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THE ROLE OF RESIDENCE CHOICE
IN ANALYSIS OF MIGRATION

by

J. Gregory Ballentine

A THESIS SUBMITTED
IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

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CHAPTER 1

Section I: The goals of this thesis

This thesis provides a theoretical and empirical analysis of two alternative models of interregional labor migration. Both are partial equilibrium models, and as such they attempt to describe the direct determinants of workers' migration behavior. They do not take into account the general equilibrium aspects of migration, specifically the indirect impact of migration on the demand for labor. Nonetheless, the models analyzed here are essential building blocks for general equilibrium regional analysis.¹

This study contributes to the already large literature on labor migration in two ways: first, the approach used to derive the determinants of migration is new; and second, one of the two models developed here hypothesizes a set of factors determining migration that is different from that found in the literature. The approach used here in deriving a model of migration begins with a set of assumptions about the determinants of workers' choices of residence. Since migration is a flow response to a disequilibrium between workers' desired and actual residences, the determinants of the size and direction of migration flows can be derived from the deter-

minants of individuals' actual and desired residences. This is the procedure followed in this thesis.

Much of the previous literature on migration hypothesizes that net labor migration between two regions will be positively related to the expected lifetime earnings differential between the two regions. This relationship is, generally, either directly assumed or stated without explicit derivation from any prior conditions. By deriving such a relationship from assumptions about individuals' residence choices and some other assumptions about lags in migration response, this study will show that the standard migration relationship used in the literature requires the assumption that, given two regions and an expected lifetime earnings differential between them (assumed the same for all workers), then all workers in both regions will desire to reside in the same region or they will all be indifferent between residence in either of the two regions.

As an alternative to the above assumption and the resulting migration model, it will be assumed that, given two regions and an expected lifetime earnings differential between them (again assumed to be the same for all workers), then some workers will desire to reside in one region while others will prefer the other. The determinants of migration derived from this assumption are the level of the expected earnings differential between the two regions and changes in that diffe-
ential. The appearance of the latter variable provides the major testable difference between the two models.

Section II: The plan of the thesis

The next chapter will provide a short review of some specific aspects of the past literature on migration. The first studies which will be examined are not strictly part of the literature which hypothesizes and tests behavioral models of migration; instead they are essentially works in economic history. As such, they examine a wide range of data associated with broad population movements (e.g., from Europe to America, from the eastern United States to the West, etc.). These studies will be briefly summarized to indicate the way in which the authors, after evaluating such broad flows, have characterized the migration process.

The second studies to be examined employ a specific behavioral hypothesis about migration, that there is a positive relationship between migration and regional income differentials. In particular, the reasons provided in the literature for the use of this hypothesis will be summarized.

The third chapter will derive two models of migration. The first, the standard model used in previous literature, will be derived from the assumption that, given two regions, i and j, and an expected earnings differential between them (which is the same for each worker), either all workers will
prefer i, all will prefer j, or all will be indifferent between i and j. Additionally, some common assumptions on the lag in migration response will be used. The relationship between the former assumption and the way in which all workers view the non-economic differences between residence in i and residence in j will also be discussed. The second model will be derived from the assumption that, given an expected earnings differential between regions i and j, some workers will prefer to reside in i while others will prefer region j. In this case migration will be seen to depend on the level of expected earnings differentials and changes in that level. To the extent that migration does depend on the level of expected earnings differentials in this model, it will be shown that these levels will influence the migration of younger workers newly entering the work force and thus making their first permanent residence choice.

The fourth chapter is an empirical evaluation of the two models. It includes a review of some of the empirical evidence presented in the previous literature in support of the standard model used there. This review shows that that evidence does not strongly support the standard model of migration.

Also in Chapter 4, the two models are tested using 1955-60 census data on interstate migration. Though the results of the tests are not completely clear-cut, the new model
presented in this thesis is generally preferable to the model which has been used in the literature.
CHAPTER 2

Section I: Some historical analysis of migration

Historical analyses of migration by economists have stressed the considerable variability of migration flows over time. As a consequence, many studies have sought to explain migration in terms of changing economic circumstances in the sending and/or receiving regions. For example, Brinley Thomas stated,\(^1\)

> What is needed is a concept of economic development which stresses the widening of markets, the dynamics of increasing returns, and the international mobility of labor and capital as a medium through which an international economy grows and changes its character. Viewed as an essential part of the process of economic expansion, migration not only induces but is itself partly determined by changes in the structure of the international economy.

Similarly, Simon Kuznets and Dorothy Thomas stated,\(^2\)

> We conceive of economic growth and population redistribution as linked by a continuous chain of interdependent variables. On the one hand, the growth in population that tends to accompany economic growth may in itself stimulate migration from the more densely to the more thinly settled areas. . . . More important in recent times is the differential effect of technological progress upon the distribution of economic opportunities. . . . technological change is usually specific, with differential impact upon sectors of the economy and upon economic opportunities in different parts of the country. . . . The rapidity and magnitude

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of the differential impacts that accompany modern economic growth are such that the vital processes of birth and death can play but a minor role in adjusting the distribution of population to economic opportunities in different parts of the country. . . . In consequence, it is migration that must provide the main mechanism of adjustment.

In this spirit several studies sought to analyze migration flows in terms of business cycles. Harry Jerome studied immigration to the United States and the international short term business cycle.\(^3\) He found a very close relationship between U.S. short term business cycles and both gross and net immigration to the U.S.\(^4\) Because European and U.S. short term business cycles were roughly coterminal over the period examined by Jerome, he concluded that migration was dominated by the "pull" of expanding employment in boom periods in the U.S. rather than the "push" of declining employment in depression periods of Europe.\(^5\)

Dorothy Thomas studied emigration from Sweden, concluding that though the "pull" of expansion in the U.S. business cycle played the most important role in migration from Sweden to the U.S., the Swedish business cycle also played a role.\(^6\)


\(^4\)Ibid., p. 84 and 106.

\(^5\)Ibid., pp. 153-208.

Along with her analysis of Swedish emigration, Dorothy Thomas examined Swedish internal migration with reference to the Swedish business cycle. She hypothesized that maximum losses of agricultural communities will be expected to coincide with periods of prosperity when the demand for labor in expanding urban industry creates a 'pull' upon migrants. This hypothesis was substantiated by her data.

While Jerome and Dorothy Thomas concentrated on the relationship between migration and short term business cycles, Brinley Thomas analyzed migration within the Atlantic community in terms of longer (approximately 18-20 years) secular growth cycles. He noted that, while the short run fluctuations appeared roughly simultaneously in the U.S. and Europe, "this long cycle was not international; times of vigorous upswing in Great Britain were times of subnormal progress in the United States."

Though Brinley Thomas found immigration to the U.S. to be closely correlated with this long cycle, upon close examination of the data he found that the cycle lagged behind migration, whereas the opposite would be expected if the U.S. cycle were "pulling" migrants. From this and other

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7 Ibid., p. 306.
8 Ibid., p. 308.
9 Brinley Thomas, Migration and Economic Growth, p. 89.
10 Ibid., p. 226.
11 Ibid., pp. 93 and 159.
considerations he concludes that the long cycles in the U.S. did not attract immigrants, but were instead greatly amplified by inflows of migrants. He argues that the influx of immigration was determined primarily by "push" factors in Europe such as the cycle of births in the Old World, the impact of innovations, and/or calamity.\textsuperscript{12}

Margaret Gordon examined migration to California during the period 1850 to 1950 in terms of both the short term business cycle and the longer secular cycle.\textsuperscript{13} She found a close positive relationship with migration for both. Of particular interest is her conclusion that\textsuperscript{14}

Changes in the rate of expansion (or contraction) of employment opportunities in the state California, relative to that in the nation, have \textit{induced} changes in the rate of net migration.

An important similarity of these studies is their tendency to analyze migration in terms of changing conditions in the sending and/or receiving nation. This approach is perhaps best exemplified by their "push" and "pull" terminology. This terminology is particularly important because recent authors have slightly altered its meaning. Dorothy Thomas gives a clear example of the use of this terminology in these historical studies. To analyze immigration from

\textsuperscript{12}\textit{Ibid.}, pp. 158 and 174.


\textsuperscript{14}\textit{Ibid.}, p. 120.
Sweden to the U.S. she divides periods into classifications of industrial pull from the U.S., no pull from the U.S., industrial push from Sweden, and no push from Sweden. To define this classification she says:15

If the curve an index of U.S. business activity indicated revival or prosperity in America, this is considered industrial pull; similarly recession or depression in America is taken to mean absence of pull. Recession or depression in Sweden is defined as industrial "push"; revival or prosperity, as absence of push. Uncertain upward or downward movements or either curve were classified for completeness, as doubtful push or pull respectively emphasis added.

In considering longer run migration patterns Brinley Thomas is more specific about the factors which make up the "push" which he felt to be dominant in this period. These factors—the birth cycle, innovations, and/or calamity—are similar to Dorothy Thomas's classification based on movements in business conditions in that they are related to changes in economic conditions.16,17

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17 Recent literature has reinterpreted the push-pull terminology in terms of the level of economic welfare in alternative regions. Thus poor regions are said to exact a push and rich regions a pull. This reinterpretation loses much of the emphasis on changing economic circumstances and their relationship to migration. For examples of this reinterpretation, see Bruce Herrick, *Urban Migration and Economic Development in Chile* (Cambridge, Mass.: The MIT Press, 1965), p. 14, or Michael Todaro, "A Model of Labor Migration," *American Economic Review* (March 1969).
As mentioned in the introductory chapter, these studies differ from recent studies of migration behavior and from this thesis in that they do not hypothesize and test specific models of migration. Instead, they tend to evaluate data covering a long time period and from this deduce a general description of the migration process, such as that outlined above in the discussion of the "push" and "pull" concepts or in the statements by Brinley Thomas and by Simon Kuznets and Dorothy Thomas quoted above. Such conclusions are of interest here because their characterization of migration does not seem to be closely related to the recent standard behavioral hypothesis of migration which relates migration only to the level of expected earnings in alternative regions.\textsuperscript{18} Instead it seems to be similar to the model to be developed in the following chapter which will relate migration to the level of expected earnings and changes in that level.

