) that with positive information costs the following relation must hold:

$$(37) \quad V_j^i = -c_{1j}^i + \max\{y_1^*, \hat{V}_j^s - c_{1j}^m\}$$

where $\hat{V}_j^s$ is equal to y_j^*, as defined in (9). Therefore at least one of the elements in the max-function of (37) must be higher than the expected return of information, and purchasing information cannot be an optimal situation in this limiting situation. Therefore the information sequence must terminate sometimes, when the individuals knowledge about the wage offer distribution is still imperfect. Only when information costs are zero, an endless information sequence is possible.

Since with positive information costs every information sequence is limited, and after termination of the information sequence the individual has to choose between the expected income of search of two regions, the expected return of information can be calculated for the individuals state of knowledge at the beginning and - if buying information is an optimal strategy - for every state of knowledge the individual can reach by the information strategy. So the individual can both, determine if buying information is optimal in his present situation, and precalculate, if buying an additional unit of information will be optimal, provided a specific wage offer is observed.

Therefore he can devide the set of all wage offers possibly observed into three sets:

1. The set of wage offers, which make him stop the information sequence and stay in region 1.

2. The set of wage offers, which make him continue the search sequence.

3. The set of wage offers, which make him stop the search sequence and migrate to region j.

The three possibilities discussed above by moving V in figures (8) and (9) indicate, that these three sets are in increasing order of wage offers. If none of the three sets is empty, very low wage offers will be in set 1, medium wage offers in set 2 and very high wage offers in set 3.

Because of the termination of every information sequence as discussed above, set 2 has to diminish during the information sequence and sometimes become the empty set.

Now let's discuss the problems of multiregional generalisation. In (32) the expected return of information about the wage offer distribution in region j is defined on expected returns of search of both, region j and region 1. This is because the expected return of search in principle is an expected return of postponing the migration decision. Therefore a multiregional version of (32) has to consider the expected returns of search and of information in all regions which can be chosen. Since the expected returns of information in the other regions, too, must be defined in this multiregional way, this creates a disturbing complexity of this model in a multiregional context.

Let me illustrate this with the following example: In the beginning the individual finds it optimal to buy information about the wage offer distribution in region j. when he observes a low wage offer, it turns out that purchasing information about an other region, region k, is optimal. When he observes a low wage offer in k in the next step, his optimal strategy is to go on to region 1 or back to region j and buy information there; and so on until he ends up in one of the regions searching for a job. In a correct calculation of V_j^i, the individual has to consider this and all the other possibilities of that kind.

Since all these parameters are elements of a max-function, it can be argued that neglecting these possibilities would not cause a large error. Following this argument one can define lower bounds for the expected returns of information for all regions in the following way:

$$(38)\quad \overline{V}_j^i = -c_{1j}^i + \sum_k u_k \max\{y_1^*,\ V_j^s(h_k(u;v)) - c_{1j}^m, V_j^i(h_k(u;v))\} \quad j=2,\ldots,n$$

In this definition for every region possibly chosen the individual makes only a paired comparison between this region and his present region. This calculation can be done for all regions seperately and the individual ends up with two (n-1)-dimensional vectors, a vector of lower bounds of expected returns of information (as defined by (38)) and a vector of expected incomes of search (as defined by (25)) net of migration costs. Note that also the possibility of return migration has to be excluded here and in definition (38) because return migration would include multiregional complexity again.

With these two vectors at hand the individual can compare their values and y^*. The largest value indicates the "optimal" strategy for the next step, which is either a search or an information strategy in one of the regions. If y^* is the maximum value the information problem is solved and the individual starts a search procedure in his present region. Is one of the V^i's, say V_l^i, the largest value, the individual observes a wage offer in region l, updates his opinion about the wage offer distribution in l and substitutes $V_l^i(u;v)$ and $V_l^s(u;v)$ by $V_l^i(h_k(u;v))$ and $V_l^s(h_k(u;v))$ in the two vectors respectively. Again the largest value out of y_j^* and the elements of the two vectors indicates the "optimal" strategy for the next step.

If V_l^s is the largest value the individual migrates to region l and starts searching for a job there. In this case not only the expected returns of information and search for region l have to be changed, but both vectors must be recalculated because of the changes in the information and migration costs. Observation of a wage offer leads to exactly the same changes as described for the information case above.

Up to now we did not analyse the influence of the different kinds of costs. Recalling (35) and (36) it is easy to see that an increase in migration costs will increase the left hand side of (35) but decrease the left hand side of (36). In extreme constellations one of these two may remain unchanged. Compared with the expected return of search in region j an information procedure becomes more, compared with the optimal reservation wage in l less attractive.

