The Determinants of Human Migration

Cebula, Richard

Jacksonville University

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Richard J. Cebula
Emory University

Table of Contents

List of Figures and Tables

Figures

Tables

Preface and Acknowledgments

A systematic analytical and empirical approach to understanding the determinants of geographic mobility in the United States is developed herein. This book seeks to afford new insight into the migration process, and, by so doing, endeavors to be not only of interest but also of great pragmatic value *to* both researchers and policy makers.

The book consists of three parts. The first part is primarily aimed at developing a rigorous analytical model of migration behavior. The second part theoretically and empirically analyzes the role of selected variables in the migration decision. The last part identifies the needs for change in migration research.

The project was undertaken over a period of three years (1976-1979). Over this time span, many people have offered helpful comments and observations. Among these people, I especially wish to thank William Shropshire, Leonard Carlson, Paul K. Gatons, Lowell E. Gallaway, and Patricia Gordon. I also owe a debt of gratitude to several research assistants, including Daisy Lui, Steve Riney, and John Werthwein, for their competent and gracious help. Finally, I also wish to thank Elizabeth House for her prompt and efficient typing efforts.

Part I
The Elements of Migration Analysis

Introduction

The four chapters in the first part of this book develop a general framework for the analysis of the determinants of migration behavior. Each of the first three chapters contributes substantially to the understanding of the role of income in the migration decision calculus. In addition, each of these first three chapters highlights certain other types of variables that are important in the migration calculus. Taken as a group, chapters 1 through 3 set the stage for the rigorous migration model constructed in chapter 4.

Most researchers analyzing the causes of geographic mobility assume that individuals seek to maximize their economic well-being when making migration decisions. Historically, the crucial factor thought to reflect the migrant's economic well-being has been the level of income. Orthodox migration theory has argued that people in general migrate to those areas where income (wage) levels are the highest.

Within the context of two different analytical models, chapter 1 takes issue with orthodox migration theory. Specifically, chapter 1 formally demonstrates that, once the costs associated with geographic mobility are accounted for, (1) persistent interregional wage (income) differentials are entirely compatible with rational labor market behavior; (2) there is likely to exist a rather substantial range of interregional wage (income) differentials that will *not* elicit interregional migration; and (3) there is likely to exist a rather substantial degree of indeterminacy in interregional wage-rate (income) analysis.

The essence of the theoretical analysis in chapter 1 is that interregional wage-rate differentials must be adequately large to compensate labor units for the costs associated with mobility if the conventionally expected relationship between wage-rate differentials and human migration is to be observed.

Assuming that population and labor flows can be regarded as identical, orthodox economic theory predicts that the higher the income level in a state, the greater the net migration to that state, ceteris paribus. As modified by chapter 1 of this book, however, such theory clearly implies that individuals living in states with either extremely high or extremely low income levels will be more responsive to interstate income differentials than those living in states with income levels near the general average for the economy.

In order to test this basic hypothesis empirically, chapter 2 investigates the relationship between net interstate population migration and income levels for the 1965-1970 time period. The forty-eight contiguous states are divided into three different groups: one including the twelve states with the highest wage levels, one including the twelve states with the lowest wage levels, and another containing the other twenty-four states.

The regression results in chapter 2 offer very strong empirical support for the theoretical analysis in chapter 1. Among other things, the findings in chapter 2 suggest that there exists an interregional wage "range" in the United States. Hence, both in specifying migration models and in interpreting empirical results, it is necessary to be extremely meticulous.

The next chapter examines the role of income in the migration decision from a very different perspective. In particular, chapter 3 examines how interregional income differentials can have very different effects on different groups of migrants. The focus in this chapter is on the very widespread finding that nonwhite migrants tend, on the average, to be more responsive to interregional income differentials than do white migrants.

Chapter 3 examines several hypotheses for this apparent difference in the responsiveness of white and nonwhite migrants to geographic income differentials. It is ultimately suggested that nonwhites may be more sensitive than whites to interregional income differentials in formulating their migration decisions because of the fact that, on the average, nonwhites are poorer than whites. The reasoning here is that since nonwhites (on the average) have lower incomes than whites, the process of moving from one area to another and receiving the prevailing income there would yield considerably greater benefits (relatively speaking) for nonwhites than for whites.

With chapters 1 through 3 as background, chapter 4 develops a rigorous model of human migration. This model basically treats the migration decision as an investment decision. The individual's investment decision is argued to be a function of three sets of factors: expected real income benefits, expected amenity benefits, and expected real benefits from state and local government policies. The chapter initially develops a model of individual migration, in which the individual is expected to migrate from one area to another only if the total expected net benefits from the move are positive. Building upon the model of individual migration, the chapter also develops a model of aggregate migration. The latter model assumes a form that is amenable to direct empirical testing with conventional regression techniques.

1 A Theory of Interregional Migration and Wage-Rate Analysis

Introduction

The issue of the determinants of migration has long been of concern to policy makers, demographers, economists, political scientists, and other researchers. In principle, the theory of labor mobility is generally regarded as an extension of the theory of resource allocation. As Sjaastad (1962, p. 80) notes, migration is a means for ". . . promoting efficient resource allocation and . . . is an activity which (itself) requires resources." In effect, most researchers dealing with geographic migration assume that individuals seek to maximize their "differential economic advantage" (Hicks 1940) when making migration decisions.

Historically, the critical factor thought to reflect (represent) the differential economic advantage has been the wage-rate differential. Numerous studies dealing with labor mobility and wage differentials have investigated the extent to which labor market forces have operated over time to equalize interfirm, interindustry, or interregional wage rates.[1]

Along this line, it was argued some years ago by Lester (1952, p. 500) that, among its basic assumptions, wage-rate theory should include the following concept:

> . . . that a range of indeterminancy is natural, so that genuine wage differentials are to be expected and, within limits, are (actually) normal . . . .

Given this argument, the primary objective of this chapter is to afford the reader a basic understanding of the migration process by developing two simple analytical models of interregional migration and wage-rate determination, each of which formally derives, rather than simply assumes, the existence of this range referred to by Lester. Furthermore, this chapter seeks to demonstrate, first, that once the costs associated with mobility are accounted for, persistent wage-rate differentials are entirely consistent with conventional wage-rate (labor-market) theory, and, second, the existence of geographic mobility (movement) costs tends to introduce a definite degree of indeterminacy into wage-rate analyses.

A Two-Region Economy with Perfect Factor Mobility

To begin our analysis, let us assume an economy consisting of two regions: region A and region B. In each of these two regions, the firms are assumed

to employ a single, perfectly homogeneous labor input, which is purchased under purely competitive labor market conditions.

The *short-run labor supply curve* in a region is defined as the *number of units of labor forthcoming from within the region in response to changes in that region's wage rate.* In this initial model, we assume (for simplicity) that the short-run labor supply curve is perfectly vertical, that is, perfectly wage-rate inelastic. In the model developed towards the end of this chapter, this assumption is relaxed.[2]

The *long-run labor supply locus* is defined, for the objectives and purposes of this chapter, as allowing for labor migration between the regions (A and B) in response to interregional wage-rate differentials.

At the very outset, we shall assume that regions A and B both have perfectly identical labor demand curves and perfectly identical short-run labor supply curves. In addition, all exogenously introduced demand changes are assumed to have a source (hereafter called the foreign sector) outside the regions and to be direct-able (perhaps because of a factor such as transport-cost considerations) at either region alone.

To facilitate the analysis, the long-run labor supply locus is first derived under conditions of "perfect mobility"; by "perfect mobility," it is meant that labor units will move between regions in response to any interregional differential in wage rates.[5] It is assumed here that regions A and B both have the same initial long-run equilibrium employment and wage levels. Region A's labor market is represented in figure 1-1, with the employment level *OS* and the wage rate *Se* determined at the intersection of labor demand curve *DD* and short-run labor supply curve *SS'*.

Let us now assume that the demand for labor units in region A increases to D_1D_1, possibly because of an increase in demand from the foreign sector for commodities produced in region A. In the short run, the wage in region A rises from *Se* to *Sa.* Given the assumption of perfect mobility, the higher wage rate induces migration of labor units from region B to region A. The short-run supply curve of labor in A begins shifting to the right and the wage falls from *Sa* along D_1D_1. With the out-migration of labor units from region B, the wage rate in B rises up along the labor demand curve (B's short-run labor supply curve shifts to the left), and the interregional labor flow continues until the wage-rate differential is eliminated.[6] Wage-rate equalization occurs at S_1b, when the number of labor units in A have increased by $S_1 - S$ units (and in B, decreased in like amount). Hence, point *b* defines one point on region A's long-run labor supply locus, whereas S_1S is the new short-run supply curve of labor in region A. Note that, although figure l-1 represents the labor market in region A, it also can be used, under these particular conditions, to indicate the wage in region B. In region B, the number of labor units has fallen by

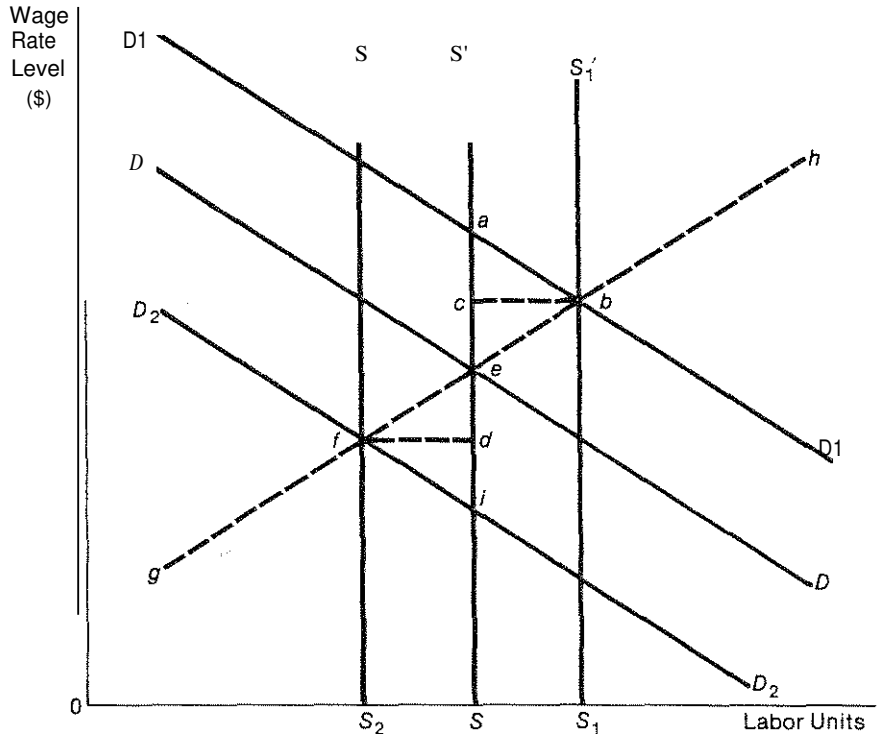

Figure 1-1. Perfect Interregional Factor Mobility

the amount $S_2 - S$, and the intersection of the unchanged labor demand curve and new short-run labor supply curves is a point on another (shifted) long-run labor supply locus for region B, with wage rate S_1b.

Yet more long-run equilibria can be derived by simply varying the demand for labor in region A while holding the demand for labor in region B unchanged (such as a decline in labor demand to D_2D_2, resulting in point *f,* with wage S_2 and employment level OS_1).[7] The locus of all such points is the long-run labor supply locus (curve) in region A and is shown as curve *gh,* which curve is compatible with any increase or decrease in the demand for labor in region A. If labor demand in region A falls from D_1D_1 back to DD, the equilibrium wage and employment levels in region A fall to the original values of *Se* and *OS,* respectively. One should also observe that the curve *gh* indicates the wage in region B for every long-run equilibrium wage or employment in region A.

The Model after Allowing for Mobility Costs

The next phase in this analysis is to impose a mobility cost constraint on the labor units, that is, to allow for the various possible costs associated with

geographic mobility. As Sjaastad (1962, p. 81) observes, there are two major types of private costs of migration:

> The private costs can be broken down into money and non-money costs. The former include the out-of-pocket expenses of movement, while the latter include foregone earnings and the "psychic" costs of changing one's environment.

For the purposes of this analysis, it is assumed that all such costs can be translated into pecuniary terms and hence can be translated into an absolute interregional wage differential, which must be overcome before any migration between the regions will take place.

Let us assume that the mobility cost constraint can be represented in figure 1-1 by the distance *de* on the initial short-run supply curve *SS'*. No movement from region B into region A will occur until the wage differential between the regions is greater than the amount *ec*; no movement out of region A into region B will take place until the wage-rate differential is greater than the amount *de*. The value of the mobility cost constraint is assumed to remain constant throughout this analysis (although, as a practical matter, it is likely to change over time due to such factors as technological advances and increased educational achievement).

The mobility cost constraint is also represented in figure 1-2, where the same initial equilibrium as in figure 1-1 is assumed. Once again, let the demand for labor in region A be increased from level *DD* to level D_1D_1, with a resulting wage increase from *Se* to *Sa*. Labor units move in response to the interregional wage differential, but now the movement ceases when region A's wage reaches $S_3 j$, with the labor employment level at OS_3. This is due to the existence of the mobility cost constraint. As region A's wage rate declines along curve D_1D_1, Region B's wage rate rises along the *gh* curve. When the wage rates in regions A and B are S_{3j} and $S_{3'j}$, the wage-rate differential at which no migration flow transpires is once again attained *(xj* is equal to *ec).* S›S; is the new short-run labor supply curve in region A. Thus, in response to this specific increase in labor demand, the labor migration is $S_3 - S$ rather than $S_1 -$ S as was the case with perfect mobility. Point *j,* not point *b,* is one point on the long-run labor supply locus of region A; the locus of such points derived from successive hypothesized increases in region A's labor demand from *DD* yields the long-run supply curve segment *ck*. Furthermore, successive decreases in labor demand from *DD* would yield the long-run supply segment *dl*. At this point in the analysis, the long-run supply curve of labor in region A appears to be the kinked locus *ldck* in figure 1-2. As before, given the assumption that the labor demand in region B remains unchanged, the curve *gh* indicates the wage in region B for any given long-run equilibrium in region A, once the mobility cost constraint is overcome.

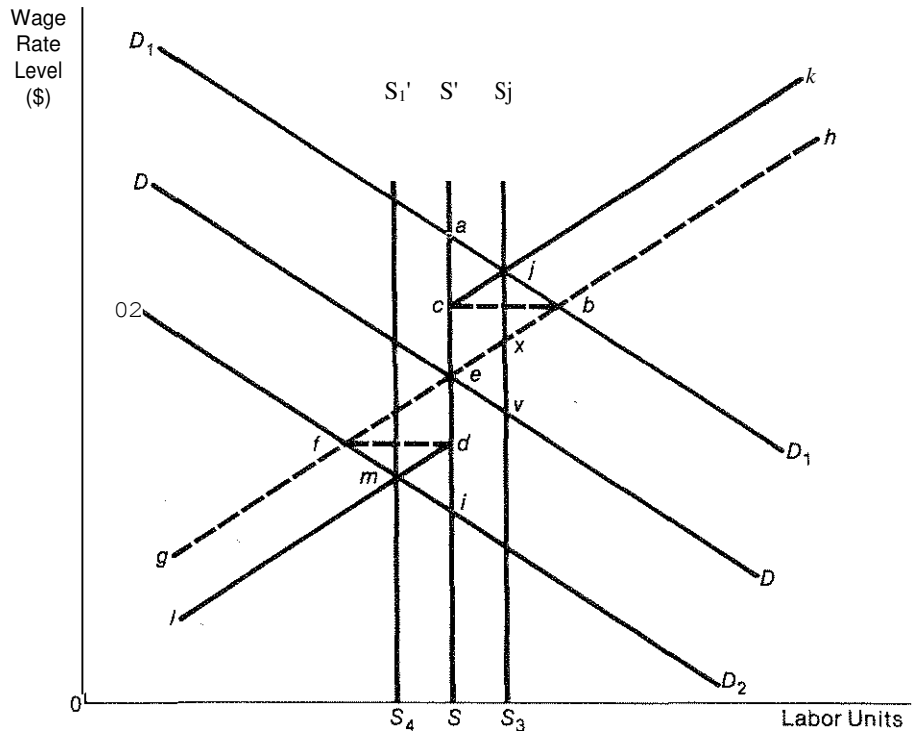

Figure 1-2. Mobility with Moving Costs

Of course, in order for the locus *ldck to* be region A's long-run locus, it must be consistent with all shifts in the demand for labor in region A. If labor demand in figure 1-2 falls from D_1D_1 to *DD,* the wage and employment levels in A will not fall back to *Se* and *OS.* There will be no out-migration from region A until A's wage level falls below S_3v. If the wage in region A falls to S_3x, it will be equal to that found in B. Hence, under the hypothesized conditions, the wage rate falls from S_3 to S_3v, but the employment level remains unchanged at OS_3 units. Hence, point *v* must be a point on the long-run labor supply locus in region A, as must every other point on segment *vj* along the short-run labor supply curve $S_3S_{3'}$, since each of these points represents a potential long-run equilibrium position. The consequences of such adjustments are illustrated in figure 1-3.

The Long-Run Labor Supply Range

Refer now to figure 1-3. If the demand for labor units in region A had increased from *DD* to $D_3D_{3'}$ the in-migration adjustments would have led to a new equilibrium wage of S_5n and a new equilibrium employment level of OS_5 in region A (and a wage rate of S_5y in region B). On the other hand, if the demand for labor in region A were to decline to $D_1D_{1'}$ the wage

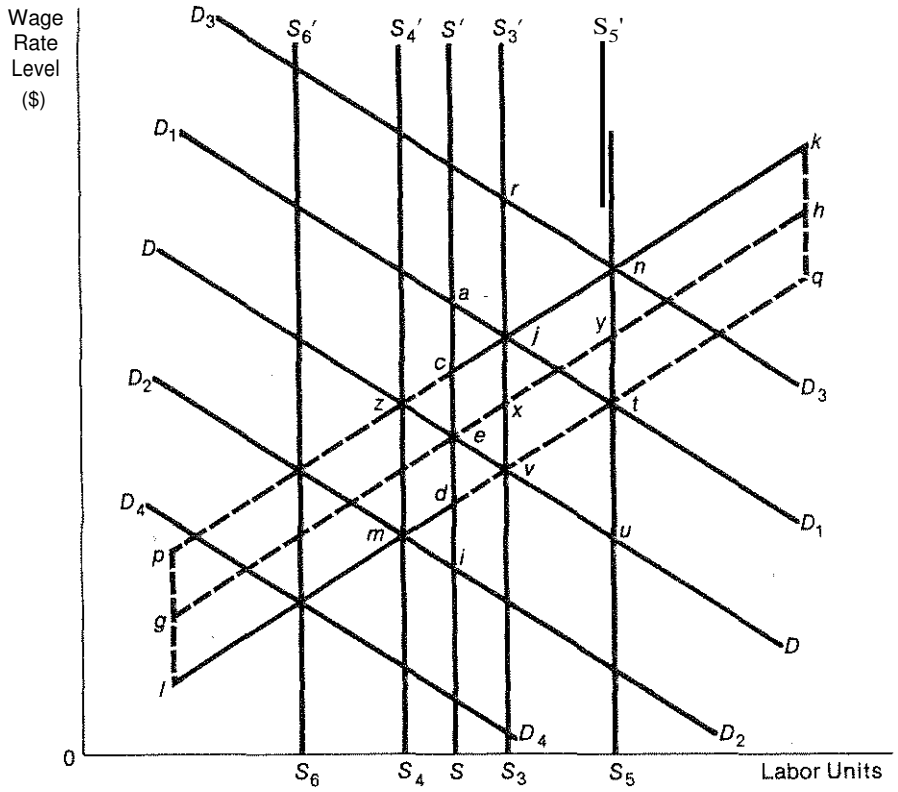

Figure 1-3. Long-Run Labor Supply

would decline to $S_5 t$, with no out-migration at all occurring. Observe again that point t represents a potential long-run equilibrium and that any labor demand decrease between $D_3 D_3$ and $D_1 D_1$ would have resulted in a long-run equilibrium somewhere along the segment nt. If a further fall in labor demand is then allowed, say to DD, the short-run wage level declines to $S_5 u$, which overcomes the cost constraint on out-migration. Out-migration occurs and continues until the wage in region A rises to $S_3 v$ (and falls to $S_3 x$ in B) where the mobility cost constraint differential is once again attained. All points derived in this fashion would yield the segment dq. The very same procedure in figure 1-3 may be applied to rises in demand from $D_4 D_4$ to obtain the segment pc.

Clearly, this analysis implies the existence of a range of potential long-run combinations of equilibrium employment levels and wage rates. Hence, this analysis implies the existence of a long-run supply range of labor units rather than a long-run supply curve of labor units. In figure 1-3, the long-run supply range is represented by area $lpkq$. The boundaries of this range are determined by the value of the mobility cost constraint. Clearly, under the posited conditions, any combination of the employment level and wage rate within or on the range is entirely compatible with long-run labor-market equilibrium in the region.

Conclusions

The model analyzed above clearly indicates that persistent interregional wage differentials can be completely compatible with conventional wage theory once there is an allowance made for the costs associated with migration.[8] In point of fact, interregional wage-rate differentials seem more likely to exist than interregional wage-rate equality, as Gallaway and Cebula (1972) have argued elsewhere in a different context. Also, the existence of a long-run supply range rather than a curve introduces an element of indeterminacy into wage analysis. Empirical studies that attempt to explain why a particular wage differential exists may reach rather different conclusions, depending upon whether or not the wage rates examined lie within or on the boundaries of the range.[9] In addition, the actual location within or on the range boundaries may influence the conclusions of studies that attempt to determine the migration responsiveness of labor to wage changes. Labor can be expected to respond quite differently if wage-rate changes start from a location on one of the boundaries of the range rather than from a location within the boundaries. In the former case, labor might appear to be extremely mobile, whereas in the latter case, labor might appear to be extremely immobile.[10]

An Alternative Model

The conclusions derived from the analysis above can be obtained without the assumption that the short-run labor supply curve is perfectly vertical. We once again deal with a two-region economy (regions A and B). Regions A and B are assumed to have identical initial labor demand and short-run labor supply curves. In contrast to the preceding analysis, however, the short-run labor supply curves are positively sloped, reflecting a direct relationship between the quantity of labor supplied within a region and that region's wage rate.[11]

In figure 1-4, region A's labor market is shown in panel (a), whereas region B's labor market is shown in panel (b). Given the initially identical curves for both regions, there is an initial interregional wage-rate equality.

Let us now postulate an exogenous rise in the demand for labor in region A, from D_1D'' to D_2D_2. The money wage rate in region A rises above that in region B, and thus migrants flow out of region B into region A. This shifts the short-run labor supply curve in region A to the right and the short-run labor supply curve in region B to the left. These shifts in turn reduce the increase in A's wage rate and cause the wage rate in B to rise. Ultimately, there is interregional wage-rate equality between A and B. In addition, in region A, the labor market has moved from point *a* to point *c*.[12]

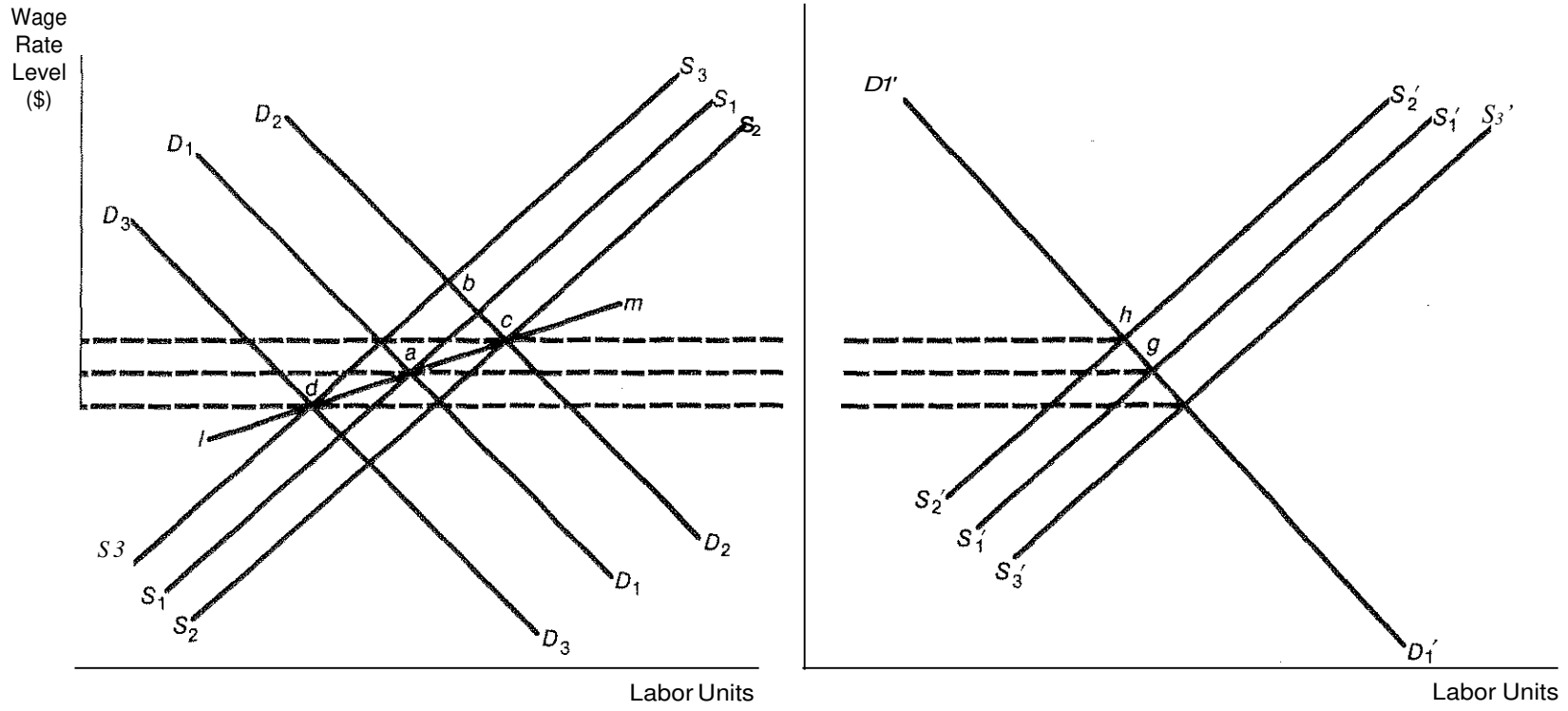

Figure 1-4. Perfect Factor Mobility

Thus, points *a* and *c* in figure 1-4 are two points on region A's long- run labor supply locus (curve).