Section II: Recent studies of migration behavior

Much recent analysis of migration hypothesizes and tests a relationship of the general form

\[ M_{ij} = f(x_{ij}) \quad f' > 0 \quad (1) \]

where \( M_{ij} \) is net migration from region \( i \) to region \( j \) and \( x_{ij} \)

\textsuperscript{18}Again one may note the change in the interpretation of the terms "push" and "pull" in the more recent literature hypothesizing the standard migration relationship. See above n. 17.
is either the current or expected discounted lifetime earnings
differential between regions i and j net of migration costs.
Such an equation is not derived in the literature from prior
equations, but some indication of its source is usually
given.  

Probably the most common justification for this equation
is provided by the investment approach to migration. Users
of this approach argue that individuals seek to maximize
their lifetime utility, of which lifetime income is a major
determinant. Since each region has associated with it a
stream of expected economic returns (income) and costs, the
migration choice is viewed as an investment decision. Then
it is concluded that the number of people moving (which is
suggested to be analogous to the amount of investment) will
be positively associated with the present value of the gains
associated with moving (i.e., the present value of the  

19 Some studies simply assume this relationship directly. See John Vanderkamp, "Interregional Mobility in Canada: A
"Labor Migration and Urban Unemployment in Less Developed Countries."

20 For examples of this approach, see Larry Sjaastad, "The Relationship Between Migration and Income in the United
Internal Migration in Brazil," Journal of Political Economy (March/April 1968); Samuel Bowles, "Migration as Investment:
and Gene Laber and Richard Chase, "Inter-Provincial Migration in Canada as a Human Capital Decision," Journal of Political
Economy (July/August 1971).
investment). In this approach, $x_{ij}$ in (1) is the expected discounted lifetime earnings differential between regions $i$ and $j$ net of migration costs.

One distinction which is not made explicit by those using this approach is the difference between a worker's decision to reside in a certain region and a worker's decision to move.\textsuperscript{21} The general discussions provided by those using the investment approach seem to argue convincingly that workers will choose their desired residence on the basis of expected lifetime income in alternative regions and other aspects of the region which affect their utility maximizing decision. However, the decision of a worker to move to, say, region $i$ implies not only that the worker now chooses region $i$, but that he is not currently residing in region $i$. This may be because the worker has always preferred $i$ but was born (or came of age to make an independent residence choice) in region $j$ and has not gotten around to

\textsuperscript{21}Those using the investment approach often argue or elucidate their statements by analogy to investment theory. In the context of such an analogy the distinction made in the text is like that made in investment analysis between the desired capital stock and increases in the capital stock (i.e., investment).

It may be further noted that a more appropriate analogy than general investment theory may be portfolio theory. This is because the "investment" nature of the migration decision is not one of increasing any analogue to a capital stock, but instead is a reallocation from residence in one region to residence in another. In the context of such an analogy, the distinction made in the text is analogous to that made between the desired portfolio balance and purchases of some asset.
moving yet, or because previously the worker preferred j and now his choice of residence has changed. It is this latter possibility that has not been explicitly discussed in the investment approach literature, but which is certainly an important aspect of the flow nature of migration.

Another means of justifying a relationship such as (1) has been to consider migration as a "special case of consumer demand."22 Migration is then analyzed in terms of the supply of labor to a region, which is the demand for residence in that region by workers. The decision by each individual to supply his labor in a particular region (i.e., reside there) is viewed as a utility maximizing decision based on the earnings he might receive in each region, costs of employment or movement to a region, and subjective preferences for one region or another.23 In the literature employing this approach, all of these factors are assumed to be quantifiable for the theoretical discussion and a region's "shadow wage" is said to represent this amalgam of factors. (It is assumed that different individuals will perceive different shadow wages in a region because they differ in their subjective


preferences for the regions.\textsuperscript{24}

Unfortunately, this approach has not clearly distinguished between the supply of labor to a region and the change in that supply through migration. For example, Galloway, Gilbert, and Smith argue: \textsuperscript{25}

The higher the offered wage and the lower the costs of employment in and movement into a region, \textit{ceteris paribus}, the higher the shadow wage rate that workers perceive in the region. This suggests that workers' response to differential wage levels in the two regions will lead to flows of labor from the low wage toward the high wage region.

It is one thing to state that the higher a region's shadow wage the greater will be the supply of workers to that region, but quite another to say that the higher a region's shadow wage the greater will be the \textit{increase} in supply over some time period (i.e., flow of labor to that region). The first of these is analogous to consumer demand, since it simply represents an upward sloping supply curve of labor to a region. However, using such a supply curve, an \textit{increase} in supply (i.e., migration) will be related to either a \textit{shift} in the supply curve (say, due to a change in subjective preferences for other regions) or a movement along the supply curve induced by a \textit{rise} in the shadow wage.\textsuperscript{26}

\textsuperscript{24}Gallaway, \textit{Geographic Labor Mobility}, p. 4.

\textsuperscript{25}Gallaway, Gilbert, and Smith, "The Economics of Labor Mobility," p. 212.

\textsuperscript{26}Gallaway uses an equation similar to (1), and essentially the same theoretical basis for it, to analyze inter-industry labor flows. In this case \textit{M}\textsubscript{1j} is interpreted as
These two approaches to justifying (1) are not at all incompatible. The investment approach lays emphasis on the need to take into account not just current values of all economic variables, but rather their capitalized values. The approach using demand theory stresses the workers' utility maximizing behavior. It is a simple step to assume that the utility maximizing decision is based on expected lifetime values of the relevant variables or to stress that the investment decision is basically a utility maximizing decision (Bowles (1970) does this). These possibilities indicate the great similarity of the two justifications for (1).\(^{27}\)

\(^{27}\) The flow of workers from industry 1 to industry 2. It is interesting to note that others have applied similar theoretical analysis (i.e., have assumed that workers evaluate not just the earnings they receive in alternative industries, but also employment costs and subjective aspects of employment in alternative industries). The result of such analysis, however, is not an equation similar to (1) but the hypothesis that net flows of labor from industry 1 to industry 2 are induced by a rise in industry 2's wage relative to that of industry 1. See Lowell E. Gallaway, Inter-industry Labor Mobility in the United States 1957-60, Research Report #18, Office of Research and Statistics, Social Security Administration (Washington: U.S. Government Printing Office, 1967). For the approach different from Gallaway's see W. B. Reddaway, "Wage Flexibility and the Distribution of Labour," Lloyd's Bank Review 54, 32-48, reprinted in B. J. McCormick and E. Owen Smith, ed., The Labour Market (Baltimore: Penguin Books, Ltd., 1968); E. H. Phelps Brown and M. H. Browne, "Earnings in the Industries of the United Kingdom, 1948-59," Economic Journal, 1962, pp. 517-49; and P. De Wolff, Wages and Labour Mobility (Organization for Economic Cooperation and Development, 1965).
The shortcomings in the two approaches are also basically similar. Equation (1) explicitly states a relationship between migration flows and earnings differentials. Both approaches seem to give a clear justification for the conclusion that the higher the economic rewards in a region the more workers will decide to reside in that region. But the conclusion that the higher the economic rewards in a region the greater will be the flow of workers into that region is not as explicitly justified. One of the contributions of this thesis will be to provide a justification for (1) which does explicitly deal with the flow aspects of migration.
CHAPTER 3

Section I: Two assumptions about residence choice behavior

In this chapter two alternative assumptions about workers' residence choice behavior and some additional assumptions concerning time lags in migration response will be used to derive two models of migration. The alternative residence choice assumptions are:

Assumption #1: Given two regions and any discounted expected earnings differential between them net of migration costs (which is assumed to be the same for each worker), then all workers will either prefer region i, they will all prefer region j, or they will all be indifferent between the two regions.

Assumption #2: Given two regions and any discounted expected earnings differential between them (which is the same for all workers), then some workers will prefer to reside in region i, while others will prefer to reside in region j. Further, if the differential in favor of, say, i increases, the number of workers who wish to reside there will increase.

Before deriving the migration model based on assumption #1 and that based on assumption #2, the relationship between these two alternative assumptions and how different workers
evaluate the non-economic aspects of the two regions will be explained.

It has long been recognized in the literature that workers consider not only the net economic rewards alternative regions have to offer but also various non-economic factors about the regions. For example, Sjaastad discusses the influence of such factors as climate, nearness to family and friends, or a worker's attachment to familiar surroundings;\(^1\) Gallaway simply notes that subjective regional preferences influence a worker;\(^2\) and Bowles considers "lifetime benefits" of a region in addition to lifetime income in a region.\(^3\)

The consequence of the influence of non-economic factors on residence choice is that a worker may not simply choose the region which offers him the highest net discounted expected lifetime earnings. Instead a worker may have a subjective preference for region i such that he must be paid some mark-up over region i's earnings in region j to induce him to prefer region j.\(^4\) The size of the mark-up required to induce this worker to prefer region j is an indication of the intensity of his preference for i. We will say that two

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\(^2\)Gallaway, *Geographic Labor Mobility*, p. 3.

\(^3\)Bowles, "Migration as Investment," p. 356.

\(^4\)Sjaastad has a very similar discussion of the influence of "psychic" costs and returns from alternative regions. See Sjaastad, 1962, p. 85.
workers have identical preferences if the mark-up required to induce them to prefer $j$ is the same for both.

We are now able to note the implications of assumptions #1 and #2 concerning the influence of non-economic preferences on the residence choice behavior of the group of workers in regions $i$ and $j$. The unanimity of residence choice required by assumption #1 implies and is implied by the condition that all workers have identical regional preferences. Conversely, assumption #2 indicates that workers have different subjective regional preferences.

Thus for assumption #1, the condition that all workers prefer either $i$, all prefer $j$, or all are indifferent at a given net expected earnings differential is also the condition that they all require the same mark-up to induce them to prefer $j$. On the other hand, under assumption #2, the condition that at a given net expected earnings differential some workers prefer $i$, some $j$, and some are indifferent is also the condition that in general the workers require different mark-ups and that for any given earnings differential the mark-up actually paid will be enough to induce some to prefer $j$, but not others.\(^5\)

Thus we can say that there are two assumptions which are equivalent to assumptions #1 and #2, respectively.

\(^5\)Realistically there will be some mark-ups high enough (low enough negative numbers) to induce all workers to prefer region $j$ ($i$). We shall ignore such extreme values.
They are:

Assumption #1a: All workers have identical regional preferences.

Assumption #2a: In general, workers have different regional preferences.

Thus, use of assumption #1 implies that #1a is also assumed, and use of assumption #2 implies #2a. With this understanding of the meanings of assumptions #1 and #2, we will now derive two models of migration, one from each assumption.