Or put it some other way round: An increase in migration costs reduces the expected return of search net of search costs, reduces the expected return of information by a smaller amount and leaves the optimal reservation wage in region 1 unchanged.

Changes in search costs can occur in region 1 and/or region j, where they cause changes in the optimal reservation wage and/or the expected return of search respectively in the opposite direction. So an increase in search costs in region 1 (region j) leads to a decrease in y* (V (u;v)) and leaves V (u;v) (y*) unchanged. Since both, y* and V (u;v), are elements of the max-function in (32) decreases in either of them reduce the expected return of information, but by an amount less than the triggering reduction.

More interesting in this context are changes in information costs. In (35) and (36) information costs are included only in the right hand sides and with positive signs. Therefore an increase in information costs makes an information strategy less attractive compared with both, the optimal reservation wage in 1 and the expected return of search in j. As we found out above, using the more general formulation (32), an infinite information strategy is possible only when the information costs are zero. This result for the limiting case and the general definition of the expected return of search (32) indicate that larger information costs will lead to a shorter information procedure prior to the migration decision. This has an important implication for migration: Assume a system of three regions, region 1, region k and region l, where k and l differ in information costs only. Using the multiregional information strategy discussed above, the optimal information procedure will be longer for the region with low information costs, say region l, and so the individual can make his migration decision concerning this region on the basis of better knowledge about the wage offer distribution. That this difference in information costs makes region l preferable to region k becomes very clear, when the information procedure is viewed in a slightly different way.

Let two individuals in region 1 follow an optimal information strategy, one with respect of region k and the other with respect of region l, and both observe exactly the same wage offers in every step of the information procedure. At the point, when it is optimal for the individual buying information about k to stop and make the migration decision, both individuals have exactly the same state of knowledge about the wage offer distributions in k and l respectively. The only difference is that the individual buying information about l has spent less money up to this point. Even if we assume that he has to stop his information procedure at this point, although his optimal strategy is to buy more information, his action is superior to the one of the individual purchasing information about region k.

With this relationship in mind the institutional framework of the information system becomes an important factor in migration. Through two channels: First it influences the a-priori state of knowledge individuals have about specific regions, and second it determines the costs of an information procedure. If the information system works in favor of a specific region or a specific type of region - usually large urban centers - migration flows will be biased towards these regions.

Also some other factors are important in this context. The most important one are friends and relatives, who live in a region possibly chosen. Usually they constitute a very cheap source of information, a fact which makes this region more attractive, even if income is the only determinant in the migration decision and social bindings are totally ignored. In empirical studies this "friends and relatives effect" is a phenomenon often found to be important (Greenwood, 1969, 1970; Laber, 1972; Levy and Wadycki, 1973; Renshaw, 1974; Langley, 1974; Kau and Sirmans, 1979; Alperovich et.al., 1977; Walsh, 1974; for an overview see: Shaw, 1975).

The question arises, where the more intensive connection between people in one and people in an other region comes from. In the studies cited above this variable is usually operationalized by lagged migration flows. It is hypothesized that people, who once lived in region i and now live in region j are an important channel of information.

But besides that in reality there are many more types of contact, which can lead to a "friends and relatives - effct". For example: holiday travels, contacts emanating form work or studies or the individual's actions space around his place of residence.

From a micro point of view, the individual's social history turns out to be an important factor in the migration decision, while in the average all these factors are correlated with distance.

Otner than in the model of section 4, now there are three mechanisms through which the migration decision is influenced by distance:

1. migration costs

2. the a-priori state of knowledge about wage offer distributions

3. information costs

Together they cause a more "realistic" distance effect.

although it always has to be mentioned that the migration model is drastically simplified compared to reality. The two most important simplifications are risk neutrality and consideration of income as the only determinant of the migration decision.

6.3 SEARCH BEFORE MIGRATION

In this strategy the individual can combine the advantages of both, search and information. He can accumulate information about an imperfectly known wage offer distribution prior to migration and accept favourable wage offers, too. These advantages are gained on the expense of higher search costs, since for every draw from the wage offer distribution in region j the individual must overcome the distance between region i and region j. This causes additional costs to the search costs, as defined in section 5. Therefore every draw in this strategy costs the standard search costs c_j^s of region j plus travel costs c_{ij}^p from region i to region j and back again, where the superscript p denotes search prior to migration.

To keep things tractable let's ignore the information strategy and consider the following options only:

The individual can

1. stay in region 1 and search for a job there

2. migrate to region j and search for a job there, or

3. stay in region 1 and search for a job in region j.