Had labor demand in region A shifted down, say from D_1D_1 to D_3D_3 the wage rate in A would have declined below that in B. Out-migration from A to B would have shifted the short-run labor supply curve in A to the left and the short-run labor supply curve in B to the right. Ultimately, region A would have ended up in equilibrium at a lower wage (as would region B). The new equilibrium point for region A is shown by point *d* in figure 1-4, at the intersection of D_3D_3 and S_3S_3. Thus, points *a, c,* and *d* are three points along region A's Jong-run labor supply curve. Repeating this procedure will result in the long-run labor supply locus (curve) *lm* (in figure 1-4). Note that, as in figure 1-1, under conditions of perfect mobility, the region faces a long-run labor supply *curve.*

The discussion up to this point has assumed costless interregional migration flows. However, as noted earlier, it is reasonable to assume that there are cost barriers to the free flow of labor between regions. We once again assume that all such costs of movement between regions A and B can be translated into a pecuniary equivalent and thus into an absolute interregional wage-rate differential that must be overcome before any interregional migration will take place. Consider figure 1-5, where curves D_1D_1, S_1S_1, D_2D_2, and S_1S_1 from figure 1-4 are reproduced. Using the points *a* and *g* as the initial equilibrium positions, we assume that the mobility cost constraint is given in figure 1-5 by the distance *su* (= *st*). The interpretation here is quite simple. No movement of labor from A to B will occur until the wage rate in region A falls by more than the amount *su* (given the wage rate in B). Similarly, no movement of labor from B to A will occur until the wage in A rises by more than the amount *st.* Restating it somewhat differently, no labor movement from A to B will take place until the wage-rate differential exceeds the amount *su;* and no such movement to A from B will take place until the differential exceeds the amount *st.*

Now let labor demand in A rise from D_1D_1 to D_2D_2, holding B's labor demand curve constant. Equilibrium A will then move to point *b.* Since the wage-rate differential does not overcome the mobility cost constraint, A's short-run supply of labor curve remains at S_1S_1. Thus, points *a* and *b* lie on A's long-run supply of labor curve. Similarly, if A's demand curve had shifted from D_1D_1 to D_3D_3, another point (point c) on A's long-run supply of labor curve is derived, one which does not bring about any interregional flows of labor. Consequently, the short-run supply of labor curve in B remains at $S'_1S'_1$.

Now let labor demand in region A rise from D_1D_1 to D_4D_4. Initially, the wage rate in A will rise toward point *d,* and since the interregional wage-rate differential exceeds the amount of the mobility cost constraint, labor will flow from region B to region A. This shifts A's short-run supply of

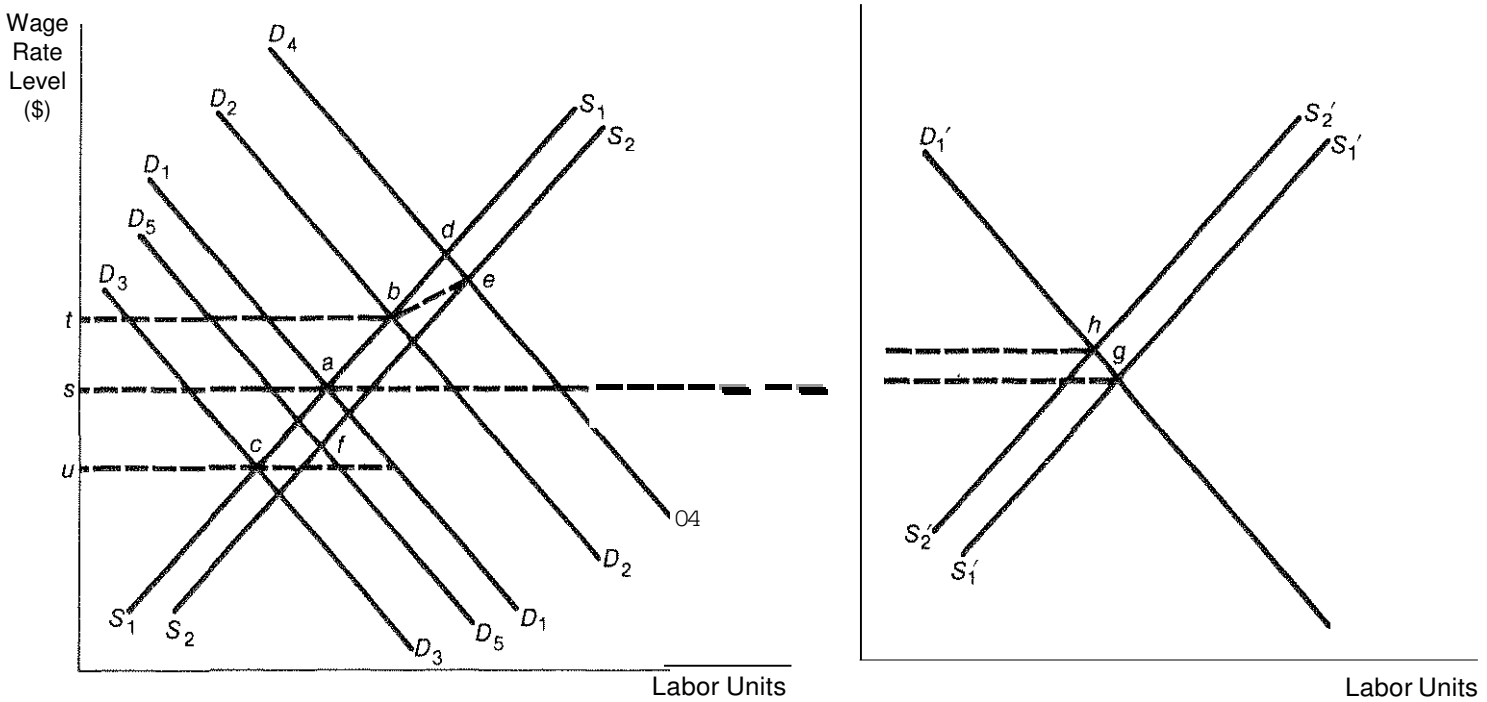

Figure 1-5. Migration with Moving Costs

labor curve to the right (and B's to the left). Labor units will continue to flow from B to A until an interregional wage-rate differential equal in amount to *st* is established at some points such as *e* in region A and *h* in region B. Point *e* is another point on the long-run supply of labor locus in region A.

With the equilibrium at point *e,* once again a mobility cost constraint is identified. Now consider a decline in demand in region A, after the establishment of equilibrium point *e.* The wage rate in A will have to decline below that in B by an amount greater in magnitude than *st* before any labor will flow from A to B. In figure 1-5, the marginal point below which an interregional flow of labor from A to B will now take place is given by point *f.*

Summary

This chapter has developed two alternative models of interregional migration and wage-rate determination. There are important implications that follow from both models. First, there is likely to be a substantial range of interregional wage-rate differentials that will not elicit interregional migration flows.[1 3.] Second, persistent interregional wage-rate differentials are entirely compatible with conventional wage-rate analysis-once geographic movement costs have been allowed for. Third, there is likely to be a substantial degree of indeterminacy in interregional wage-rate analysis.

One final observation can now be made. The models presented here suggest that the sensitivity of interregional migration to interregional wage-rate differentials may depend upon the presence or absence of systematic labor demand shifts in one direction in one region. That is, if in figure 1-5, labor demand in region A continues to shift rightwards, interregional migration into region A will take place *pari passu.* However, should the labor demand shifting reverse direction, reverse migration from A to B may very well not occur, and the apparent sensitivity of migration to interregional wage-rate differentials may thus disappear. This suggests that where there is not a systematic growth in labor demand in one region vis-a-vis another, interregional migration may display an apparent insensitivity to wage-rate differentials.

Notes

1. See, for example, Benham, Maurizi, and Reder (1968), Bunting (1961), Cebula, Kohn, and Vedder (1973), Cebula and Vedder (1973),

Chapin, Vedder, and Gallaway (1970), Fuchs (1967), Fuchs and Perlman (1960), Gallaway (1967), Gallaway and Cebula (1972), Gallaway and Vedder (1971), Gatons and Cebula (1972), Greenwood (1969), Greenwood and Sweetland (1972), Krueger (1968), Lampman (1956), Raimon (1962), Rottenberg (1956), Sjaastad (1962), Vanderkamp (1971), and Ziegler (1976).

2. Thus, if *LA* is the number of internally supplied units of labor in region A and is the money wage rate in region A, we are assuming initially that:

$$\partial L_A/\partial W_A = 0$$

Later on in this chapter, we shall relax this assumption so that

$$\partial L_A/\partial W_A > 0$$

3. This section essentially combines and expands the analyses in Lester (1952), Sjaastad (1962), Nourse (1968), Gatons and Cebula (1972), and Gallaway (1969).

4. For simplicity and to facilitate this exposition, we assume that (a) the total labor force in the economy (regions A and B combined) is fixed (initially) and (b) that there is no technological change, embodied or disembodied. Thus, our definition of the long-run labor supply locus arbitrarily excludes quantitative and qualitative changes in the labor force of regions A and B combined so as to focus on the crucial variables of the analysis. Absolute wage differentials, rather than relative wage differentials, are used here only to simplify the analysis. The basic concepts and conclusions of the model do not change with the use of relative wage differentials. Assumption (a) is relaxed later on in the chapter.

5. See Lerner (1952), Nourse (1968), or Samuelson (1948).

6. See Lerner (1952), Nourse (1968), or Samuelson (1948).

7. In places where the models developed in this chapter use a decrease in labor demand and decrease in absolute wage rates, it is merely to simplify the derivation of the long-run labor supply curve. In real world situations, it seems quite likely that wage differentials would result from differential increases in labor demand between regions.

8. Sjaastad (1962).

9. Regarding the causes of such differentials, the reader is referred to Gallaway and Cebula (1972) and Scully (1969) and (1971).

10. Obviously, the terms mobile and immobile refer to the sizes of dL_A / dW_B and dL_B / dW_A.

Although it is assumed in figures 1-4 and 1-5 that

$$\partial^2 L_A/\partial W^2{}_A = 0$$

as in Nourse (1968), the analysis could be easily extended to allow

$$\partial^2 L_A/\partial W^2{}_A \gtrless 0$$

11. Although the wage rate in region A initially was approaching point *b,* the interregional migration from B to A shifted the short-run supply curve rightwards from $S_1 S_1$ to an ultimate location of $S_2 S_2$.

12. Note that this range was logically derived, not simply assumed.

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2 Differentials and Indeterminacies in Interregional Wage-Rate Analysis

Introduction

Chapter 1 develops two analytical models, each of which formally derives, rather than assumes, the wage-rate range discussed by Lester (1952). Moreover, both of the models constructed in chapter 1 demonstrate, first, that once the costs associated with mobility are accounted for, persistent interregional wage-rate differentials are entirely consistent with conventional wage-rate theory and, second, the existence of movement costs tends to introduce a definite degree of indeterminacy into wage-rate analysis.

The crux of the analysis in chapter 1 is that interregional wage-rate differentials must be adequately large to compensate labor units for the costs associated with mobility if the conventionally expected relationship between wage-rate differentials and human migration is to be observed. In other words, it can be argued that empirical studies that attempt to explain why a particular wage differential exists may reach rather different conclusions, depending upon whether or not the wage rates examined lie within or on the boundaries of the range. Going further, it is argued that the actual location within or on the range boundaries may profoundly influence the conclusions of studies that attempt to determine the migration responsiveness of labor to wage-rate changes. Labor can be expected to respond quite differently if wage-rate changes start from a location on one of the boundaries of the range rather than from a location within the boundaries of the range. In the former case, labor might appear extremely mobile, whereas in the latter case, labor might appear extremely immobile. The present chapter is directed explicitly at evaluating the empirical validity of these arguments.

In order to test these hypotheses, this chapter proposes to investigate the empirical relationship between net population migration and income (wage) levels, by state, within the United States. The analysis deals with the 1965-1970 time period.

Assuming that population and labor flows can be regarded as identical in this context, orthodox economic theory predicts that the higher the wage-rate (income) level in a state, the greater the net migration to that state, ceteris paribus. Furthermore, such theory, as modified by chapter I of this book, clearly implies that individuals living in states with either extremely high or extremely low wage rates will be more responsive to interstate wage differentials than those living in states with wage levels near the general average for the economy. This suggests that if only states with very high or very low wage levels are considered, the empirical relationship between net

migration and wages should be much stronger than among states with intermediate wage levels. For that reason, we have divided the forty-eight contiguous states into three different groups: one including the twelve states with the highest wage levels; one including the twelve states with the lowest wage levels; and another containing the other twenty-four states. If the hypothesis is valid, we should observe a greater sensitivity of net migration to wage differentials in the groups with extremely high or low income levels.[1]

The Basic Model

In order to carry out the empirical testing of the basic hypothesis formulated in chapter 1, we first consider the following model of net out-migration:

$$Mi = Mi\,(Yi,\ QOLi) \tag{2.1}$$

where Mi = a measure of net migration out of area (state) i
Yi = a measure of the average income level in area (state) i
$QOLi$ = an indicator of the quality of life in area (state) i

At the outset, we observe that this analysis is concerned solely with net (as opposed to gross) migration patterns. The reasoning here is quite simple. Namely, as Liu (1975, p. 329) notes, most empirical migration analyses are expressly

> …concerned with a gross migration, and they always agree that employment or income consideration dominates other factors in making locational decisions among migrants. However, it should be noted that it is… *net* migration…that directly affects…labor force growth and, consequently, regional growth.

Next, also following Liu (1975), we acknowledge the need in our analysis to include quality-of-life considerations when trying to analyze migration patterns. To provide some measure of the quality-of-life variable, *QOL,* we introduce two dummy variables, *DW and DA,* where:

DW = a dummy variable to indicate a "western" state; if a state is classified as western, the variable takes on a value of one, and if a state is not classified as western, the variable assumes a value of zero.

DA = a dummy variable to indicate a "warm weather" state; if a state is classified as being warm weather, the variable assumes a value of one, and if a state is not classified as being warm weather, the variable takes on a value of zero.

Let us now hypothesize signs for $\partial Mi/\partial DWi$, and $\partial Mi/\partial DAi$. As Liu (1975) has argued, people generally view location in the West as desirable because they perceive the general quality of life (amenities of all sorts) as being superior in the West.

Hence, other things being equal, we expect that

$$\partial Mi/\partial DWi < 0 \qquad (2.2)$$

Next, following Cebula and Vedder (1973), Greenwood (1969), Liu (1975), and others, it is argued here that people, on the average, prefer locations in warmer or more moderate climates. Hence, we would expect, ceteris paribus, that

$$\partial Mi/\partial DWi < 0 \qquad (2.3)$$

Thus, people are hypothesized here as being quite reluctant to migrate from western or from warm weather states.

The states classified as western states and as warm weather states are listed in table 2-1. As shown, it is entirely possible for a given state to be classified as both a warm weather and a western state (witness, for example, the case of Arizona).

Table 2-1
Classifications of States

The Western States	*The Warm Weather States*
Montana	Maryland
Wyoming	Virginia
Colorado	North Carolina
New Mexico	South Carolina
Idaho	Georgia
Utah	Florida
Nevada	Kentucky
Arizona	Tennessee
Washington	Alabama
Oregon	Mississippi
California	Arkansas
	Louisiana
	Texas
	New Mexico
	Arizona
	California

According to the basic hypothesis from chapter 1, it is expected here that

$$|\partial Mi/\partial Yi| \text{ for high or low income states} > |\partial Mi/\partial Yi| \text{ for intermediate income states} \qquad (2.4)$$

In other words, those states having very high or very low income levels will probably not lie within the boundaries of the interregional wage range; consequently, migration should in these cases appear to be (empirically speaking) highly sensitive to income differentials. On the other hand, states that have more intermediate (average) income levels will tend to lie within the boundaries of the range; thus, in these cases, migration will tend to exhibit a relative insensitivity to income differentials.

Empirical Analysis

In order to test the hypothesis in equation 2.4 empirically, we rewrite equation 2.1 in the following linear regression form:

$$Mi = a_0 + a_1 Yi + a_2 DWi + a_3 DAi + \mu \qquad (2.5)$$

where a_0 = constant
Mi = net interstate migration *out of* state *i,* 1965-1970, expressed as a percent of state *i's* total population
Yi = 1965 per capita income in state *i*
DWi, DAi = as above, in equations 2.2 and 2.3
μ = error term

The income variable pertains to the beginning of the period considered here. The reasoning for this derives from Greenwood's argument (1975, p. 519) that simultaneity bias can be encountered in studies that use variables "…defined for the end of the period…to explain migration that occurred over the period."

Equations 2.2 and 2.3 imply here, for all state groupings, that

$$a_2, a_3 < 0 \qquad (2.6)$$

From inequality 2.4, it is expected that |a1| for high or low income states

> |a1| for intermediate income states (2.7)

Estimating equation 2.5 by ordinary least squares for the three sets of states yields the following results:

For high income states:

$$Mi = +28.75609 - 0.01310\,Yi^{**} \quad (+0.003)$$

$$- 3.045\,DWi^{*} - 5.43\,DAi^{**} \quad ; \quad (+1.301) \quad (+1.53)$$

$$DF = 8 \qquad R^2 = 0.84 \qquad F = 13.69^{**} \qquad (2.8)$$

For low income states:

$$Mi = +15.96611 - 0.00701\,Yi^{*} \quad (+0.003)$$

$$- 5.2651\,DAi^{*} \quad (+0.738)$$

$$DF = 9 \qquad R^2 = 0.85 \qquad F = 25.43^{**} \qquad (2.9)$$

For intermediate income states:

$$Mi = +10.20421 - 0.00501\,Yi \quad (+0.006)$$

$$- 2.1581\,DWi - 9.88\,DAi^{**} \quad (+1.734) \quad (+2.139)$$

$$DF = 20 \qquad R^2 = 0.56 \qquad F = 8.366'' \qquad (2.10)$$

Those variables marked with a single asterisk are statistically significant at the 0.05 level, while a double asterisk indicates statistical significance at the 0.01 level, where terms in parentheses are standard errors.[2]

To aid the reader in interpreting the results in equations 2.8, 2.9, and 2.10 of this chapter, Tables 2-2 and 2-3 are provided. Table 2-2 indicates the means and standard deviations for each of the exogenous variables in each of the estimated equations. Table 2-3, in turn, indicates the contribution to R^2 attributable to each exogenous variable in each of the three estimated equations.

Overall, the results in equations 2.8 through 2.10 are very encouraging. All eight of the estimated coefficients had the correct signs. In addition, six of these eight coefficients were statistically significant at the 0.05 level or beyond. Moreover, the F-ratios were all statistically significant at the 0.01 level or beyond. Finally, the R^2 values in equations 2.8 and 2.9 were 0.84 and 0.85, respectively, so that the model explains the vast majority of the net out-migration from high- and low-income states; in fact, the model even explains a majority of the net out-migration from the intermediate income states.

Before commenting on the income variable, we observe that the quality of life, as reflected in the dummy variables *(DW* and *DA)* was a basically

Table 2-2
Means and Standard Deviations by State Grouping

State Grouping	*Variable*	*Mean*	*Standard Deviation*
High Income	*Y,*	2,245.75	188.39
	DW,	0.25	0.45
	DA,	0.17	0.39
Intermediate	*Y;*	1,706.92	149.31
Income	*DW,*	0.33	0.48
	DA ,	0.2!	0.41
Low income	*Y;*	1,272.17	1ll.06
	DA ,	0.75	*OAS*

Table 2-3
Change i11 R^2 Attributable lo Selected Variables

State Grouping	*Variable*	*Change in* R^2
High income	*Y*	0.213
	DW	0.367
	DA	0.257
Intermediate income	*Y*	0.013
	DW	0.063
	DA	0.481
Low income	*Y*	0.081
	DA,	0.768

very important determinant of human migration. This is entirely consistent with a number of earlier studies, including Cebula and Vedder (1973), Greenwood (1969), and Liu (1975).

Now we consider the results on the income variable. In equations 2.8 and 2.9, the coefficient for income is statistically significant at the 0.01 and 0.05 levels, respectively. In addition, as table 2-3 indicates, the income variable contributes an R^2 of 0.213 and 0.081 to equations 2.8 and 2.9, respectively. Thus, we conclude that net out-migration from high-income states on the one hand and from low-income states on the other are both significantly affected by income. By constrast, as equation 2.10 and table 2-3 both reveal, income was not a significant determinant of net out-migration from intermediate income states.[3,4]

Conclusion

The empirical analysis in this chapter constitutes strong evidence in support of the analytical models developed in chapter 1.[5] We may, among other things, thus conclude that an interregional wage-rate range does exist in the real world. Furthermore, in practical reality, we might then expect that studies which attempt to explain why a particular interregional wage-rate differential exists may reach rather different conclusions, depending upon whether or not the wage rates examined lie within or on the boundaries of this range. As shown in equations 2.8 through 2.10, migrants can be expected to react quite differently if wage-rate changes start from a location on one of the boundaries of the range rather than from a location within the boundaries of the range. Hence, we must be very cautious, both in specifying migration models and in interpreting regression results.

Notes

1. The states of Alaska and Hawaii are excluded from this analysis. Washington, D.C., is excluded as well.

2. It should be observed, as equation 2.9 implies, that none of the low income states in the year 1965 fell into the western state category.

3. We might also observe here that the income coefficients in equations 2.8 and 2.9 were both larger than that in equation 2.10.

4. Results somewhat analogous to those in regressions 2.8 through 2.10 were obtained in the analysis of interregional capital flows in the recent study be Cebula and Zaharoff (1974).

5. This chapter also provides direct support for the conceptual analysis developed by Sjaastad (1962).

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3 Race and the Sensitivity of Migration to Income Differentials

Introduction

As the two preceding chapters indicate, migration rates can refer to the flow of all migrant types combined. In point of fact, historically, most studies have taken this form. It has, however, become increasingly prevalent in recent years for the literature to examine migration patterns which are disaggregated according to race, that is, white and nonwhite (Bowles 1970, Chao and Renas 1976, Delong and Donnelly 1973, Kau and Sirmans 1976). Along these lines, we may observe that one of the more interesting results reported by researchers studying the causes of human migration in the United States is that nonwhites appear, on the average, to be relatively more sensitive (responsive) than whites to interregional income differentials in formulating their migration decisions (Greenwood 1976, Pack 1973, Sommers and Suits 1973-at least for the years 1960-1970). This chapter seeks to provide the reader with insights into the possible reasons for these empirical results.

A Hypothesis

One of the leading American scholars in the field of migration, Professor Michael Greenwood, has offered a hypothesis to explain the apparent differences in the responsiveness of white and nonwhite migrants to geographic income differentials. Specifically, Greenwood (1976) has suggested that the level and availability of welfare benefits are both likely to be of great concern to low-income people and, consequently, to nonwhites. Greenwood (1976, p. 11) also notes that the

> ...level of per capita welfare benefits is significantly more highly correlated with the level of nonwhite income than with the level of white income.... Hence, for nonwhites, the destination income level may serve as a better proxy for the availability of welfare benefits of various sorts.

Greenwood thus holds that the nonwhite income level represents more than just income to nonwhites and hence is likely to influence nonwhites more than white income would influence whites.

The purpose of this particular chapter is to investigate formally the possible reasons for the differential white-nonwhite migration flow sensitivity

to geographic income differentials. Initially, the analysis focuses on the hypothesis of Greenwood (1976); ultimately, however, it will turn to a brief discussion of various possible alternatives to the Greenwood hypothesis.

Empirical Analysis

To examine Greenwood's hypothesis, we turn to a rather simple empirical model of migration. Given that this chapter is not attempting to explain as much migration behavior as possible, it does not include all the variables which have been shown elsewhere to affect the migration calculus. The basic model, which consists of a separate equation each for white migration and black migration, is given by the following:

$$Mi = M\ (Y^{(+)}, DW^{(+)}, Warm^{(+)}) \tag{3.1}$$

$$Mi = M\ (Y^{(+)}, DW^{(+)}, Warm^{(+)}) \tag{3.2}$$

where $M_i^w (M_i^B)$ = net number of white (black) migrants into state between 1965 and 1970, expressed as a percentage of that state's white (black) population in 1970[1]

$Y_i^w (Y_i^B)$ = median family income in state i, in 1969, for whites (blacks)[2]

$West_i$ = a western location dummy, taking on the value of one when the state is located in the West and taking on the value of zero otherwise

$Warm_i$ = average January temperatures for state i[3]

The figures used in this chapter to estimate the equations are for some forty-eight states for which sufficient data were available. The expected signs of the coefficients to be estimated are found in parentheses over each of the respective explanatory variables in the equations. The sign for Y is expected to be positive on the grounds that people are likely to be attracted to and not so likely to leave a state where family income is relatively higher.[4] The hypothesized sign for the variable *DW* is positive. It is expected that people have a preference for location in the western United States, due to quality-of-life considerations (Gallaway and Cebula 1973 or Liu 1975).[5] The hypothesized sign for the variable *Warm* is also positive, suggesting that people tend to prefer locating in areas that have comparatively warmer or more moderate climates (Cebula and Vedder 1973, Graves 1976, or Liu 1975).

Empirical results from the ordinary least squares estimations of 3.1 and 3.2 are presented in equations 3.3 and 3.4, respectively:

$$Mi = -13.92633 + \underset{(+3.20)}{0.00096\,Yi}^{***} + \underset{(+0.54)}{0.53675\,DWi} + \underset{(+4.24)}{0.14011\,Warmi}^{***}$$

$$R^2 = 0.38 \qquad DF = 44 \tag{3.3}$$

$$M = -26.1923 + \underset{(+3.23)}{0.00294\,Yi}^{***} + \underset{(+0.54)}{0.1123\,DWi} + \underset{(+4.24)}{0.1846\,Warmi}^{***}$$

$$R^2 = 0.19 \qquad DF = 44 \tag{3.4}$$

A single asterisk indicates significance at the 0.10 level, a double asterisk significance at the 0.05 level, and a triple asterisk significance at the 0.01 level, where terms in parentheses are t-values.

In both regressions, all the estimated coefficients have the hypothesized signs. Coefficients for two of the three variables in each regression, *Y* and *Warm,* are statistically significant at the 0.05 level or better. Most relevant for this analysis is the result that the magnitude of the estimated coefficient for Y in the black regression, 0.00294, is over three times the magnitude of the estimated coefficient for Y in the white regression, 0.00096. Thus, in terms of the white-nonwhite (black) differential in the income sensitivity of migration flows, these findings are entirely compatible with those in Greenwood (1976), Pack (1973), and Sommers and Suits (1973) (for the 1960-1970 period).

In order to test empirically Greenwood's hypothesis that the differential income sensitivity of migration between whites and nonwhites (blacks) is a consequence of welfare considerations, we replace Y^w (Y^b) in the white (black) equation with two new variables, *E* and *AFDC*. E^w (E^b) is the value of median earnings of employed whites (blacks) in state *i* in 1969.[6] *AFDC;* is the average monthly payment per family under the Aid to Families with Dependent Children Program, in state i, in 1970. The expected sign for *E* in both equations is positive, since people of both races presumably would prefer a state where earnings are higher to a state where earnings are lower, ceteris paribus. For the variable *AFDC,* we hypothesize a positive coefficient in the black regression and a negative coefficient in the

white regression. Since blacks are relatively poor and many lack marketable skills, we would expect that they would be attracted to states offering relatively high welfare benefits.[8] Whites, on the other hand, who (on the average) have higher incomes than blacks, may view a state in which welfare benefits are relatively high as unattractive since high welfare benefits may indicate a fiscal system that places great emphasis on redistributing income from those who have to those who have not (Aronson and Schwartz 1973). By replacing Y^w (Y^b) and *AFDC,* we decompose income received into an earned component and an unearned income component (welfare). [9] If Greenwood is correct in his argument that the income received variable is more important for nonwhites (blacks) than for whites because income received is picking up the effects of the welfare factor, then we should expect the coefficient of $E\,w$ in the white regression equation to be approximately equal to the coefficient of EB in the black regression equation.