Section II: Migration behavior under assumption #1

In this section we shall use assumption #1 and some additional assumptions to derive equation (1). Migration occurs if a worker is not currently residing in the region which he prefers. Thus from assumption #1, one can determine, simply from the level of the expected earnings differential and the mark-up all workers require to prefer region j, the direction in which net migration will proceed. To see this, and for future use, restate assumption #1 in the following manner:  

\[6\]

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6 We shall assume that migration costs are zero. This is done purely for expositional ease. However, some analysts have argued that the costs of migration are sufficiently small relative to lifetime earnings that they can be ignored. Presumably this conclusion would depend on the age of the potential migrant. (See Bowles, "Migration as Investment," p. 356.)
Let $p^i_t$ = the number of workers residing in region $i$ in period $t$, analogously for $p^j_t$.

$\bar{p}^i_t$ = the number of workers who prefer to reside in region $i$ in period $t$, analogously for $\bar{p}^j_t$.

$p_t$ = the total number of workers in regions $i$ and $j$ at the end of period $t$.

$x_t$ = the expected lifetime net earnings differential between regions $i$ and $j$ (positive if earnings in $j$ exceed those in $i$), and

$x^*_t$ = the value of $x_t$ just necessary to get all workers to be indifferent between regions $i$ and $j$. (Under assumption #1, $x^*_t$ is the same for everyone.)

Assumption #1 then states that

$$\text{if } x_t > x^*_t, \text{ then } \bar{p}^j_t = p_t, \quad (2)$$

$$\text{if } x_t < x^*_t, \text{ then } \bar{p}^i_t = p_t, \quad (3)$$

and if $x_t = x^*_t$, then $\bar{p}^i_t = p^i_t$. \quad (4)

Since migration occurs when an individual does not reside in the place he prefers, then if $x_t < x^*_t$ (and there are workers residing in region $i$, i.e., $p^j_t \neq p_t$), then $\bar{p}^j_t < p^j_{t-1}$ and net migration will proceed from $j$ to $i$.\footnote{This assumption indicates that the supply curve of labor to either region as a function of $x_t$ is a horizontal line. For region $j$ this line would intersect the vertical...}
Since in this case the direction of migration depends only on $x_t$, the migration behavior associated with assumption #1 is similar to that indicated by equation (1), which is repeated below.

$$M_t = f(x_t), \quad f' > 0 \quad (1)$$

The value of $x_t$ which makes $M_t = 0$ is simply $x_t^*$. However, from equation (1) not only the direction but the magnitude of net migration in each time period can be determined from knowledge of $x_t$. Specifically, net migration in time $t$ is positively related to $x_t$. This conclusion can not be obtained simply from assumption #1.

As the main purpose of this section is to indicate explicitly the conditions needed to derive the migration relationship indicated in equation (1), we shall add to assumption #1 an additional assumption on the time lag in migration response to give us equation (1). We shall assume that the greater are the gains from migration in time $t$, the more people will move in time $t$. The gains from migration for an individual are defined as the difference between the existing expected earnings differential, $x_t$, and the one at which that individual (and, by assumption #1, all other workers) is just indifferent between the two regions, $x_t^*$.

Before using this lag assumption and assumption #1 to (x.) at $x_t^*$. Thus any values above $x_t^*$ would cause a disequilibrium requiring a flow of labor to $t$.\]
describe migration behavior in full, it will be useful to explain briefly why a lag in migration response might occur and why this particular lag assumption is used. There are two principle reasons for a lag in migration response: (1) a tendency for some costs of migration to decline the longer ahead a move is planned, and (2) a tendency for a worker's feeling of certainty that any given differential will remain to increase the longer that differential has persisted.

A worker who decides to move immediately may find that he will take a loss on selling his home or by breaking a lease, while a worker who delays may not. Additionally, the worker who moves immediately may pay more for a less desirable home in the region of destination than one who plans ahead. Such factors as these indicate the tendency for costs to decline with the delayed response in migration.

The second factor tending to induce a slow migration response can be briefly explained. The appearance of any expected earnings differential--due to, say, a change in current earnings in one of the regions--may be viewed quite cautiously at first, but with much greater certainty if the

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8 Strictly speaking, this means that there is associated with any expected lifetime earnings stream a set of values of x_t which depend on how long the individual has planned the move. With considerable additional complexity in the algebra and notation used, this could be explicitly taken into account, but for our purpose (i.e., to indicate the "reasonableness" of the time lag assumption used above) we shall avoid this and consider x_t as being calculated on the basis of the minimum (i.e., pre-planned) costs of migration.
new level of current earnings persists.

Counterbalancing these two tendencies is the fact that, since individuals have only a finite working life, a delay in moving will reduce the lifetime gain to be earned from the move. Thus there is a trade-off between the factors inducing delayed movement and those inducing rapid movement. The greater the potential gains the greater the tendency to move rapidly and capture those gains in spite of higher costs and uncertainty. But the lower the gains the greater the tendency to delay.

It is this trade-off relationship which is the basis for the assumption that the higher are the gains from migration, the more rapidly people will move from region i to region j.

Returning to the derivation of migration behavior, since assumption #1 (or more directly the equivalent assumption #1a) states that the value of \( x_t \) at which any individual is indifferent between the two regions (i.e., \( x_t^* \) is the same for all workers, then the gains from migration are the same and can be written as \( (x_t - x_t^*) \). When \( (x_t - x_t^*) \) is positive, migration will proceed from i to j, as noted above simply from assumption #1. Using the lag assumption, larger values of \( (x_t - x_t^*) \) induce a larger migration flow in any time period. When \( (x_t - x_t^*) \) is negative, migration proceeds from j to i, becoming a larger flow the smaller algebraically is
\((x_t - x_t^*)\).\(^9\) This allows us to write migration \((M_t)\) as

\[ M_t = p_{ij}^j - p_{ij}^t = f(x_t - x_t^*), \quad f' > 0 \]

But, treating \(x_t^*\) as a constant (i.e., keeping the non-economic aspects of the regions unchanged), this can be written simply as

\[ M_t = f(x_t) \quad f' > 0 \]

Thus from assumption #1 or #1a and the lag assumption, we have derived the standard migration equation. Before deriving the migration behavior associated with assumption #2, it is important to note that the analysis of this section can be essentially revised to show that the standard migration equation requires assumption #1 or #1a and our lag assumption. To see this, let \(x_t\) be greater than \(x_t^*\) such that

\[ M_t = f(x_t) > 0 \]

and thus workers are moving from \(i\) to \(j\). Supposing that the demand for labor is such that \(x_t\) remains at the same level, then eventually everyone will have moved from \(i\) to \(j\) and thus at that (or any higher) value of \(x_t\) everyone prefers to reside in region \(j\). Similar reasoning can be applied for

\(^9\)Note that what is assumed is that the flow in any time period will be greater the larger the gains from migration. This does not indicate that the larger are the gains from migration, the greater will be the number of people who wish to migrate when, say, \(x_t > x_t^*\) is \(p_t^i\), which is not positively related to \((x_t - x_t^*)\).
any value of $x_t > x_t^*$ making $f(x_t) > 0$. Such reasoning indicates that the standard migration equation implies assumption #1 and equivalently #1a.

Since assumption #1 means that the gains from migration are the same for everyone, the conditions $f' > 0$ and $f(x_t^*) = 0$ are equivalent to our lag assumption.

Section III: Migration behavior based on assumption #2

In this section a new description of migration behavior will be derived. Using the notation of the previous section, assumption #2 states that

$$P_t^j = g(x_t^j), \quad g' > 0 \quad (5)$$

That is, the number of people who will prefer to reside in $j$ is an increasing function of $x_t$. Over the range of values of $x_t$ which we shall consider, some people will always prefer to reside in $i$ and others in $j$. For expository simplicity we shall assume that $g$ is continuous, and thus for any value of $x_t$ some worker is just indifferent between the two regions. Another way of stating this is that for any value of $x_t$, there is some worker for whom that value represents the mark-up (or mark-down) just necessary to induce him to prefer region $j$.

---

10. Assumption #2, in the context of a standard supply curve of labor diagram, assumes that each region faces an upward sloping supply curve of labor from other regions.
As in Section II, migration will proceed from i to j whenever \( \bar{P}_t^j > P_{t-1}^j \) and from j to i whenever \( \bar{P}_t^i > P_{t-1}^i \). But now, unlike before, we cannot determine even the direction of migration simply from knowledge of \( x_t \). To determine the direction of migration, one must know not just \( x_t \) (allowing one to know \( \bar{P}_t^j \)), but also \( P_{t-1}^j \).

We can write

\[
P_{t-1}^j = P_{t-2}^j + M_{t-1}.
\]

Thus the population in j in period \( t-1 \) is equal to the population there in \( t-2 \) plus the migration flow during \( t-1 \) due to disequilibria. If we initially assume that there is no lag in migration response (that is, that any disequilibrium is fully adjusted to in one time period), then

\[
M_t = \bar{P}_t^j - P_{t-1}^j.
\]

Thus

\[
P_{t-1}^j = P_{t-2}^j + \bar{P}_{t-1}^j - P_{t-2}^j = \bar{P}_{t-1}^j.
\]

Under this immediate adjustment assumption we can write migration as

\[
M_t = \bar{P}_t^j - P_{t-1}^j = \bar{P}_t^j - \bar{P}_{t-1}^j = g(x_t) - g(x_{t-1}).
\]

Since \( g' > 0 \), if \( x_t > x_{t-1} \) (i.e., discounted expected lifetime earnings in j rise relative to those in i), then \( M_t > 0 \), indicating that workers will move from i to j. The opposite occurs if j's relative earnings fall, and no migration will result if \( x_t = x_{t-1} \).
Because of the discussion in Section II concerning the likelihood that migration will proceed with a lag and in order to make the two models of migration as comparable as possible, the immediate adjustment assumption will be dropped and in its place a lag assumption similar to that used in Section II will be employed. The lag assumption used before stated that the number of people who moved in a given time period was positively related to the gains from migration \((x_t - x_t^*)\). Because under assumption #2 the gains from migration will differ for different individuals, since \(x_t^*\) differs for different individuals (i.e., they require different mark-ups to induce them to prefer \(j\)), a slightly different form of the lag assumption is needed.

