POTENTIAL ECONOMIC COSTS OF MIGRATION: A CASE STUDY OF A SOUTH ATLANTIC METROPOLITAN AREA

V. J. Evans and W. J. Serow

I. INTRODUCTION

Studies attempting to measure the economic impact of migration to or from a given area have typically concentrated on factors such as the strength of push-pull forces, migration as a function of interregional wage differentials, migration as an equalizer of wage and opportunity differentials, and so on. Regarding the first point, Rutman has recently found that for the state of West Virginia outmigration was mainly dependent upon the age composition of the population, while inmigration was most clearly dependent upon the level of economic opportunity in the area of destination.[1] In substance, the findings of Rutman provided confirmation of many of the results previously obtained by Lowry, who has analyzed migration for large metropolitan areas.[2] A concept closely allied to this line of thought is that migration represents a form of investment; that is, as Bowles has noted"... the present value of the expected income gain from moving out of the South is positively related to the probability of moving..."[3]

Such an approach differs in substance from that which relates migration to regional income differentials and which treats it as a contributing factor to regional economic growth. Examples of such an approach are to be found, for example, in recent papers by Okun, Okun and Richardson, Borts and Stein, McDonald, and Bjork. The latter, for instance, tries to assess how well migration has worked as a mechanism to move population from labor-surplus to labor-scarce areas of the United States, and to calculate the amount of migration needed to bring about a state of wage homogeneity.[4] Finally, some attention has been paid in the literature to outmigration as a beneficial force in depressed areas.[5]

The approach taken in our research is quite different from the foregoing. We have examined a single metropolitan area (Guilford County, North Carolina, which includes the cities of Greensboro and High Point)[6] which has experienced moderate inmigration in recent years and we have assumed that two alternative fertility-migration patterns would hold from 1970 to 2000. We attempt to measure that portion of total population growth directly and indirectly attributable to migration and suggest the types of costs associated with providing services to these persons.

In general, political leaders, with a perhaps forgiveable degree of civic pride, have welcomed population growth, and especially inmigration. In addition, appropriations from state and federal governments which are made on a per capita basis are favorably affected. Similarly, chambers of commerce, banks, utilities, and other business groups often encourage inmigration. However, it may be true that while many of the benefits of migration are private (increased earnings to the migrant, increased corporate profits), many of the costs are social (increasing demand for services, increasing demand for the community's irreplaceable and depletable resources).

In general, there are fairly predictable long-range economic and environmental costs associated with inmigration. Many of these costs are of such type and are so far in the future that they may not be considered by decision makers in either the private or the public sector.

Attempts to isolate some of these costs are found in recent works by Hite and Laurent. These authors note that "... regional planning must also take cognizance of the effect of economic development in the natural environment. Unfortunately, many environmental considerations are not priced in markets. As a result, the information necessary to bring such considerations into traditional economic analysis is lacking."[7] They go on to suggest the strong need for a methodology to account for all economic and ecologic inputs of an economic activity. Following a line of thought pursued by Isard as well,[8] their technique involves use of the standard Leontief model and an environmental matrix containing data on resource use or residual emission per dollar of gross output for each sector of the Leontief matrix. In brief, then, their research deals with levels of pollution or resource exhaustion resulting from a particular act of development. Our research is somewhat complementary to this approach, suggesting that there are additional costs associated with the inmigration which often follows area development.

METHODOLOGY

The base for the demographic analysis in this research was the population of the cities of Greensboro and High Point and the balance of Guilford County as recorded by the 1970 Census of Population. By application of the Leslie matrix, this population was projected over successive five year intervals from the base year to 2000.

The Leslie matrix was first formulated in 1945 by the biologist P.H. Leslie. It is a series of first-order difference equations solved simultaneously which permit the analyst to determine the impact of changing age-specific rates of mortality, fertility, and migration over time. This method recognizes that as a cohort (group of persons born at a specified time) ages, probabilities change. Since this technique deals in discrete rather than continuous time, the model essentially involves a weighted average of probabilities for each cohort over each projection period (generally five years).[9]

The method of constructing a Leslie matrix is quite simple. If ${}_5B_x$ indicates the number of births to women aged x to x+5 in a given year, and ${}_5P_x$ indicates the number of women aged x to x+5 in that year, then the age specific fertility rate, ${}_5F_x$, is:

$${}_5F_x = {}_5B_x / {}_5P_x \qquad (1)$$

As a rule, such rates can be computed for all five-year age cohorts, 10-14, 15-19, . . . , 45-49.

