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Determinants and Consequences of Internal Migration in the United States

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ABSTRACT**.** This paper develops a simultanous-equations model of metropolitan employment growth and migration that differs from previous similar models in four ways: (1) It endogenizes migrant characteristics, namely, employment and unemployment status of civilian labor force migrants. (2) It incorporates amenities while endogenizing not only income, but also rents, both of which are affected by amenities. (3) Relative to past work, it greatly refines the migration measures and also uses a novel econometric procedure for estimation purposes. (4) Within a system that incorporates three decades, it develops estimates of the models for the 1950s, 1960s, and 1970s. The empirical results strongly support the mutual causation hypothesis that employment and migration are interdependent and each stimulates the other. One of the major findings that has never been shown before is that net migration of employed persons tends to encourage income growth, whereas net migration of unemployed persons tends to discourage such growth. Generally, the results are strong and in several respects provide advances over those of roughly comparable simultaneous systems.

1. Introduction

During the 1960s, two alternative hypotheses were offered regarding the relationship between metropolitan employment growth and migration. The first assumes perfectly elastic labor supply and suggests that employment demand drives migration. The direction of causation thus runs from employment change to migration. Studies claiming to support this hypothesis were conducted by Blanco [1], [2]. Lowry [3], and Mazek [4] but these authors never provided a convincing rationale for a perfectly elastic labor supply curve, which is contrary to the findings of numerous studies relating to the U.S. (Killingsworth, [5]). The second hypothesis assumes perfectly elastic labor demand and suggests that migration drives employment. The direction of causation thus runs from migration to employment change. The main study propounding this hypothesis was done by Borts and Stein [6], who justify a perfectly elastic demand curve by supposing that an area's exports are sold in a competitive market. In an effort to reconcile these alternative hypotheses, Muth [7], [8], made one of the first efforts to model regional growth in the context of a simultaneous- equations system. His main conclusion is that net migration and employment growth are jointly dependent. More precisely, he [8], concludes that every 100 jobs attract about 67 migrants and every 100 labor force migrants result in about 100 jobs. This latter conclusion caused Muth to come down on the side of the Borts and Stein hypothesis of perfectly elastic metropolitan labor demand.

At about the same time, Okun [9] and Olvey [10] also used simultaneous systems to study the mutual causation between migration and employment change. Okun distinguished migrant characteristics, but whereas he treated migration as endogenous, he treated migrant characteristics as exogenous, which is a highly questionable procedure. Olvey studied in-and out-migration separately, rather than net migration, which was a clear advance over ealrier work. However, although he includes employment change in his in-migration equation, he does not include it in the out migration equation; perhaps because he found a wrong sign and/or insignificant coefficient on this key variable when he did so.

As summarized by Mueller [11], Greenwood [12], [13], [14], expanded the basic metropolitan model based on cross-sectional data in several ways, such as separately distinguishing in-and out-migration by metropolitan versus non-metropolitan source or destination as a crude proxy for differential migrant characteristics, disaggregating employment by major sector, disaggregating unemployment as a component of labor force change along with employment, and including per person income change, all as endogenous variables in a simultaneous system. In a study that includes both rural and urban areas, Chamblers and Greenwood [15] endogenize labor force participation rates as a means of accommodating local employment change, along with migration. The simultaneous-equations approach was also applied to cross- sectional data on migration and employment change in countries other than the U.S. For example, Greenwood [16] uses the approach to study Mexico, Greenwood and Hunt [17] develop temporal models of migration and employment change for a spatially exhaustive set of U.S regions. Their findings mainly confirm the earlier empirical results of Muth [8] based on cross- sectional data, except that their estimates of the migrant-attractive lower of an incremental job are lower than those of Muth. Greenwood and Hunt conclude that about (45) employed migrants accommodate (100) incremental jobs in the average large U.S. region. Later, Greenwood, Hunt, and McDowell [18] show that the cross-sectional estimates of the migrant-attractive power of an incremental job and of the number of jobs caused by an incremental employed migrant have a temporal dimension.

Perhaps due to the data requirements of such studies, simultaneous-equations models of migration and employment change are almost never seen in the current literature. The absence of this type of model has in a sense stunted efforts to study the macroeconomic (i.e., regional) consequences of migration, as noted by Greenwood, Mueser, Plane, and Schlottmann [19]. The present paper is, in an important sense, an effort to resurrect the simultaneous-equations approach to the study of the causes and consequences of migration.

This paper advances the multiple-equation approach to the study of the causes and consequences of migration in at least four ways. First, in- and out-migration streams are disaggregated by the employment status of the migrants. We are unaware of any prior published study that has endogenized migrant characteristics in the context of a simultaneous-equations approach. Second, since the activity on such models during the 1970s and early 1980s, the idea that migration occurs within an equilibrium system has gained a foothold in the literature. The equilibrium hypothesis calls for the introduction of location-specific amenities in migration models and also suggests that both wages and rents will reflect the values of these amenities. Unlike earlier simultaneous models of migration, the model developed here includes a set of amenity variables. Also unlike earlier similar studies, not only wages but rents are treated as endogenous. Moreover, the inclusion of the amenity variables has the practical consequence of contributing to the identification of the various equations of the system. Third, in several ways discussed below, this study uses refined data and estimation techniques. Fourth, the study includes estimates for the decade of the 1970s, whereas most previous cross-sectional studies concentrated on the 1950s and 1960s.