Before stating the lag assumption, note that any given rise in \(x_t\) above \(x_{t-1}\) (assuming for expositional ease that equilibrium was achieved in period \(t-1\)) will induce some individuals who were in region \(i\) at the end of \(t-1\) to prefer region \(j\), thus \(P_t^j < P_{t-1}^j\). Of these people, some who in \(t-1\) were just or almost indifferent between \(i\) and \(j\) will experience larger gains from migrating than those who at the new value of \(x_t\) just barely prefer region \(j\).\(^{11}\)

\(^{11}\)Remembering that the gains from migration are \((x_t - x_t^*)\), where \(x_t^*\) is the mark-up an individual requires to prefer region \(j\), then this value will be close to \((x_t - x_{t-1})\) for those who were just or almost indifferent between \(i\) and \(j\) in period \(t-1\). For those who, in period \(t\), just prefer \(j\), this value will be close to \((x_t - x_t) = 0\).
The lag assumption which we shall use is basically that those with the most to gain move quickly while others delay. The somewhat stronger algebraic form of this is

$$M_t = \delta (\bar{P}_t^j - P_{t-1}^j) \text{ where } 0 < \delta < 1.$$  \hspace{1cm} (6)

With this lag assumption and by assuming that $g(x_t)$ in equation (5) is linear, and writing it as

$$\bar{P}_t^j = \alpha + \beta x_t$$  \hspace{1cm} (7)

we can obtain an explicit equation for $M_t$ in terms of earnings. Using (6) and (7), this can be written as

$$M_t = \beta \delta (x_t - x_{t-1}) + (1-\delta) (\bar{P}_{t-1}^j - P_{t-2}^j).$$

This divides the migration flow in period $t$ into that induced by the change in expected earnings in period $t$ and that induced by the disequilibrium which existed in period $t-1.

More generally this can be written as

$$M_t = \beta \delta (x_t - x_{t-1}) + (1-\delta) \beta (x_{t-1} - x_{t-2})$$
$$\quad + (1-\delta)^2 \beta (x_{t-2} - x_{t-3}) + \cdots$$
$$\quad + (1-\delta)^n \beta (\bar{P}_{t-n}^j - P_{t-n-1}^j).$$

\textbf{12} The algebraic form is stronger since it specifies not only that some move faster than others, but that the number that move is a constant proportion of those remaining who wish to move. With more complex algebra, a lag function could be specified dropping the constant proportion assumption; however, this would not greatly affect the analysis. Note that with this lag assumption, unlike the one used in Section II, the number who do move in any time period is positively related to the number who wish to move.

Further, the algebraic formulation does not specify
In terms of the algebra presented thus far, \( n \) can take any value; that is, we can extend the lag as far back as we wish. However, that is unrealistic. For any worker there will be an initial residence decision made when that worker becomes independent and enters the work force. Earlier residence decisions by that worker would not be based on his expected earnings (i.e., he would not behave according to (7)), but would depend on his parents' residence. For the moment, assuming that all the workers under consideration entered the work force in period \( t-z \), this means that by lagging back \( z+1 \) periods we come to the "initial condition" of these workers, that is, their residence with their parents. Thus one can write

\[
M_t = \delta \beta (x_t - x_{t-1}) + (1 - \delta) \beta (x_{t-1} - x_{t-z}) \\
+ \ldots \ldots + (1 - \delta)^z \beta (\bar{F}^j_{t-z} - p^j_{t-z-1})
\]

where \( p^j_{t-z-1} \) is the initial condition of the workers in question.

Since \( p^j_{t-z-1} \) depends on the preferences of the parents toward the alternative regions while \( \bar{F}^j_{t-z} \) expresses the regional preferences of the new entrants, the influence of the last term in the equation above depends on whether or not these preferences differ. This is simply the conclusion which workers move first. However, it is consistent with the assumption that those who will make the greatest gains from migration move first.
that there will be a tendency for new entrants to migrate when they enter the work force if their regional preferences differ from their parents' preferences. For example, if new entrants in general prefer higher earnings regions than their parents do, then one would observe new entrants moving from low to high earnings areas.

To see this possibility more clearly without adding considerable complexity to the algebra and notation, assume that the number of new entrants in a region is equal to the number of parents in that region, that the parents were in equilibrium in period t-z, and that the parents' regional preferences are described by the equation

\[ \bar{L}_{t-z}^{j} = \lambda + \theta x_{t-z} \]

where \( \bar{L}_{t-z}^{j} \) is the number of parents who prefer to reside in region j. Since it is assumed that the parents were in equilibrium in t-z, then \( \bar{L}_{t-z}^{j} = L_{t-z-1}^{j} \) (where \( L_{t-z-1}^{j} \) is the number of parents actually residing in j in period t-z-1) and, by assumption, there is one new entrant for each parent in each region, therefore \( p_{t-z-1}^{j} = \bar{L}_{t-z}^{j} \).

Thus we can write \( (\bar{p}_{t-z}^{j} - p_{t-z-1}^{j}) \) as

\[ \alpha = \lambda + (\beta - \theta) x_{t} \]

If the regional preferences of new entrants are more responsive to earnings than are their parents' preferences (i.e., \( \beta > \theta \)), then migration will be positively associated with
earnings. The opposite result holds if $\beta < \theta$. 13

For older workers the importance of the initial condition in the migration flow is small since the lag term $(1 - \delta)^2$ will be small. However, the above discussion of the influence of the initial condition is relevant to the migration behavior of the segment of workers who have recently entered the work force. For this segment the discussion has provided the important result that, since these workers are making an initial residence decision, their migration behavior may be influenced by the levels of earnings differentials provided their regional preferences are more or less responsive to earnings than are their parents' preferences.

Since, in general, net migration of all workers is the interesting variable, the behavior of new entrants must be included. Thus the model developed here indicates that net migration is a function of changes in expected earnings differentials and the level of earnings differentials. The model unambiguously states that the relationship between net migration and changing earnings differentials is positive. However, the influence of the level of earnings is ambiguous. If new entrants' preferences are more responsive to earnings

\[ \text{Dropping the assumption that parents are in equilibrium and are equal in number to new entrants, a term similar to } (\beta - \theta) x_{t-z} \text{ still appears with the same interpretation, though the notation required is considerably messier.} \]
than are their parents' preferences, the relationship is positive; otherwise, it is negative.

Section IV: A comparison of the basic results of the models

From the two alternative residence choice assumptions #1 and #2 (or #1a and #2a), two alternative behavioral migration models have been derived. The model which has been commonly used in the literature was derived from assumption #1 and a new model from assumption #2. The crucial testable difference between the two is that in the new model net migration to a region is positively related to increases in that region's relative earnings while on the other hand the standard model predicts a positive relationship between net migration and the level of relative earnings.

While a positive relationship between the migration of all workers and the level of regional earnings differentials is predicted by the first model, it is also consistent with the second model. However, a disaggregation of workers by age does bring out a clear distinction between the two models with respect to this point. Using the standard model, various authors have pointed out that the migration response of older workers to earnings differentials is less than that of younger workers, but they have not suggested that different factors influence the migration of older workers from those which influence younger workers. The new model clearly suggests that the migration of younger workers, who are most
likely to be new entrants, may be associated with the level of earnings differentials and with changes in earnings differentials, while the influence of the levels variable on the migration of older workers will be negligible. This difference between the factors influencing younger and older workers in the new model and the absence of such a difference in the standard model provides a supplementary testable difference between the two models.
CHAPTER 4

Section I: Introduction

This chapter will provide some original analysis of interstate migration in the United States over the period 1955-60 and will review some empirical analyses which have appeared in the literature using the standard migration model. The migration data to be used for the original empirical analysis comes from a 25% sample of the 1960 U.S. Census of Population.¹ We shall use data on the net migration of all persons above the age of five between all pairs of states in the contiguous United States and data on the net migration of males between the ages of 20 and 59, as a group and disaggregated by five-year age groups, from each state to all the other states combined.

The testing of the two models involves regressing migration on variables which are proxies for expected earnings. Following much of the literature, the two proxy variables to be used will be labor income per capita in each state and the unemployment rate in each state.² Only labor income and not total personal income is used because much

¹United States Census of Population 1960, Mobility for States and State Economic Areas.

²For examples of the use of actual earning and unemployment rates see Sjaastad, "The Relationship Between Migration and Income," Michael C. Greenwood, "The Determinants of Geographic Labor Mobility," Review of Economics and
property income, which is included in personal income, may be easily transferable between states (i.e., income from stocks, bonds, land, etc.). The unemployment rate is included because a worker's expected income in, say, state i will depend not only on what workers in state i are making, but also on how likely it is for a worker to obtain and retain a job in state i. The likelihood of this will, in general, be negatively related to the unemployment rate in state i.\(^3\)

The following section will examine, in turn, the migration of all persons above the age of five in 1960 and that of all males between ages 20 and 59 in 1960. These two variables will serve as proxies for the migration of workers, which was the relevant variable in the theoretical analysis of Chapter 3. The tests in that section will hinge on the significance of changing labor earnings per capita and changing unemployment rates in explaining migration.

Sections III and IV will provide supplementary tests of the two models. In Section III some previous empirical analyses of migration which have disaggregated migrants by age will be reviewed. In Section IV original evidence on the migration of males between the ages of 20 and 59,

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Statistics (May 1969), or Gallaway, Gilbert, and Smith, "The Economics of Labor Mobility."

\(^3\) See Todaro, "Labor Migration and Urban Unemployment," for a clear and extensive discussion of such a relationship.
disaggregated by five-year age groups, will be analyzed. Since the new model developed in Chapter 3 hypothesizes that different factors may determine the migration of young and old workers (specifically it hypothesizes that the migration of young workers may be determined by the level of earnings, but that that of older workers will be determined by changing earnings differentials), while the standard model predicts no such difference in the factors influencing the migration of old and young, the examination of migration data disaggregated by age will aid in the testing of the two models.

Before proceeding to the tests outlined above, an important shortcoming of the data used in this thesis, and in other studies on migration, should be noted. The data which are available do not provide a time series on migration into or out of each (or any) region, but, instead, only cross section data on migration into and out of each state over one time period are available.

To see why this is an important limitation, note that the migration variable for both models developed in Chapter 3 is simply the flow response to disequilibrium in the supply of labor to a region. If one had a time series on net migration into one region, regression of migration rates on expected earnings and/or changing earnings could be interpreted as an attempt to determine the supply curve of labor
to that region. When cross section data are used there is no single underlying supply curve, but instead each observation shows the flow response to disequilibrium in a different supply curve (i.e., the supply curve of labor to a different region). For example, using cross section data, one observation on net migration to Alabama and the rest of the United States is based on the supply curve of labor to Alabama, but another observation on net migration to North Dakota is based on the supply curve of labor to North Dakota.

