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Cebula, Richard and Vedder, Richard

Jacksonville University, Ohio University

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A NOTE ON MIGRATION, ECONOMIC OPPORTUNITY, AND THE QUALITY OF LIFE

Richard J. Cebula and Richard K. Vedder*

The increased interest in recent years in environmental matters and the quality of life has led to a propagation of scholarly studies relating to the economic impact of man's social and cultural milieu.[1] The uniqueness of this study to that literature, we feel, is that it empirically examines the extent to which a variety of economic, social, and environmental variables affect the spatial allocation of a major productive resource, namely, labor. Specifically, we hope to answer the question, "Can contemporary American human migration be significantly explained by such 'environmental' factors as air pollution, crime rates, or climate?"

We begin by postulating a theoretical framework in which the decision to migrate is treated as an investment decision. The theoretical framework is then followed by an empirical analysis relating economic, social, and environmental variables to labor migration. Concluding remarks are provided in the closing section of the paper.

1. THE DECISION TO INVEST IN MIGRATION

The basic framework of this paper is one in which the individual chooses to migrate from one area to another if there are positive net benefits over time from such migration. Analysis of the net benefits of migration (which obviously need not be positive) involves appraisal of all the benefits and of all the costs associated with migration.[2]

The benefits (costs) associated with migration may assume a variety of different forms, including higher (lower) earnings and improved (worsened) employment opportunities. There may also be psychic advantages (disadvantages) to be derived from migration to a more (less) desirable environment. These advantages (disadvantages) may include superior (inferior) climatic conditions, lower (higher) crime rates, lower (higher) pollution levels, superior (inferior) medical facilities, etc. Aside from these considerations, of course, there are the many forms of cost which are associated with movement per se. First, and perhaps most obviously, there are the direct money costs incurred in moving. Second, there may be foregone

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* Assistant Professor and Associate Professor of Economics, Ohio University, respectively.

1 Related to this, see Culbertson [1], Gallaway [2], Goldman [5], and Pascal [6]. There has also been a considerable literature concerned in the purely theoretical sense with quality of life variables. See, for example, Demsetz [2], Ruffin [8], and Zerbe [11].

2 Related to this, see Sjaastad [9].

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earnings while in transit and/or while in the process of packing and unpacking. Next, there are the psychic costs of movement. In addition, movement from one area to another may impose costs in the form of loss of seniority, pension plan losses, and/or retraining costs. Assuming that all of the various benefits and costs that can be associated with migration can be expressed in pecuniary terms, we maintain that an individual residing in area i will migrate to area j only if the discounted present value of the net benefits associated with the migration is positive. Mathematically, this may be expressed as

$$(1) \qquad M_{ij} > 0 \quad \text{only if} \quad \left[\frac{B_1 - C_1}{(1+r)} + \frac{B_2 - C_2}{(1+r)^2} + \cdots + \frac{B_x - C_x}{(1+r)^x}\right] > 0$$

where B_e, $e = 1, \cdots, x$, represents the value of the benefits associated with migration from area i to area j for year e, C_e, $e = 1, \cdots, x$, represents the value of 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 M_{ij} denotes migration from area i to area j.[3]

2. DATA AND TECHNIQUES

Fortunately, a substantial amount of data is available providing reasonably reliable indicators of factors that we believe affect the net benefits (total gross benefits minus total gross costs) of American migration. All of the basic economic and socioeconomic data used in this analysis are included in recent volumes of the *Statistical Abstract of the United States* (U.S. Department of Commerce [10]). Because of data limitations for a key variable, air pollution, we are confining our analysis to 39 large Standard Metropolitan Statistical Areas. These 39 SMSA's contained an estimated population of more than 76,000,000 in 1968—more than 65 percent of the total population in SMSA's of more than 250,000, and about 38 percent of the estimated total American population in 1968.