The paper is set up as follows: The model and its theoretical underpinnings are laid out in Section 2. Section 3 provides a fairly detailed discussion of the data used to estimate the model. Section 4 discusses econometric procedures, and Section 5 presents the empirical results. The paper concludes in Section 6 with a summary and assessment of the findings.

2. The Model

The model presented here consists of 17 equations (10 structural equations and **7** identities) and 17 jointly dependent (endogenous) variables and 19 independent (exogenous) variables. The endogenous variables include eight migration variables, four employment variables, and five other variables. The migration variables are: rate of civilian labor force in-migration (IMR), rate of civilian labor force out-migration (OMR), out-migration rate of the employed civilian labor force (OMREM), out-migration rate of the unemployed civilian labor force (OMRUN), in-migration rate of the employed civilian labor force (IMRBM), in-migration rate of the unemployed civilian labor force (IMRUN), net migration rate of the employed civilian labor force (NMREM), and net migration rate of the unemployed civilian labor force (N\ 41RUN). All migrant characteristics are defined at the end of the relevant period. The employment variables are employment growth (EMPG), manufacturing employment growth (MEMPG), government employment growth (GEMPG) and other employment growth (OEMPG). The remaining five endogenous variables are the rate of real income growth (INCG), the rate of unemployment growth (UNBMPG), the rate of growth of median contract rent (RMCRG), the rate of total civilian labor force growth (CLFG), and the rate of natural growth of the civilian labor force (NATG). Specifically, the model is of the following form:

$$\text{OMREM} = f_1\,[\text{IMR, EMPG, UNEMPG, INCG, RMCRG, CLF, UNBMPR, INC, AGE, EDU, RMCR}, D_1, D_2, D_3, D_4, e_1] \qquad (1)$$

$$QMRUN = f_2 [IMR, EMPG, UNEMPQ, UCG, RMCRG,.CLF, UNEMPR, INC, AGE, EDU, RMCR, D_1, D_2, D_3, D4_7, e_2] \quad (2)$$

$$IMREM = f_3 [QMR, EMPG, UNEMPG, INCG, RMCRG, CLF, UNEMPR, INC, RMCR, D_1, D_2, D_3, D_4, e_3] \quad (3)$$

$$IMRUN = f_4 [QMR, EMPG, UNEMPG, INCG, RMCRG, CLF, UNEMPR, TNc, RMCR, D_1, D_2, D_3, D_4, e_4] \quad (4)$$

$$INCG = f_5 [MAREM, NMRUN, UNEMPG, NATO, RMCRG, INC, EDUG, ARMFG, RMCR, D_1, D_2, D_3, D_4, e_5] \quad (5)$$

$$MEMPG = f_6 [OMR, IMR, NATG, INC, MEMP, EDUG, ARMFG, D_1, D_2, D_3, D_4, e_6] \quad (6)$$

$$GEMPG = f_7 [OMR, NR, NATG, INC, GEMP, EDUG, ARMFG, D_1 7 D_2, D_3, D_4, e_7] \quad (7)$$

$$OEMPG = f_8 [OMR, IKIR, NATG, INC, OEMP, EDUG, ARNIFO, D_1, D_2, D_3, D_4, e_8] \quad (8)$$

$$UNEMPG = f_9 [OMREM, OMRUN, IMREMP, IMRUN, INCG, NATG, UNEMPR, ARMFC, D_1, D_2, D_3, D_4, e_9] \quad (9)$$

$$RMCRG = f_{10} [INCO, CLFG, RMCR, PDENS, CRRTV, ThMPY, AWDS, HDD, CDD, HUD, D_1, D_2, D_3, D_4, e_{10}] \quad (10)$$

$$OMR = OMREM + OMRUN \quad (11)$$

$$IMR\ IMRBM + IMRUN \quad (12)$$

$$MYIREM - = IMREM - OMREM \quad (13)$$

$$NMRUN\ IMRUN\ OMRUN \quad (14)$$

$$CLFG\ EMPG + UNEMPG \quad (15)$$

$$EMPO - = MEMPG + GEMPG + OEMPG \quad (16)$$

$$NATG\ CLFG + OMR - IMR-1 \quad (17)$$

As shown above, the model contains four structural migration equations. The first two equations are related to the out-migration variable and the second two to the in-migration variable. The model also contains three structural equations for employment growth, an unemployment-growth equation, an income-growth equation, and a rent-growth equation. Finally, it has seven identities related to total out- and in-migration rates, net out- and in-migration rates, employment growth, civilian labor force growth, and civilian labor force natural increase.