The ordinary least squares are given by equations 3.5 and 3.6 below:

$$\begin{aligned} Mi = {} & -13.14279 + 0.00143\ Ei^{***} \\ & \qquad\qquad (+2.65) \\ & -0.0053\ AFDCi + 0.27386\ DWi \\ & (-0.56) \qquad\qquad (+0.26) \\ & +0.12972\ Warmi^{***} \\ & \quad (+3.33) \\ R^2 = 0.35 \qquad & DF = 43 \end{aligned} \tag{3.5}$$

$$\begin{aligned} Mi = {} & -22.69286 + 0.0037\ Ei^{***} \\ & \qquad\qquad (+3.97) \\ & +\ 0.0041\ AFDCi + 2.437\ DWi \\ & \quad (+0.20) \qquad\qquad (+1.08) \\ & +0.1107\ Warmi^{*} \\ & \quad (+1.32) \\ R^2 = 0.32 \qquad & DF = 43 \end{aligned} \tag{3.6}$$

Once again, all of the coefficients exhibit the hypothesized signs. Two of the variables in each equation, *E* and *Warm,* have coefficients that are statistically significant at the 0.10 level or better. The coefficient for the welfare variable is not statistically different from zero in either equation. Most pertinent for the present analysis is a comparison of the coefficients of the earnings variables. The size of the coefficient of *EB* in the black regression equation,

0.00373, is (once again) nearly three times the size of the coefficient of E_{win} the white regression equation, 0.00143. Hence, it would appear that Greenwood's hypothesis that the observed white-nonwhite (black) differential in the income sensitivity of migration is a consequence of welfare benefit considerations is in fact unsubstantiated by the actual empirical results.

Data Sources

Given the extreme importance in this particular study of the distinction between earnings on the one hand and income received on the other, it may be helpful to the reader to know the precise data sources used in this study. These are listed in the Notes section of this chapter.

Alternative Hypotheses

The observed disparity of white-nonwhite migration sensitivities to geographic income differentials appears to be the result of some factor(s) other than welfare. One possible explanation may be that given by Pack (1973) that simply because nonwhites (blacks), on the average, are relatively poorer than whites, they may be more sensitive to interregional income differentials in formulating their migration decisions. The reasoning here is that since nonwhites on the average have lower incomes than whites, the process of moving from one area to another and receiving the prevailing income there would yield considerably greater benefits (relatively speaking) for nonwhites than for whites. Another possible explanation involves skill-level differentials that exist between the races. Whites may be more likely than nonwhites (blacks) to migrate as a result of a job transfer or a new job offer. Given that whites, on the average, possess more specialized skills than nonwhites (blacks), there in fact may be a smaller number of employers who could utilize the services of whites. Thus, it would be fairly risky for many whites to migrate in response to interregional income differentials and, once in the new location, then to search for employment. Since nonwhites (blacks), however, tend on the average to possess less specialized skill, the risks would be considerably less for them.

Clearly, although this chapter has helped to clarify the basic issue here, the issue nevertheless remains fundamentally unresolved. Perhaps future research may yield more positive insight.

Notes

1. Data source for *M:* U.S. Bureau of the Census, *Census of the Population: 1970,* Subject Reports, Final Report PC (2)-2B, *Mobility for*

States and the Nation, Washington, D.C., 1972, Table 58 and U.S. Bureau of the Census, *Census of the Population: 1970,* Vol. 1, *Characteristics of the Population,* Part 1, United States Summary-Section 1, Washington, D.C., 1972, Table 60.

2. Data source for *Y:* U.S. Bureau of the Census, *Census of the Population: 1970,* Vol. 1, *Characteristics of the Population,* Part 1, United States Summary-Section 2, Washington, D.C., 1972, Table 345.

3. Data source for *Warm:* U.S. Bureau of the Census, *Statistical Abstract of the United States, 1969,* Washington, D.C., 1969, Table 262.

4. Median family income, as opposed to per capita income, is used here for reasons stated in Graves (1976). In particular, it is felt that median family income is the preferred variable since variation from state to state in the percentage of children, retired people, and other non-workers would make per capita income an imperfect measure of the expected income that could be obtained through migration.

5. The western states are Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, Oregon, California, Alaska, and Hawaii. Related to this classification, see Gallaway and Cebula (1973).

6. Data source for *W, E:* U.S. Bureau of the Census, *Census of the Population: 1970,* Vol. 1, *Characteristics of the Population,* Parts 2-52, Washington, D.C., 1972, Table 195.

7. Data source for *AFDC:* U.S. Bureau of the Census, *Statistical Abstract of the United States, 1971,* Washington, D.C., 1971, Table 467.

8. Welfare may be viewed as a form of income or as a form of long-term unemployment compensation.

9. Several studies, including those by Pack (1973), Chao and Renas (1976), De.Jong and Donnelly (1973), Kau and Sirmans (1976), and Sommers and Suits (1973), include both income received variables and welfare variables in the same equation. This is a technical misspecification since welfare payments are already embodied in income received.

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4 A General Theory of Migrant Behavior

Introduction

The preceding chapters have basically stressed the role of current income in determining geographic mobility in the United States. In point of fact, most empirical studies and most theoretical studies of internal migration in this country have treated current income as *the* fundamental causal factor in migration.

Although this approach to analyzing migration behavior has been reasonably useful in many respects, it is not sufficiently rigorous or sophisticated to forecast migration flows accurately and in depth. In other words, the conventional analysis of migration behavior is far too elementary to deal adequately with the myriad of forces that influence contemporary migration patterns.

Accordingly, this chapter seeks to develop a rigorous model of the determinants of human migration. The analysis begins by developing a model of individual human migration. Once this model has been completely constructed, a model of aggregate human migration flows is developed. A theoretical application of these models is then presented in the closing section.

A Model of Individual Human Migration

This section develops a model of individual human migration. In recent years, it has become increasingly common to view the migration decision as an investment decision. This idea can be traced, at least in part, to Theodore W. Schultz (l961, p. 1), who argued:

> Much of what we call consumption constitutes investment in human capital. Direct expenditures on education, health, and internal migration to take advantage of better job opportunities are clear examples.

Accordingly, following Schultz (1961), as well as Sjaastad (1962), Bowles (1970), Gallaway and Cebula (1972), and Riew (1973), this analysis expressly treats the decision to migrate as an individual investment decision.

In this section, the investment in migration depends upon three general sets of forces:

1. expected real income differentials
2. expected amenity differentials
3. expected differential benefits and costs from state and local government policies

Expected Income Differentials

For simplicity, it is initially assumed here that the economic system consists of two regions (areas), region A and region B. It is also assumed that the individual (referred to as simply individual *i)* initially resides in area A. Let Y^A_{it} be the money income expected in area A by individual i during period t, and let Y^B_{it} be the money income expected in area B by individual i during period t. The discounted present value of the expected nominal income differential between areas A and B for individual i, D^{AB}_{iY}, is then given by

$$D^{AB}_{iY} = \sum_{t=1}^{n_i} (Y^B_{it} - Y^A_{it})(1 - r_i)^{-t} \tag{4.1}$$

where r_i = the discount rate for individual i
n_i = individual $i's$ time horizon.[1]

At the outset, it should be observed that rather than assuming arbitrarily that all persons have the same discount rate, equation 4.1 ascribes a unique discount rate to each individual. This procedure is predicated upon the empirical finding by Renas and Cebula (1972, p. 61) that ". . . the marginal rate of time preference is a function of a person's socioeconomic status."

Of course, the rational individual is concerned not only with his expected nominal income in areas A and B, but also with the cost of living in areas A and B. Let the expected private cost of living during period t *in* areas A and B be represented by C^A_{it} and C^B_{it} respectively. Accordingly, the discounted present value (for individual i) of the expected living-cost differential between areas A and B, D^{AB}_{ic}, is given by

$$D^{AB}_{ic} = \sum_{t=1}^{n_i} (C^B_{it} - C^A_{it})(1 + r_i)^{-t} \tag{4.2}$$

The definition of private living costs in equation 4.2 is taken to exclude all living costs directly associated with public policy decisions. Such exclusions involve primarily the following: property taxes, state and local govern-

ment sales taxes, and state and local government income taxes. This definition of living costs also excludes the actual pecuniary costs of moving and any non-pecuniary personal costs (or benefits) that may be incurred during movement. These items are to be dealt with in equation 4.4.

If the factors dealt with in equations 4.1 and 4.2 are logically combined, we obtain the discounted present value (for individual *l)* of the expected real income differential between areas A and B for individual *i*, $D^{AB}{}_{iR}$:

$$D^{AB}{}_{iR} = \sum (Y^{B}_{it}/C^{B}_{it} - Y^{A}_{it}/C^{A}_{it})(1 - r_i)^{-t} \qquad (4.3)$$

Of course, equation 4.3 is technically incomplete in the sense that it omits both income foregone while individual i is in transit and individual *i's* moving expenses.[3] Including these two factors in the model yields

$$D^{AB}{}_{iR} = \sum (Y^{B}_{it}/C^{B}_{it} - Y^{A}_{it}/C^{A}_{it})(1 - r_i)^{-t} - T_i - E^{AB}_{i} \qquad (4.4)$$

where T_i = individual *i*'s expected foregone income while in transit between areas A and B and

E^{AB}_{i} = individual i's pecuniary and non-pecuniary moving costs between areas A and B[8]

It should be observed that E^{AB}_{i} may be broadly interpreted to include net capital losses (or gains) from housing (or other asset) sales and purchases associated with the movement from area A to area B.

Expected Differential Amenities

Let F^{A}_{ij} be the expected value to individual *i* of amenities in period *t* in area *A,* and F^{A}_{ij} be the corresponding value for individual *i* in area *B.* The discounted expected present value for individual *i* of the differential values of amenities is then given by

$$D^{AB}{}_{iF} = \sum_{t=1}^{n;} (F^{B}_{it} - F^{A}_{it})(1 - r_i)^{-t} \qquad (4.5)$$

As discussed in chapters 7, 8, and 9 of this book, these amenities include such considerations as air pollution, climatic conditions, congestion, the availability of recreation, and many other factors. Following the

arguments in Cebula and Vedder (1973), Graves (1976), and Liu (1975), these amenities may be classified as dimensions of the quality of life. These amenities are integrated into this analysis because, as Perloff and Wingo (1964) and others have claimed, these amenities allegedly have been very significant determinants of the location of both individuals and private firms and, hence, of regional economic growth and development in the United States.

Expected Differential Benefits and Costs from Government Policies

When an individual contemplates the differences between areas A and B, he presumably considers the government policies in these two areas.[4] Among the various state and local government policies that are likely to be evaluated are educational quality, police protection, fire protection, public assistance, property tax levels, sales tax levels, and income tax levels.

In order to relate these public policies to the individual's migration decision, let the real values of the expected state and local government tax liabilities in areas A and B in period t for individual i be X^A_{it} and X^B_{it}, respectively. Furthermore, let the real A and B values of the publicly provided educational facilities for individual i period t be R^A_{it} and R^B_{it}, respectively. Finally, for individual i, let the real A and B values of all other publicly provided government goods and services be S^A_{it} and S^B_{it}, respectively.[5]

Thus, for this individual, it follows that the discounted present value of the differential expected real net benefits from state and local government[6] is then given by

$$D^{AB}_{iG} = \sum_{t=1}^{n;} [(R^B_{it} + S^A_{it}) - X^B_{it} - (R^B_{it} + S^A_{it}) + X^A_{it}] \ (1 - r_i)^{-t} \qquad (4.6)$$

The Synthesized Model

The synthesis of these three classes of factors influencing the individual's location decision yields the total discounted present value of all the expected real net benefits for individual I of moving from area A to area B:[7]

$$D_i = \sum [(R^B_{it} + S^A_{it}) - X^B_{it} - (R^B_{it} + S^A_{it}) + X^A_{it} +$$

$$(Y^B_{it}/C^B_{it} - Y^A_{it}/C^A_{it}) + (F^B_{it} - F^A_{it})] \ (1 - r_i)$$

$$-T_i - E^{AB}_i \qquad (4.7)$$

Given the nature of the components of D_i in equation 4.7, it logically follows that

$$\partial Di/\partial D^{AB}_{iR},\ \partial Di/\partial D^{AB}_{iF},\ \partial Di/\partial D^{AB}_{iG} > 0 \qquad (4.8)$$

Finally, if we let M^{AB}_i represent the migration of individual i from area A to area B, it follows from the above that

$$Di > 0 \text{ implies } M^{AB}_i > 0 \qquad (4.9)$$

Clearly, this framework can be extended to any number of regions. The individual compares the region of current residence with each of her/his alternatives. She/he will choose that region with maximum net benefits.[9]

A Model of Aggregate Migration

The analysis in the preceding section implies, for the two-region case (areas A and B), that

$$P^{AB}_i = P^{AB}_i (D^{AB}_{iR}, D^{AB}_{iF}, D^{AB}_{iG}) \qquad (4.10)$$

Where P^{AB} = the probability that the person will migrate from area A to area B.

For simplicity, let us assume that all persons residing in area A have homogenous preferences. Proceeding locally, we may then observe that the actual aggregate flow of migrants from area A to area B is a number such as

$$OM^{AB} = V.\ P^{AB}_i \qquad (4.11)$$

where OM^{AB} = the volume of people migrating from area A to area B
V = the total population in area A

Substituting from equation 4.10 into equation 4.11 yields

$$OM^{AB} = V.\ P^{AB}_i (D^{AB}_{iR}, D^{AB}_{iF}, D^{AB}_{iG}) \qquad (4.12)$$

Dividing both sides of equation 4.12 by the term V yields [10]

$$OM^{AB}/V = P^{AB}_{i}\,(D^{AB}_{iR}, D^{AB}_{iF}, D^{AB}_{iG}) \tag{4.13}$$

Equation 4.13 can easily be expanded to allow for more than merely two regions. In addition, equation 4.13 can easily be altered to reflect non-homogeneous preferences within any given population group. Modified in these ways, equation 4.13 becomes a basic frame of reference for the analysis of gross out-migration. Since net migration is essentially the difference between opposing gross migration flows, equation 4.13 actually provides a conceptual foundation for all forms of migration studies.

Prior to closing this section, it should be observed that, given the nature of the migration-determining factors that are stressed in this chapter , the models developed here serve as the basic framework for all five of the chapters in the next portion of this book. In some fashion or another, each of these five chapters is significantly linked to the models given in equations 4.7 and 4.13.

The Models Applied to Factor-Price Equalization

Earlier in this chapter a model of individual migration is developed, whereas the preceding section develops a model of aggregate migration. This closing section applies these models to the theorems of factor-price equalization.

We begin by considering a two-region (A and B) economy where the following conditions prevail:

1. identical two-variable (capital and labor) production functions in the two regions
2. perfect factor markets
3. maximizing behavior by the owners of both productive factors

As argued in Samuelson (1948) and Lerner (1952), under these three conditions, one expects interregional factor proportions to adjust (through geographic mobility) until the returns to each of the productive factors are precisely equal in the two regions.[11]

Naturally, in a world of spatial dimensions and risk, factor movement from one region to another is not costless. Given that interregional factor

movement is not costless, it follows that assumption 2 above is violated and that interregional factor-price equalization over time may very well never come to pass. This raises the issue of whether or not the traditional factor-price equalization theorems are in fact at all relevant or significant.

This section seeks to reinterpret the factor-price equalization theorems so that they still may exhibit both relevance and significance.

To begin with, let us reconsider equation 4.7 above. As indicated in this equation, a positive value for the total discounted present value of the expected real net benefits from mobility induces geographic migration. Let the equation now refer to any productive factor. Clearly, then, it is entirely possible that, for any given productive factor, a factor-price differential between areas A and B could exist over time without causing interregional migration- simply because the size of the factor-price differential was insufficient to make the total discounted present value *Di* positive. Thus, as argued in a different context in chapter l, the persistence of sizable interregional factor-price differentials does not necessarily violate the theorems in Samuelson (1948) and Lerner (1952). In point of fact, it might be simply a reflection of rational decision making by "economic man." [12]

What must be especially stressed here is that this so-called rational decision-making is entirely consistent with the factor-price equalization theorems, once the latter are expanded to accommodate the myriad of considerations included in equation 4.7. In other words, in a world that includes all the types of benefits and costs found in equation 4.7, factor-price equalization is violated only if a positive value for *D ;* fails to induce movement from region A to region B. This conclusion analytically reaffirms the arguments in chapters 1 and 2 that there exists an interregional wage-rate range. [13] Of course, this conclusion also illustrates the continued vitality of the Samuelson (1948) and Lerner (1952) theorems.

Notes

1. In this analysis, the symbol *Y* expressly excludes all forms of public welfare.

2. Due to its geographic uniformity, federal taxation is excluded from all of these calculations.

3. See Gallaway (1967) and (1969) and Sjaastad (1962). Also see chapter 1 of this book.

4. This argument can be traced back to both Buchanan (1950) and Tiebout (1956).

5. The symbol *S* refers to the values of such items as police protection, fire protection, public health facilities, highways, and public recreation. It also includes the value of public welfare.

6. The "fiscal surplus" referred to and developed by Buchanan (1950) may be expressed as the value of $R + S - X$. Clearly, equation 4.6 involves the evaluation of two alternative fiscal surpluses.

7. In equation 4.7, it follows that

$$D_i = D_{iY}^{AB} + D_{iF}^{AB} + D_{iG}^{AB}$$

8. Technically, one could argue that equation 4.9 should read as

$$D, \quad > 0 \ \ implies M^{AB}{}_i = 1$$

9. In other words, the individual chooses that area which maximizes the value of D_i.

10. The formulation in equation 4.13 is quite similar in principle to that found in Miller (1973).

11. This conclusion is very similar to that derived from figures 1-1 and 1-4of this book.

12. An alternative analysis, which stresses embodied human capital but which nevertheless yields very similar final conclusions to these, is found in the study of Gallaway and Cebula (1972).

13. Actually, it can be argued that there exists a factor-price range, rather than just a wage-rate range.

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Part II
Empirical Analyses of Selected Migration Determinants

Introduction

This part which consists of five chapters, investigates the impact on migration patterns of a variety of economic and noneconomic variables. In principle, the choice of variables examined in this portion of the book is predicated upon the migration models constructed in chapter 4.

Chapter 5 addresses an issue that has been essentially ignored in the literature-the impact of geographic living-cost differentials on migration. In this chapter, four regressions are estimated by ordinary least squares; on the basis of these estimations, the chapter arrives at two very important conclusions. First, the cost of living is an extremely important determinant of geographic mobility in the United States. Second, the omission of living costs from migration studies constitutes a very serious specification (omitted variable) error.

Chapter 6 develops an analytical model of income expectations in which the expected income associated with migration depends upon several economic variables. The empirical analysis in this chapter establishes that migrants' income expectations are significantly affected by employment opportunities, living costs, and the annual growth rate of median income. Taken as a group, these various measures of income expectations appear to be extremely useful predictors of net migration patterns in this country.

Chapter 7 is unique in at least three respects. First, it focuses at great length upon the quality of life as a determinant of human migration. Second, it deals strictly with the determinants of elderly migration, that is, migration of persons sixty-five years of age or older. Third, this chapter argues that since the labor force participation rate of the elderly is far below that of other age groups in the economy, the elderly should be essentially insensitive to economic factors in formulation their migration decisions.

The empirical analysis in chapter 7 arrives at essentially three basic conclusions. First, the elderly exhibit essentially no sensitivity whatsoever to purely economic factors when making migration decisions. Second, elderly migrants are effectively insensitive to interregional tax differentials. Finally, quality-of-life considerations explain nearly the entire pattern of elderly migration in this country.

Chapter 8 develops a rigorous economic analysis of the impact of quality-of-life considerations on total net migration in the United States. The model consist of two primary sets of forces: income expectations and quality-of-life expectations. The empirical findings indicate, first, that migrants, on the average, are drawn to areas where their expected incomes are greater and, second, that migrants, on the average, are also attracted to areas having a perceived better quality of life. The latter result notwithstand-

ing, however, it is found that the income-expectations variables appear to be quantitatively far more important in the migration decision than do the quality-of-life variables.

In chapter 9, the role of differential state and local government policies in determining migration is examined. The focus here is on two specific policies: welfare benefits (per recipient) and state plus local government non-welfare expenditures (per capita). The migration flow is disaggregated according to race: white and black. The empirical findings in this chapter indicate that white migrants prefer to locate in areas having lower welfare benefit levels, whereas black migrants prefer to locate in areas with higher welfare benefit levels. In addition, the regression results indicate that white migrants are essentially insensitive to non-welfare spending, whereas black migrants exhibit a strong preference for areas with higher non-welfare expenditure levels. Overall, the empirical evidence strongly implies that differential state and local welfare policies act to distort labor-market behavior in the United States.

The policy implications of chapter 9 include a call for a standardized welfare system. It is argued, however, that unless welfare benefits are standardized in real terms, welfare reform might become a total disaster.

In closing this set of remarks, it is observed that all of the chapters in this portion of the book deal with topics that are largely ignored in the existing migration literature.

5 The Migration Impact of Geographic Living-Cost Differentials

Introduction

Scholars have long been interested in the determinants of human migration patterns. Most empirical studies of migrant behavior regress migration rates against a variety of economic variables, such as unemployment rates, per capita income, and median income. More recently, the trend in the migration literature has been to include in these regressions various quality-of-life variables, such as climate, pollution, and congestion. Except for Rabianski (1971), however, no real effort has been made in the empirical migration literature to account for geographic living-cost differentials (although their potential importance has been noted; see, for example, Riew (1973) and chapter 4 of this book). In the United States, such differentials are relatively large. Hence, ignoring geographic living-cost differentials introduces the distinct possibility of money illusion on the part of migrants. Accordingly, the objective of this chapter is to analyze empirically the impact on migration of explicitly including geographic living costs in the migration decision calculus. This analysis is directed toward an investigation of net migration to some thirty-six metropolitan areas in the United States for which the needed living-cost data are available.

A Basic Model

The basic problem this chapter must address is how precisely to introduce living costs into an empirical migration model. When Rabianski (1971) addressed this problem, he chose to use price indexes to deflate nominal earnings into real earnings. Rabianski then compared the results of two migration regressions. One regression included nominal earnings, as well as certain other explanatory variables; the second regression differed from the first by its inclusion of real rather than nominal earnings.

His comparison of the two regressions led him to conclude (Rabianski 1971, pp. 191-192):

> ...in both models the *T*-ratios for the earnings ratios are significantly diffferent from zero at the 0.01 level of significance. However, the inclusion of the inter-regional cost-of-living deflator did not significantly improve the model based upon nominal earnings.

In view of the fact that the deflator approach did not significantly influence the regression results, this chapter adopts an alternative approach to the problem at hand. In particular, this chapter examines the impact of geographic living-cost differentials on migration by including the cost of living as a separate explanatory variable. The basic model to be examined intitially is the following:

$$Mi = a_0 + a_1 Yi + a_2 U_i + a_3 DW_i + u_1 \qquad (5.1)$$

where Mi = volume of net in-migration to area i, 1960-1970, expressed as a percentage of area i's 1960 population.

a_o = constant

Yi = 1969 median family income in area i

Ui = 1960 average unemployment rate in area i

DWi = dummy variable to indicate location of the metropolitan area in a western state (the variable takes a value of one if the metropolitan area is located in a western state and a value of zero otherwise; related to this, see Gallaway and Cebula (1973)

μ_1 = error term

This model, which contains standard migration-determining variables, is expected, on the basis of previous studies, to yield the following coefficient signs:

$$a_1 > 0, a_2 < 0, a_3 > 0$$

The ordinary least squares estimation of 4.1 is given by

$$Mi = -1.56822 + 0.00161\ Yi - 2.95482\ Ui$$
$$(+1.23) \qquad (-3.29)$$

$$+ 10.66963\ DWi$$
$$(+4.03)$$

$$DF = 32 \qquad R^2 = 0.39 \qquad F = 8.256 \qquad (5.2)$$

where terms in parentheses are t-values.

All three of the estimated coefficients have the expected signs. Two of these coefficients, a_2 and a_3, are statistically significant at well beyond the 0.01 level; only the coefficient for income a_1 fails to be significant at an acceptable (that is, 0.05) level. In addition, the F-ratio is statistically significant at beyond the 0.01 level.

To appreciate the role of living costs in migration, we add a new variable, Ci, which is the average cost of living for a four-person family in metropolitan area i, 1970, expressed in current dollars.[2] Presumably, the higher

the living costs in an area, the less attractive it should be to migrants, *ceteris paribus*, hence, we expect the coefficient for variable *Ci* to be negative.

The ordinary least squares estimate for this expanded model is

$$Mi = +31.53623 + \underset{(+2.95)}{0.00401\,Yi} - \underset{(-3.19)}{2.58603\,Ui}$$

$$+ \underset{(+3.95)}{9.46006\,DWi} - \underset{(-3.05)}{0.0061\,Ci}$$

$$DF = 31 \qquad R^2 = 0.51 \qquad F = 10.133 \tag{5.3}$$

All of the estimated coefficients in equation 5.3 have the hypothesized signs and are significant at the 0.01 level or beyond. In addition, the F-ratio is significant at beyond the 0.01 level.

Estimations 5.2 and 5.3 are different in a number of important ways. First, the coefficient for income is not significant at even the 0.10 level in .equation 5.2, whereas it is significant at well beyond the 0.01 level in equation 5.3. Second, equation 5.3 has an additional variable, the cost of living, which is statistically significant at well beyond the 0.01 level. Finally, equation 5.3 has a considerably higher R^2 than does equation 5.2: 0.51 versus 0.39.

In sum, then, contrasting results 5.2 and *5* .3 implies that the cost of living is an important determinant of migration behavior and that omission of this variable from migration analysis constitutes a specification omitted variable error (see Johnston 1972, pp. 168-169).

An Alternative Model

Contemporary migration models ordinarily include a number of variables besides those listed in equation 5.1. In an effort to deal with a more complete basic model, the following migration equation is postulated:

$$M_i = b_0 + b_1 Y_i + b_2 U_i + b_3 DW_i + b_4 DA_i + b_5 Ei + \mu_2 \tag{5.4}$$

where *Mi, Yi, Ui, and DWi* are as above, and

b_0 = constant

μ_2 = error term

DAi = dummy variable to indicate location of the metropolitan area in a warm weather state (the variable assumes a value of one if the metropolitan area is located in a warm weather state and a value of zero otherwise; see Gallaway and Cebula, 1973).

Ei median education level of the adult population (age twenty-five years or older) in metropolitan area *i,* 1960.

On the basis of studies by Gallaway and Cebula (1973) and Pack (1973), respectively, the following signs are expected on the coefficients for the two additional variables, DAi and Ei:

$$b_4 > 0 \text{ and } b_5 > 0$$

Estimating equation 5.4 by ordinary least squares yields:

$$\begin{aligned} Mi = & -14.25610 + 0.00108\, Yi - 3.14821\, Ui \\ & \quad (+0.51) \qquad (-3.23) \\ & + 3.478\, DWi + 9.0812\, DAi + 2.08104\, Ei \\ & (+0.92) \qquad (+3.37) \qquad (+1.31) \end{aligned}$$

$$DF = 30 \qquad R^2 = 0.42 \qquad F = 6.134 \tag{5.5}$$

All five of the estimated coefficients have the hypothesized signs; however, of these five coefficients, only two-those for unemployment and warm weather- are statistically significant at acceptable (that is, 0.05) levels. The R^2 is 0.42, so that the model explains somewhat over two-fifths of the net migration. Finally, the F-ratio is statistically significant at beyond the 0.01 level.