Therefore the expected return of a search before migration strategy is

$$(39)\quad V_j^p(u;v) = -c_{1j}^p - c_j^s + \sum_k u_k \max\{y_1^*, V_j^s(h_k(u;v)) - c_{1j}^m, V_j^p(h_k(u;v)), x_k - c_{1j}^m\}$$

in the beginning the individual has to find the best one out of the options listed above; i.e. he has to find the maximum from y_1^*, V_j^s and V_j^p. If V_j^p is this maximum value, observation of a wage offer brings up a fourth option. The individual can accept this wage offer. He will do this, if the observed wage offer minus migration costs is higher than the returns of the three other options calculated on basis of the revised wage offer distribution. If some other option offers a higher net return the individual will choose this one in the next step. This optimal selection is expressed in the max-function in (39).

As in section 6.2. let's drop the element $V_j^p(h_k(u;v))$ in (39). This is done for simplification.

Then, for the individual to accept a search before migration strategy, the following two relations must hold:

$$(40)\quad V_j^p(u;v) > V_j^s(u;v)-c_{1j}^m$$

$$(41)\quad V_j^p(u;v) > y_1^*$$

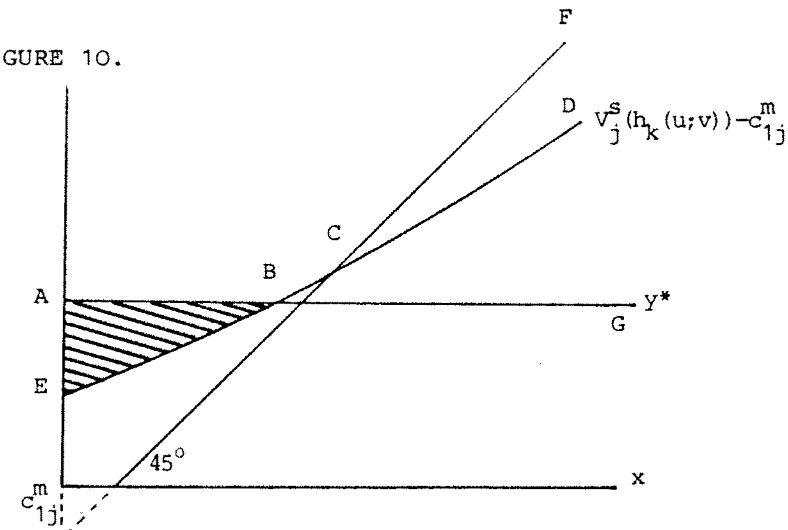
Substitution and some basic transformations yield the following two conditions sufficient for the search before migration strategy to be optimal.

$$(42)\quad \sum_k u_k\{\max\{y_1^*,V_j^s(h_k(u;v))-c_{1j}^m,x_k-c_{1j}^m\}-\max\{V_j^s(h_k(u;v))-c_{1j}^m,x_k-c_{1j}^m\}\} > c_{1j}^p$$

$$(43)\quad \sum_k u_k\{\max\{y_1^*,V_j^s(h_k(u;v))-c_{1j}^m,x_k-c_{1j}^m\}-y_1^*\} > c_j^s+c_{1j}^p$$

These condtitions are similar to (35) and (36) above. This is clearly revealed by the graphical analysis:

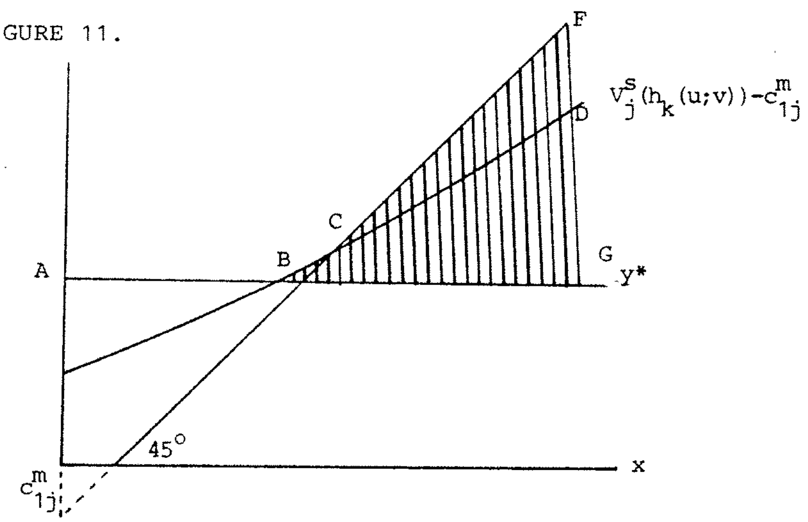
FIGURE 10.



The first max function in (42) is graphed by the line A-B-C-F, while the second max function is E-B-C-F. The difference between the two functions is indicated by the shaded area in figure 10.

The left hand side of condition (43) is presented in figure 11.

FIGURE 11.