It is necessary to make a minor change in the theoretical models to correct at least partially for the difference in state sizes when cross section data are used. In both models the dependent variable will be the migration rate, that is, total net migrants for a state as a percentage of population of that state. In spite of this change and the general limitation imposed by the cross section data, the essential differences between the two models can still be analyzed. The first, the standard model, indicates that states with high expected earnings will gain migrants vis a vis states with low earnings. The second model argues that, while such a phenomenon may occur among younger workers, among all workers the states with rising relative earnings will also gain vis a vis states with falling relative earnings.

4 Though, even with time series data, this can only be done with the assumption that the supply curve has not shifted, i.e., that people's preferences based on the non-economic aspects of the alternative regions have not changed.
Section II: Interstate migration

In this section the two models of migration will be directly tested using data on U.S. interstate migration.\(^5\) The first group of regressions used to test the two models will employ the following variables:

\[M_{ij} = \text{net migration of all persons above the age of five between states } i \text{ and } j \text{ (positive if } i \text{ is a net gainer) during the period } 1955-60 \text{ divided by the total population in states } i \text{ and } j \text{ in } 1960\]

\[Y_{ij} = \text{wages and salaries per capita in state } i \text{ in } 1955 \text{ divided by wages and salaries per capita in state } j \text{ in } 1955\]

\[U_{ij} = \text{the insured unemployment rate in state } i \text{ in } 1955 \text{ divided by the insured unemployment rate in state } j \text{ in } 1955\]

\[Y_{ij} = \text{the change in } Y_{ij} \text{ over the period } 1955-60\]

\[U_{ij} = \text{the change in } U_{ij} \text{ over the period } 1955-60\]

\[D_{ij} = \text{the highway mileage between the major city of state } i \text{ and that of state } j\]

\(^5\)Since the two migration models are derived from a lag assumption and assumptions #1 and #2 (or #1a and #2a) respectively, the test of the two models can be viewed as an indirect test of these assumptions.
The regression equation derived from the standard migration model is

$$M_{ij} = \alpha + \beta_{1}Y_{ij} + \beta_{2}U_{ij} + \beta_{3}D_{ij}. \quad (8)$$

For the new model the regression equation is

$$M_{ij} = \alpha + \beta_{1}Y_{ij} + \beta_{2}U_{ij} + \beta_{3}D_{ij} + \beta_{4}\Delta Y_{ij} + \beta_{5}\Delta U_{ij}. \quad (9)$$

The hypothesized signs of the income and unemployment variables are $\beta_{1}, \beta_{4} > 0$, and $\beta_{2}, \beta_{5} < 0$. The distance variable serves as a proxy for a variety of factors; for example, presumably the costs of migration increase with the distance migrated, the uncertainty one attaches to potential earnings in other regions increases, and the number of intervening opportunities (i.e., alternative residences) increases with the distance between two regions.\(^6\)

These factors indicate that greater distances between two regions, *ceteris paribus*, tend to decrease the net migration between them, whichever direction the flow happens to be going. Thus the $D_{ij}$ variable serves to decrease the absolute value of $M_{ij}$.

It is a relatively simple procedure to translate such

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\(^6\)For a discussion of these different aspects of the distance variable, see Abba Schwartz, "Interpreting the Effect of Distance on Migration," *Journal of Political Economy* (September/October 1973) and Mildred B. Levy and Walter J. Wadyckl, "What is the Opportunity Cost of Moving? Reconsideration of the Effects of Distance on Migration," *Economic Development and Cultural Change* (January 1974).
a relationship into a clear hypothesis on the sign of $\beta_3$. For all pairs of states there are really two migration observations. For example, if New York was a ten per cent gainer vis a vis Maine (i.e., net migration from Maine to New York was ten per cent of their total population), then Maine was also a ten per cent loser vis a vis New York. By simply changing which state's income or unemployment rate is the numerator and which is the denominator in $Y_{i,j}$ and $U_{i,j}$, either of these two observations may be used. The important point is that noting that Maine was a ten per cent loser vis a vis New York adds no information not already gained by noting that New York was a ten per cent gainer vis a vis Maine. This means that we can simply use only all the positive values of $M_{i,j}$ (the ones corresponding to state $i$ being the gainer vis a vis state $j$) in the regression. 7 In this case the hypothesized sign of $\beta_3$ is negative, which corresponds to saying that distance decreases the absolute value of a positive number.

Regressions of the form of (8) and (9) were first run on all 1128 observations ($(48 \cdot 47)/2$). The results are shown in Table 1. 8 ("t" scores are shown in parentheses

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7 Gallaway, Gilbert, and Smith, in "The Economics of Labor Mobility," employ the same procedure for identical reasons.

8 Besides regressions based on (8) and (9), regressions using simply $\Delta U_{i,j}$, $\Delta Y_{i,j}$, and $D_{i,j}$ are also shown. This is done here, simply for completeness. In Section IV, where
below the coefficients.) All regressions pass an F test at better than the 1% level. The distance variable is highly significant in all regressions. The addition of $\Delta Y_{ij}$ and $u_{ij}$ does not pass an F test at the 5% level, indicating that the new model is not preferable to the standard model.

Table 1

<table>
<thead>
<tr>
<th>$Y_{ij}$</th>
<th>$\Delta Y_{ij}$</th>
<th>$u_{ij}$</th>
<th>$\Delta u_{ij}$</th>
<th>$D_{ij}$</th>
<th>$R^2$ adj.</th>
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<td>-0.0013**</td>
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<tr>
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<td>.045</td>
<td>-0.0014**</td>
<td>.024</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>(.82)</td>
<td>(-5.20)</td>
<td></td>
<td></td>
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<tr>
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<td>-.080*</td>
<td>-.015</td>
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<td>(1.86)</td>
<td>(-2.03)</td>
<td>(-.24)</td>
<td>(-5.00)</td>
<td></td>
</tr>
</tbody>
</table>

*Significant at the 5% level.
**Significant at the 1% level.

In these regressions, migration to Florida was consistently an extreme outlier. However, much of that migration may be for retirement or non-economic purposes. The average age of migrants to Florida is over three and a half years higher than the average age of migrants to any other state and over six and a half years older than the average age of all interstate migrants.9 People over sixty years old made subgroups of older workers are considered, such regressions will be of direct interest.

up almost 24% of the net migration to Florida; further, those over sixty who migrated to Florida comprised over 22% of all interstate migrants over sixty.¹⁰ This suggests that the migration flow to Florida is strongly influenced by retirement migration, which will not depend on earnings expectations.

A second factor which may be causing the poor results for migration to Florida could be changes in some non-economic aspects of life in Florida. For example, the advent of relatively inexpensive air-conditioning would make Florida a more attractive residence even though income expectations in Florida have not changed. Or the development, promotion, and advertisement of seaside communities could make Florida appear more desirable.

For these reasons it was decided to omit Florida from the regressions. First only observations on migration to Florida from the seven states New York, New Jersey, Pennsylvania, Ohio, Indiana, Illinois, and Michigan were dropped. This was done because the average age of migrants to Florida from these states was even higher than that of all migrants to Florida. The results of these regressions are shown in Table 2. The omission of these observations does not greatly affect $R^2$ adj. but does cause the significance of $Y, \Delta Y$, and $\Delta U$ to rise while causing the signi-

¹⁰Ibid.
ficance of \( U \) to fall. The addition of \( \Delta Y \) and \( \Delta U \) to the regression is highly significant, which indicates that the new model is superior.

<table>
<thead>
<tr>
<th>( y_{ij} )</th>
<th>( \Delta y_{ij} )</th>
<th>( u_{ij} )</th>
<th>( \Delta u_{ij} )</th>
<th>( d_{ij} )</th>
<th>( R^2 ) adj.</th>
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</thead>
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<td>(-3.55)**</td>
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</table>

<table>
<thead>
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<th>( y_{ij} )</th>
<th>( y_{ij} )</th>
<th>( u_{ij} )</th>
<th>( d_{ij} )</th>
<th>( R^2 ) adj.</th>
</tr>
</thead>
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<td>-.021</td>
<td>-.097</td>
<td>.0003</td>
</tr>
<tr>
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<td>(4.48)***</td>
<td>(-.59)</td>
<td>(-1.94)*</td>
<td>(-3.35)</td>
</tr>
</tbody>
</table>

*Significant at the 5% level.
**Significant at the 1% level.
***Significant at the 0.1% level.

A final regression was run in which all observations on migration to Florida were omitted. The results of these regressions are shown in Table 3. Again \( R^2 \) adj. was not affected greatly while the significance of \( Y \) and \( \Delta Y \) rose. The addition of \( \Delta Y \) and \( \Delta U \) to the regression was highly
significant, again indicating that the new model is preferable to the standard model.

Thus two out of the three sets of regressions do indicate that the new model is an improvement on the old, but all three sets of regressions have very poor explanatory power. Two important reasons for this are the proxy nature of $Y_{ij}$ and $U_{ij}$ and the fact that the net migration of all persons above the age of five includes many who are moving for non-economic reasons. With respect to this latter point it is worth noting that of all male interstate migrants during the period 1955-60, 20% were in the military and half of these were aged 18-19.\(^{11}\) Further, male and female migrants between the ages 15-19 in 1960 comprise about 10% of total interstate migrants, and of that age group 43% were in college in 1960; thus much of that migration may have been simply the move to college.\(^{12}\)

In order to eliminate some of this non-economic migration from the dependent variable, another set of regressions was run on only the net migration of males between the ages of 20 and 59. Disaggregation by age and sex in this manner comes at the cost of losing some of the geographic detail.


\(^{12}\)United States Census of Population 1960, Mobility for States and State Economic Areas, Table 3 and Table 6.
of the previous regressions. For this age and sex group, only data on the net migration into or out of each state is known, not the net migration between each pair of states. Thus, now there are only 48 observations, one for each state.