Next, we consider regression equation 5.4 with the living-cost variable Ci included. The ordinary least squares estimation of this modified version of equation 5.4 is given by

$$\begin{aligned} Mi = & +23.08902 + 0.00301\, Yi - 2.90404\, Ui \\ & \quad (+2.37) \qquad (-3.35) \\ & + 4.22006 DWi + 7.94803\, DAi + 1.55001\, Ei \\ & \quad (+1.25) \qquad (+3.30) \qquad (+1.10) \\ & - 0.007\, Ci \\ & \quad (-3.07) \end{aligned}$$

$$DF = 29 \qquad R^2 = 0.55 \qquad F = 8.112 \tag{5.6}$$

In estimation 5.6, all six of the coefficients have the expected signs. In addition, four of these six coefficients are significant at the 0.01 level or beyond; only the variables DWi and Ei fail to have coefficients that are significant at an acceptable statistical level. Next, the R^2 has a value of 0.55, so that over half of the net migration has been explained. Finally, the F-ratio is significant at beyond the 0.01 level.

Results *5.5* and *5.6* are different in a number of important respects. First, the coefficient for income is not statistically significant at even the 0.10 level in equation 5.5, whereas it is significant at the 0.01 level in equation 5.6. Second, equation *5.6* has an additional variable, the cost of living, which is significant at well beyond the 0.01 level. Finally, the R^2 in equation 5.6 is perceptibly greater than that in *5.5: 0.55* versus 0.42.

Hence, contrasting results *5.5* and 5.6 imply (as observed in the preceding section) that the cost of living may be an important determinant of migrant behavior and that omission of the living-cost variable may amount to significant specification (omitted variable) error.

Data Profile

Tables 5-1 and 5-2 are included here to aid the reader in evaluating the various empirical results derived in the preceding sections of this chapter. Table 5-1 indicates the zero-order correlation coefficients among the various exogenous variables. As shown, there are no consequential multicollinearity problems in the model. Table 5-2 in turn lists the means and standard deviations of the exogeneous variables. This should aid in evaluating the coefficients in the regressions presented.

Table 5-1
Correlation Matrix

	Y	*U*	*DW*	*DA*	*E*
U	-0.07				
DW	0.06	0.38			
DA	-0.39	0.12	0.25		
E	0.29	-0.12	0.36	0.07	
C	0.65	0.05	0.06	-0.36	0.08

Table 5-2
Means and Standard Deviations of Selected independent Variables

Variable	*Mean*	*Standard Deviation*
Y	10,582.02	995.81
U	4.63	1.34
DW	0.17	0.38
DA	0.39	0.49
E	11.24	0.86
C	10,556.47	740.97

Conclusion

This chapter has argued that migrant behavior should be, assuming the absence of money illusion, sensitive to geographic living-cost differentials. An earlier study by Rabianski (1971), which deflated nominal earnings into real earnings, found living costs to have no real impact on migration patterns. The present study, however, which introduces geographic living costs into the migration regression as a separate variable, yields results that strongly imply that, ceteris paribus, migrants do in fact prefer areas with lower living costs. Moreover, estimations of more than a half-dozen different variations on the models in this analysis have yielded the same basic results,[3] namely: the cost of living is an important determinant of migration behavior and omission of this variable from the migration regression constitutes a specification error.[4]

Hence, future empirical migration research should, whenever possible (that is, whenever adequate data are available), take geographic living-cost differentials expressly into account. Failure to do so results in a mis-specified model. Furthermore, inclusion of this variable in empirical migration analyses may markedly improve the dependability, accuracy, and relevance of research efforts.[5]

Notes

1. The metropolitan areas studied in this chapter were Atlanta, Ga.; Austin, Tex.; Bakersfield, Calif.; Baltimore, Md.; Baton Rouge, La.; Buffalo, N.Y.; Cedar Rapids, Iowa; Champaign, Ill.; Chicago, Ill.; Cincinatti, Ohio; Cleveland, Ohio; Dallas, Tex.; Dayton, Ohio; Denver, Colo.; Detroit, Mich.; Durham, N.C.; Greenbay, Wis.; Honolulu, Hawaii; Houston, Tex.; Indianapolis, Ind.; Kansas City, Mo.; Lancaster, Pa.; Los Angeles, Calif.; Milwaukee, Wis.; Nashville, Tenn.; Orlando, Fla.; Philadelphia, Pa.; Pittsburgh, Pa.; St. Louis, Mo.; San Diego, Calif.; San Francisco, Calif.; Seattle, Wash.; Washington, D.C.; Wichita, Kans.; New York, N.Y.; and Minneapolis, Minn. The geographically comparable living-cost data indicate the annual cost of a moderate living standard for a four-person family.

2. The year 1966 is the earliest year for which such data are available for a reasonably large number of metropolitan areas. For years prior to 1966, living cost data are available for a maximum of twenty cities.

3. These results will be supplied by the author upon request.

4. This conclusion is compatible with the analysis by Renas and Kumar (1978).

5. The empirical findings in subsequent chapters of this book lend further strength to this contention.

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6 An Income-Expectations Model of Human Migration

Introduction

Income expectations have been examined at considerable length as a consequence of their central role in the permanent income hypothesis formulated initially by Friedman (1957) and in the life cycle hypothesis subsequently formulated by Ando and Modigliani (1963).[1] Income expectations have also been investigated in terms of their impact on a number of other economic issues, including the investment in human capital,[2] the efficacy of economic stabilization policies,[3] and the causes of migration.[4]

This chapter seeks to extend the migration literature by investigating how and to what extent certain income expectations proxies may influence internal human migration decisions in the United States.

The following section presents the basic theoretical framework (model) of the chapter, while the third section provides an empirical analysis of the relationship between labor migration and expected income changes. Concluding remarks are offered in the final section of the chapter.

Investing in Migration

Following Bowles (1970), Riew (1973), and Sjaastad (1962), as well as the basic theory in chapter 4, the framework of this analysis is one in which the individual decides to migrate from one area to another if over time there are positive net benefits expected from such migration. In particular, we maintain here that an individual residing in area *i* will choose to migrate to area *j* only if the discounted present value of the expected net benefits associated with the migration is positive. Assuming that all of the various benefits and costs that can be associated with migration can be expressed in pecuniary terms[5] we argue that the decision to migrate from area *i* to area *j* requires that his/her expected net discounted present value of migration from area *i* to area *j* be both (a) positive and (b) the maximum net discounted present value that can be expected from moving from area *i* to *any other* known and plausible alternative area:

$$Mij > 0 \text{ if } DPVij = \sum Be - Ce > 0 \qquad (6.1)$$

where $Be = 1, \ldots, m$, represents the value of all the benefits associated with migration from area i to area j for year e; $Ce = 1, \ldots, n$, represents the

value of all the costs associated with migration from area *i* to area *j* for year *e; r* is the appropriate rate of discount for the individual, and *Mij* denotes migration from area i to area *j*.

As observed in chapter 4, the analysis of the net benefits associated with migration (which benefits need not be positive) involves the appraisal of all the various costs and of all the various benefits of the migration. As also observed in chapter 4, there may of course exist many diff erent sources of benefits and of costs from migration which may accrue over a given time period (year). The total gross value of the benefits accruing from the migration in eth year, *Be*, may thus be represented as

$$Be = \sum Bek,\ k=1,\ldots,m \tag{6.2}$$

where *Bek*, $k = 1, \ldots, m$, is the value of the kth form of benefit accruing from migration in year *e*. Similarly, the total gross value of the costs accruing in year e, *Cem,* may be represented as

$$\mathrm{Ce} = \sum Cel,\ e=1,\ldots,n \tag{6.3}$$

where *Cel* , $l = 1, \ldots, n$, is the value of the *l*th form of cost experienced (accruing) in year *e*.

It follows from equations 6.1, 6.2, and 6.3 that migration from area *i* to area *j, Mij,* is a function of *Bek* and *Cel* such that

$$Mij = Mij\ (Be,\ Ce) \tag{6.4}$$

where it logically also follows that

$$\partial Mij/\partial Be > 0 \tag{6.4a}$$

and

$$\partial Mij/\partial Ce < 0 \tag{6.4b}$$

The primary emphasis of this particular chapter is on the impact of income expectations on migration. Accordingly, we note that the income increase expected from migration in year *e* is represented as one of the expected *x*

benefits accruing from migration in year *e, e* = 1 ,…, *n.* More generally, the income increase expected from migration in any given time period represents one of the benefits from migration accruing in that time period. It follows, then, from 6.4a that

$$\partial Mi/\partial Y^*aij > 0 \quad \text{for all } a \tag{6.5}$$

where *Y*aij* is the expected increase in income in period *a* as a result of migration from area *i* to area *j*.

Ideally, following (in principle) the analysis by Muth (1961), the income increase expected as a result of migration from area *i* to area *j* should be expressed as some weighted average of actually observed past income growth differentials between the two areas:

$$Y^*aij = \delta \sum_{S=0}^{\infty} \lambda^s Y_{t-s} \tag{6.6}$$

where Y_{t-s} = the observed income growth differential between areas *i* and *j* during time period *t-s.*

However, given that data limitations confine us to just cross-section analysis, and given that-following Liu (1975)-we feel it is in many respects more relevant to deal with net rather than gross migration, we are forced here to construct a somewhat cruder expectations function. In particular, it is argued here that the expected income increase over period *a* associated with migration from area *i* to area *j* is a function of the following variables:

the level of median income in area j, *Yj*

the growth rate of median income in area j per period *a,* ΔYj

the unemployment rate in area j, U_j

the education level in area j, E_J

the cost of living in area j, *Cj*

In this chapter, the expected relationship between *Y*aij* and these five exogenous variables is given by

$$Y^*aij = Y^*aij\,(Yj,\ \Delta Yj, Uj, Ej, Cj) \tag{6.7}$$

where

$\partial Y^*_{aj}/\partial Y_j > 0$
$\partial Y^*_{aj}/\partial \Delta Y_j > 0$
$\partial Y^*_{aj}/\partial E_j > 0$

and

$\partial Y^*_{aj}/\partial U_j < 0$
$\partial Y^*_{aj}/\partial C_j < 0$

Empirical Analysis

In order to test whether and to what extent income expectations, as they are being measured here (see equation 6.7), influence migration, we shall test the following empirical model of net migration to SMSAs:

$$Mj = a_0 + a_1 Y_j + a_2 U_j + a_3 \Delta Y_j + a_4 DA_j + a_5 Ej + a_6 Cj + u \qquad (6.8)$$

where

Mj = the net number of migrants into SMSA j between 1960 and 1970 expressed as a percentage of the total 1960 population in SMSA j
Yj = 1969 median family income in SMSAj
Uj = average unemployment rate of the civilian labor force in SMSA j in 1960
ΔY_j = annual rate of change of median family income in SMSA j between 1959 and 1969, expressed in percentage terms
DAj = a dummy variable to indicate location of SMSA j in a warm weather state[6]
Ej = median school years completed in 1960 for the population twenty-five years of age and over in SMSA j
Cj = annual cost in SMSA j of an intermediate budget for a four- person family, 1970
u = error term[7]

For the purpose of this chapter, the annual growth rate in median family income in area, ΔYj, is computed as follows:

ΔYj = -1 + 10 times the square root of Y_{69j}/Y_{59j} (6.9)

where Y_{69j} = median family income in area j in 1969
Y_{59j} = median family income in area j in 1959

On the basis of our arguments in equation 6.7 and on the basis of certain earlier studies,[8] it is expected here that

$$a_1, a_3, a_4, a_5 > 0$$

$$a_2, a_6 < 0 \qquad (6.10)$$

Estimating regression equation 6.8 by ordinary least squares yields

$$M_j = \underset{}{-31.85211} + \underset{(+1.58)}{0.00202}\,Y_j - \underset{(-1.48)}{1.35904}\,U_j$$

$$+ \underset{(+2.04)}{533.73512}\,\Delta Y_j + \underset{(+2.87)}{6.90106}\,DA_j + \underset{(+2.41)}{3.16011}\,E_j$$

$$- \underset{(-2.42)}{0.00513}\,C_j \qquad (6.11)$$

$$DF = 29 \qquad R^2 = 0.66 \qquad F = 9.211$$

where terms in parentheses are *t*-values.

Overall, these results are most encouraging. All six of the estimated coefficients have the expected signs. Moreover, four of the six coefficients are statistically significant at the 0.05 level or beyond. The coefficient of determination R^2 is 0.66, so that the model explains two-thirds of the variation in the rate of net in-migration to these SMSAs. Finally, the F-ratio is significant at the 0.01 level.

Before interpreting the specific coefficients (results) in regression equation 6.11, we refer to Tables 6-1 and 6-2. Table 6-1 indicates the zero-order correlation coefficients among the various exogenous variables. As shown in the table, there are no consequential multi-collinearity problems. In table 6-2, the change in R^2 attributable to each of the exogenous variables is shown. This information should aid the reader in interpreting the actual effects of each of the exogenous variables in equation 6-11.

Table 6-1
Correlation Coefficients

	Y	U	ΔY	DA	E
U	-0.07				
Y	0.03	-0.51			
DA	-0.39	0.12	0.19		
E	0.29	-0.12	-0.11	0.07	
C	0.66	0.05	-0.20	-0.36	0.08

Table 6-2
Change in R^2, by Variable

Variable	*Change in* R^2
Y	0.01
ΔY	0.28
E	0.21
DA	0.08
U	0.02
C	0.07

In equation 6.11 the climate variable, *DA* is statistically significant at well beyond the 0.01 level, indicating that warm or mild climates, *ceteris paribus*, are a strong attraction to the migrant. This is consistent with a number of earlier studies, such as Cebula and Vedder (1973), Greenwood (1969), Liu (1975), Miller (l973), and Renas and Kumar (1978). Moreover, as Table 6-2 clearly indicates, this climate variable is responsible in equation 6.11 for an R^2 contribution of 0.08.

Observe next the coefficients for the five income-expectations variables. As shown in equation 6.11, although the income *Y* and unemployment *U* variables do not play major roles, the income growth Δ*Y*, education *E*, and living-cost *C* variables *do.* All three of these variables are statistically significant at the 0.02 level or beyond. Moreover, as shown in Table 6-2, the combined R^2 for Δ*Y, E*, and *C* is roughly 0.56. Hence, it appears that, as a group, our proxies for income expectations are extremely strong predictors of human migration patterns in the United States.

Conclusion

This model of internal labor migration maintains that the migration decision is basically an investment decision in which migration from one area to another occurs if the discounted present value of the expected future stream of net benefits from such migration is positive. Within this framework, this chapter has sought to ascertain the impact of income expectations on the interregional migration of labor. The present empirical findings indicate that income expectations, as measured by our set of proxies, *Y*, Δ*Y*, *U, E*, and *C,* in fact play a very significant role in explaining migration behavior in the United States. Moreover, it also appears that the use of merely a single variable, such as Y^9 to represent income expectations may be most inadequate and, indeed, may even constitute a serious specification error.

Finally, we observe that one possible implication of this analysis is that there may exist some form of permanent income or life-cycle hypothesis of migration. Just as the household consumption of commodities may be partially explicable in terms of a permanent income hypothesis, or a life-cycle hypothesis, so might consumption of (investment in) migration be explained. This notion would seem especially appealing if migration in fact can be somehow treated as a commodity.

Notes

1. Some of the literature dealing with these and related hypotheses include Arak (1978), Arak and Spiro (1971), Bewley (1977), Bodkin (1959), Chao and Renas (1975), Houthakker (1958), Laumas (1969), Mayer (1966), Peterson (l972), and Wright (1969).

2. Renas and Cebula (1972).

3. See, for example, the somewhat related study by Cebula (1973), which deals with a form of income expectations derived from the size of government budget deficits.

4. There have been a few papers which deal, although only briefly, with income expectations per se and migration patterns. Among them are Bowles (1970), Cebula and Vedder (1973), Pack (1973), Riew (1973), Sjaastad (1962), and Vanderkamp (1968).

5. Recall that this was done expressly in chapter 1.

6. Related to which states are classified as warm weather states, see table 2-1. The variable here assumes a value of one if the SMSA is located in a warm weather state and a value of zero otherwise.

7. The data were gathered and computed for the following thirty-six metropolitan areas: Atlanta, Ga.; Austin, Tex.; Bakersfield, Calif.; Baltimore, Md.; Baton Rouge, La.; Buffalo, N.Y.; Cedar Rapids, Iowa; Champaign, Ill.; Chicago, Ill.; Cincinnati, Ohio; Cleveland, Ohio; Dallas, Tex.; Dayton, Ohio; Denver, Colo.; Detroit, Mich.; Durham, N.C.; Greenbay, Wis.; Honolulu, Hawaii; Houston, Tex.; Indianapolis, Ind.; Kansas City, Mo.; Lancaster, Pa.; Los Angeles, Calif.; Milwaukee, Wis.; Nashville, Tenn.; Orlando, Fla.; Philadelphia, Pa.; Pittsburgh, Pa.; St. Louis, Mo.; San Diego, Calif.; San Francisco, Calif.; Seattle, Wash.; Washington, D.C.; Wichita, Kans.; New York, N.Y.; and Minneapolis, Minn.

8. See chapter 5, as well as Cebula and Vedder (1973), Greenwood (1969), Pack (1973), Renas and Kumar (1978), and Sommers and Suits (1973). Note especially that, following Pack (1973), E is taken to indicate the presence of growth industries.

9. Per capita income or median income is usually the primary variable used in empirical migration studies to measure expected income.

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7 The Migration Impact of the Quality of Life: The Case of the Elderly

Introduction

The greatly increased interest and concern in recent years in environmental matters and the quality of life in the United States has manifested itself in a variety of ways. As Professor Robert Carson (1978, p. 54) has put it, during

> …the late l960's, Americans were made increasingly aware of the dangers of pollution by a small but growing band of environmentalists and ecologists. School children planted trees, "Earth Days" were proclaimed, and more important, citizen's lobbies pressed successfully for environmental protection acts. The high-water mark of environmentalist activity probably came on December 2, 1970, when the Environmental Protection Agency was established as an independent regulatory agency of the federal government. The EPA was charged with coordinating government action to assure proection of the environment by abating and controlling pollution.

In scholarly circles, interest in the environment and the quality of life has manifested itself in a propagation of studies pertaining to the economic impact of man's social and cultural milieu (Culbertson 1972, Demsetz 1971, Dorfman and Dorfman 1972, Gallaway 1972, Goldman 1972, Kneese and Schultze 1975, Liu 1974, Livingston 1973, Ng 1978, Roos 1975, Pascal 1971, Ruffin 1972, and Zerbe 1970. Although most such studies have been basically abstract in nature, there have been a few empirical studies, some of which try to relate the quality of life to human migration patterns. For example, Cebula and Vedder (1973) and Liu (1975) both examine the effects of the quality of life on total migration, whereas Kohn, Vedder, and Cebula (1973) investigate the effects of the quality of life on migration disaggregated according to race (white and black).

The present chapter seeks to add to the above literature by empirically investigating the effect of selected quality-of-life variables on the migration of the elderly. The uniqueness of this chapter rests primarily on its concentration on one particular age grouping of migrants, the elderly. For the purposes of this chapter, the term elderly refers to all persons who are sixty-five years of age or older.

Migration of the Elderly

The first question that may arise is "Why concentrate on the migration of the elderly *per se*?" The answer is really quite simple: namely, as Table 7-1

Table 7-1
Elderly Population, by Sex, as a Percentage of Total Population

Year	*Male*	*Female*
1965	8.4	10.3
1970	8.5	11.1
1975	8.6	11.5
1977	8.9	11.8

Source: U.S. Bureau of the Census, *Statistical Abstract of the United States, 1978,* Washington, D.C., 1978, Table 32.

indicates, the elderly are a significant and growing proportion of our total population. In fact, given current birth-rate trends in the United States, it can be expected that the elderly will constitute an ever-increasing proportion of the total United States population, at least until the close of this century. Hence, our attention in this chapter is directed at an increasingly important component of our society.

As stressed in chapters 1 and 4 above, the conventional analysis of the determinants of human migration basically treats the migration decision as an investment decision [1] in which the individual chooses to migrate to that area which maximizes his differential economic advantage over time, The standard migration study, then, examines the impact of variables such as income differentials, unemployment rates, distance, and education on the migration decision. The present chapter, however, since it is concerned with the migration of the elderly, emphasizes the role of a different set of variables. In particular, this chapter argues that for the elderly the main determinants of migration are those concerned with the quality of life, and that purely economic variables such as income differentials have little or no influence on elderly migration.

The basic rationale for arguing that purely economic (labor-market) variables are likely to be of relatively little concern to elderly migrants can be inferred from Table 7-2. As Table 7-2 indicates, the elderly have a very low labor force participation rate vis-a-vis any other relevant age group. Moreover, Table 7-2 also reveals that the labor force participation rate of the elderly has actually been declining rather dramatically in recent years. This would further attest to the likelihood that labor market conditions would tend to be comparatively unimportant [2] to elderly migrants.

Thus, although this chapter includes certain purely economic variables, the primary focus will be on the quality of life. Of course, there are many possible ways to measure the quality of life. In this chapter, we have singled out five specific measures: the availability of medical care, the amount of sunshine, temperature levels, air pollution levels, and the availability of recreation facilities. The argument regarding the impact of each of these vari-

Table 7-2
Labor Force Participation Rate, by Age

Year and Age Group	*Participation as a Percent*
1965	
20-24	86.2
25-34	96.0
35-44	96.2
45-54	94.3
55-64	83.2
65 and over	26.9
1970	
20-24	85.1
25-34	95.0
35-44	95.7
45-54	92.9
55-64	81.5
65 and over	25.8
1975	
20-24	84.6
25-34	94.2
35-44	94.8
45-54	91.1
55-64	74.8
65 and over	20.8
1977	
20-24	85.3
25-34	94.2
35-44	94.9
45-54	90.3
55-64	73.0
65 and over	19.3

Source: U.S. Bureau of the Census, *Statistical Abstract of the United States, 1978,* Washington, D.C., 1978, Table 644.

ables is quite straight-forward. For example, the more abundant the medical care in an area, other things held constant, the more attractive that area should be to elderly migrants. Next, the elderly presumably will be more attracted to areas that offer better climatic conditions, that is, more sunshine and warmer temperatures. As for pollution, it is argued that the lower the level of air pollution in an area, the more attractive the area should be to elderly migrants. Finally, since the elderly are for the most part retired or semiretired, the availability of recreation facilities should be of concern in a migration decision. It is argued here that the greater the availability of such facilities in an area, the more attractive the area will presumably be to the elderly migrant.

The Migration Model

In order to investigate empirically the effects of the quality of life on elderly migration patterns, the following net migration model is hypothesized:

$$Mi = Mi\ (Di,\ Si.\ Ti,\ Pi,\ Xi,\ Yi) \qquad (7.1)$$

where Mi = the net migration rate of the elderly to state i[3]

Di = a measure of the availability of medical care in state i[4]

Si = a measure of the average amount of sunshine in state i[5]

Ti = a measure of the average amount of cold weather I state i[6]

Pi = a measure of the average amount of air pollution in state i[7]

Xi = a measure of the average level of state plus local government taxes in state i[8]

Yi = a measure of the average income level in state i[9]

Following Cebula and Vedder (1973) and Liu (1975), our migration data refer solely to net in-migration (that is, gross in-migration less gross out-migration). The actual data on net migration of the elderly were obtained from the 1970 *Census of the Population.* To control for variations in the population among the states, the variable Mi takes the form of the ratio of net elderly migration to state i between 1965 and 1970 to the 1965 population of state i. The migration data were assembled for all of the states except Alaska and Hawaii. Washington, D. C., was also excluded from this study.

The variable Di is the number of physicians per hundred thousand population in state in the year 1966. The elderly presumably should prefer to locate in communities where health (medical) services are relatively more abundant, ceteris paribus. Accordingly, we would expect a direct relationship between variables M_i and D_i:

$$\partial M_i/\partial D_i > 0 \qquad (7.2)$$

The variable Si is the average of daylight periods when there is sunshine in state i. Clearly, the larger the value of Si, the greater the average amount of sunshine in the ith state. Since the elderly presumably are interested in climatic conditions, they are likely to be attracted to states where there are, other things held constant, greater amounts of sunshine. Thus, the relationship between Mi and Si is argued here to be:

$$\partial M_i/\partial S_i > 0 \qquad (7.3)$$

The variable *Ti* is the average number of days per year when the mean temperature in state *i* falls to 32° Fahrenheit or below. It is assumed here that, other things held the same, the elderly on average would prefer mild or warm climates to colder climates. Thus, the relationship between *Mi and Ti* is expected to be inverse:

$$\partial M_i/\partial T_i < 0 \qquad (7.4)$$

Somehow, no analysis of the relationship between migration and the quality of the environment would seem complete without explicitly considering pollution. As our measure of air pollution, *Pi*, we use the amount of suspended particulate matter per cubic meter of air. Suspended particulate matter consist of the more visible forms of pollution: smoke, soot, dust and fumes, and droplets of viscous liquid remaining in the air for varying periods of time. We use the mean amount of suspended particulate matter observed in the forty-eight states in the year 1966. Given that greater amounts of air pollution in an area lower the quality of the environment and therefore its attractiveness to migrants, we would expect an inverse relationship between *Mi* and *Pi*:

$$\partial M_i/\partial P_i < 0 \qquad (7.5)$$

Given that most elderly migrants are either retired or semiretired, it is likely that they would be attracted to those areas that provide the better recreation facilities. The variable *Ri* is used as a measure of the availability of such facilities. *Ri* was computed by dividing the number of state, municipal, and county parks in 1965 in state *i* by the 1965 population in state *i*, thus yielding the number of such parks per capita. Since a higher value for *Ri* implies a greater abundance of recreation facilities in the ith state, we would expect a direct relationship between *Mi* and *Ri:*

$$\partial M_i/\partial R_i > 0 \qquad (7.6)$$

The variable *Xi* represents the per capita level of all state and local government taxes in the *i*th state for the year 1967. In a very real sense, *Xi* can be interpreted as one of the costs associated with living in state *i.* Presumably, then, the higher the per capita tax level in a state, the less attractive the state will tend to be to migrants, *ceteris paribus*. Thus, we argue the following:

$$\partial M_i/\partial X_i < 0 \qquad (7.7)$$

The variable *Yi* is the per capita income level in the *i*th state in the year 1965. The use of some variable to measure per capita income or wage rates is a standard procedure in most migration studies. The conventional argument in these studies is that migrants are attracted, other things held constant, to areas that offer higher wages. In this chapter, however, it is argued that income (wage-rate) differentials among states are likely to exercise little or no impact on the migration of the *elderly* since, as table 7-2 shows, the latter are, by and large, not full-time participants in the labor market. Therefore, it is argued here that the relationship between Mi and Yi, whatever its sign, will be statistically insignificant:

$$\partial M_i/\partial Y_i \geq 0 \tag{7.8}$$

The actual regression equation to be estimated in this chapter is given by

$$Mi = a_0 + a_1 Di + a_2 Si + a_3 Ti + a_4 Pi + a_5 Ri + a_6 Xi + a_7 Yi + u \tag{7.9}$$

where a_0 = constant term
u = error term

Empirical Results

Estimating regression equation 7.9 by ordinary least squares yields the following results:

$$Mi = -13.63262 + \underset{(+2.08)}{0.0616}\, Di - \underset{(+3.51)}{0.2995}\, Si$$

$$- \underset{(-2.65)}{0.03663} Ti + \underset{(-0.51)}{0.0092}\, Pi + \underset{(+3.05)}{0.0289}\, Ri$$

$$- \underset{(-1.18)}{0.02071} Xi - \underset{(-0.75)}{0.00215}\, Yi$$

$$DF = 40 \qquad R^2 = 0.49 \tag{7.10}$$

where the terms in parentheses are *t*-values.