However, in projecting a population forward for a five-year period, it should be recognized that any cohort is growing older and is subject to differing rates of fertility and mortality. To permit this recognition, the top row of the matrix consists of fertility rates adjusted for the changing age of the cohort. For any age group, the top element of the matrix, ${}_5\phi_x$, is defined as follows:

$${}_5\phi_x = [{}_5F_x + ({}_5L_{x+5}/{}_5L_x)\ {}_5F_{x+5}]\ \frac{{}_5L_0}{2l_0} \qquad (2)$$

where ${}_nL_i$ (from the life table) may be thought of as the number of person-years that will be lived by the cohort as it passes through ages i to i+n, and

l_0 is the initial cohort size of the life-table population (customarily 100,000). It can be intuitively recognized that the only age groups with a value of $_5\phi_x$ other than zero are 5-9, 10-14, ..., 45-49. The elements of the subdiagonal of the matrix (that is, second row, first column; third row, second column; and so on) are equal to the life-table survival rates $_5L_{x+5}/_5L_x$, for all x. The matrix will, in general, be of n by n dimenstions. Multiplying the matrix by the initial population vector of n elements produces a projection of the population for a period equal to the number of years in the cohort (customarily five). The first element of the projected population (this is the number of surviving births to mothers of all ages) is equal to:

$$_5P_0' = \sum_{x=0}^{n} (_5P_x)(_5\phi_x) \qquad (3)$$

where $_5P_0'$ is the projected size of the birth cohort, and $_5P_x$ and $_5\phi_x$ are equal to the values described above.

The remaining elements of the projected population are:

$$_5P_{x+5}' = (_5P_x)(_5L_{x+5}/_5L_x) \qquad x=0, \ldots, n \qquad (4)$$

Because we have also assumed certain age-specific rates of net migration equation 4 must be modified. This can be accomplished by multiplying the right side of the equation by unity plus the appropriate rate (expressed as a percent). Thus equation 4 becomes:

$$_5P_{x+5}' = (_5P_x) \; (_5L_{x+5}/_5L_x) \; (1+_5M_x) \quad x=0, \ldots, n \qquad (4a)$$

where $_5M_x$ is the age-specific rate of net migration.

The mortality rates employed in our projections were those of the United States for 1968 (adjusted for differences in racial composition). Those were held constant over the entire projection period. Fertility rates were those observed for North Carolina in 1970. These were assumed to decline gradually over time until a level approximating replacement was attained. This assumption was made because of the national level, fertility is presently at an all-time low, and if this trend continues, the replacement level may be reached in a relatively short time. Additionally, this assumption permits easier isolation of migration as a significant force in the population growth of the area. It should be noted in this regard that migration patterns are such that those age groups with the highest mobility levels are also those with the highest fertility levels.

There were two assumptions made regarding migration: first, that the rate of inmigration experienced by the Greensboro area would rise to approximate those experienced by the Virginia portion of the Washington, D. C., Standard Metropolitan Statistical Area from 1955 to 1960 (about 0.4 percent per annum); and, second, that the net migration rate would be zero for the entire period. In this fashion, we are able to isolate population growth both directly and indirectly attributable to migration. The direct impact is simply the net number of persons who move into the area. Because of the nature of the Leslie matrix, we are able to determine the age composition as well as the number of these persons. The indirect impact of migration may be considered as the number of children that these newcomers will bear after migration (and, eventually, the children of these children). It is here that some of the neglected social costs of migration may appear. Migration is at a maximum between the ages of 20 and 44; since persons of this age are most frequently in the labor force, their additional contributions to public and private revenues are probably greater than the additional costs of providing them public services. Hence, short-run migration costs may be relatively small and susceptible to being overlooked.

However, continued inmigration of the most fertile elements of the population may eventually begin to alter the age composition of the population. By examining two alternative projections we hope to be able to isolate the possible direct and indirect demographic impact of migration.

The results of these population projections could then be applied to a matrix containing age specific demands for services and age specific contributions to public and private revenues. Consider that there are m such publicly provided services, $S_1, \ldots, S_m$. If demand for each service is known for each of the n age groups, we are able to construct a n by m matrix of coefficients specific to age and service. Demand could be expressed as a monetary cost, for the sake of comparability. Thus, the difference in demand for any (or all) services (s) between the two projected populations is a function of both differences in population size and age composition induced by migration.

RESULTS

Table I, below, shows the impact on population size and composition of the Greensboro area as a result of varying rates of migration. Since the age-specific fertility and mortality schedules are identical, we are able to isolate the effects of migration.

The data show that with migration the population of the area would increase from the 1970 level of 288, 590 to 407, 516 by the end of the present century. In the absence of migration, this figure would be 359, 583 a difference of nearly 48, 000 persons. These represent the total impact of migration on the population size of the area.