The variables used for these regressions are:

\[ M^i \] = net migration of males aged 20-59 for state
i between 1955-60 divided by the number of
males aged 20-59 in state i in 1960

\[ Y^i \] = wages and salaries per capita in state i
in 1955 divided by wages and salaries per
capita for the whole U.S. in 1955

\[ U^i \] = the insured unemployment rate in state i
in 1955 divided by the insured unemployment
rate for the whole U.S. in 1955

\[ \Delta Y^i \] = the change in \( Y^i \) from 1955 to 1960

\[ \Delta U^i \] = the change in \( U^i \) from 1955 to 1960

Since each observation indicates migration flows between one state and all other states, no distance variable is used. Once again migration to Florida was an extreme outlier in the regressions; thus two sets of regressions are reported, one which includes all states (i.e., \( n = 48 \)) and another which omits Florida (\( n = 47 \)). The results for both sets of regressions are presented below in Table 4.

The most important conclusion to be drawn from these
Table 4: Migrants Aged 20-59

<table>
<thead>
<tr>
<th>Constant</th>
<th>Y</th>
<th>ΔY</th>
<th>U</th>
<th>ΔU</th>
<th>N</th>
<th>R² adj</th>
</tr>
</thead>
<tbody>
<tr>
<td>-6.023</td>
<td>7.2617**</td>
<td>-1.2932</td>
<td>47</td>
<td>.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3.51)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2.979</td>
<td>6.470**</td>
<td>-3.345*</td>
<td>48</td>
<td>.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2.70)</td>
<td></td>
<td>(-2.20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-.903</td>
<td>14.045</td>
<td>-6.981*</td>
<td>47</td>
<td>.09 t</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1.23)</td>
<td></td>
<td>(-2.11)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-.555</td>
<td>13.961</td>
<td>-6.795</td>
<td>48</td>
<td>.05 t</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1.04)</td>
<td></td>
<td>(-1.75)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-9.561</td>
<td>11.776***</td>
<td>48.511***</td>
<td>-2.053</td>
<td>-6.952*</td>
<td>47</td>
<td>.57</td>
</tr>
<tr>
<td>(6.22)</td>
<td>(5.10)</td>
<td>(-1.86)</td>
<td>(-2.90)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-6.288</td>
<td>10.781***</td>
<td>47.388***</td>
<td>-4.168**</td>
<td>-7.994*</td>
<td>48</td>
<td>.49</td>
</tr>
<tr>
<td>(4.49)</td>
<td>(3.91)</td>
<td>(-3.19)</td>
<td>(-2.62)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant at the 5% level.

**Significant at the 1% level.

***Significant at the 0.1% level.

t The regression does not pass an F test at the 5% level.
regressions, for our purposes, is that the addition of $\Delta Y$ and $\Delta U$ to the standard model is highly significant at the 1% level, indicating that the new model is a great improvement over the standard model. The addition of $\Delta Y$ and $\Delta U$ more than doubles $R^2_{\text{adj}}$. For the regression using the new model and excluding Florida, the $U^i$ variable is just insignificant at the 5% level, while the other variables are highly significant. For the new model including Florida, all variables are significant.

Thus, for the migration behavior of males aged 20-59 and for all persons above five years of age when extreme outliers are omitted, the regression equation based on the new model is preferable to the standard model. However, except for the regression using data on males aged 20-59, the explanatory power of the regressions is quite weak and more conclusive evidence is desirable. To provide such evidence, the next two sections will employ supplementary tests of the two models using migration data disaggregated by age.

Section III: Supplementary tests of the two models: Previous analyses

Analysts using the standard model have argued that when regressions similar to those used in the previous section are run for different age groups of workers, the coefficients of variables such as $Y^i$ and $U^i$ will be smaller for
older workers than for younger ones. This is because, they argue, the lifetime earnings differential associated with any value of \( Y^i \) and \( U^i \) will be smaller for older workers because of their shorter remaining work life and because the costs of migration, which are approximately fixed for all ages, become more of a constraint to movement in the migration decision of older workers, since they will have less time to earn income to offset those costs. Both of these reasons suggest that in response to some earnings differential, fewer older workers will move than younger workers.\(^{13}\) While arguing in this manner, those using the standard model do not suggest that the factors which influence the migration of older workers differ from those which influence younger workers. That is, they hypothesize that, considering, say, a cross section of the 48 states, those states with the highest earnings will, in general, experience the greatest net inflow of both old and young subgroups, while states with the lowest earnings will experience the greatest net outflow of old and young subgroups, though in both cases the number of young workers moving will be greater than the number of old workers moving.\(^{14}\)

---

\(^{13}\) See Sjaastad, "The Relationship Between Migration and Income," p. 41; Gian S. Sahota, "Internal Migration in Brazil," p. 220; or Bowles, "Migration as Investment," p. 357-8, for examples of these age group hypotheses using the standard model.

\(^{14}\) This is the hypothesis behind regressions run by, among others, Sjaastad, "The Relationship Between Migration
In contrast to this, the new model indicates that the determinants of the migration of young and old workers differ. That is, the migration of young workers (new entrants) will be determined, at least partially, by the level of expected earnings differentials, while that of old workers will be determined by changes in those differentials. As a result the new model admits of the possibility that one will observe young workers moving, in general, from low to high income states, while older workers are moving from states with falling relative incomes to those with rising relative incomes.

These differing implications about age patterns of migration provide the basis for supplementary tests of the two models. In this section some previous empirical analyses of age patterns of migration using the standard model will be reviewed to see if they support the hypotheses of that model. Then the data on migration of males aged 20-59 used in the previous section will be disaggregated further by age and the implications about age patterns of migration of both models will be tested.

Sjaastad examined net male migration for three age groups for each state during the period 1940-49.\footnote{Sjaastad, "The Relationship Between Migration and Income."} The

dependent variable in his regression was net male migration for a particular age group in each state divided by the male population of that age in that state. The earnings variable he used was the level of labor income per capita in each state. He ran eleven regressions for each of his three age groups. Shown below are the range and average values of the coefficient of the earnings variables and its "t" score over the eleven regressions for each of the three age groups.\textsuperscript{16}

\begin{table}[h]
\begin{center}
\begin{tabular}{|c|c|c|c|}
\hline
Age & Range of the coefficient of the wage variable & Average value of the coefficient of the wage variable & Range of the "t" score & Average value of the "t" score \\
\hline
15-24 & 4.32 - 2.74 & 3.350 & 5.93 - 2.22 & 3.360 \\
25-44 & 4.30 - 1.60 & 2.630 & 5.56 - 1.38 & 2.510 \\
45-64 & 1.11 - (-.17) & .276 & 2.58 - (-.23) & .650 \\
\hline
\end{tabular}
\end{center}
\caption{Table 5}
\end{table}

In these regressions the coefficient of the income variable was significant in all regressions for those aged 15-24, nine of the eleven regressions for those aged 25-44, and only one of the eleven for those aged 45-64. Thus the regression results indicate not just that the response of older workers is less than that of younger workers, but that it is so much less that the response is not statistically

\textsuperscript{16} Ibid., pp. 57-61.
significant.

Schultz, in his study of rural ruban migration in Colombia, provides an extensive breakdown of male migration by age.\(^{17}\) His dependent variable is male migration from rural to urban municipalities for a given age group divided by the male population of the rural municipality of that age. The earnings variable he uses is the local (rural) agricultural wage. His results for the earnings variable are presented below.\(^{18}\)

<table>
<thead>
<tr>
<th>Age</th>
<th>Coefficient of Wage Variable</th>
<th>&quot;t&quot; score</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-11</td>
<td>.51</td>
<td>1.35</td>
</tr>
<tr>
<td>12-16</td>
<td>1.25</td>
<td>3.36</td>
</tr>
<tr>
<td>17-21</td>
<td>1.45</td>
<td>3.62</td>
</tr>
<tr>
<td>22-26</td>
<td>1.03</td>
<td>2.66</td>
</tr>
<tr>
<td>27-31</td>
<td>.36</td>
<td>.86</td>
</tr>
<tr>
<td>32-36</td>
<td>.46</td>
<td>1.27</td>
</tr>
<tr>
<td>37-41</td>
<td>.29</td>
<td>.80</td>
</tr>
<tr>
<td>42-46</td>
<td>.21</td>
<td>.59</td>
</tr>
<tr>
<td>47-51</td>
<td>-.18</td>
<td>-.52</td>
</tr>
</tbody>
</table>

From these results Schultz reaches the correct conclusion that "No significant effect of rural wages on male


\(^{18}\)Ibid., p. 161.
rural migration is evident after age 26.  

Thus, while the hypothesis based on the standard model was that older workers would be less responsive than younger workers to earnings differentials, the results of these two studies are much stronger: both studies show that the migration of older workers is not significantly related to earnings differentials.

As a final example of empirical analyses of age patterns of migration using the standard model, Samuel Bowles' paper on migration into and out of the South will be examined. Rather than running a group of cross section regressions, each using the net migration of a different age group as the dependent variable (as Sjaastad and Schultz do), Bowles uses only one regression which has as the dependent variable the net migration for one region (the southern U.S.) by different age and education subgroups of males. His regression equation is

$$NM = b_0 + b_1Y + b_2AY + b_3SY + b_4P$$

where $NM =$ the number of net out-migrants with a given set of age, schooling, and other characteristics divided by the total population in the region of origin with those

---

19Ibid., p. 161.

20Bowles, "Migration as Investment."

21Ibid., p. 263.
characteristics, or the net migration rate for that population subgroup;

\[ Y = \text{the logarithm of expected increase in the present value of lifetime income associated with out-migration for the population subgroup in question, in thousands of dollars;} \]

\[ A = \text{the age which defines the population subgroup;} \]

\[ S = \text{the number of years of schooling which defines the population subgroup; and} \]

\[ P = \text{a measure of the extent of poverty: the fraction of male workers in the population subgroup in the South that earned less than } \$1,000 \text{ in } 1959. \]

Two of Bowles' hypotheses are that migration is positively related to the gains from migration and that the effect of any particular level of those gains on migration will be less for older workers than for younger workers. The algebraic equivalent of the first hypothesis in terms of his regression equation is \(^{22}\)

\[ \frac{\partial \text{NM}}{\partial Y} = b_1 + b_2A + b_3S > 0 \]

\(^{22}\)Bowles interprets the first hypothesis as requiring only \(b_1 > 0\). He does not indicate his reasons for this conclusion. (See Bowles, "Migration as Investment," p.
Bowles ran separate regressions for whites and non-whites. The values of $\frac{\partial \text{NM}}{\partial Y}$ obtained from those regressions are shown below.\(^\text{23}\)

\[
\begin{align*}
\frac{\partial \text{NM}}{\partial Y(\text{non-white})} &= .01586 - .00118 \, A + .002015 \\
\frac{\partial \text{NM}}{\partial Y(\text{white})} &= .03124 - .00082 \, A + .001135
\end{align*}
\]

Clearly the sign and size of the response to an increase in the gains from migration depends on the age and education of the migrant subgroup.\(^\text{24}\) As pointed out by Apgar, when the values of $\frac{\partial \text{NM}}{\partial Y}$ are evaluated at the mean values of A and S, $\frac{\partial \text{NM}}{\partial Y}$ is negative for non-whites and positive for whites.\(^\text{25}\) In Bowles' data, S takes the values 4, 8, 10, 12, 14, and 16, and A takes the values 27, 32, 37, 42, 47, 52, 57, and 62. For both whites and non-whites, and for any value of S, there are subgroups old enough (i.e., values of A high enough among those listed above) to make the value of $(\frac{\partial \text{NM}}{\partial Y})$ negative. (In some cases this becomes negative

\(^{361}\) Reviewing Bowles' work, William C. Apgar also notes this error. See Apgar, "Migration as Investment: Some Further Considerations," pp. 7-8.