Overall, these results are extremely encouraging: by and large, they confirm all of our hypotheses. To begin with, the model explains nearly 50 percent of the variation in the rate of elderly net in-migration. Qualitatively speaking, all of the exogenous variables behaved as expected, that is, they all had the correct signs. As for specific results, the sunshine *Si*, cold temperature *Ti* , and recreation *Ri* variables were all statistically significant with the correct signs at beyond the 0.01 level; in addition, the medical care variable *Di* had the correct sign and was statistically significant at about the 0.05 level. Although the pollution *Pi* and tax *Xi* variables each had the correct sign, neither was statistically significant at an acceptable level. Finally, the coefficient for the income variable had a negative sign, but was, as hypothesized, not statistically significant at any acceptable level.

The basic argument of this chapter has been that the primary type of determinant of elderly migration is the quality of life and that purely economic variables have a comparatively small impact on elderly migration. As evidence of the validity of our argument, we observe that the quality-of-life variables (combined) accounted for an R^2 in equation 7.10 of about 0.48, while the purely economic variables (combined) accounted for an R^2 in equation 7.10 of merely 0.01. That is, essentially 98 percent of the explanatory power of our model was attributed to the quality-of-life variables, whereas less than 2 percent was associated with the purely economic variables. This is in contrast to the results that might be expected in an analysis of total as opposed to only elderly migration. [11]

We may now refer to the specific components of the quality of life. Clearly, the elderly migrant tends to be quite sensitive to the availability of medical care. This same basic result has been obtained elsewhere in the analysis of total migration (Cebula and Vedder, 1973). Elderly migrants are also quite sensitive to climatic conditions, as evidenced by their apparent strong aversion to cold weather and attraction to sunshine. This is also consistent with other studies.[12] Elderly migrants apparently also are quite sensitive to the availability of recreation facilities. On the other hand, there was little to indicate that they were particularly concerned about pollution levels in making their migration decisions. This relative insensitivity to the pollution variable has been found elsewhere in the analysis of total migration (Cebula and Vedder, 1973).

We now turn to the purely economic variables, per capita state and local government taxes *Xi* and per capita income *Yi*. Clearly, elderly migrants were not particularly sensitive to either of these variables. Especially interesting is the coefficient for the income variable: it is both statistically insignificant and negative. This statistical insignificance is consistent with our argument above that, since the elderly are by-and-large retired or semi-retired, they are not expressly concerned with wage (income) levels when making migration decisions. The negative value for the income coeffi-

cient could well be expected given the fact that climatic conditions tend to be superior in states where per capita income levels are, on the average, below the national average, and climatic conditions tend to be inferior in states which, on the average, have per capita income levels that are above the national average. For example, the states of Florida, Arizona, Texas, and New Mexico combined to attract a preponderant majority (over 75 percent) of all elderly net migration during 1965-1970 period; yet, the per capita income in each of these states was perceptibly below the national level. On the other hand, the states of New York and Illinois combined to experience a net loss of nearly fifty percent of all the elderly net migration; however, both of these states had per capita income levels well above the national average.[13]

Conclusion

In their study of *total* migration, Cebula and Vedder (1973, pp. 209-210) conclude that, empirically speaking, most

> …migrants seem to be interested in both explicit economic considerations, such as income, job opportunities, and potential growth in earnings (human capital gains), and in the more implicit (economic) considerations of an environmental nature.

Liu (1975) has arrived at very similar conclusions in his more elaborate study of total migration.

This chapter, by contrast, has argued that the elderly migrant, on the average, is primarily interested in noneconomic (that is, quality-of-life) considerations. Given the relatively low (and declining) labor force participation rate of the elderly, this hypothesis seems most reasonable. The strong empirical support for this hypothesis thus implies that elderly migrants *do* have primarily quality-of-life arguments in their location decision calculus. The quality of life, therefore, should be a fine guide to forecasting future migration patterns of the elderly in the United States.

Notes

1. See especially Sjaastad (1962) or Riew (1973).
2. At the very least, labor-market conditions should be relatively *less important* to the elderly than to other pertinent age groups.
3. Data source for *Mi:* U.S. Bureau of the Census, *Census of the Population: 1970, Migration between State Economic Areas,* Final Report PC(2) -E, Washington, D.C., 1972, Tables 2 and 3.
4. Data source for *Di:* U.S. Bureau of the Census, *Statistical Abstract of the United States, 1968,* Washington, D.C., 1968, Table 88.

5. Data source for *Si*: U.S. Bureau of the Census, *Statistical Abstract of the United States, 1968,* Washington, D.C., 1968, Table 273.

6. Data source for *Ti*: U.S. Bureau of the Census, *Statistical Abstract of the United States, 1968,* Washington, D.C., 1968, Table 263.

7. Data source for *Pi*: U.S. Bureau of the Census, *Statistical Abstract of the United States, 1968,* Washington, D.C., 1968, Table 262.

8. Data source for *Ri*: U.S. Bureau of the Census, *Statistical Abstract of the United States, 1968,* Washington, D.C., 1968, Tables 291-292.

9. Data source for *Xi*: U.S. Bureau of the Census, *Statistical Abstract of the United States, 1969,* Washington, D.C., 1969, Table 594.

10. Data source for *Yi*: U.S. Bureau of the Census, *Statistical Abstract -of the United States, 1969,* Washington, D.C., 1969, Table 469.

11. Related to the analysis of *total* migration, see Cebula and Vedder (1973) or Liu (1975).

12. See Cebula and Vedder (1973), Liu (1975), and Kohn, Vedder, and Cebula (1973).

13. Before this section is closed, it should be noted that there was no significant multi-collinearity among the independent variables in this study.

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8 The Quality of Life and Migration: A Generalized Model

Introduction

To some degree or in some fashion, the role of the quality of life in human migration decisions has been acknowledged in nearly all of the preceding chapters of this book. These chapters have found the quality of life to be at least a reasonably significant determinant of migration patterns in the United States. This finding is consistent with a number of already published studies, including those by Cebula and Vedder (1973), Chao and Renas (1976), Graves (1976), Greenwood (1969), Jones and Zannaras (1976), Kau and Sirmans (1976), Liu (1975), Miller (1973), Renas and Kumar (1978), and Vedder and Cooper (1974).

The objective of this chapter is to develop a rigorous analysis of the migration impact of the quality of life in the United States. The present chapter seeks to deal with this issue more thoroughly and more directly than does the presently existing literature. [1] Hopefully, by thoroughly analyzing this topic, improved insight into the patterns of regional economic growth in the United States can ultimately be generated. [2]

A Basic Framework

The basic framework of this chapter is one wherein the individual will migrate from one area to another area only if there are positive net benefits expected from the migration. As noted in chapter 4, the analysis of the expected net benefits from any migration requires the appraisal of both the costs and benefits expected as a result of the migration.

As chapter 4 indicates, the costs and benefits associated with geographic mobility may assume a large number of different forms. For the purposes of this chapter, it is assumed that all of the basic benefits and costs associated with geographic mobility can be classified into either of two distinct categories: (1) economic considerations and (2) quality-of-life considerations.

In this chapter, economic considerations consist of those factors that affect the migrant's expected income. As chapter 6 illustrates, in the absence of money illusion, the expected income changes associated with

migration depend upon such factors as current income levels, the growth rate of current income, employment opportunities, and the cost of living.

Next, quality-of-life considerations essentially consist of those aspects of human existence which affect utility levels but which are not expressly economic in nature. The expected utility of the quality of life in any given geographic area is assumed, in this analysis, to be a function of two primary variables: climatic conditions and the perceived availability of amenities.

Thus, the migrant is portrayed here as evaluating both differential income expectations and differential quality-of-life considerations in deciding where to reside. Given two areas, area A and area B, the flow (net or gross) of migrants from A to B, M_{AB}, is then a function of economic considerations and quality-of-life considerations:

$$M_{AB} = M_{AB}\,(\text{economic and quality of life considerations}) \qquad (8.1)$$

Within this very general framework, the subsequent sections of this chapter develop an in-depth theoretical and empirical analysis of the relationship between migration patterns and the quality of life in the United States.

A Generalized Theoretical Model

In order to examine empirically the migration impact of the quality of life within a generalized model, the following migration equation is hypothesized:

$$Mi = Mi(Yi,\ \Delta Yi,\ Ci,\ Ui,\ Ei,\ DAi,\ DWi) \qquad (8.2)$$

where Mi = the net number of migrants into SMSA i between 1960 and 1970, expressed a percentage of the 1960 population in SMSA i

Yi = median family income in SMSA i, 1969

ΔYi = annual rate of change of median family income in SMSA i, between 1959 and 1969, expressed in percentage terms

Ci = average annual cost of living in SMSA i, 1970, for a four-person family with an intermediate budget

Ui = average unemployment rate of the civilian labor force in SMSA i, 1960

Ei = median school years completed, in 1960, for the population twenty-five years of age and over, in SMSA i

DAi = a dummy variable to indicate location of an SMSA in a warm weather state

DWi = a dummy variable to indicate location of an SMSA in the western portion of the United States

Certain specific comments pertaining to this model and to the variables it embodies are in order. To begin with, in computing the variable *Mi,* the net number of in-migrants to SMSA *i* is divided by the total population in SMSA *i.* This is done to control for the population-size differentials that exist among the various SMSAs studied. There are actually some thirty-nine metropolitan areas for which adequate (appropriate) living-cost data are available; however, because of deficiencies in the migration data, only thirty-six of these metropolitan areas are studied here.[3] Next, the two income variables, Yi and $\Delta Yi,$ both refer to median income rather than to per capita income. This specification follows the reasoning found in Graves (1976) that median family income is the preferred variable since the variation from state to state in the percentage of children, retired people, and other non-workers would make per capita income an imperfect measure of the expected income that could be obtained through migration. Finally, as in chapter 6, the annual rate of change of median family income, $\Delta Yi,$ is given by

$$\Delta Yi = -1 + 10 \text{ times the square root of } Y_{69i}/Y_{59\,i} \qquad (8.3)$$

where Y_{69^i} = median family income in area *i* in 1969
Y_{59^i} = median family income in area *i* in 1959

In this model, the expected real income gain associated with net in-migration to SMSA *i* is treated as a function of a set of five independent variables: *Yi, ΔYi, Ci, Ui,* and *Ei*. Following the reasoning in chapter 6 and in the studies by Pack (1973) and Pursell (1977), it is argued here that

$$\partial Mi/\partial Yi,\ \partial Mi/\partial \Delta Yi,\ \partial Mi/\partial Ei > 0$$

$$\partial Mi/\partial Ci,\ \partial Mi/\partial Ui < 0 \qquad (8.4)$$

For the migrant, these five variables, taken as a group, reflect the expected probability of obtaining gainful employment in area *i* and the expected real income which that employment would yield.

In this analysis, the quality of life in an SMSA is thought to be basically reflected by two variables *DAi* and *DWi*:

where *DAi* = a dummy variable used to indicate location of an SMSA in a warm weather state; if the SMSA is located in a warm weather state, the variable assumes a value of one, and if the SMSA is not located in a warm weather state, the variable takes on a value of zero.

DWi = a dummy variable used to indicate location of an SMSA in a western state; if the SMSA is located in a western state, the variable assumes a value of one, and if the SMSA is not located in a western state, the variable takes on a value of zero.

Table 2-1 of chapter 2 lists both the warm weather states and the western states.

Following, Liu (1975), Greenwood (1969), and Cebula and Vedder (1973), it is argued here that, on the average, people prefer location in warmer or more moderate climates to location in relatively colder climates. Hence, it is expected here that

$$\partial Mi/\partial DAi > 0 \tag{8.5}$$

In addition, as Liu (1975) notes, people generally view the western portion of the United States as being relatively more amenity rich than elsewhere in the nation. Hence, it is also argued here that

$$\partial Mi/\partial DWi > 0 \tag{8.6}$$

Before proceeding to the actual empirical estimation, it is worth noting that the present analysis differs from other related studies in that it deals with the migration impact of the quality of life at the same time that it introduces a set of several explicitly economic variables, all of which are aimed at measuring income expectations. In other words, this analysis deals with a relatively more complete set of explicitly economic variables than do most other studies dealing with migration and the quality of life.

The Empirical Analysis

The actual migration equation to be estimated here is given by

$$Mi = a_o + a_1 Yi + a_2 \Delta Yi + a_3 Ci + a_4 Yi + a_5 Ei + a_6 Dai + a_7 DWi + u \tag{8.7}$$

where a_o = constant
u = error term

Estimating equation 8.7 by ordinary least squares yields the following set of results:

$$Mi = -35.294 + 0.000207\ Yi + 909.828\ \Delta Yi - 0.004\ Ci - 1.66512\ Ui$$

$$(1.38) \qquad (11.73) \qquad (6.24) \qquad (4.09)$$

$$+ 21.193\ Ei + 4.08004\ DAi + 9.64375\ DWi,$$

$$(3.11) \quad (3.02) \quad (8.62)$$

$$DF = 28,\ R^2 = 0.74,\ F = 11.202 \qquad (8.8)$$

where terms in parentheses are unsigned t- values.[4]

Overall, these results are quite encouraging. To begin with, all seven of the exogenous variables exhibit the correct signs. Next, with the exception of the coefficient for the income variable, all of the estimated coefficients are statistically significant at the 0.09 level or better. The coefficient of determination has a value of 0.74, so that the model explains nearly three-fourths of the total net migration to these SMSAs. Finally, the *F*-ratio is statistically significant at well beyond the 0.01 level.

Before making an in-depth evaluation of the regression results in equation 8.8, it will be helpful to refer to Tables 8-1 and 8-2. In Table 8-1, the change in R^2 attributable to each of the exogenous variables in equation 8.8 is shown. This information indicates how each of these variables contributes to the overall explanatory power of the model. In Table 8-2, the means and standard deviations of the exogenous variables are presented. This permits the reader to evaluate more precisely the regression coefficients shown in equation 8.8.

Let us now consider the results in equation 8.8 in somewhat greater depth. To begin, except for the income variable *Yi,* all of the variables used to measure income expectations are statistically significant determinants of net migration to the thirty-six SMSAs studied. In fact, as Table 8-1 indicates, these five variables (combined) contribute over 0.56 to the R^2 of the equation. This result lends further empirical support to the argument of Sjaastad (1962) that the expected economic benefits from migration are extremely important components of a migrant's location-decision calculus.

Table 8-1
Change in R^2 Attributable to Exogenous Variables

Variable	*Change in R'*
Yi	0.001
ΔYi	0.276
Ci	0.059
Ui	0.022
Ei	0.205
DAi	0.083
DWi	0.092

Table 8-2
Means and Standard Deviations of Exogenous Variables

Variable	*Mean*	*Standard Deviation*
Yi	I0.582.03	995.54
ΔYi	0.05	0.01
Ci	10,566.47	740.97
Ui	4.64	1.34
Ei	11.24	0.86
DAi	0.39	0.49
DWi	0.17	0.38

Table 8-3
Correlation
Matrix

	Yi	*Ui*	*DWi*	*DAi,*	*Ei*	*Ci*
Ui	-0.07					
DWi	0.06	0.38				
DAi	-0.39	0.12	0.25			
E;	0.29	-0.12	0.36	0.07		
Ci	0.65	0.05	0.06	-0.36	0.08	
ΔYi	0.03	-0.51	-0.51	0.19	0.11	-0.20

We turn now to the two quality-of-life variables in the model. The dummy variable for warm weather, *DAi,* is statistically significant at the 0.09 level with the correct sign. The dummy variable for western location, *DWi,* is statistically significant at well beyond the 0.01 level with the correct sign. Moreover, as shown in Table 8-1, the variables *DAi* and *DWi* contribute R^2 values of 0.083 and 0.092, respectively, to the total explanatory power of the model.[5] From these results, we conclude that, as argued by Liu (1975) and Cebula and Vedder (1973), the quality of life exercises a very important impact on geographic mobility in the United States.

Before proceeding to the concluding section of this chapter, it is appropriate to refer to Table 8-3, which lists the zero-order correlation coefficients for the exogenous variables in this analysis. As shown in this table, there appear to be no major problems of multi-collinearity in this system.[6]

Summary and Observations

The empirical findings in this chapter indicate that both economic variables and quality-of-life variables enter as significant arguments in the migrant's location decision. Migrants are found, on the average, to be drawn to areas where their expected incomes are likely to be greater, ceteris paribus. In addition, migrants are attracted to areas having a perceived better quality of life, ceteris paribus. The latter fact notwithstanding, however, it should be stressed that, as shown in table 8-1, the income-expectations variables appear to be quantitatively far more important in the migration decision of the average migrant than do the quality-of-life variables.[7]

One question that arises from this analysis concerns the possible roles of migration and the quality of life in determining the pattern of regional growth rates. For instance, it might by hypothesized that the rate of average income growth over time in a geographic area may be profoundly affected by such factors as the rate of net in-migration to the area and the nature of the quality of life in the area.

To examine this possibility, we estimate the following regression:

$$\Delta Yi = b_0 + b_1 Mi + b_2 DWi + b_3 DAi + b_4 Ei + u \qquad (8.9)$$

where b_0 = constant

u = stochastic error term

Estimating equation 8.9 by ordinary least squares yields the following empirical results:

$$\Delta Yi = +0.06214 + \underset{(+26.54)}{0.0004\ Mi}$$

$$- \underset{(+25.54)}{0.00802\ DWi} - \underset{(+1.32)}{0.00133\ Ei}$$

$$+ \underset{(+0.16)}{0.00044\ DAi},$$

$$DF = 31 \qquad R^2 = 0.67 \qquad F = 15.397 \tag{8.10}$$

where terms in parentheses are *t*-statistics.

This very elementary analysis confirms the notion that net migration and quality-of-life considerations may each play a very significant role in determining the annual growth rate of median income in a region.[8] Nevertheless, given the simplicity of equation 8.9 and given the complexity of the issue at hand, the estimation in equation 8.10 should merely serve to open the door to further investigations.[9] Such investigations would seem especially pertinent in this era of the energy-crisis, where the future long-term prosperity of the sunbelt states appears to be very promising.

Notes

1. Liu (1975) examines the effects on total net interstate migration of the quality of life by constructing indexes of the quality of life and of other factors. In all, he uses well over one hundred variables in his analysis. Given such a large number of variables, it is very difficult to develop an adequate way in which to interpret and apply his various empirical results. Most other related studies deal with only one quality-of-life variable, usually a climate variable such as cold weather.

2. Although the issue of regional economic growth is briefly addressed at the end of this chapter, there is no attempt made in this book to develop a rigorous and formal theoretical or empirical model of regional economic growth processes. Such an effort would lie far beyond the scope of this book.

3. The three SMSAs having adequate living-cost data but lacking other needed data were Boston, Mass., Hartford, Conn., and Portland, Maine. For a complete list of the thirty-six SMSAs studied here, see the first end note in chapter 5 of this book.

4. Recall that the F-statistic is the square of the t-value; hence, it is always a positive value.

5. Thus, the variables *DA;* and *DW;* combined provide approximately 24 percent of the actual explanatory power of the model.

6. Extensions of this migration model might include such variables as the rate of change of the cost of living (as in Renas and Kumar, 1978 and Werthwein, 1978), pollution levels (as in Cebula and Vedder, 1973 and chapters 7 and 9 of this book), and congestion.

7. This conclusion contrasts sharply with the findings in chapter 7, where the emphasis is strictly on the migration of the elderly.

8. Dropping off the statistically insignificant variables from equation 8.10 and re-estimating by ordinary least squares yields

$$\Delta Yi = +0.05312 + 0.00042\ Mi - 0.00804\ DWi$$
$$(+36.13) \qquad (+34.65)$$

$$DF = 33 \qquad R^2 = 0.65 \qquad F = 30.178$$

where terms in parentheses are *t*-statistics.

Clearly, these results are entirely compatible with those in equation 8.10.

9. Such investigations would necessarily involve the development of multi-equation systems to be estimated by the two-stage least squares method or by some similar alternative method. Pertaining to this and related issues, see Gallaway and Cebula (1972), Hartman and Seckler (1967), and Richardson (1973) and (1974).

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9 Government Policies and Migration Patterns in the United States

Introduction

Government policies influence society in a wide variety of ways through taxation, transfer, and expenditure activities. As taxation, transfers, and expenditures are carried out, income redistribution and variations in the levels of burdens and benefits from governmental action are experienced. For instance, when a governmental unit increases the level of welfare benefits, it further redistributes income through a taxation-transfer process. Alternatively, whenever a governmental unit raises the levels of, say, educational spending and of taxes, there will likely result a myriad of additional benefits and costs for the various members of the society.

Considerations such as these were to lead Professor Charles M. Tiebout (1956, p. 418) to hypothesize:

> . . . the consumer-voter may be viewed as picking that community which best satisfies his preference pattern for public goods . . . the consumer-voter moves to that community whose local government best satisfies his set of preferences.

Professor Tiebout was essentially arguing that differences among local governments in the mix and amounts of various public goods and services provided will, other things being held the same, influence the pattern of human migration.

More recently, within a somewhat different context, Gordon Tullock (1971, p. 917) has made a rather similar statement: "The individual deciding where to live will take into account the private effects upon him of the bundle of government services and taxes…" Tullock's statement differs slightly from Tiebout's in that it explicitly introduces the notion that differential local government tax systems (that is, both methods and levels of taxation) also may influence human locations decisions.

The idea that, other things held the same, people move in order to express effectively their preferences for publicly provided goods and services may be referred to as voting with one's feet. Consumers, as independent individuals, usually can do little by themselves to change local government policies. On the other hand, individuals potentially can to a large degree consume the public goods they desire by locating in the area most compatible with their preference pattern.

In order to illustrate in succinct, formal terms the idea of voting with one's feet, let us assume for simplicity that an individual can move to either of two areas (regions), area A or area B. Associated with residing in area A, the consumer can expect to receive a certain gross income, say Y_A. Likewise, in area B, his expected gross income would be Y_B.[1] Going further, residence in area A would presumably mean a tax liability for the consumer of value T_A, whereas residence in area B would involve a tax liability of T^8. Hence, the consumer's expected disposable money income in area A, Yd_A, would be:

$$Yd_A = Y_A - T_A \tag{9.1}$$

Similarly, his expected disposable money income in area B, Yd_B, would be

$$Yd_B = Y_B - T_B \tag{9.2}$$

In figure 9-1, the consumer is shown, if he resides in area A, to be consuming C_A units of public goods. His disposable money income in area A is Yd_A; hence, given the price of private goods x in area A as PxA, he can consume YdA/Px_A units of x and C_A units of public goods while residing in area A. Observe that the budget constraint is now perfectly vertical, unlike conventional consumer theory, where it is negatively sloped.

In figure 9-2, the consumer is shown, if he decides to reside in area B, to be consuming C_B units of public goods. His disposable money income in area B is Yd_B; therefore, given the price of private goods in area B as value Px_B, the individual then can consume Yd_B/Px_B units of x and C_B units of public goods when residing in area B. As in figure 9-1, the consumer's budget constraint is perfectly vertical.

In figures 9-1 and 9-2, the highest attainable utility levels for the consumer are IA and IB, respectively. The consumer presumably will move to whichever of these two particular areas places him at the higher utility level (that is, on the higher indifference curve).

Clearly, if real income differentials between areas are small, then comparison of the real tax burden and the real expenditures on public goods in each community with those of other communities determines the location decision. Other things equal, the individual prefers communities with lower real tax burdens, since with a lower real tax burden his disposable real income for purchasing private-sector commodities is greater and hence so is his utility level. Moreover, other things equal, the individual prefers communities providing higher real levels of public expenditures, so long as those expenditures are of a variety he can directly consume or vicariously benefit from in a meaningful way.