The max function in (43) is equal to the first one in (42) and again graphed by A-B-C-F. y* is constant over all observable wage offers and so graphed by A-B-G. The difference between these two functions is indicated by the shaded area in figure 11.

Figure 10 in the search before migration case corresponds to figure 8 in section 6.2. The positive (shaded) areas are the same in figure 8 and 10, but in figure 10 no dotted area has to be substracted. So the left hand side in (42) exceeds the left hand side in (35) by the area F-C-D in figure 10. Comparison of figure 9 with figure 11 reveals that the left hand side of (43) exceeds the left hand side of (36) by exactly the same amount, the area F-C-D in figure 11. So both, the left hand side of (42) and (43) differ from the left hand side of (35) or (36) respectively by the area F-C-D.

An analogous statement can be made for the right hand side in (42) and (43). They differ from the right hand sides in (35) and (36) by the factor $c_j^s + c_{1j}^p - c_{1j}^i$.

So search before migration is a strategy very similar to the information strategy and all the results derived in section 6.2. in principle hold for this strategy, too.

Because of the similarity between the information and the search before migration strategy, it is easy to derive the condition when the second strategy is preferable to the first one.

Calculations of exactly the same kind as done before lead to

$$(44)\ \sum_k u_k \{\max\{y_1^*, V_j^s(h_k(u;v)) - c_{1j}^m, x_k - c_{1j}^m\} - \max\{y_1^*, V_j^s(h_k(u;v)) - c_{1j}^m\}\} > c_j^s + c_{1j}^p - c_{1j}^i$$

where the difference of the max-functions of the left hand side is nonzero (and positive) only when $x_k-c_{1j}^m$ is the maximum element in the first max-funtion. So the left hand side of (44) again can be graphed by the area F-C-D in figure 10 or 11. The right hand side of (44) is a function of the costs of the two strategies compared and it is easy to find out the effects of changes in costs of the different types in this formulation. But it should be noted, that condition (44) compares the search before migration and the information strategy only. For the search before migration strategy to be the optimal one out of all strategies discussed, conditions (42) and (43) must hold too.

7.0 SUMMARY AND CONCLUSIONS

In a migration context the assumption of the standard search model turn out to be too restrictive to permit insights into the decision process. Many hypotheses derived from these assumptions contradict empirical observations (see sections 3 and 4). Dropping the assumption of perfect information about the wage offer distribution results in a more complex search model (section 5). In this model information about the wage offer distribution is imperfect and accumulated through the search process. When based on this search model, the migration model is largely enriched and also more realistic. Strategies, which are suboptimal or even absurd with perfect information about the wage offer distribution, can be preferable in a migration model, when imperfect information is assumed. The strategies discussed in the paper are "return migration", "purchase of information about the wage offer distribution" and "search before migration".

With these additional strategies many phenomena often dedected in empirical migration studies can be explained. As an example the theoretical foundation in this model for the well-known "friends and relatives effect" was discussed in section 6.2.

Many of the factors important in this model, such as information costs, travel costs, a priory state of knowledge, are highly correlated with distance. They bring some theoretical flesh to the bones of the distance effect, which is so important in all migration studies.

On the other hand the high correlation with distance causes problems for the empirical testing of this model. With migration data as usually available, the different factors discussed above can hardly be seperated through estimation. What is needed is information on the state of knowledge migrants and non-migrants have about wage offer distributions in different regions and on the strategies they apply to improve their state of knowledge. Some information of this kind could be gained from questionaires, a technique not very common in this field of science.

At the end of the paper let's turn to a short discussion of the individual's risk preference. Throughout the paper risk neutrality was assumed, an assumption, which eased the presentation dramaticly. The question arises, whether the results I have derived above are valid under this special assumption only or they hold for a risk averse individual too.

It is easy to see that in a search process the risk averse individual is less selective than the risk neutral one. The search process can be viewed as a sequence of decisions between a certain income - the observed wage offer - and a distribution of uncertain incomed - the possible draws later on. Since the risk averse individual values an uncertain income less than the risk neutral individual, there are wage offers, which the risk averse individual accepts, while they are rejected by the risk neutral one.

In the case of search with imperfect information about the wage offer distribution a second risk component is introduced in the model through the unknown parameters of the wage offer distribution. The individual's state of knowledge (u;v) is an indicator for this second risk component. Because of the nature of the search process this risk component is a repelling factor even with a risk neutral individual. The assumption of risk aversion will reinforce this tendency.

However, the effects of risk aversion show a tendency in the same direction as the model under the assumption of risk neutrality. Although not formally discussed this indicates that for a risk averse individual the results of the model would be strengthened. So the results derived seem to be valid not only under the very special set of assumptions used throughout the paper.

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