The basic net migration statistics used in this study are Bureau of Census estimates for the period 1960 to 1968. By net migration we mean net in-migration, i.e., in-migration less out-migration. We use the ratio of net migration to the 1960 population, thereby controlling for variations in population of the 39 SMSA's. The net migration rates ranged from a +16.5 percent of the 1960 population in Houston to a −8.9 percent in Charlotte, North Carolina. We examined the relationship between net migration for the 39 large SMSA's and eight variables believed to affect the net benefits from migration. Our basic mobility model is described as follows

$$(2) \qquad M_i = M_i(Y_i, U_i, G_i, D_i, C_i, N_i, T_i, P_i) \qquad i = 1, \cdots, 39$$

[3] As (1) indicates, a positive value for the discounted present value of the net benefits associated with migration implies a positive flow of migrants. Clearly, it is quite possible that a wage rate (income) differential between areas i and j could exist over time and yet fail to induce migration—simply because the wage differential was insufficient to overcome the various costs of migration. Should such a wage differential persist, it would not imply a failure of the market to work efficiently. Quite to the contrary, it would be a reflection of rational decision making by economic man. Related to this see Gatons and Cebula [4].

where

M_i = net migration into the ith SMSA,
Y_i = level of per capita income in the ith SMSA,
U_i = average annual rate of unemployment in the ith SMSA,
G_i = annual average percentage rate of growth in personal income per capita in the ith SMSA,
D_i = number of physicians per 100,000 population in the ith SMSA,
C_i = number of major crimes per 100,000 population in the ith SMSA,
N_i = proportion of the ith SMSA's population that is nonwhite,
T_i = average number of days per year that the ith SMSA's temperature is below freezing, and
P_i = average number of micrograms of suspended particulate matter per cubic meter of air in the ith SMSA.

We used Department of Commerce estimates of SMSA personal income per capita for the year 1968. We would expect, ceteris paribus, that net migration would be greater (more positive) the higher the per capita income of an SMSA, since the more prosperous an area is, the greater the net benefits of migration into the area are likely to be. Symbolically, we postulate

$$\frac{\partial M_i}{\partial Y_i} > 0 \tag{3}$$

For an unemployment rate, we used an average of the mean total unemployment rate for each SMSA for the years 1963, 1966, and 1968. The use of unemployment rates for several years should reduce problems relating to intertemporal fluctuations in relative rates of unemployment in the 39 metropolitan areas. By measuring the extent of the gap between the aggregate supply of labor and the aggregate demand for labor, unemployment rates serve as a measure of job opportunities. We would expect net migration, ceteris paribus, to be inversely related to the average rate of unemployment

$$\frac{\partial M_i}{\partial U_i} < 0 \tag{4}$$

Since we theorize that movers are sensitive to the discounted present value of the stream of expected future net benefits from migration, it follows that their expectations as to long-run (future) earnings and employment-possibilities may be as important as the immediate (short-run) earnings prospects. If expected future income changes are conditioned by the trend of income (wages) over time, then incomes may be expected to rise most rapidly in those areas which have exhibited the greatest rate of income growth over time. Accordingly, migrants will prefer to migrate to areas where incomes (wages) are growing most rapidly, ceteris paribus. Net migration thus is an increasing function of the rate of change in income, such that

$$\frac{\partial M_i}{\partial G_i} > 0 \tag{5}$$

G_i in this case is the percentage growth in personal income per capita in the ith SMSA over the 1959–1968 period (a period roughly coinciding with the observed migration flows).

Turning now to variables often cited in contemporary discussions on the environment and the quality of life, we would expect migrants to prefer to locate in communities where health (medical) services are more abundant, ceteris paribus. Accordingly, we postulate

$$\frac{\partial M_i}{\partial D_i} > 0 \tag{6}$$

D_i in this case represents the number of physicians per 100,000 population in the ith SMSA in the year 1969.

For our measure of the incidence of crime, we have used the total rate of major crime (both violent and property crime) per 100,000 population in each SMSA in the year 1969. Higher crime rates should lower net benefits obtainable from migration in a number of ways: loss through theft of property, higher insurance rates, an increase in fear and tension, etc. Thus, it follows that

$$\frac{\partial M_i}{\partial C_i} < 0 \tag{7}$$

Since the social costs associated with racial tension and strife are presumably greater where the nonwhite population is relatively larger, we would expect net total migration to be greater, the smaller the proportion of an SMSA's population that is nonwhite. Thus

$$\frac{\partial M_i}{\partial N_i} < 0 \tag{8}$$

Presumably, a majority of the population prefer mild or warm climates to cold climates, other factors held equal. To test this assertion, we hypothesize

$$\frac{\partial M_i}{\partial T_i} < 0 \tag{9}$$

No analysis of the relation between migration and the environment would be complete without explicitly considering pollution. Indeed, our choice of cities was dictated by the availability of air pollution data. As our measure of air pollution, we will use the amount of suspended particulate matter per cubic meter of air. Suspended particulate matter includes the more visible forms of pollution: smoke, soot, dust, and "fumes and droplets of viscuous liquid remaining in the air for varying periods of time" (U.S. Department of Commerce [10, p. 172]). We will use an average of the mean amount of suspended particulate matter observed in the 39 SMSA's in each of the nine years, 1960 through 1968. We would expect that the social costs of pollution would lower the net positive benefits of migration so that

$$\frac{\partial M_i}{\partial P_i} < 0 \tag{10}$$

P_i in this case is the average number of micrograms of suspended particulate matter per cubic meter of air in the 1960–1968 period in the ith SMSA.