Clearly, there are some social costs which would be attributable to this increase in numbers. Various services which must be provided to the entire population-water and sewage, police and fire protection, and so on- must be provided to these individuals. As the number of persons added by migration increases, it is possible that the marginal cost of providing these services will rise.[10] However, there is no way to determine effectively at what point of user demand this would occur, if any. If it does, then, ceteris paribus, it will occur sooner with sustained inmigration than without it.

There are other types of service which are particularly used by a particular age group of the population. The most obvious example, of course, is education. As migrants come into an area, they may provide immediate revenues and immediate demand for the general types of services mentioned above. However, the demand for a service such as education will be lagged in terms of its total impact since some of the children who migrate with their parents will be of pre-school age and others will be born after migration has occured.

Consider the data in Table II, which shows projected population size with and without migration, the amount of cumulative inmigration (that is, the direct impact of migration) and the indirect impact of migration on population size. Note that the share of population increase due to the indirect impact rises over the thirty year period at a rate greater than that due to the direct impact.

Additionally, the indirect impact of migration is felt only in those cohorts born after the beginning of the projection period (1970), while the direct impact is felt in all cohorts. By 2000, there would be 47, 933 additional

Table I. Population Size and Age Composition of Guilford County, with and without Migration: 1970,· 1980, 2000

with migration

Age	1970	1980	2000
0-4	24,556	30,271	29,513
5-9	27,724	28.154	28,853
10-14	28,976	24,645	29,527
15-19	28,984	28,141	30,853
20-34	63,818	89,697	89,282
35-64	92,180	104,701	165,846
65+	22,352	24,409	33,642
TOTAL	288,590	330,018	407,516

without migration

Age	1970	1980	2000
0-4	24,556	29,080	26,759
5-9	27,724	27,530	26,344
10-14	28,976	24,290	27,011
15-19	28,984	27,519	28,269
20-34	63,818	84,670	80,481
35-64	92,180	99,748	139,768
65+	22,352	23,877	30,951
TOTAL	288,590	316,714	359,583

Table II. Population Size, with and without Migration, Cumulative Net Migration, and Indirect Impact of Migration, Guilford County, 1970-2000

Year	Population with migration	Cumulative Migration	Population without migration	Indirect Impact
1970	288,590			
1975	306,666	5,874	300,750	42
1980	330,018	12,628	316,714	676
1985	352,469	20,012	330,836	1,621
1990	372,605	27,733	342,352	2,520
1995	390,564	35,538	351,480	3,546
2000	407,516	43,521	359,583	4,412

persons in the population as a result of migration - 43, 521 migrants and 4,412 offspring of migrants (and offspring of offspring). At that time, 9. 2 percent of all population increase attributable to migration would stem from this source. Overall, migrants would account for 11. 8 percent of the total population - 10. 7 from migration and 1. 1 percent from the indirect impact of migration. Of the total addition to population through migration by 2000, 19, 164 persons, or 40. 0 percent, would be in the ages 0-34. The indirect impact of migration would account for 23. 0 percent of these persons.

The services provided to these persons represent some drainage of the community's resources. In the short run, say by 1980, migration has added 13, 304 persons to the community. The majority of these, 9, 980 are between the ages of 20 and 64 and are likely to be in the labor force. Although there would be real costs of providing services to these persons, the increase tax revenues (to the public sector) and increased output (to the private sector) are likely to be of such magnitude as to cancel out the increased costs of providing services to the 1, 601 persons of school age added to the population (967 migrants and 634 born in the area of migrant parents). For every new potential user of the educational system, there would be 6. 2 potential contributors to revenue and output added through migration.

With the passage of time, such a relationship is likely to change somewhat as the indirect impact of migration becomes more pronounced. In 2000, migration would add 34, 879 persons of working age (approximately 34,200 migrants and the balance being children of migrants) and 7, 609 persons of school age (4, 739 inmigrants and 2, 870 children of migrant parents). For every person of school age added to the population through migration, there would be 4. 6 potential contributors to revenue and output.

Overall, in 1980, the ratio of persons of working age to persons of school age would be 2. 40 with migration and 2. 32 without it. In 2000, there ratios would be 2. 86 and 2. 70, respectively. Thus, the net benefits of migration as measured through impact on the age structure would appear to be positive in the aggregate. However, the increments to population through migration are such that the net benefits of migration would appear to grow at a diminishing rate over time, since the ratio of those who are of working age among the segment of the population added by migration to those of non-working age diminishes with the passage of time. In 1980, there would be 28.36 persons under age 20 and 5. 41 persons over age 65 for every 100 persons aged 20-64 in the population added by migration. By 2000 these ratios would increase to 29. 71 and 7. 71, respectively. If it is recalled that we assumed diminishing fertility over the entire period, it would appear that these results would have somewhat of a downward bias.