There are two possible interpretations of the Tiebout-Tullock hypothesis of voting with one's feet. On the one hand, areas A and B may be inter-

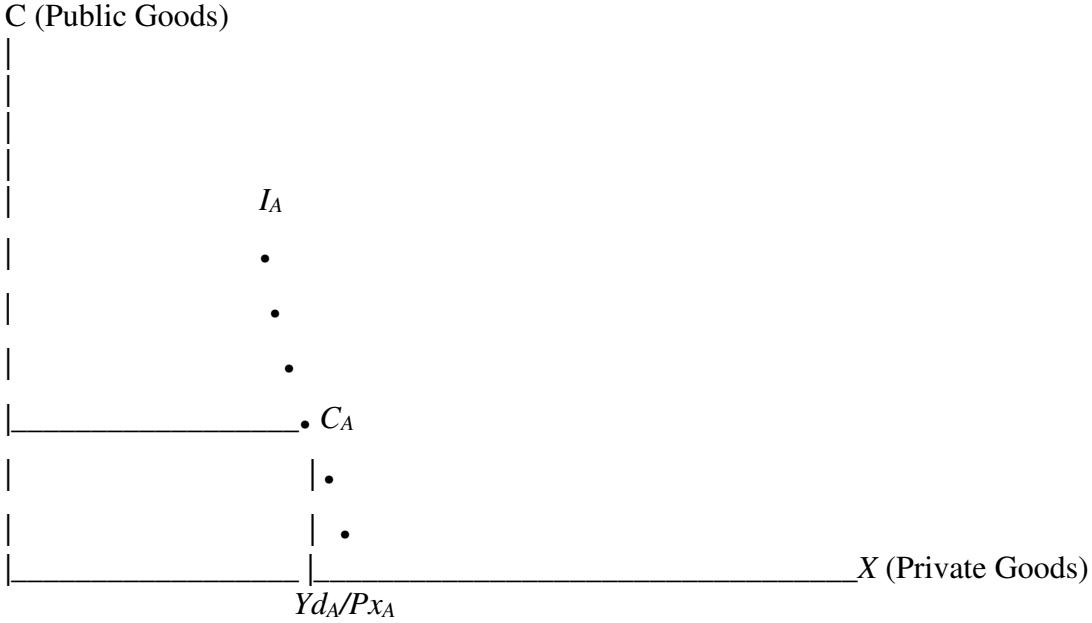

Figure 9-1. Maximum Utility in Area A

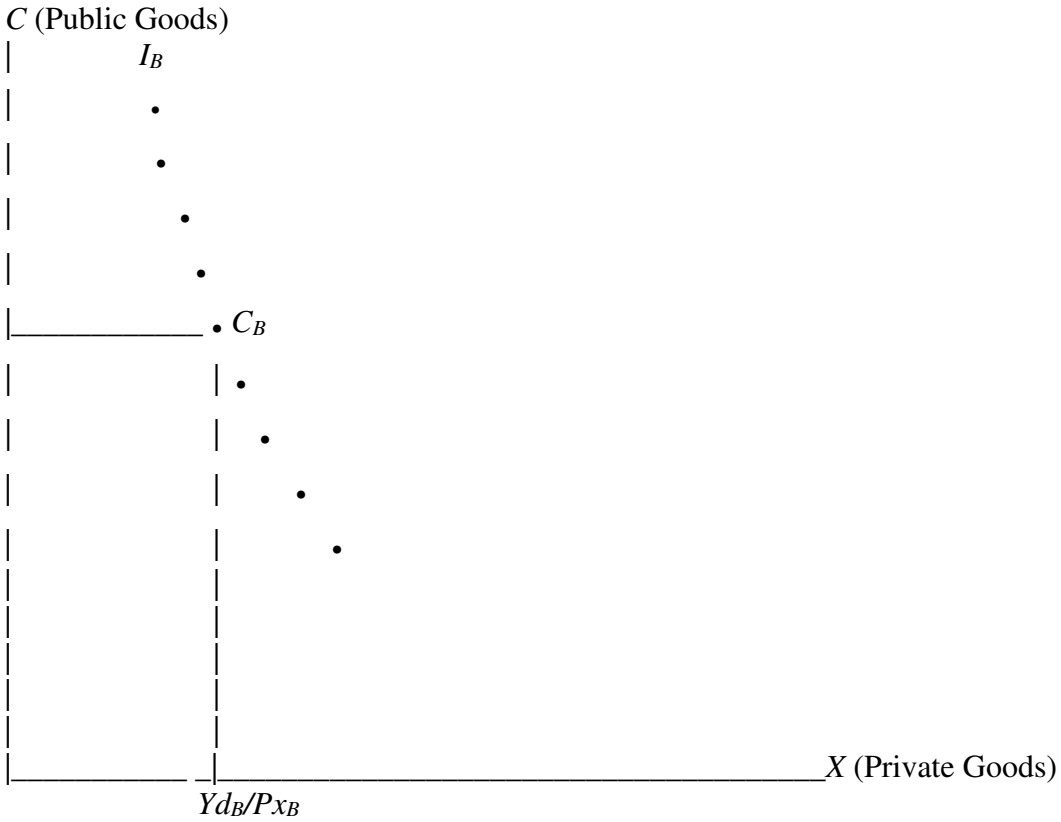

Figure 9-2. Maximum Utility in Area B

preted as being relatively close to one another, perhaps in the very same metropolitan area. This is indeed the precise context of Tullock's argument, and, moreover, it is the original interpretation of Tiebout's argument (see, for example, (Oates, 1969; Schmalensee, 1976). On the other hand, a more

recent interpretation has been that areas A and B may alternatively be geographically quite distant from one another. In point of fact, recent years have witnessed a proliferation of studies adopting the latter interpretation (see, for example, Barsby and Cox, 1975; Chao and Renas, 1976; DeJong and Donnelly, 1973; Glantz, 1974; Kau and Sirmans, 1976; Kleiner and McWilliams, 1977; Pack, 1973; Riew, 1973; and Sommers and Suits, 1973).

The simple framework developed here is flexible enough to accommodate either of the above two interpretations; among other things, it also explicitly allows for the following sets of measurable factors in the location decision calculus:

1. differential income levels
2. differential local government policies

Clearly, both of these sets of factors may vary greatly if areas A and B are geographically distant. In addition, although these factors may differ to a lesser degree within a given metropolitan area, they nevertheless can (potentially) vary by a good bit even then.

Obviously, this analytical framework can be easily applied (expanded) to any number of areas (regions). In the many-area case, the consumer logically would choose that area from among his various alternatives which maximizes his utility level.

Two Hypotheses Relating Government Policies to Migration

The basic objective of this chapter is to investigate, in principle, the impact on human migration of state and local government expenditure and income redistribution policies. This analysis is directed at two specific policies: the per capita level of state and local government non-welfare expenditures and the average level, per recipient, of welfare benefits. By empirically investigating the two hypotheses (A and B) formulated below, this chapter seeks to test the validity of the Tiebout (-Tullock) hypothesis of voting with one's feet.

In order to carry out the analysis, attention will be focused upon two types of migrants: white migrants and black migrants. A much larger proportion of blacks than of whites is eligible for welfare benefits. Thus, it may be expected that the level of welfare benefits will act as a stronger attraction to black would-be migrants [2] than to their white counterparts. In addition, by virtue of the fact that welfare benefits represent a redistribution of income from the economically better off to the economically worse off, whites may tend to view areas with higher welfare benefits as areas that, on average, redistribute income from themselves to others. Thus, *ceteris pari-*

bus, the would-be white migrants may be expected to gravitate to areas with lower levels of welfare benefits. The present chapter in part investigates whether in fact welfare benefits tend to have these opposing effects on white and black migrants. This will be referred to as hypothesis A.

On the other hand, the higher the per capita level of combined state plus local government non-welfare spending, presumably the higher the level of general benefits per capita derived from such spending. In turn, the higher the level of such spending in an area, the more attractive the area will tend to be to would-be migrants, black and white. However, to the extent that higher per capita state-local government expenditure levels imply higher levels of local tax burdens per capita and that whites view their share of the tax burden as relatively greater per capita than that of blacks, higher levels of per capita local government spending may be expected to be more potent an attracting influence on black migrants than on white migrants. In point of fact, higher levels of per capita non-welfare public spending may even act as a net deterrent to white migrants. The present chapter in part, then, seeks to investigate whether in fact the level of per capita local government spending is a more potent positive attraction to black migrants than to white migrants. This is referred to as hypothesis B.

Aside from the presence of hypotheses A and B above, this study differs from other related studies in at least two ways. First, the models examined here are more complete than in other studies. Specifically, this study simultaneously includes (1) multiple purely economic variables, (2) a quality of life variable, and (3) multiple public-policy variables. Second, the models examined here are not in pure linear form; that is, unlike other related studies, the present study allows the dependent variable (migration) to be related in a nonlinear fashion to the various exogenous variables in the analysis.

The Basic Migration Model

In order to investigate hypotheses A and B empirically, the following net migration model is postulated:

$$M_i = M_i(Y_i, U_i, W_i, E_i, P_i) \tag{9.3}$$

where M_i = a measure of net in-migration to state i
Y_i = a measure of the average income level in state i
U_i = a measure of the average unemployment rate in state i
W_i = a measure of average welfare benefit levels in state i
E_i = a measure of the average level of state plus local government nonwelfare expenditures in state i
P_i = a measure of the level (degree) of air pollution in state i

The variable Mi is used to measure migration of whites on the one hand and migration of blacks on the other. Mi is defined then as the ratio of the net migration of whites or blacks to state i between 1960 and 1970 to the total population of state i in 1960. Mi is formulated thus in order to control for variations in the population among the states considered. The migration data were obtained for forty-eight states (Alaska and Hawaii were excluded from the study).

The variable Yi refers to the per capita personal income level of whites or blacks for the year 1960. In accord with conventional economic theory, it is assumed that white and black migration should each be directly related to white and black income, respectively, so that:

$$\partial Mi/\partial Yi > 0 \tag{9.4}$$

The variable Ui measures the average unemployment rate for whites on the one hand and for blacks on the other hand. The variable Ui was obtained by averaging the 1960 and 1970 unemployment rates for whites and for blacks, respectively. The expected relationship between migration (white or black) and the unemployment rate is

$$\partial Mi/\partial Ui < 0 \tag{9.5}$$

The reasoning here is quite simple. In particular, for those whose movement between states is not merely of the job-transfer variety, the higher the unemployment rate in a state, the greater the uncertainty (risk) associated with obtaining employment in that state tends to be.

To measure welfare benefits, Wi, data on monthly payments in the year 1971 to welfare recipients in the form of aid to families with dependent children (AFDC) by state were gathered. Since our proxy for welfare levels effectively may represent a form of benefit (that is, unemployment benefit and/or income) for those eligible for such payments, the following relationship may be expected:

$$\partial Mi/\partial Wi > 0 \tag{9.6a}$$

In accord with our earlier comments, however, we would expect blacks to be differentially more responsive to welfare benefits than whites. In particular, since a larger proportion of blacks is eligible for welfare benefits, blacks

can be expected to be more attracted by welfare benefits than whites. In addition, since whites may view higher welfare benefits in an area as implying a higher degree of unfavorable net income redistribution, they can be expected to be less attracted to areas with higher welfare benefits than blacks. In fact, it is entirely possible that, *ceteris paribus*, they may prefer to move to areas with lower welfare benefits; thus, while blacks may be argued to conform to 9.6, for whites it may well be that

$$\partial Mi/\partial Wi < 0 \qquad (9.6b)$$

The measure *Ei,* data were assembled on total (non-welfare) direct per capita expenditures of state and local governments in 1970. These expenditures include spending for education, highways, and health and hospitals. In accord with our earlier arguments, *Ei* presumably may represent, for blacks, a form of benefit, so that the higher the level of *Ei* in a state, the more attractive residence in that state. Thus, for black migrants, it is hypothesized that

$$\partial Mi/\partial Ei > 0 \qquad (9.7a)$$

The impact of *Ei* on white migration may not be quite so clear-cut, however. As argued above, while higher levels of *Ei* may imply greater benefits for whites, they may also imply higher levels of local taxation and on average an increased degree of unfavorable income redistribution. Thus, the relationship between Mi (for whites) and the variable *Ei* is not *a priori* determinate:

$$\partial Mi/\partial Ei > 0 \text{ or } < 0 \qquad (9.7b)$$

To measure air pollution, *Pi*, data were assembled measuring suspended particulate matter by state for the year 1966. Presumably, higher pollution rates impose greater disutility on individuals, *ceteris paribus*. Thus, the following relationship would be expected for whites and blacks alike:

$$\partial Mi/\partial Pi > 0 \qquad (9.8)$$

Profile of the Welfare Data

The welfare system in the United States has come under fire from many different quarters in recent years (see, for example, Cebula 1976). The most common criticism of the system pertains to its benefit structure. As Orr (1976, p. 359) has stated:

> One of the dominant features of the U.S. income transfer system is the great disparity in benefits available to similarly situated persons in different political jurisdictions.

Given this feature of our welfare system, it may be of interest and utility to examine the raw welfare data used in the estimations presented in the next section of this chapter. As noted earlier, the models to be estimated in this study utilize the AFDC level for 1971. These data, along with AFDC data for the years 1965 and 1975, are provided in Table 9-1. As shown, the interstate disparities are enormous; in 1965, the ratio of the highest AFDC level to the lowest is over 6:1. Moreover, the extreme AFDC disparities persist from one year to the next: there is absolutely no sign of a trend toward relative uniformity (that is, less disparity). It is little wonder we hypothesize that low-income persons residing in low-welfare areas may be strongly attracted by the prospects of much higher welfare benefits elsewhere.[4]

Table 9-1
Average Monthly Aid to Families with Dependent Children, per Family, by State

State	*1965*	*1971*	*1975*
Alabama	48	59	95
Alaska	130	216	283
Arizona	121	120	134
Arkansas	65	97	123
California	179	204	264
Colorado	138	174	207
Connecticut	177	245	263
Delaware	128	123	194
Florida	59	92	124
Georgia	89	102	100
Hawaii	172	285	339
Idaho	152	205	250
Illinois	186	238	279
Indiana	110	148	168
Iowa	156	194	276
Kansas	151	168	222
Kentucky	88	119	179
Louisiana	101	88	122
Maine	109	147	172
Maryland	142	161	184

Table 9-1 continued

State	*1965*	*1971*	*1975*
Massachusetts	170	252	382
Michigan	141	228	287
Minnesota	162	236	266
Mississippi	33	55	49
Missouri	98	110	140
Montana	144	153	165
Nebraska	118	152	206
Nevada	123	110	150
New Hampshire	156	210	230
New Jersey	195	256	275
New Mexico	122	116	139
New York	197	288	357
North Carolina	97	118	155
North Dakota	164	206	247
Ohio	124	161	204
Oklahoma	130	136	189
Oregon	152	174	247
Pennsylvania	141	239	286
Rhode Island	148	229	247
South Carolina	60	76	90
South Dakota	122	160	205
Tennessee	95	105	105
Texas	91	116	109
Utah	138	186	239
Vermont	113	232	273
Virginia	104	175	193
Washington	145	197	257
West Virginia	107	118	167
Wisconsin	174	245	298
Wyoming	136	147	176

Sources: U.S. Bureau of the Census, *Statistical Abstract of the United States, 1973,* Washington, D.C., 1973, Table 490; U.S. Bureau of the Census, *Statistical Abstract of the United States, 1977,* Washington, D.C., 1977, Table 492.

Empirical Findings

Conceptually, what is proposed in this chapter is the estimation for white migration and for black migration of log-linear regression equations of the following form:

$$\log Mi = a + b \log Yi + c \log Ui + d \log Wi + e \log Ei + f \log Pi + \mu \qquad (9.9)$$

where a = constant
μ = error term

The ordinary least squares estimations of regression 9.9 for white migration and for black migration are given in equations 9.10 and 9.11, respectively:

$$\begin{aligned} \log Mi = {} & -0.75953 + 0.34686 \log Yi \\ & \qquad (+3.31) \\ & - 0.04180 \log Wi \; - 0.12585 \log Ui \\ & \quad (-0.76) \qquad\quad (-2.88) \\ & - 0.01661 \log E; \; - 0.0682 \log Pi \\ & \quad (-0.14) \qquad\quad (-1.68) \end{aligned}$$

$$DF = 42 \qquad R^2 = 0.54 \qquad (9.10)$$

$$\begin{aligned} \log Mi = {} & -2.04582 + 0.00528 \log Yi \\ & \qquad (+0.04) \\ & - 0.11868 \log Ui + 0.29580 \log Wi \\ & \quad (-1.13) \qquad\quad (+2.49) \\ & + 0.54669 \log Ei - 0.00661 \log Pi \\ & \quad (+2.37) \qquad\quad (-0.07) \end{aligned}$$

$$DF = 42 \qquad R^2 = 0.67 \qquad (9.11)$$

where the terms in parentheses are *t*-values. We first analyze the regression results for white migration in equation 9.10. The income variable worked as hypothesized and was statistically significant at the one percent level. This conforms to the conventional wisdom. The unemployment variable had the hypothesized sign but was not statistically significant at even the 10 percent level. The welfare variable showed up with a negative coefficient and was statistically significant at the one percent level. This confirms the hypothesis in equation 9.6b that whites view a higher welfare level as implying, on average, a more unfavorable net income redistribution. Thus, they tend to gravitate to states where the welfare benefits per recipient are lower, *ceteris paribus*. The expenditures variable, *Ei* turned up with a negative coefficient, but was not statistically significant at even the 10 percent level. The possibility of a negative coefficient was indicated by 9.7b above, where it was suggested that whites on the average *may* view a higher level of *Ei* not only as implying higher benefits from the public sector but also higher taxation and a higher degree of unfavor-

able income redistribution as well. Finally, the pollution variable showed up with the hypothesized sign and was statistically significant at the 5 percent level. Apparently, white migrants prefer lower pollution rates to higher pollution rates, *ceteris paribus*. The statistical significance for *Pi* is contrary to that of an earlier study of total migration between metropolitan areas in the United States for the 1960-68 period (see Cebula and Vedder, 1973).

We next interpret the regression results on black migration in 9.11. The income variable here had the hypothesized sign but was not statistically significant at even the 10 percent level. This apparent insensitivity of migrants to wage differentials has been found elsewhere, but it has been shown to be compatible with conventional wage theory under certain conditions (see chapters 1 and 4). The unemployment variable *Ui* had the hypothesized sign but, as in the case of white migration, this variable was not statistically significant at even the 10 percent level. The welfare variable, *Wi* here had the hypothesized sign (see 9.6) and was statistically significant at the 1 percent level. This is in sharp contrast to the results on white migration in regression 9.10. Next, as hypothesized in 9.7a, the public expenditures variable *Ei* had a positive coefficient. In addition, *Ei* was a statistically significant determinant of black interstate net migration. Thus, the level of public non-welfare expenditures, as a proxy for public benefits, apparently acts as a potent lure to black migrants. Finally, although the pollution variable, *Pi* had the expected sign, it was not significant at even the 10 percent level. This is in contrast to the results in 9.10 on white migration but is consistent with another recent study, that by Cebula and Vedder (1973).[5]

Concluding Remarks and Implications

We may now proceed to comment on the validity of hypotheses A and B. As formulated in this chapter and summarized in equations 9.6 and 9.6a. Hypothesis A argues that white migrants and black migrants will have opposing reactions to the level of welfare benefits in an area, that is, whites will be attracted to areas with lower welfare benefits and blacks will be attracted to areas with higher welfare benefits. As equations 9.10 and 9.11 and the discussions thereof indicate, the interstate migration patterns of whites and blacks strongly support hypothesis A. One may thus infer that state-local income redistribution policies may be significant determinants of human migration, with higher levels of welfare deterring whites on the one hand and attracting blacks on the other.

As our equations 9.7a and 9.7b indicate, hypothesis B holds that blacks seeking benefits will be attracted to areas of higher per capita (nonwelfare) public expenditures, whereas whites, because higher per capita public expenditures imply higher taxation and a higher average degree of unfavor-

able net income redistribution, may be expected to be less responsive to, and perhaps even deterred by, higher per capita public (nonwelfare) spending. Regression result 9.11 clearly lends support to hypothesis B, with blacks being attracted to areas with higher public (nonwelfare) expenditures. Regression result 9.10, by contrast, indicates that the level of public (nonwelfare) spending was not a potent net influence on white migrants. This is consistent with hypothesis B, as represented in equation 9.7b.

It appears, from the results summarized in equations 9.10 and 9.11, that there is considerable empirical support for the Tiebout (-Tullock) hypothesis that state and local government policies have had a significant impact on the interstate allocation of human resources in the United States. To a large degree, welfare levels and nonwelfare state-plus-local government expenditures in the United States are determined by essentially independent political bodies, bodies that are not coordinated to influence geographic population distribution in a socially optimal fashion. Consequently, the fact that such policies influence the spatial allocation of human resources leads one to infer that the policies in question probably act significantly to distort resource allocation.[6]

Hence, the idea of establishing uniform welfare (and other) policies throughout the United States is intuitively attractive.[7] Welfare uniformity should, in theory, act to remove welfare considerations from the locational decision calculus.[8] Nevertheless, since living-cost differentials also influence migration patterns (see chapter 5), welfare-benefit levels should probably be made to approximate uniformity in *real* terms. A uniform real welfare system-which is feasible, given currently available geographic living-cost data-seems most appealing indeed; moreover, failure to provide living-cost allowances within the system may well render welfare reform a potential disaster.

Notes

1. "Income" includes earned income plus public welfare, as well as other income sources. Note that, if an individual is a would-be welfare recipient, his income can vary (very substantially, in some cases) from one area to the next.

2. This is suggested in the papers by DeJong and Donnelly (1973), Kau and Sirmans (1976), Kleiner and McWilliams (1977), Pack (1973), and Sommers and Suits (1973).

3. This consists of micrograms per cubic meter of air of particles of smoke, dust and fumes and droplets of viscous liquid remaining in the air for varying periods of time.

4. Similar disparities among the states in the level of nonwelfare expenditures, especially education, also exist.

5. Observe here that the results presented in regressions 9.10 and 9.11 involve elasticities, not coefficients *per se*.

6. Ultimately, such distortions are reflected by diminished output growth or higher prices or other higher costs in the economy.

7. Related to such a welfare scheme, see the comments by Orr (1976).

8. This would theoretically then eliminate the labor market distortions of the current welfare system.

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Part III
Needs for Change in Future Migration Research

Introduction

The first part of this book develops a rigorous model of geographic mobility, while the second part of this book both theoretically and empirically examines the impact on migration of a number of significant variables. This third section consists of two chapters which help to isolate basic changes that are necessary for the improvement of future migration research.

Chapter 10 serves essentially three basic functions. First, it summarizes the principal findings of empirical studies that have investigated the impact on migration of geographically different state and local public policies. Among the many public policies examined by this particular literature are welfare benefit levels, property tax levels, and levels of spending on public education. Second, this chapter examines some of the possible economic implications of this literature to date. Among other things, it concludes that the existing structure of geographically different state and local public policies leads to severe factor-market distortions. Furthermore, these factor-market distortions are alleged both to distort patterns of regional economic growth in the United States and to contribute significantly to the financial problems of many state and local governments. Third, this chapter points out the basic shortcomings of the migration literature in question and then offers a number of specific suggestions for improving the quality of future research in the area of migration.

Unlike chapter 10, chapter 11 does not summarize the findings of specific empirical studies. Instead, chapter 11 concentrates on certain rather widespread problems and deficiencies of the non-policy migration literature as a whole.

The first issue addressed in this chapter is that of properly specifying the migration variable. By expanding the scope of the migration models developed in chapter 4, chapter 11 indicates how to specify properly the migration variable in models of either gross migration or net migration.

The next issue addressed in this chapter is that of properly specifying exogenous variables. It is pointed out that, for the most part, the migration literature has failed to deal adequately with geographical living-cost differentials and variables that measure the quality of life. It is also argued that the literature has failed to specify income variables properly and to distinguish appropriately between total income received and earned income.

The last major issue raised in this chapter concerns theoretical models of migration behavior. It is argued that most studies of migration fail altogether to develop a rigorous theoretical behavioral model. It is pointed out

that, typically, migration studies contain only very cursory analytical models; most such studies rely very largely on merely *ad hoc*, intuitive arguments.

In the final analysis, while chapter 11 identifies certain very common problems in the migration literature, it also indicates reasonable ways in which to eliminate, or at least to lessen, the existing problems in this literature. In fact, chapters l0 and 11 both are aimed at identifying ways in which to improve the quality, and hence the usefulness, of future migration research.

10 The Migration Impact of Public Policies: A Critique of the Literature

Introduction

As West, Hamilton, and Loomis (1976) have observed, the United States Commission on Population Growth and the American Future *(Population and the American Future,* 1972, Vol. 5) has focused attention on population distribution as a major national policy issue and concern. In the United States, both birth rates and death rates are comparatively stable; consequently, internal migration is presently the major short-run determinant of changes in population distribution. This migration occurs largely as a result of voluntary decisions made by individuals in response to economic, social, and political factors. Policies that modify the political, social, and economic environment may induce or discourage these population movements. Consequently, it is extremely important that we try to understand, in pragmatic terms, precisely how current types of government policies affect geographic mobility.

Recent years have witnessed the proliferation of numerous research projects seeking to ascertain the relationship between state and local government policies and human migration patterns. The specific policies considered, the empirical techniques adopted, the specification of models, and the data bases used have all been very diverse. Given the extremely important policy implications that may be derived from this type of research, it is essential for us to have a sound basic knowledge of the research findings obtained to date; moreover, it is essential for us to understand the shortcomings of this research so that future research may produce more relevant and more fruitful insights. Accordingly, this chapter surveys the principal research contributions on the migration impact of state and local government policies and then offers a number of suggestions for improved research efforts for this area in the future.

The following section surveys the literature pertaining to the relationship between public assistance (welfare) levels and migration patterns. Then the next section surveys the relationship between migration and nonwelfare state and local government policies, that is, tax levels and levels of nonwelfare spending. After this, some general economic implications of the main findings in the survey sections are considered. Finally, a plea for some specific, basic changes in the research undertaken in this general area is made.

The Literature on Welfare and Migration

Although there are potentially several different public policy variables that could have been analyzed by researchers, it turns out that the impact of geographic welfare level differentials was in fact to receive the first attention and by far the most extensive attention.

At the outset, it should be stressed that there exist enormous geographic welfare differentials in the United States. This has been observed by numerous authors, such as Heilbrun (1974), Steiner (1971), Wohlenberg (1976), Grumm (1972), and Orr (1976). It was also exemplified in chapter 9 of this book (see Table 9-1).

Why Should Welfare Differentials Affect Migration?

Given the existence of these enormous geographic welfare differentials in the United States, it would seem reasonable to inquire *"Why* should welfare differentials affect migration?"

In response to this question, there appear to exist at least two rather different views. One view is suggested in research by Brehm and Saving (1964), who argue (p. 1003) that the "...demand for government assistance programs... may be looked upon as a special case of the demand for leisure..." After a theoretical and empirical analysis, they conclude (1964, p. 1018) that welfare "...recipients are like the remainder of consumers in that they react to economic incentives."

Traditionally, the migration literature has argued that income differentials are to be viewed as a (the) critical determinant of location decisions. What Brehm and Saving in effect are suggesting is that, at least for would-be or actual welfare recipients, welfare benefits are an extension of or form of income; hence, given that there exist large geographical welfare differentials, we would expect would-be or actual welfare recipients to respond to such differentials, *ceteris paribus.*

In point of fact, much of the literature dealing with migration and welfare either implicitly or explicitly takes the view that welfare is seen by the poor as being a form of income per se or as being a form of long-term unemployment compensation. In reality, the literature abounds with statements, such as that found in Greenwood and Sweetland (1972, p. 669), which claim that "...the real *income* aspects of...(welfare) programs should be greater for persons with lower incomes..." and with statements such as that found in Ostrosky and Jensen (1978, p. 68), which refer to the alleged "... fact... that most welfare recipients- would-be *or* actual- take the view that welfare is, in effect, either an income form or a form of longer-term unemployment benefit." Studies that adopt such a view postulate welfare as a primary cause of migration of the poor.

There is an alternative view of the alleged migration-welfare relationship. This view argues that welfare benefits are *not* seen as an income form *per se*. Rather, when the poor migrate in search of employment, they seek areas where they feel employment opportunities are likely to be the best. Very often this leads them to larger, non-southern areas, where expected adverse discrimination is presumably less (see Cebula and Schaffer 1975 or Greenwood and Gormely 1971). Statistically speaking, however, these same areas are most often those where welfare tends to be the highest. But this does not mean that these migrants moved basically to get on welfare. Quite the contrary is argued to be true. For example, Long (1974, p. 55) argues that these migrants overall "…are distinguished by their attitudes towards life and work." In fact, Long (1974, p. 55) claims that among these migrants there exists "…the absence of an ideology to justify the 'right' of welfare…"

Thus, while these migrants are in fact gravitating towards high-welfare areas, they are not as a group in search of welfare *per se*. They merely are seeking employment in areas which just happen (coincidentally) to have high welfare benefits. Furthermore, this argument is supported by certain studies (de Ferranti, 1974 and Ostow and Dutlea, 1975) which have found new in-migrants very slow to enroll on welfare if they failed to find employment. In fact, it also is *argued* by Long (1974, p. 54) that, for some migrants, there in fact is "…difficulty adjusting initially to big-city living…" In such cases, however, welfare merely helps these new in-migrants to weather the crisis; it was not the primary objective of or primary cause of their mobility.