\(^{24}\) That the size of that response varies according to those factors was, in fact, a central hypothesis of Bowles' paper. However, he did not take into account the fact that the sign of the response varies also according to those factors. See Bowles, "Migration as Investment," pp. 361-2.

for age groups as low as 32; only for whites with sixteen years of education does it require raising $A$ to the oldest subgroup, $A = 62$, to make it negative.)

The clear conclusion from this set of data is that for older age groups there is a negative relationship between migration and the level of the expected earnings differential. This conclusion is inconsistent with the standard model, but not with the new model.

Section IV: Supplementary tests of the two models: Original Analysis

The data on net migration for each state for males aged 20-59 used in Section II can be disaggregated by five-year age groups. Thus data on net migration for males aged 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, and 55-59 can be used for supplementary tests of the two migration models.

One of the supplementary tests to be used later in this section will involve running regressions like those used for males aged 20-59 in Section II for each of the eight age groups delineated above and comparing the two models for each age group. As with the regressions in Section II, such regressions will be more or less inaccurate due to the proxy nature of $Y^i$ and $U^i$. To avoid this difficulty, at least partially, the first test to be used here will not use the variables $Y^i$ and $U^i$.

As noted above, users of the standard model have
hypothesized that, while fewer older workers than younger workers will move, the states with the highest incomes will tend to be the greatest net gainers of both old and young, while those with the lowest earnings will tend to be the greatest net losers of old and young. This implies that there would tend to be considerable similarity in the state by state pattern of migration of old and young workers. Or, more specifically, a regression of the form

\[ M^i_Y = \alpha + \beta M^i_O \]  

(10)

where \( M^i_Y \) = the migration rate of state i for young workers, and

\( M^i_O \) = the migration rate of state i for older workers,

would have a high value of \( R^2 \), with \( \beta \) being positive and highly significant.

The new model implies a distinct difference in the migration behavior of old and young workers. Remembering the general equation for migration derived from the second model for a group of migrants who entered the work force z periods ago,

\[ M_t = \delta \beta (x_t - x_{t-1}) + \cdots + (1-\delta)^Z (\beta - \theta)x_{t-Z} + (1-\delta)^Z (\alpha-\lambda), \]

if the workers in question are very young and entered the work force only, say, one period ago, then this is
written as

\[ M_t = \delta \beta (x_t - x_{t-1}) + \delta (1 - \delta) (\beta - \theta) x_t + \delta (1 - \delta)(\gamma - \lambda). \]  

(11)

If, however, the workers are quite old, the term \( \delta (1 - \delta)^2 \) becomes very small and effectively insignificant. Then the equation, lagged only one period, is

\[ M_t = \delta \beta (x_t - x_{t-1}). \]  

(12)

The fact that the younger workers are more influenced by a term such as \((\beta - \theta)x_t\) implies that the state-by-state migration patterns of old and young may not be greatly similar. Thus the new model predicts that regressions of the form of (10) will not have high values of \( R^2 \).  

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For the specific tests we shall run seven regressions, each one using the migration rate of the middle group, aged 40-44, as the independent variable and the migration rate of one of the remaining seven age groups as the dependent variable. Thus the regressions will be of the form

\[ M^i_j = \alpha + \beta M^{40-44} \]

where \( M^i_j \) is the migration rate for the \( i^{th} \) state and the \( j^{th} \) age group.

The standard model predicts that all seven of these regressions will have high values of \( R^2 \). The new model

\[ \text{Since, in the new model, both young and old are influenced by changing earnings, that model does not predict that } \beta \text{ in (10) will be insignificant.} \]
predicts that the regressions using the migration of the youngest age groups as dependent variables will not have high $R^2$, but for older age groups who, like those aged 40-44, are behaving according to (12) the regressions will have a high value of $R^2$.\textsuperscript{27} The results, shown in Table 7, clearly indicate that, while there is great similarity in the state-to-state migration patterns of workers 30 years old and older, contrary to the prediction of the standard model, there is not nearly so close a similarity in the migration of workers under 30.\textsuperscript{28}

These regressions, while tending to support the new model, have not shown what the determinants of the migration behavior of these age subgroups are. To address this question we shall again use the proxy variables $Y^i$ and $U^i$ and run regressions of the form used in Section II for all males aged 20-59. We shall now run eight sets of such regressions, one for each of the eight age groups indicated above.

\textsuperscript{27}At what point workers become old enough for (12) to apply cannot be precisely stated, particularly purely a priori. (In the text it is implicitly assumed that by age 40 the effect of the initial condition is slight.) However, we can use regressions such as we are using for this test to get an idea about when (12) begins to apply.

\textsuperscript{28}Confirming the hypothesis that fewer older workers move than younger workers, whether or not they tend to move to or from the same states, is greater than one for all regressions in which the age group of the dependent variable is less than that of the independent variable (40-44) and is less than one in all other regressions.
<table>
<thead>
<tr>
<th>Age group of the dependent variable</th>
<th>Coefficient of the independent variable</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-24</td>
<td>1.902</td>
<td>.37</td>
</tr>
<tr>
<td></td>
<td>(5.17)</td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td>1.031</td>
<td>.34</td>
</tr>
<tr>
<td></td>
<td>(4.83)</td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td>1.293</td>
<td>.93</td>
</tr>
<tr>
<td></td>
<td>(24.12)</td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td>1.183</td>
<td>.96</td>
</tr>
<tr>
<td></td>
<td>(42.14)</td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td>.826</td>
<td>.98</td>
</tr>
<tr>
<td></td>
<td>(44.67)</td>
<td></td>
</tr>
<tr>
<td>50-54</td>
<td>.779</td>
<td>.93</td>
</tr>
<tr>
<td></td>
<td>(23.51)</td>
<td></td>
</tr>
<tr>
<td>55-59</td>
<td>.643</td>
<td>.91</td>
</tr>
<tr>
<td></td>
<td>(21.47)</td>
<td></td>
</tr>
</tbody>
</table>
The standard model predicts that regressions of the form

\[ M^i = \alpha + \beta_1 Y^i + \beta_2 U^i \]

will have significant coefficients for all age groups. The new model predicts that the regression of the form

\[ M^i = \alpha + \beta_1 Y^i + \beta_2 U^i + \beta_3 Y^i + \beta_4 U^i \]

will have all variables significant for the younger age groups, and for those groups it will be a significant improvement over the standard model. For older workers the new model predicts that the relevant regression equation would be

\[ M^i = \alpha + \beta_3 Y^i + \beta_4 U^i \]

and that, for those above 30, this equation will be a significant improvement over the standard model for the same age groups. Again, two sets of regressions were run, one for all states and the other excluding Florida. The results of the regressions for each age group are shown in Tables 8-15.

As predicted by the new model, for the youngest two age groups the regressions using \( Y, U, \Delta Y, \) and \( \Delta U \) are a great improvement over the standard model; the addition of \( \Delta Y^i \) and \( \Delta U^i \) to the standard model easily passes an \( F \) test at the 1% level. For those over 35, and omitting Florida from the observations, the value of \( R^2 \) adj. using \( \Delta Y \) and \( \Delta U \) is significantly greater than that obtained using \( Y \) and \( U \),
Table 8: Migrants Aged 20-24

<table>
<thead>
<tr>
<th>Constant</th>
<th>$\gamma_{ij}$</th>
<th>$\Delta \gamma_{ij}$</th>
<th>$u_{ij}$</th>
<th>$\Delta u_{ij}$</th>
<th>n</th>
<th>$R^2$ adj.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-16.033</td>
<td>20.4337**</td>
<td>-5.1892</td>
<td></td>
<td></td>
<td>47</td>
<td>.21</td>
</tr>
<tr>
<td>(3.20)</td>
<td>(-1.20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2.99)</td>
<td>(-1.89)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-3.096</td>
<td>.506</td>
<td>-24.395*</td>
<td>47</td>
<td>.10$^t$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(.01)</td>
<td>(-2.43)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2.595</td>
<td>.384</td>
<td>-24.126*</td>
<td>48</td>
<td>.08$^t$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.01)</td>
<td>(-2.32)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3.92)</td>
<td>(2.38)</td>
<td>(-2.07)</td>
<td>(-3.06)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3.69)</td>
<td>(2.29)</td>
<td>(-2.83)</td>
<td>(-3.14)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant at the 5% level.

**Significant at the 1% level.

***Significant at the 0.1% level.

$t$The regression does not pass an F test at the 5% level.
Table 9: Migrants Aged 25-29

<table>
<thead>
<tr>
<th>Constant</th>
<th>Y</th>
<th>ΔY</th>
<th>U</th>
<th>ΔU</th>
<th>n</th>
<th>R² adj.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-11.947</td>
<td>15.173***</td>
<td>-3.9664</td>
<td>47</td>
<td>.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4.75)</td>
<td>(-1.84)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-9.291</td>
<td>14.482***</td>
<td>-5.757**</td>
<td>48</td>
<td>.38</td>
<td></td>
<td></td>
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Table 15: Migrants Aged 55-59

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often being twice as large. This means that for seven of the eight age groups considered, the new model is clearly preferable to the standard model.