II. CONCLUSIONS

In brief, we have attempted to suggest that the time path of the flow of the benefits and costs of migration to the area of destination may be quite different. Due to the anticipated age composition of the migrants (primarily of working age) benefits to both the private and public sectors may begin to flow rather quickly. Because, at least at first, there are relatively few dependents among those persons added to the population via migration, the costs of providing services to these persons may be small relative to increases in revenue and output attributable to them. With the passage of time, the number of dependents among this segment of the population is almost certain to rise, primarily due to the indirect demographic effects of migration, relative to the number of persons of working age. Consequently, the costs of inmigration may begin to rise relative to the benefits.

Although we have taken as an empirical example the case of Guilford County, North Carolina, considerations of this sort are applicable to any area, including those with a pattern of outmigration (where the role of benefits and costs would be reversed). Naturally, the precise results would vary with the course taken by fertility, mortality, and migration phenomena. In our view, in considering the impact of migration to or from an area, the time horizon should be long enough to account for longer run changes in population attributable to migration.

FOOTNOTES

[1]Gilbert L. Rutman, "Migration and Economic Opportunities in West Virginia: A Statistical Analysis," Rural Sociology, XXXV (1970), 206-17.

[2]Ira S. Lowry, Migration and Metropolitan Growth: Two Analytical Models. Los Angeles: University of California, Institute of Government and Political Affairs, 1966. Much of Lowry's work is, as he readily admits, heavily indebted to Cicely Blanco's "Prospective Unemployment and Interstate Population Movements," Review of Economics and Statistics, XLVI (1964), 221-22; and "The Determinants of Interstate Population Movements," Journal of Regional Science, V (1963), 77-84.

[3]Samuel Bowles, "Migration as Investment: Empirical Tests of the Human Investment Approach to Geographical Mobility," Review of Economics and Statistics, LII (1970), 356-62. See also Larry A. Sjaastad, "The Costs and Returns of Human Migration," Journal of Political Economy, LXX (1962), 80-92 (Supplement).

[4]G. C. Bjork, "Regional Adjustment of Economic Growth: The United States 1880-1950," Oxford Economic Papers, XX (1968), 81-97; Bernard Okun, "Interstate Population Migration and State Income Inequality: A Simultaneous Equation Appraoch," Economic Development and Cultural Change, XVI (1968), 297-313; Bernard Okun and Richard W. Richardson, "Regional Income Inequality and Internal Population Migration," Economic Development and Cultural Change, IX (1961), 128-143; G.H. Borts and J. L. Stein, "Regional Growth and Maturity in the United States," Schweizerische Zeitschrift fur Volkswirtschaft und Statistik, XCVIII (1962), 290-321; and Stephen L. McDonald, "Economic Development and Population Shifts in the Southwestern States since 1920," Texas Business Review, XXXIX, (1965), 96-103.

[5]See, in particular, John B. Parr, "Outmigration and the Depressed Area Problem," Land Economics, XLII (1966), 149-59.

[6]This is not the entire Greensboro-Winston-Salem-High Point SMSA, which also includes Forsyth, Randolph, and Yadkin counties.

[7]Eugene A. Laurent and James C. Hite, Economic-Ecologic Analysis in the Charleston Metropolitan Region: An Input-Output Study. Clemson: Clemson University, Water Resources Research Institute, 1971, 1. This technique is also presented in a paper by the same authors delivered at the 1971 meetings of the American Agricultural Economics Association: "An Economic-Ecologic Model for Evaluating in Environmental Repercussions of Area Development," (abstracted in the American Journal of Agricultural Economics, December 1971).

[8]Walter Isard, et. al., Ecologic-Economic Analysis for Regional Development. New York: The Free Press, 1972, 95-113.

[9]P.H. Leslie, "On the Use of Matrices in Population Mathematics," Biometrika, XXXIII, (1945), 183-212; and "Some Further Notes on the Use of Matrices in Population Mathematics," Biometrika, XXXV (1948), 213-45. See also Nathan Keyfitz, "The Population Projection as a Matrix Operator," Demography, I (1964), 56-73.

[10]As Sjaastad, op. cit. notes (pp. 91-92), there is a divergence between private and social costs of migration when charges for publicly provided services are based upon per capita rather than marginal costs. Ideally, migrants

should pay the marginal, not the average, cost of the service which they demand. Political considerations and other non-market factors tend to make this practice difficult to implement.