Gross versus Net Migration

Before surveying the literature dealing with welfare and migration, or the literature considered in other parts of this chapter, we should briefly address the problem of migration analysis that uses net rather than gross migration. [1] In the present context, when gross in-migration to an area is being discussed, it would seem that the attractiveness of the area's welfare level to migrants is being examined in a clear and straightforward fashion. The results should help indicate to what degree (if at all) welfare acts to attract, that is, to stimulate, in-migration. When gross out-migration is under consideration, we are really addressing the issue of how much high welfare merely tends to reduce out-migration, particularly among those who have been unsuccessful in gaining employment. Thus, when net in-migration is being examined, it seems unclear whether the attraction of high welfare basically influences in-migration or basically influences out-migration or actually influences both. In fact, there is evidence to indicate, at least in some cases, that high welfare benefits actually act less to stimulate

in-migration than merely to reduce out-migration among those who have been unsuccessful in securing employment. For example, studies by Abt Associates (1970), de Ferranti (1974), Ostow and Dutlea (1975), Long (1974), Reischauer (1971), and Podell (1967) all find that new migrants have usually been quite slow to enroll on welfare if they failed to find employment. Hence, we conclude that one must be extremely cautious when interpreting regression results; furthermore, given the possible problems associated with net migration analysis, it would seem that results on net migration must be especially well scrutinized.

Welfare Levels and the Flow of Total Migration

The first study to examine formally the possible effect of geographically different welfare benefit levels on migration was a 1967 article by Gallaway, Gilbert, and Smith. In this article, they examine patterns of total interstate migration in the United States over the period 1955-1960. They examine both gross and net in-migration determinants by ordinary least squares. Their analysis fails in either case to find a significant relationship between migration and welfare benefit levels.

Several other studies of the impact of welfare on total net in-migration have been conducted in a similar vein and have yielded similar results. For example, a detailed study by Gallaway (1967) of 1950-1960 net interstate total in-migration, published by the Social Security Administration, comes to the same essential conclusions as the study by Gallaway, Gilbert, and Smith (1967). In addition, Sommers and Suits (1973) have found total net interstate in-migration over the 1950-1960 period to be insensitive to welfare differentials, whereas Kohn and Gallaway (1973) have found AFDC levels to be an insignificant determinant of total net in-migration to SMSAs over the 1960-1970 time period.

In view of the remarks in the section above, it is interesting to observe that the one study involving *total* migration which did come to an at least somewhat different conclusion from these other four studies was an article by Greenwood and Anderson (1974) which dealt expressly and solely with gross (as opposed to net) migration. Greenwood and Anderson examine patterns of gross migration for rural state economic areas (SEAs) in the South Census Region of the United States. A total of 131 SEAs is considered for the time period 1960-1970. Their model consists of a seven-equation system, of which five are structural and two are identities. Both gross in-migration and gross out-migration are studied, with the model being estimated by the three-stage least squares method.[2] The welfare variable is

the percentage of total income that is directly attributable to welfare and assistance payments. Welfare so defined is found to be only slightly significant in determining both gross total in-migration to and gross total out-migration from SEAs in the South.

All of these studies of the migration impact of differential welfare levels suffer a common shortcoming. Namely, they all fail to disaggregate migrants according to race, income class, age, or some other such criterion which would have helped to separate actual or potential welfare recipients from the rest of the general flow of migrants. This shortcoming of merely analyzing total migration is anticipated by at least one of these studies. Specifically, Gallaway, Gilbert, and Smith (1967, p. 223) acknowledge that "... need exists for greater disaggregation of the data..."

Welfare Benefits and Disaggregated Migration

It should be noted that, except for the five studies cited above, the migration impact of welfare has generally been investigated by researchers who *have* chosen to disaggregate migration flows, usually according to race (white versus nonwhite). This particular disaggregation has been suggested by a number of authors. Rogers (1968, chapter 7), for example, has borrowed concepts from Markov chain theory and analyzed 1955-1960 migration by race in California. Among other things, he finds that the factors influencing nonwhite migration patterns are strikingly different from those influencing white migration patterns. Similar observations are found in Greenwood and Gormely (1971), Ostrosky and Jensen (1978), Sommers and Suits (1973), and elsewhere.

More recently, specific hypotheses regarding differential white-non- white migrant behavior have been offered. Cebula (1974b, p. 86), for example, has argued:

> ...a much larger proportion of blacks than of whites is eligible for welfare benefits. Consequently, it may be expected that the level of welfare benefits will act as a stronger attraction to black would-be migrants than to their white counterparts. In addition, by virtue of the fact that welfare benefits represent a redistribution of income from the economically better-off to the economically worse-off, whites may tend to view areas with higher welfare benefits as areas which on average redistribute income from themselves to others. Thus, *ceteris paribus,* the would-be white migrants may be on average expected to gravitate to areas with lower levels of welfare benefits.[3]

This view of welfare as it applies to nonwhite migration is essentially

echoed in a more recent paper by Kleiner and McWilliams (1977, p. 77), who hypothesize AFDC

> . . . payments in a state . . . as being a significant attraction or retention variable for nonwhites because the percentage of nonwhites who have received welfare payments has been over four times as large as that for whites.

The hypothesis that higher welfare areas are more attractive to nonwhites than lower welfare areas has been investigated by several studies. These studies all operate, either implicitly or explicitly, under the assumption that race, i.e., being nonwhite or black, is a reasonable proxy for the probability of being poor. Conversely, being white is generally viewed as a proxy for being on average economically better off, that is, not poor.

Gross Migration Studies by Race. Given the discussion of the preceding section, we survey studies of gross migration separately from those of net migration.

One of the first studies of the determinants of solely black gross in-migration was by Cebula, Kohn, and Vedder (1973). They examine the determinants of black gross interstate in-migration over the 1965-1970 time period. They argue that black migration depends upon such variables as distance, income, racial composition of the destination, and AFDC levels. With respect to the AFDC variable, they hypothesize states "...offering higher levels of welfare benefits..." are likely to be the more attractive ones to black migrants (1973, p. 500). Their findings lead them to conclude that (1973, p. 505) "...welfare- as one specific form of income-may be a very important determinant of black migration..."

In a comment on the paper by Cebula, Kohn, and Vedder (1973), Ziegler (1976) also empirically analyzes gross black interstate in-migration for the period 1965-1970. Using somewhat different migration data from that of Cebula, Kohn, and Vedder (1973), Ziegler also hypothesizes that black migration depends upon AFDC levels, as well as upon other variables. Ziegler finds welfare differentials to be only a moderately strong determinant of black migration patterns, with blacks being attracted to high welfare states. Thus, Ziegler's results are basically but not entirely compatible with those in the study by Cebula, Kohn, and Vedder (1973).

In yet another study concerned solely with gross nonwhite in-migration, Kleiner and McWilliams (1977) argue that nonwhites should be strongly attracted to high welfare states. Examining gross migration of nonwhites to states over the 1955-1960 and 1965-1970 time periods, they find the prospect of higher welfare to be a relatively strong attraction for nonwhite migrants.

In a study of nonwhite gross in-migration to SMSAs (rather than to states), Kau and Sirmans (1976) estimate a simultaneous-equations system by the two-stage least squares method. They classify black migrants in the United States into three different categories: (1) migrants returning to their state of birth; and non-return migrants separated into (2) migrants moving for the first time (new migrants), and (3) migrants making at least their second move (repeat migrants). They allege (1976, p. 1144) that "…this separation of migrants corrects possible differences in the propensity to migrate and thus reduces specification bias." The paper analyzes the determinants of mobility for each category of black migrants. Welfare (in the form of AFDC) is found to be a highly significant determinant of migration for all three migrant categories. Thus, in this multi-equation system attempting to minimize specification bias, further evidence of a distinct migration impact of government welfare policy is revealed.

The studies just cited above are all concerned solely with nonwhite migration and all find that, statistically speaking, high welfare areas are relatively more attractive to nonwhite migrants than low welfare areas are, that is, welfare is a significant determinant of nonwhite migration.[4]

Other studies have been concerned with the impact of welfare benefits on gross white migration as well as on gross nonwhite migration. For example, Pack (1973) has examined the determinants of both white and nonwhite gross in-migration to central cities for the 1955-1960 period. Gross white in-migration and gross nonwhite in-migration are both hypothesized to depend upon AFDC levels, as well as upon other factors (for example, median income, median income growth, and unemployment rates).[5] She adopts single-equation models, which are estimated by ordinary least squares. One model is estimated for white migrants; two are estimated for nonwhite migrants.

Her regression results indicate that higher levels of AFDC payments apparently act strongly to inhibit white in-migration. The reasoning offered for this result is that areas with higher welfare levels are viewed by whites (on the average) as more adversely redistributing income away from them to nonwhites than do areas with lower welfare levels. In her analysis of nonwhite migration, her results appear to indicate that (1973, p. 254) "…high AFDC levels act as a strong attraction to nonwhites…" She argues that this is attributable to the fact that welfare is an important source of income for many non-white families.[6]

Net Migration Studies by Race. The first net migration study of welfare and migration by race was a paper by DeJong and Donnelly (1973). Delong and Donnelly examine the net in-migration of nonwhites, ages twenty-five to twenty-nine between the years 1950 and 1960, to counties in SMSAs of the contiguous United States. Welfare is defined as the level in each county

of aid to families with dependent children (AFDC) in the year 1960. Four single-equation regressions are estimated by ordinary least squares. The basic overall statistical result is that differential AFDC levels exercise an important attraction for nonwhite migrants.

Delong and Donnelly (1973, p. 341) conclude that public welfare "…is a community resource for income support which migrants…can fall back on if necessary." They proceed to argue (pp. 341-342) that to "…interpret this resource . . . as the *primary* cause of net in-migration seems questionable…" They resort (p. 344) to various field studies (Abt Associates 1970 and Podell 1967) to reject the argument "…that the differential level of welfare payment is a *direct* cause of nonwhite migration to cities." Thus, they seemingly accept the basic arguments (cited in an earlier section by Long (1974).

Two subsequent studies of net in-migration to SMSAs, one by Cebula (1974b) and the other by Kohn (1976), find results qualitatively very similar to those obtained for gross migration by Pack (1973). Cebula estimates single-equation models of net in-migration by race (white and nonwhite) over the 1965-1970 period. He finds that white in-migrants strongly prefer low welfare areas, whereas nonwhite in-migrants strongly prefer high welfare areas. Kohn (1976) obtains very similar findings in alternative single-equation estimates of net in-migration by race over the 1965-1970 period.

In another study, Sommers and Suits (1973) examine net in-migration, to states, of white families and black families over both the 1950-1960 and 1960-1970 decades. The model is single-equation and is estimated by ordinary least squares. It basically relates white and black net in-migration each to total income, the total unemployment rate, and welfare levels per recipient in the form of AFDC. It finds that, over the 1950-1960 decade, the level of AFDC payments exercised a strong impact on net black in-migration patterns. In particular, higher AFDC payments acted as a strong attraction to black families. On the other hand, the pattern of net white in-migration was basically unaffected by differential AFDC levels.

During the 1960-1970 decade, net white in-migration was found to be strongly and negatively influenced by AFDC levels. In particular, the higher the level of AFDC payments, the less attractive a state was to white migrants. In this period, by contrast, net black in-migration was found to be relatively insensitive to AFDC levels, a result contrary to that obtained for the 1950-1960 period.

In a comment on the Sommers and Suits paper (1973), Cebula and Schaffer (1975) criticized the use of total income and total unemployment data in examining migration by race. Arguing that color specific income and unemployment figures were logically superior, Cebula and Schaffer

re-estimated the Sommers and Suits model for the 1960-1970 period for both white migrants and nonwhite migrants. Use of color specific data resulted in changing the signs of and significance levels of a number (three of six) of variables. From a public policy viewpoint, the most important change was that AFDC differentials were found significantly to influence net white in- migration for the period, with higher welfare states being found the less attractive ones to such migrants. Nevertheless, it should be noted that Cebula and Schaffer did confirm one of the Sommers and Suits results pertaining to interstate welfare differentials, namely, the higher the AFDC level in a state, the less attractive the state was for white migrants.

Some Additional Observations. It was observed earlier that, in most of the literature, race (that is, being nonwhite or being black) is taken as a surrogate for poverty (or for a related population trait, such as relatively low levels of education or training or human capital). Thus, nonwhite migration is effectively taken as a proxy for migration of the poor (or of persons who are relatively uneducated or untrained). Along these lines, it is interesting to refer to two additional recent studies, one by Glantz (1975) and the other by Vedder and Cooper (1974).

Glantz (1975) attempts to identify some of the key factors affecting the gross in-migration of the poor per se into and among large metropolitan areas in the United States over the 1965-1970 time period. He argues on *a priori* grounds that poor migrants logically should be attracted by higher welfare benefits (per recipient). He argues (1975, p. 30) that "…race alone is not a good surrogate for a migrant's economic status." This represents a definite departure from previous studies. He argues (p. 30):

> For the poor, expected welfare payments is a viable alternative . . . to labor income and hence may be expected to play a vital role in the migration decision.

His empirical results (obtained by ordinary least squares) strongly support his hypothesis that the poor (*per se*) migrate to areas offering higher welfare benefits.

Also stressing the importance of welfare benefits to the poor per se, Vedder and Cooper (1974) have examined net in-migration to counties in nineteenth century England and Wales. Although they obtain welfare coefficients that differ significantly from Glantz's, Vedder and Cooper nevertheless derive results qualitatively similar to those of Glantz in that they find counties with higher welfare benefits to be very attractive to the migrating *poor*. Thus, both Glantz (1975) and Vedder and Cooper (1974) choose an alternative to the use of race as a surrogate for poverty; they instead resort to examination of the behavior of the poor *per se*.

Welfare and Migration: The Bidirectional Hypothesis

The studies discussed above are all concerned with whether geographically different welfare benefit levels exercise an important impact on migration patterns. It should be noted that, in point of fact, several studies (for example, Cloward and Piven 1968, Goolsby 1974, Sommers and Suits 1973, West, Hamilton, and Loomis 1976, and Ziegler 1976) have argued that, with regard to welfare and nonwhite migration, causality may run in both directions, that is, nonwhite migration depends upon welfare levels, but welfare levels may also be dependent upon nonwhite migration patterns. Sommers and Suits, for example (1973, p. 197), argue specifically that while higher welfare benefits attract black migrants, we should also be aware that these black migrants modify the environment of which they become a part. Going further, Sommers and Suits (p. 197) argue:

> Negroes who were disenfranchised in the South became voters in the North. Although welfare rolls were not large to begin with, a growing black electorate manifested itself in a number of changes in public policies, some of which had the consequence of enlarging . . . welfare . . . .

Thus, these studies are hypothesizing that while welfare payments directly influence the locational decisions of black families, these same families over time form a growing electorate which manifests itself in political pressures (the vote) for more and higher welfare benefit levels.

In this section we review five articles which to date have attempted to ascertain the true nature of cause and effect between migration and welfare. In so doing, we hope better to appreciate the essence of and relevance of the migration impact of state and local government policies.[7]

The first empirical effort to test this possible bidirectional relationship between welfare and migration was a paper by Cebula (1974a). Cebula constructs a two-equation model of welfare and migration. The welfare equation treats welfare as a function of migration and various exogenous forces. The migration equation in turn treats migration as a function of welfare and various exogenous factors.

The migration data are disaggregated according to race (white and nonwhite), sex (male and female), and age (age categories twenty to thirty-nine, forty to sixty-four, and sixty-five and over). Thus, twelve migrant groups were examined. Moreover, "migration" refers solely to net in-migration to the various states over the 1965-1970 time period. The welfare variable takes the form of AFDC payments (in 1965) for all persons in the twenty to thirty-nine and forty to sixty-four age groups and the form of old-age assistance (in 1965) for the remaining age category (age sixty-five and over).

In all of the six sets of regressions pertaining to whites, net white in-

migration was strongly and negatively influenced by welfare: white migrants showed a strong preference for low welfare states. On the other hand, net white in-migration was shown in all six cases to have no consequential impact on welfare levels. Thus, at least in terms of white net in-migration, the relationship between migration and welfare is *not* found to be bi-directional.

In the net nonwhite in-migration regressions, high welfare levels were shown to exercise an important attraction for nonelderly nonwhite migrants, a result completely in contrast to that obtained in the regression for whites. Moreover, in all four of the regression sets for nonelderly nonwhites, welfare levels are shown to be significantly and directly influenced by migration; the greater the net influx of nonwhite migrants, the greater the welfare level tends to be. Thus, the two-pronged (bidirectional) hypothesis referred to above receives strong empirical support for the 1965-1970 period.

Southwick (1976) has examined the bidirectional hypothesis by using the maximum level of welfare benefits obtainable in an area as a surrogate for welfare benefits. This use of the maximum welfare level possible thus far appears to be unique in this literature. His two-stage least squares analysis of interstate migration finds that while net in-migration of welfare recipients is an increasing function of welfare benefits, welfare benefits themselves are not significantly affected by the migration pattern in question. Thus, the bidirectional hypothesis *per se* fails to generate support here.

Somewhat more recently, Cebula (1976) has used the two-stage least squares method to examine the possibility of a bidirectional relationship between nonwhite migration and welfare levels. His two-equation model analyzes net nonwhite interstate in-migration for the period 1960-1970. In this study, the welfare variable is the change in AFDC payments per recipient over the 1960-1970 time period; this differs from the other studies, which have all used some measure of the actual or maximum potential level of AFDC per recipient as a surrogate for welfare. Cebula's results strongly support the bidirectional hypothesis that nonwhite migration and the growth in welfare levels are interdependent.

Commenting on Cebula's study, Kumar (1977) argues three major points. First, he challenges the use of the change in welfare benefits and argues instead for the use of welfare benefit levels *per se*. Second, he argues the need to include taxes (as a measure of costs) in the analysis. Finally, he argues the need to adjust for geographic living-cost differentials.

Kumar then proceeds to estimate a two-equation system of net interstate nonwhite in-migration by the two-stage least squares method. This system, which takes Kumar's three basic arguments into account, yields empirical results which support the bidirectional hypothesis and which are qualitatively compatible with Cebula's estimates.

Yet another study of this bidirectional hypothesis has been recently published by Ostrosky and Jensen (1978). Their study is very similar to the one by Cebula (1976). In fact, the only major difference between the Cebula study and that by Ostrosky and Jensen is that the latter deals with net nonwhite in-migration to SMSAs (rather than to states). The findings of the Ostrosky and Jensen paper add further empirical support to the bi-directional hypothesis.

In sum, then, four of these five studies have found empirical support for the bi-directional welfare-nonwhite migration hypothesis. Thus, in addition to the studies in the preceding section, most of which provided support for the argument that nonwhite in-migration (net and gross) is significantly affected by geographically different welfare benefit levels, it also appears highly plausible that the pattern of net nonwhite in-migration may influence welfare levels.

Before proceeding to the next section of this chapter, it is interesting to note a recent, modified version of the bi-directional hypothesis noted above. Specifically, Chao and Renas (1976) examine the relationship between AFDC levels and net white in-migration to SMSAs over the 1960-1970 time period. They estimate a three-equation system by two-stage least squares. They find that white migration is not significantly affected by welfare level differentials. However, they find that welfare levels are negatively and significantly influenced by white in-migration patterns. Thus, in examining the direction of causality between welfare and migration, they arrive at the rather novel conclusion that, when white migrants enter an area, they effectively act to inhibit the growth of welfare programs in that area. This hypothesis is not to found elsewhere in the migration literature.

In closing here, we must lament the failure of all of these studies to consider the possible role of the percent of an area's total population that is poor as a welfare policy determinant. Logically, it would seem that this variable, which encompasses so many more people than net nonwhite in-migration, would be even more likely to influence welfare policy. Similarly, it is unfortunate that there is no mention in any of these studies of median voter theories of local public-goods provision.

Migration and Nonwelfare Fiscal Variables

In point of fact, most of the studies of the migration impact of state and local government policies have dealt with welfare. Nonetheless, there have been a number of published studies dealing with the migration effects of other, that is, nonwelfare, policies. Accordingly, in order to make this survey more complete and more informative, this section of the chapter deals specifically with those studies which have investigated the migration effects

of state and local government (1) tax policies, (2) educational spending policies, and (3) nonwelfare spending policies.

In a general sense, as implied in chapter 9, the conceptual base of these various studies can be traced back to Charles M. Tiebout (1956, p. 418) who argued:

> . . . the consumer-voter may be viewed as picking that community which best satisfies his preference pattern for public goods . . . the consumer-voter moves to that community whose local government best satisfies his set of preferences.

As Tullock (1971, p. 917) observes, this hypothesis effectively holds that, ceteris paribus, the "…individual deciding where to live will take into account the private effects upon himself of the bundle of government services and taxes…" Expressed somewhat differently, migrants will exam- ine and appraise 'the value to themselves of the government services and taxes (negative values) in communities. As Riew (1973) argues, other things equal, migrants will prefer areas where they can obtain the greatest fiscal surplus, that is, where they can get the most in services for their tax payments, and also get the quantity of local government services that is most *compatible with their tastes*. With this as background, our survey continues.

Migration and Property Tax Considerations

A number of studies have dealt with the possible migration impact of our system of large geographic property tax differentials. With respect to the possible impact of such differentials, it is argued that the higher the property tax level in an area, the higher the cost of living in that area. Since migrants are apparently quite sensitive to living-cost differentials (Renas and Kumar 1978 or Fields 1976), it is argued in the literature that, ceteris paribus, migrants should prefer areas with lower property taxes.

It should be observed at the outset that there is a weakness in this entire argument. In particular, as noted by Aaron (1970, p. 802), "the . . . Internal Revenue Code contains massive subsidies for housing." Clearly, this is likely to create a less pronounced sensitivity of migrants to property tax differentials than would be the case in the absence of such subsidies. This weakness in the above argument notwithstanding, the enormous geographic property tax differentials in the United States have stimulated a number of research efforts.

The first study to examine the possible migration impact of state and local government tax policies was a paper by Cebula (1974b). Cebula examines net in-migration to SMSAs over the 1965-1970 time period. Migration

patterns are disaggregated by race: white and nonwhite. Following certain earlier studies (see Rogers 1968), he argues that white and nonwhite migrants should in certain respects be expected to behave quite differently. In particular, with regard to the property tax, which he measures on a per capita basis, Cebula (1974b, p. 86) argues that a

> . . . relatively small portion of blacks own property as compared with their white counterparts . . . white migrants are likely to be sensitive to property tax levels, whereas black migrants are likely to be relatively insensitive to property tax levels.

Cebula' s single-equation, ordinary least squares estimates of net in-migration to SMSAs find white migrants preferring low property tax areas and black migrants essentially insensitive to property tax differentials.

Further empirical support for the sensitivity (insensitivity) of white (black) migrants to property tax differentials is provided in a two-equation, two-stage least squares analysis of net interstate in-migration by Cebula (1974a). Disaggregating migration according to race, age, and sex, Cebula finds that higher property taxes appear strongly to discourage nonelderly, white in-migration and to exercise no perceptible impact on black net in-migration (or elderly white net in-migration).

Ostrosky (1978) has also found that per capita property taxes exercise at least a moderate impact on net white in-migration patterns. Ostrosky's (1978, p. 56) three-equation, two-stage least squares analysis of SMSA migration over the 1960-1970 time period suggests that "…to some extent, migrants do seem to express a preference for areas with lower property tax levels…"

Results that are qualitatively compatible with the above three papers are found in the analysis by Pack (1973) of gross in-migration (by race) to SMSAs over the 1955-1960 time period. For white migrants, Pack (1973) finds that higher levels of per capita property taxes act significantly to inhibit in-migration; black migrants, on the other hand, appear (according to Pack's study) to be essentially unaffected by property tax considerations.

The four studies discussed above all have found that, at least for some (that is, white) migrants, geographic property tax differentials are a reasonably important migration determinant. Nevertheless, it should be noted that there have been, to date, at least three studies which in certain respects have derived quite different findings. For example, in a study stressing the causes of elderly migration, Barsby and Cox (1975) consider the impact of various tax variables, including the property tax. They examine net interstate in-migration of persons age sixty-five or older during the 1950-1960 decade. Their ordinary least squares results[8] suggest that elderly migrants are essentially insensitive to special tax treatment and per capita property tax levels. Cebula's (1974c) analysis of net interstate in-migration of the elderly (per-

sons age sixty-five or older) over the 1965-1970 period produces the same essential results as those in Barsby and Cox (1975). Specifically, there was no significant relationship found between elderly migration patterns and per capita property tax levels.

Next, we note that Liu (1977) has estimated a four-equation model by the two-stage least squares method. In this model, "migration" refers to differential rates of total net in-migration to SMSAs for the period 1960-1967. Liu actually includes three fiscal variables in his analysis: (1) the average tax rate, expressed as the ratio of total tax (including property tax) revenues to total personal income; (2) per capita local government expenditures (excluding welfare); and (3) changes in the average tax rate, 1960-1967. Liu (1977, p. 1384) observes that "…the extremely high correlation between the average tax rate and per capita local government current expenditures …presents an empirically difficult, multicollinearity problem." (The existence of such a problem has been observed elsewhere, for example, by Kohn 1976.)

Lui finds that the average state tax rate has no consequential effect on total migration; similarly (1977, p. 1384), "The variable changes in the average tax rate…is shown with no…effect upon…migrant locational decisions."

In closing, we note that the possible migration effects of geographically different property tax (or overall tax) levels have been formally investigated by at least seven studies. Of these, three-those by Cebula (1974c), Barsby and Cox (1975), and Liu (1977)-all cast certain doubts upon the migration impact of property tax differentials. The other four studies-those by Cebula (1974a), (1974b), Pack (1973), and Ostrosky (1978)-find that, at least for certain population groups, property taxes did influence (negatively) migration patterns. Although it would seem that as a whole there is sufficient evidence to infer that, *ceteris paribus*, nonelderly, white migrants probably do prefer lower property tax areas, the results otherwise are overall sufficiently mixed so that we probably should not as yet make any other further judgments on the issue. Perhaps future research will permit us to do so, especially if that research includes efficient and dependable means whereby to separate property taxes from gross rental payments and personal property taxes from business property taxes.

Migration and Other Fiscal Variables

Aside from the provision of public assistance, state and local governments provide a wide array of impure public goods, including public education, health and hospital services, highways, police and fire protection, and recreation. Since these public goods are presumably of importance to con-

sumers and since there are enormous geographic differentals in the levels (amounts) of these commodities provided by state and local governments, certain studies have investigated the possible migration impact of nonwelfare state and local government spending.

The first study to investigate the possible migration impact of differential nonwelfare state and local government expenditures was by Greenwood and Sweetland (1972). Greenwood and Sweetland deal with *total* gross migration between SMSAs over the 1955-1960 time period. The authors (p. 699) argue:

> In-migration rates will be higher and out-migration rates will be lower the higher the SMSA's level of government expenditures per capita, *ceteris paribus.* This…holds for a variety of reasons…

For one thing, they argue (p. 669) that superior educational opportunities are likely to be available in communities where per capita government expenditures are comparatively higher. They also argue that better educated people will be more likely to move to such areas than elsewhere, and less likely to move away from such areas, because the demand for educated persons is likely to be greater, because the educational opportunities for their children are likely to be better, and because they are likely to find certain amenities in such areas that are deemed important. Similarly, it is argued that many less-educated individuals would also tend to move to such localities, or not move away therefrom, in order to improve their own or their children's prospects by taking advantage of the better educational opportunities. Furthermore, SMSAs that have relatively high per capita government expenditures are likely to afford relatively high per capita welfare benefits of various sorts. Thus, they argue that such areas are likely to be very attractive to low-income persons.