3. THE EMPIRICAL RESULTS

Before proceeding to our results, we should note that in general the nine variables in our analysis are not strongly correlated with one another. Indeed, in only two instances is the zero order correlation coefficient in the range of +.50 to +1.00 or −.50 to −1.00: the simple correlation between net migration and the change in per capita income from 1959 to 1968 is +.667, while the simple correlation between the average number of days with below freezing temperatures and the change in per capita income is −.509. The complete correlation matrix is included as an appendix to this paper.

The estimated regression equation is

$$\begin{aligned} M_i = {} & -14.9268 + \underset{(1.20)}{0.00237\, Y_i} - \underset{(2.04)}{0.91527\, U_i} + \underset{(3.69)}{3.20643\, G_i} \\ & + \underset{(2.40)}{0.00544\, D_i} - \underset{(1.57)}{0.00127\, C_i} - \underset{(1.29)}{0.09472\, N_i} - \underset{(2.51)}{0.05950\, T_i} - \underset{(0.27)}{0.00571\, P_i} \qquad (11) \\ & DF = 30, \quad F\text{-ratio} = 6.871, \quad R^2 = .647 \end{aligned}$$

where the symbols retain their previous meaning and where the numbers in parentheses represent t-values.

The model explains a large majority—nearly 65 percent—of the variation in the rate of net migration for the 39 SMSA's. All eight independent variables behave in the hypothesized direction. Only one variable, our measure of air pollution P_i, is not statistically significant at the 12 percent level, using a one-tailed test. Three variables, one measuring economic growth (G_i, change in per capita personal income), one measuring coldness of climate (T_i, number of days under 32°F. temperature), and another measuring the availability of health services (D_i, number of physicians per 100,000 population), are significant at the two percent level, while the unemployment variable, U_i, is significant at the three percent level.

Particularly striking to us is the strong relationship between net migration and economic growth occurring in the same period. By itself, change in per capita income can explain more than 44 percent of the total variation in net migration rates. This equation suggests that for each one percent change in the rate of growth in per capita income over the nine-year period 1960–1968, population changed, because of changes in net migration, by 3.21 percent, other factors held constant.

This tends to confirm the theoretical notion that migrants are interested in long-run, not merely short-run, benefits from migration, as one would expect if the migration decision is in fact an investment decision. Expectations as to the future may be as important a consideration to human capital (migrant) investors as to investors in physical capital. Indeed, human migration, like physical investment, might be somewhat sensitive to the rate of interest, as the discounted present value of future net benefits depends on interest rates. That, however, is a matter beyond the scope of this investigation.[4]

Overall, migrants seem to be interested in both explicit economic considerations, such as income, job opportunities, and potential growth in earnings (human

[4] Related to this, see Renas and Cebula [7].

capital gains), and in the more implicit (economic) considerations of an environmental nature. We would conclude that migrants, at least in the 1960 to 1968 period, behaved in a manner consistent with the predictions of economic theory, attempting to maximize the net positive benefits of migration.

APPENDIX

Correlation Matrix

	Net Migration Rate	Income Per Capita	Unemployment Rate	Changes in Per Capita Income	Physicians Per 100,000 Population	Crime Rate	Percent Population Nonwhite	Days Below Freezing	Suspended Particulate Air Pollution
Net Migration Rate	—								
Income Per Capita	.028	—							
Unemployment Rate	−.191	.075	—						
Changes in Per Capita Income	.667	−.170	−.119	—					
Physicians Per 100,000 Population	.327	.306	.283	.147	—				
Crime Rate	.227	.264	.371	.401	.417	—			
Percent Population Nonwhite	.073	−.206	.344	.281	−.022	.177	—		
Days Below Freezing	−.417	.254	−.429	−.509	−.152	−.459	−.400	—	
Suspended Particulate Air Pollution	−.157	.196	−.011	−.223	−.085	−.078	−.264	.322	—

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