On the basis of the regressions presented in Table 7 (i.e., migration of each age group regressed on the migration of those aged 40-44), the group aged 30-34 was classified as "older workers." This would imply that the regressions using $\Delta Y$ and $\Delta U$ would be preferable to those using $Y$ and $U$. This was not the case; in fact the regressions using $\Delta Y$ and $\Delta U$ did not pass an F test at the 5% level. However, since this group is the borderline age group between old and young, it might be that the lagged effect of the initial condition is still strong. Under the new model, this would imply that the addition of $\Delta Y$ and $\Delta U$ to the regressions on $Y$ and $U$ would be significant, which was in fact true. Thus the apparent failure of the new model for this age group may simply be due to a remaining lagged effect of the initial condition on the migration of workers 30-34. (It should be noted that the ages given are those in 1960, the end of the period under study; thus these workers were 25-29 in 1955.)

With this qualification for the age group 30-34, the regressions results show that, under a straightforward comparison of the two models, the new model is superior. In addition, the regressions have provided one unexpected result. For all age groups, even those above 35, the
regressions using all four variables are a great improvement over those using only $Y$ and $U$ or $\Delta Y$ and $\Delta U$. While we have rationalized this result for those aged 30-34 by suggesting that the initial condition is still affecting their migration, this is unlikely to be true for those aged, say, 50-54. In what follows we shall provide a rationalization of these results based on the standard model and one based on the new model; then we shall see which better fits the empirical results.

Reasoning on the basis of the standard model, we should note that only current values of earnings and unemployment were used in the regressions, not expected lifetime values. It may be that workers expect that any current trend in a state's relative earnings will continue. This implies that expected lifetime earnings will be positively associated with both $Y$ and $\Delta Y$. (A similar argument holds for $U$ and $\Delta U$.) Thus a worker may conclude that a state with low but rising relative current earnings will provide him with greater lifetime earnings than a state with high but falling current earnings. This indicates that all four variables would be significant, as was the case.

Such reasoning also implies that, comparing older workers with younger workers, the older workers will be more influenced by the level of current earnings than by changes in that variable; while just the opposite holds for younger workers. For example, a younger worker with a 40-
year work life may decide that a state with low but rising current earnings, assuming the trend continues, will give him higher lifetime earnings than a state with high but falling current income. At the same time, an older worker with a remaining work life of only, say, ten years may conclude that the state with high current earnings also has the highest expected lifetime income for him. Thus the older worker's migration behavior will be more influenced by the level of current earnings and the younger worker by his expectations about the trend in earnings (which are assumed to be based on changes in current earnings).

Under the new model we have previously assumed that the non-economic factors influencing residence choice have remained unchanged; thus older workers changed their desired residence only when their earnings expectations changed. To rationalize the results of the regressions which used all four variables we must conclude that some non-economic factors changed, inducing many workers of all ages to move from some low to some high income states.

The number of non-economic factors influencing residence choice is large, and those factors are difficult to specify. A general example of something which could have caused such a flow is the increased ease of interstate transportation and communication. Such a trend would make everyone a little less unwilling to leave family and friends. As a result, some workers who were previously
just unwilling to move to high income states might now be induced to do so.

A more specific example relates to the large inflows of migrants of all ages to the high income states California and Navada. The advent of cheaper air-conditioning and the promotion of new communities in the dry, warm climate of the southern parts of these states could have a strong influence inducing people to move there even though relative earnings fell slightly in both states.

While such changes in non-economic factors may cause some workers of all ages to move from low to high income regions, they will not alter the age pattern of the influence of the variables Y and Y implied by the new model. Contrary to the implications of the standard model, the new model still indicates that for young workers whose migration behavior is strongly influenced by the initial condition, the significance of Y and U will be greater than it is for older workers, and that the significance of ΔY and ΔU relative to Y and U will be greater for older workers than for younger workers.

Thus the over-all results of the significance of all four variables can be rationalized using either model. However, the rationalization based on the new model has far different implications about the significance of the variables for different age groups from those of the standard model. Reasoning from the standard model, it was argued
that $\Delta Y$ and $\Delta U$ would be relatively more significant for young than old workers and $Y$ and $U$ relatively more so for old than young. The conclusion from the new model was just the opposite.

Simply recalling the results already summarized, the burden of evidence on this point is in favor of the new model. When only $Y$ and $U$ were used in the regression, the regressions for each of the three age groups above 45 did not pass an F test at the 5% level, while they were highly significant for the youngest two age groups. On the other hand, the regressions using only $\Delta Y$ and $\Delta U$ perform best for those aged over 35.

The results of the regressions using all four variables are shown for each age group in Table 16. They strongly support the predictions based on the new model. The income variable attains its highest significance levels for those aged 25-29 and 30-34; the unemployment variable is significant only for those aged 20-24 and 25-29. On the other hand, the change in income variable attains its greatest significance for those aged 35-39 and 40-44 and is more significant than the income variable for all workers above 35. Except for a very high significance level for those aged 20-24, the change in unemployment variable follows a pattern very similar to the change in income variable.  

\[\text{29} \text{ The results for the group aged 20-24 do not seem to fit closely the over-all age pattern. This may be related} \]
Thus the results are quite clear. As predicted by the new model, in the regressions using only two variables at a time and those using all four, the young are shown to be more influenced by the level of earnings expectations while the old are more influenced by changes in earnings expectations. This result is in direct contrast to the predictions of the standard model.

Thus far we have dwelt on the statistical results derived from various regressions. It is also instructive to consider the migration predictions of the two models for particular states. The industrial states of Ohio, Michigan, Illinois, Indiana, and Pennsylvania all had incomes well above the national average, but their incomes fell slightly over the period 1955-60. The standard model would predict that these states would be net gainers for all ages; the new model is consistent with young workers entering these states at the same time that older workers are leaving them. In confirmation of the new model, all of these states had net in-migration of workers under 30 and net out-migration of workers over 35.

The results for many southern states also tend to confirm the new model. For example, both Alabama and Georgia

to the fact that about 45% of the migrants in this age group were not in the work force when they moved (as opposed to about 15% for the other age groups). Some of those not in the work force were in the army and others were in school. See the United States Census of Population 1960, Mobility for States and State Economic Areas.
Table 16

<table>
<thead>
<tr>
<th>Age Group of Migrants</th>
<th>Y</th>
<th>ΔY</th>
<th>U</th>
<th>ΔU</th>
<th>R² adj</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-59</td>
<td>11.776</td>
<td>48.511</td>
<td>-2.053</td>
<td>-6.952</td>
<td>.57</td>
</tr>
<tr>
<td></td>
<td>(6.22)</td>
<td>(5.10)</td>
<td>(-1.86)</td>
<td>(-2.90)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.92)</td>
<td>(2.38)</td>
<td>(-2.07)</td>
<td>(-3.06)</td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td>18.523</td>
<td>38.164</td>
<td>-4.795</td>
<td>-7.462</td>
<td>.48</td>
</tr>
<tr>
<td></td>
<td>(5.09)</td>
<td>(2.09)</td>
<td>(-2.27)</td>
<td>(-1.62)</td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td>14.611</td>
<td>30.952</td>
<td>-1.373</td>
<td>-7.377</td>
<td>.46</td>
</tr>
<tr>
<td></td>
<td>(5.22)</td>
<td>(4.33)</td>
<td>(-2.84)</td>
<td>(-2.08)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4.67)</td>
<td>(4.88)</td>
<td>(-3.5)</td>
<td>(-2.15)</td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td>9.603</td>
<td>51.792</td>
<td>-7.38</td>
<td>-6.195</td>
<td>.45</td>
</tr>
<tr>
<td></td>
<td>(4.54)</td>
<td>(4.87)</td>
<td>(-2.6)</td>
<td>(-2.31)</td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td>7.559</td>
<td>42.346</td>
<td>-6.67</td>
<td>-5.094</td>
<td>.42</td>
</tr>
<tr>
<td></td>
<td>(4.17)</td>
<td>(4.64)</td>
<td>(-2.64)</td>
<td>(-2.22)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4.09)</td>
<td>(4.19)</td>
<td>(-1.38)</td>
<td>(-1.72)</td>
<td></td>
</tr>
<tr>
<td>55-59</td>
<td>5.136</td>
<td>32.367</td>
<td>-2.62</td>
<td>3.059</td>
<td>.31</td>
</tr>
<tr>
<td></td>
<td>(3.24)</td>
<td>(4.06)</td>
<td>(-1.52)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
have very low but rapidly rising relative incomes, and (excluding migration to Florida) both states have net out-migration for young workers and net in-migration of older workers. Further, states such as Arizona, Colorado, and New Mexico, which had both high and rising earnings, also had among the highest net in-migration rates for all ages.

There were some states which did not seem to fit the new model. West Virginia had an income below average but rising rapidly. It also had heavy out-migration of all ages. It might be that in this case the rise in the income variable (which is basically an average earnings variable) rose because many workers (in particular, miners) with below average incomes left, causing the average to rise.

In spite of states such as West Virginia and Florida (which did not seem to fit either model), there are many states which seem to confirm the new model. Also, the statistical analysis consistently shows the new model to be preferable.

Section V: Conclusion

This thesis has extended previous analysis in two ways. First it has explicitly treated migration as a flow response to disequilibria and, following techniques developed in investment theory, portfolio analysis, and inventory adjustment analysis, has derived the determinants of migration flows based on the determinants of the desired and actual
residences of workers. In this manner the assumptions about workers' desired residences which must be made in order to justify the standard migration model used in previous literature were derived. That model requires the assumption that, given two regions and an expected earnings differential between them, then all workers will prefer to reside in the same region or all will be indifferent between the two regions.

The second contribution of this thesis has come from deriving a new migration model from the assumption that, given two regions and an expected earnings differential between them, then some workers will prefer to reside in one region while others will prefer the other. The new model, derived from the above assumption, hypothesizes that migration will be positively related to changes in regional earnings differentials and the level of such differentials. The standard model hypothesizes a positive relationship between migration and the level of earnings differentials.

The two alternative models were directly tested using 1955-60 United States interstate migration data. While the results were not unambiguous, the new model was generally preferable to the standard model. To provide more conclusive evidence, supplementary tests were used based on migration data disaggregated by age. Again there was some ambiguity, but the results were more consistent with the new model than with the standard one.
SELECTED BIBLIOGRAPHY

Apgar, William C. "Migration As Investment: Some Further Considerations." Harvard University Program on Regional and Urban Economics, Discussion Paper #64.