Greenwood and Sweetland (1972) examine the one hundred SMSAs in the continental United States that had a 1960 population in excess of two hundred fifty thousand. From these one hundred SMSAs, a random sample of fifty was chosen. The authors then pool the information on migration from each of these fifty SMSAs to each of the other forty-nine. This procedure results in 2,450 (that is, 50 x 49) total observations. Their ordinary least squares results indicate that the greater the per capita government expenditure differential between SMSAs, the greater the migration rate between them.

The next study to investigate the possible migration impact of differential nonwelfare state and local government spending was by Pack (1973). Considering the impact on gross white in-migration to SMSAs (1955-1960),

Pack finds that higher per capita public expenditures on education exert a relatively strong attraction. Moreover, she also finds (1973, p. 256) that "…higher levels of nonwelfare (including education) public spending exert a strong positive influence on gross nonwhite in-migration."

Four other studies have delved into the issue at hand, those by Cebula (1974b), Kohn (1976), Liu (1977), and Ostrosky (1978). All four studies examine patterns of net in-migration.

Cebula (1974b) deals with net in-migration to SMSAs, 1965-1970, by race. His ordinary least squares analysis (1974b, p. 91) finds that both white migrants and black migrants "…appear…to prefer…high nonwelfare spending areas, *ceteris paribus.*" Furthermore, a subsequent comment on the Cebula paper by Kohn (1976), which also examines net in-migration by race to SMSAs, 1965-1970, offers further substantiation of these findings by Cebula.

In yet another study of migration to SMSAs (this time, over the 1960-1970 period), Liu (1977) finds that per capita local government expenditures have a very significant positive influence upon total net in-migration with migrants showing a very strong preference for high expenditure areas.

Shifting the emphasis from SMSAs to states, a recent study by Ostrosky (1978, p. 49) has observed that, in the United States, "…education far and away receives the largest share of state plus local government expenditures." Estimating a two-equation model of total net interstate in-migration (1960-1970) by the two-stage least squares method, he finds (p. 56) that "…state and local government commitments to public education appear to significantly influence spatial resource allocation (migration)."

The six studies just discussed all stress the migration impact of state and local government spending commitments to public education or to total nonwelfare public spending (education included). It should be noted that very recently Greene (1977) has found educational spending to be significantly influenced by migration patterns.[9] In particular, Greene (p. 91) finds total net in-migration to cities to have "…a positive and significant impact on local school expenditures (per full-time student)."

In sum, then, Greene finds that the level of public education commitment (per full-time student) is an increasing function of the rate of net in-migration, whereas Greenwood and Sweetland (1972), Pack (1973), Cebula (1974b), Kohn (1976), Liu (1977), and Ostrosky (1978) all find that higher levels of educational commitment (or of total nonwelfare public spending, including education) are attractive to migrants. Thus, a question may arise as to the true nature of cause and effect between, say, public education spending and migration. It appears that causality conceivably could even run both ways, that is, the causality *could* be bidirectional.

Along these lines, Cebula (1977, p. 113) has argued that differential local government commitments to public education may exercise a very significant influence on household locational decisions, ceteris paribus. Moreover, he (p. 114) hypothesizes:

> By the same token, it would seem reasonable to argue that if public educational "quality" were important in the location decision, then the nature (quality) of public educational commitment should continue as well to be of concern . . . *after* the move has been made. This continued concern in turn might then be reflected in household actions (the "vote," parent-teacher organizations, etc.) to further influence ("improve") the educational system in the household's new community of residence. Thus, not only is local government policy toward public education likely to be a possible influence on migration, but the public educational policy itself may be influenced by migration.

That is, with respect to local government policy toward (commitment to) public education on the one hand and migration patterns on the other, causality may run both ways.

Estimating a two-equation system of total net in-migration to SMSAs (1965-1970), Cebula finds empirical support for this bidirectional hypothesis. ln particular, his two-stage least squares results indicate that total net in-migration is an increasing function of public education expenditure levels (per full-time student) and that public education levels (per full-time student) are also an increasing function of the rate of total net in-migration.

Overall, then, the literature specific to this discussion seems to substantiate the idea that, *ceteris paribus*, differential public education (or total nonwelf are) spending levels exercise an important effect on migration. Moreover, there appears to be some evidence (Greene 1977 and Cebula 1977) that, *ceteris paribus*, public education spending per full-time student may be positively related to migration patterns as well.

A Concluding Remark on Nonwelfare Policies

The idea of a fiscal surplus (or fiscal residue) was first introduced by Buchanan (1950), who defined it as the value of public expenditure benefits minus tax payments. The evidence in the preceding section, and to a lesser degree, the evidence in the section before that tend somewhat to substantiate the idea that people include differences in fiscal residue in their calculation of where to live. Unfortunately, the literature to date has certain shortcomings (to be discussed in a following section) which, when coupled with the somewhat inconsistent findings summarized above, make it impractical for us to accept totally the migration role of the fiscal surplus without at least some reservations.

Some Possible Implications of the Literature to Date

The body of literature with which this survey deals has a variety of shortcomings; a number of these are discussed in the next section. Nevertheless, there are a number of tentative observations that might be made. For example, most of the literature seems to indicate that geographic welfare level differentials may well exercise a perceptible impact on various groups of migrants, particularly on the poor (both white and nonwhite). [10] Although a few studies argue to the contrary, the general finding seems to be that, ceteris paribus, such groups are strongly attracted by the prospect of higher welfare benefits. Many authors argue that this should be expected in view of the enormous geographical differentials in welfare benefits (especially AFDC) in the United States. Various studies of white migration also indicate that welfare differentials may be important, although in the opposite way found for the poor. In particular, higher welfare benefits appear to represent a form of economic disincentive (on the average) to white migrants; consequently, white migrants appear, *ceteris paribus*, to be attracted to low welfare areas and to be discouraged from locating in high welfare areas.

On the average, the poor migrant is endowed with relatively less human capital than the economically better-off migrant. Hence, the factor-market distortions resulting from large geographic welfare differentials may act to create problems of economic inefficiency in spatial resource allocation. Over time, high welfare regions tend, on balance, to experience a net loss in the average level of embodied human capital. Among other things, over the long run this may imply an increasing interregional divergence of economic growth in the United States.

A number of the studies examined above find certain migration patterns quite sensitive to geographic differentials in property tax levels. In particular, it seems that at least one group, the economically advantaged nonelderly, tends (on the average) to prefer low property tax areas.

These apparent effects of property tax differentials, when combined with those of welfare differentials, may create severe financial problems for certain state or local governments. In particular, as welfare rolls in high welfare areas increase in size, the levels of state and local government spending must rise. To the extent that state and local governments try to pay for growing welfare costs with, increased taxes (higher property taxes), they very well may induce at least some economically better off persons, as well as some private firms (see Goolsby 1974 and Harriss 1974), to relocate elsewhere. This clearly erodes their tax base-the core of the community they tap to generate tax receipts. Some state and local governments may then be confronted by a financial dilemma: rising expenditures on the one hand and depressed capacity to elevate taxes on the other. The only options open to them are increased federal grants or increased borrowing; in the latter case,

fiscal crises such as that experienced by New York City in recent years may in many cases be (or become) inevitable. Given the broad, adverse effects of such crises, this is a problem we definitely would do best to prevent if at all reasonably possible.

Need for More Directed Research on the Migration Impact of State and Local Government Policies

Regarding local governments in the areas around major cities, Gordon Tullock (1971, p. 917) has argued, "The individual deciding where to live will take into account the private effects upon him of the bundle of government services and taxes in each suburb." Judging from the studies reviewed here, the individual apparently applies a similar decision calculus in comparing areas geographically distant from one another as well.

Having now reviewed the basic empirical literature on the migration impact of state and local government policies, it would seem appropriate formally to indicate some of the basic shortcomings of this literature and the directions future research might take.

First, most of the literature considered here has concentrated exclusively on a single public policy variable-welfare. Thus, with few exceptions, analyses of the impact of local government policies have ignored the possible impact of such factors as public education expenditures, property tax levels, highway and health expenditures, the general (average) level of state plus local taxes, and so forth. In the case of public education expenditures, we are dealing with the single largest component of all state and local spending and hence potentially the most important source of benefits to the average migrant. Similarly, in the case of the property tax, we are dealing with the typically most important source of local government revenue and hence a potentially very important dimension of the cost of living in a locality. Moreover, concentration solely on the welfare variable precludes the possibility of a systematic benefit/ cost analysis of the impact of state plus local government policies, an analysis that is essential to a rational relocation decision (see, for example, Brennen 1965, Riew 1973, and Sjaastad 1962). Hence, to the extent that data permits, we suggest that future research should endeavor to include variables reflecting both the costs and the benefits associated with state and local government units.

A shortcoming common to nearly all this published research is the failure to account for cost-of-living differentials among geographic areas. Such a failing leads to the very distinct possibility of money illusion on the part of migrants, especially in view of the enormity of the geographic cost-of-living differentials in the United States. Future research should, to the extent possible, attempt to use cost-of-living (family budget) and inflation data, which *are* available for many metropolitan areas and states.[11]

Next, there is the problem of disaggregation of the migration flows between areas. It is essential for migration studies to disaggregate to an appropriate degree for at least two reasons:

1. There are distinct differences in the propensity of various population cohorts to migrate.
2. Various population groups/cohorts (for a variety of reasons) respond to different sets of stimuli.

We observe that in terms of the variables crucial to this literature, disaggregation could potentially be made along such lines as education, race, age, sex, income level of migrants, and whether the migrants being studied are new migrants, repeat migrants, or return migrants. We strongly suggest that future research in this area should attempt to ascertain the most relevant of such options in order to reach the most useful and valid policy conclusions.

In closing this chapter, we wish to stress the need for continued research in this area. The public policy implications involved are enormous, for, as West, Hamilton, and Loomis (1976, p. 66) have observed ". . . policies with indirect effects (on migration) have been formulated without regard to their consequences on population distribution." Moreover, important economic and political ramifications can be derived from such research. For example, it has already been proposed (see Orr 1976, p. 359), due to the enormous welfare differentials among political jurisdictions in the United States, that our nation ". . . establish a uniform benefit schedule in all states." [12] Thus, the significance of research in this area cannot be easily understated. Hopefully, this review has provided sufficient information on the state of research in this area to be of benefit to future research efforts.

Notes

1. The nature of some of these problems can be seen in the discussion by Alperovich, Bergsman, and Ehemann (1977). See also Greenwood (1975a, esp. pp. 397, 408, and 409).

2. The use of multiequation systems, estimated by the two-stage least squares method or by the three-stage least squares method, has become rather widespread in recent years. Essentially, this is because researchers have become increasingly interested in learning the true direction of cause-and-effect in migration. Related to this, see, for example, Muth (1971) or Greenwood (1975a) or (1975b).

3. Related to Cebula's argument concerning the impact of welfare on white migration, see also Aronson and Schwartz (1973) and von Furstenberg and Mueller (1971).

4. Although it is not necessarily found to be the primary cause of or determinant of nonwhite migration.

5. In addition, public policy variables other than welfare are considered in Pack's model. These are to be discussed in a later section of this chapter.

6. Pack's analysis has been attacked by Cebula and Curran (1974) on several points. Among the criticisms, it is argued by Cebula and Curran that simultaneity bias may be quite severe in her study. Her use of end of period variables and of "percentage change in median family income, 1950-1960" implies a very probable simultaneity problem.

7. It should be noted that all of the studies considered in this part of the chapter have estimated multi-equation systems by the two-stage least squares method. This allows one to account for simultaneity among variables under analysis, as between welfare and migration, for example.

8. Barsby and Cox (1975) also find elderly migration essentially unaffected by levels of old age benefits and by the availability of public health and hospital care.

9. Greene (1977) basically repeats an experiment performed initially by Weisbrod (1964). Related to Greene's results, see also Lyons (1978).

10. Recall that, as noted above, in most of the literature race is taken as a surrogate for poverty (or relatively low levels of education of training), that is, nonwhite migration is taken as a proxy from migration of the poor (or of persons who are relatively uneducated or untrained).

11. Kumar (1977), Rabianski (1971), Renas and Kumar (1978), and Fields (1976) have all considered living costs in analyzing the determinants of migration. Related to this issue, see also chapter 5 of this book.

12. Related to welfare reform, see the conclusions in chapter 9 of this book.

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11 General Shortcomings of the Non-policy Migration Literature

Introduction

During the past two decades, there has been a proliferation of studies dealing with the causes, and to a lesser degree, the effects, of human migration. This literature has been especially rich in American scholarly journals, where economists, political scientists, demographers, sociologists, and historians have examined internal geographic mobility in the United States. As a consequence of this diversity of researchers, the migration literature is characterized by enormous differences in the variables examined, the hypotheses tested, the data bases used, and the empirical techniques adopted.

Chapter 10 of this book constitutes an in-depth critique of the migration literature dealing with state and local government policies. Although the literature examined in chapter 10 is rather extensive, it nevertheless comprises less than one-third of all the migration literature that has been published during the last twenty years.

Accordingly, the present chapter of this book seeks to present an overview of the general shortcomings of the vast migration literature not covered in chapter 10. Unlike chapter 10, however, this analysis is not particularly concerned with summarizing the actual results of specific empirical studies. In point of fact, to a large degree, this task has already been accomplished in the well-known survey article by Greenwood (1975). Instead, this chapter concentrates on certain widespread problems and deficiencies of the migration literature as a whole. It is hoped that the observations and recommendations of the present chapter may help to improve the quality of future migration research.

Proper Specification of the Migration Variable

In empirically examining the determinants (or effects) of human migration, it is essential properly to specify the migration variable. In this section the analytics of properly specifying the migration variable are presented. Hopefully, insight derived from this exposition can prevent unnecessary errors in future empirical research dealing with migration.

For simplicity, let the economy initially consist of just two regions (areas), area A and area B. On the basis of the analysis in chapter 4, an individual (simply referred to as "individual *i*) residing in area A chooses to migrate to area B only if the discounted present value expected from the move is positive:

$$Di = \sum [(R^{B}_{it} + S^{A}_{it}) - X^{B}_{it} - (R^{B}_{it} + S^{A}_{it}) + X^{A}_{it} + (Y^{B}_{it}/C^{B}_{it} - Y^{A}_{it}/C^{A}_{it}) + (F^{B}_{it} - F^{A}_{it})] \ (1 - r_i) - T_i - E^{AB}_{i} > 0 \qquad (11.1)$$

[1]

It follows from equation 11.1 that

$$P^{ABi} = P^{ABi}(R^{Bi}, S^{Bi}, X^{Bi}, R^{Ai}, S^{Ai}, X^{Ai}, Y^{Bi}, C^{Bi}, Y^{Ai}, C^{Ai}, F^{Bi}, F^{Ai}, Ti, Ei, ri) \qquad (11.2)$$

where P^{ABi} = the probability that individual i will migrate from area A to area B.

As most empirical migration studies indicate, an economic system ordinarily is viewed as consisting of more than merely two regions. Accordingly, consider now an economy consisting of H regions, where $H > 2$. If the symbol OM^{AB} represents the total gross flow of migrants out of area A, it logically follows that

$$OM^{AB} = VA \sum_{\substack{B=1 \\ B \neq A}}^{H} P^{AB} \qquad (11.3)$$

where VA = area A's total population

Dividing both sides of equation 11.3 by the population size of area A yields

$$OM^{AB}/VA = \sum_{\substack{B=1 \\ B \neq A}}^{H} P^{ABi} \tag{11.4}$$

Substituting from equation 11.2 into equation 11.4 for P^{ABi} yields:

$$OM^{AB}/VA = \sum_{\substack{B=1 \\ B \neq A}}^{H} P^{ABi} (R^{Bi}, S^{Bi}, X^{Bi}, R^{Ai}, S^{Ai}, X^{Ai}, Y^{Bi}, C^{Bi}, Y^{Ai}, C^{Ai}, F^{Bi}, F^{Ai}, Ti, Ei, ri) \tag{11.5}$$

Equation 11.5 provides the proper specification of the migration variable in a model of total gross out-migration from area A to all other areas in the economy. The form of equation 11.5 is entirely amenable to empirical testing through the use of standard regression techniques.

Of course, rather than studying patterns of gross *out*-migration, many researchers choose to examine patterns of gross *in*-migration. To derive a model for gross in-migration, let the symbol represent the number of migrants flowing into area A from area B, $B = 1,...,H \neq A$. In the *H*-region case, the migration equation will then become

$$\sum_{\substack{B=1 \\ B \neq A}}^{H} IM^{BA} = \sum_{\substack{B=1 \\ B \neq A}}^{H} VB\, P^{BAi} \tag{11.6}$$

Dividing equation 11.6 through by the population variable and substituting from equation 11.2 for P^{AB} properly specifies for the migration variable a general model of gross in-migration

$$IM^{BA}/VB = \sum_{\substack{B=1 \\ B \neq A}}^{H} P^{ABi} (R^{Bi}, S^{Bi}, X^{Bi}, R^{Ai}, S^{Ai}, X^{Ai}, Y^{Bi}, C^{Bi}, Y^{Ai}, C^{Ai}, F^{Bi}, F^{Ai}, Ti, Ei, ri) \tag{11.7}$$

The model shown in equation 11.7 is suitable for direct empirical testing with conventional regression analysis.

As the survey in chapter 10 indicates, many research efforts have been directed toward the study of net rather than gross migration. Accordingly, it is appropriate now to develop an explicit model of net migration. From the analysis in equation 11.3 and 11.6, it follows that

$$\sum_{\substack{B=1 \\ B\neq A}}^{H} OM^{AB} - \sum_{\substack{B=1 \\ B\neq A}}^{H} IM^{BA} = NO^{A} \qquad (11.8)$$

where NO^A = net number of out-migrants from A to all other areas combined.

Substituting appropriately into equation 11.8 for OM^{AB} and IM^{AB} yields the following:

$$NO^A = VA \sum P^{AB} - \sum VB \text{ X } P^{BA} \qquad (11.9)$$

Finally, dividing both sides of equation 11.9 by the population in area A yields the proper specification of the migration variable for a model of net out-migration. [2]

$$NO^A/VA = \sum P^{AB} - VA^{-1} \text{ X } \sum VB \text{ X } P^{BA} \qquad (11.10)$$

Equations 11.5. 11.7, and 11.9 are basic models for the proper specification of a migration variable. A trait common to all three of these models is the division of the number of migrants by a population scalar. This implies that studies that do not divide the migrant flow by a population scalar are very likely to be mis-specified. Although certain studies attempt to compensate for not scaling by using "population size" as a separate independent variable, these efforts generally result in very crude empirical estimations. If the migration literature is to be accurate and dependable and hence useful in predicting regional economic growth patterns, it is essential that future researchers endeavor to specify the migration variable much more meticulously than has been done in the past. Future research *must* resort to formulations such as those in equations 11.5, 11.7, and 11.10. [3]

Specifying the Independent Variables

The preceding section of this chapter indicates that too much of the empirical migration literature fails to address the problem of how to specify the

migration variable properly. Naturally, the researcher must also deal with the problem of deciding which exogenous variables are to be included in an empirical analysis. Unless this problem is suitably handled, the efforts of the researcher are likely to provide very few, if any, meaningful insights into the migration process.

Perhaps the most common problem in specifying migration models is that of the "omitted variable." As stressed in chapter 5 of this book, the most frequently omitted variable from migration analyses is the cost of living. In point of fact, there is strong empirical evidence indicating that the omission of this particular variable amounts to a very significant error. Given the fact that, until relatively recently, geographically comparable living-cost data were not readily available for a large number of geographic areas, it is understandable that this variable has been so neglected. Nevertheless, the fact that such data now are available for both SMSAs and states virtually obligates future research efforts to take this variable expressly into account. Failure to account somehow for this variable threatens the relevance of all contemporary migration research.

Aside from the cost of living the most commonly neglected variables in the empirical migration literature are those which deal with geographically different state and local government policies and those which measure the quality of life.

As chapter 10 indicates, the literature dealing with the effects on migration of state and local government policies has grown enormously, especially since 1973. As also pointed out in chapter 10, this body of literature suffers from a number of basic shortcomings. Nevertheless, there is a very rapidly growing interest in this aspect of the migration process. This accelerating interest greatly increases the likelihood that future research efforts will ultimately deal quite adequately and properly with this set of variables. Thus, the outlook here is quite optimistic.

On the other hand, the migration literature has made only a comparatively small effort to include quality-of-life variables in empirical analyses. Aside from this book and the studies by Liu (1975), Cebula and Vedder (1973), and Kau and Sirmans (1976), only very modest efforts have been made to account for the quality of life in the migration decision. This neglect of the quality of life is unfortunate, especially in view of findings such as those by Kau and Sirmans (1976, p. 85) that "…all migration flows tended to be toward destinations with a 'higher' quality of life." In the interest of increased relevance, it is strongly suggested here that future research efforts in the migration area endeavor to a greater degree to include quality-of-life considerations. Given the abundance of appropriate data this task should not be excessively difficult.

Two additional comments regarding the choice of exogenous variables to be included in migration analyses are now in order. First, whenever migration flows are disaggregated, whether it is according to race, age, sex, educational attainment, or by some other criterion, the researcher should

endeavor to choose variables that are appropriate to the migrant type being examined. For example, if a migrant is black and between the ages of twenty and fifty years, the relevant income variable to adopt is median or per capita black income. In this country, there exist enormous differentials between the median income of the entire population and black median income; there are also great differentials between the per capita income of the entire population and black per capita income. Hence, it would be an altogether inappropriate procedure to use either the median income level or the per capita income level of the entire population as a measure of the income opportunities of blacks. Nevertheless, this is a procedure quite common in the migration literature.[4] In the interest of increased relevance and increased empirical accuracy, however, it is a procedure that should be ended.

The final comment pertaining to the choice of exogenous variables to be included in migration studies concerns the distinction between income received and income earned. Many recent studies, including Chao and Renas (1976), Delong and Donnelly (1973), Glantz (1975), Pack (1973), and Sommers and Suits (1973), have empirically examined the impact of welfare benefits on migration patterns. In each of these studies, the regression equation includes not only welfare benefits but also some measure of the total income received. This is a misspecification in the model since income received already includes welfare benefits.[5]Consequently, in those studies that are concerned with the effects on migration of both welfare and income, it is appropriate to measure income only in terms of earned income. Clearly, specifying the model in this fashion helps to improve forecasting accuracy.[6]

The Need for Theoretical Foundations

The two preceding sections of this chapter have stressed certain very common problems in the empirical migration literature. This section of the chapter addresses perhaps the most fundamental of all the shortcomings of the migration literature: the lack of rigorous theoretical foundations.

It has long been recognized that the migration decision is fundamentally an investment decision. It has been nearly two full decades since Schultz (1961, p. 4) observed that "...the costs of...migration are a form of human investment." Unfortunately, the theoretical base of the migration literature has grown relatively little beyond this initial contribution; aside from the contribution by Sjaastad (1962), there has been essentially no major new theoretical development in the entire body of the migration literature since the paper by Schultz (1961).

In point of fact, most studies of migration altogether fail to develop a rigorous theoretical behavioral model. Typically, empirical migration studies contain only a very cursory analytical model. Rarely does such a model even attempt to relate migration behavior to maximizing behavior. At best, such models rely merely upon superficial, intuitive arguments.

This is unfortunate for at least two important reasons. First, unless there is some type of formal analytical model, there is no genuinely logical way in which to hypothesize the appropriate types of variables that belong in the migration decision calculus. As a result, in the absence of a rigorous theoretical model, the choice of variables to be included in a migration regression equation becomes an entirely arbitrary decision. Second, in the absence of a formal analytical migration model, there may be no logical way in which to decide the appropriate form of regression equation that is to be estimated. Once again, the decision to use a linear regression or to use some alternative (for example, log-linear) regression form becomes entirely arbitrary.

Chapter 4 of this book presents a rigorous model of migrant behavior in which the migration decision is treated as an investment decision.[7] Three sets of forces influencing this investment are isolated: expected net income benefits, expected net amenity benefits, and expected net benefits from state and local public policies. The common denominator of all these sets of forces is the term "expectations." Although the model developed in chapter 4 has identified several types of expectations, the issue of how such expectations are actually formed has been left unresolved.

In point of fact, there exists a very extensive literature dealing with the formation of economic expectations. Unfortunately, very little of this literature extends expressly into the realm of migrant behavior. Hence, there is a pressing need to develop formal analytical models to explain the formation of migrants' expectations; this is a need which must ultimately be satisfied if genuinely sophisticated migration research is ever to become a reality.

In closing this section, it must be emphasized that migration models must be constructed with an acute awareness of the possibility of economic interdependence. For example, if the flow of migration is argued on theoretical grounds to be a function of the annual growth rate of per capita income, then there must exist an awareness of the possibility that the annual rate of growth of per capita income may itself be a function of the migration flow. In cases where economic interdependence can reasonably be expected to exist, the migration model ultimately must take the form of a system of simultaneous equations. To test such a system empirically would then require a regression method such as two-stage least squares. The computer software for such empirical techniques is now quite widespread;

hopefully, the analytical tools needed to apply the two-stage least squares method properly to migration studies are soon to become widespread as well.

Summary

This chapter has singled out certain basic shortcomings of the literature dealing with the relationship between migration and non-policy variables. Among other things, it has been observed that there is a pressing need to measure the migration variable much more meticulously than does current research, that there is a need to specify models which do not neglect important exogenous variables, and that there is a need to develop more analytically rigorous models of migration behavior. Hopefully, these observations can help future research efforts to produce more accurate results and thus more useful insight into contemporary real-world problems.

Notes

1. Following Schultz (1961), Sjaastad (1962), Riew (1973), and others, the migration decision is viewed strictly as an investment decision.

2. Of course, it is possible to rewrite equation 11.10 after substituting functional forms for P^{AB} and P^{BA}; however, to do so here may make equation 11.10 more cumbersome than necessary for the purposes of the present analysis.

3. Several studies have addressed the issue of properly specifying the migration variable. Among these, the studies by Glantz (1975) and Davanzo (1978) are especially worth noting.

4. Two examples of recent studies guilty of this practice are Pack (1973) and Sommers and Suits (1973). Related to this problem see also the comments in Cebula and Curran (1974).

5. See chapter 3 of this book.

6. The issue of simultaneity bias is not discussed here because Greenwood (1975b) has already dealt at length with this topic. It is sufficient simply to observe that a number of studies, including Cebula and Vedder (1973), Greenwood (1969), Laber and Chase (1971), Pack (1973), Pursell (1972), and Rabianski (1971), suffer from simultaneity bias because of improperly chosen exogenous variables.

7. The theoretical model developed by Alperovich, Bergsman, and Ehemann (1977) is a less rigorous but nevertheless quite useful alternative to that developed in chapter 4 of this book.

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Index

About the Author

Richard J. Cebula is an associate professor of economics at Emory University. He received the A.B. degree from Fordham College, the M.A. degree from the University of Georgia, and the Ph.D. degree from Georgia State University. Dr. Cebula has published numerous articles in major journals in the fields of migration, macroeconomics, and microeconomics. In addition, he has presented papers at meetings of major professional societies in the United States.