The Out-and In-Migration Equations

The use of separate out- and in-migration variables is preferable to the use of a variable relating to net migration, which was used by Muth [8]. The use of net migration involves a substantial loss of information about the system, because out- and in-migrants embody different human capital characteristics. Moreover, certain factors that are relevant to explaining out-migration are not relevant to explaining in-migration.(1) Furthermore, the magnitude of the influence of certain factors on out-migration is likely to be different from the magnitude of the influence of these factors on in-migration. The use of out- and in-migration rates also allows account to be taken of not only differences in the determinants but also differences in the consequences of each one.

Both the out- and in-migration equations are disaggregated according to the migrants' employment status. Thus, the model contains two out-migration equations, one for employed (OMRBM) and one for unemployed (OMRUN) CLF migrants, and also two in-migration equations, one for employed (IMREM) and one for unemployed (IMRUN) CLF migrants. Employed and unemployed out-migrants are assumed to be affected by the same origin and destination characteristics, although the magnitude of the effect may differ for the two groups. Therefore, the same variables are included in each out-migration equation. By the same assumption, each of the in-migration equations has the same variables.

Out-migration and in-migration of both the employed and unemployed are expected to be positively correlated with each other. Those places that have much in-migration of both the employed and unemployed are expected to have much out-migration, and vice versa. One reason for this phenomenon is that generally the more in- migrants to the SMSA, the more mobile the population of that SMSA, and therefore, the more out-migrants from the SMSA.(2)

It is generally expected that a greater rate of employment growth, which is a measure of job opportunities in an area, will decrease the out-migration rate of both the employed and unemployed migrants and increase the in-migration rate of both groups to the area in question, *ceteris paribus*. The employment growth variable has been problematic in previous out-migration equations that are included in a simultaneous system (Olvey, [10] Greenwood, [13]). Moreover, both groups of CLF members are expected to move to areas with relatively high income levels and relatively high income growth rates, and to move out of areas with relatively low income levels and relatively low income growth, ceteris paribus. Areas with a high rate of unemployment are expected to experience more out-migration and less in-migration of civilian labor force members. Moreover, both groups of CLF members should move away from areas with high unemployment growth rates and towards areas with low unemployment growth rates.

Certain personal characteristics such as age and education are expected to be important determinants of the individual's decision to migrate. Older people have a lower tendency to migrate because they have established more family and other ties and because their rate of return to migration is lower due to their shorter expected

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(1) These are the factors that relate to the propensity to depart, like age and education, which are regarded as proxies for characteristics of a population that is at risk to leave (out-migrate).

(2) This argument relies on homogeneity of the population. Another argument could be given if people are heterogeneous; that is, when in-migrants alter a location (higher rents, congestion, pollution, etc.) in such a way as to induce out-migration by those whose optimal amenity bundle now requires a move to a different location. This means that out-migration and in-migration of both employed and unemployed should be positively correlated with each other.

working life. Therefore, *ceteris paribus*, out-migration rates for both employed and unemployed CLF are expected to be lower the higher the median age of the area in question. Furthermore, more educated people have a higher tendency to migrate. Therefore, *ceteris paribus*, out-migration rates for both of the CLF groups are expected to be higher, the higher the level of education of the area in question. Lansing and Mueller [20] argue that unemployed people are usually associated with low education levels and advanced age and youth. Both age and education are meant as characteristics of the places from which the migrants are being drawn, and they are not included in the in-migration equations for employed and unemployed CLF members.

The rate of growth of median contract rent (RMCRG), as well as the level of median contract rent (RMCR), are used as cost of living measures and as an amenity characteristic for SMSAs. As will be explained later, the median contract rent variable is used as a proxy for a set of endogenous and exogenous amenity variables that we expect to affect the individual migration decision. The level and the growth rate of the median contract rent have indeterminate signs in each of the out- and in-migration equations for both employed and unemployed CLF members, depending on whether they capture production amenities or consumption amenities and on the extent of "capture".

In general, we expect employed CLF migrants to be more responsive to the amenity variables, whereas the unemployed should be more responsive to the economic variables. An unemployed person is not expected to move from one place to another to fulfill his need for amenities while he does not have a job or a source of earnings.

Four regional dummy variables (D_1, D_2, D_3, and D_4) are included in each of the four migration equations as well as in the other six structural equations of the model. The main purpose of including these four dummy variables in each equation is to reflect the influence of other variables that are not included in the model and, as in Greenwood [14], to reflect the significance of the differential (intercept) shift for any one region (West, South, North Central, or Northeast), relative to each of the other regions. Considering $\propto_1$, $\propto_2$, $\propto_3$, and $\propto_4$ as the coefficients of the four dummy variables, respectively, the regional intercepts are: West = $\propto_1$; South $\propto_1 + \propto_2$; North Central = $\propto_1 + \propto_2 + \propto_3$; Northeast = $\propto_1 + \propto_2 + \propto_3 + \propto_4$ The West is the benchmark region; thus, the coefficient on D_2 shows how the South differs from the West; that coefficient on D_3 shows bow the North Central differs from the South; and that on D_4 shows how the Northeast differs from the North Central.

The Income-Growth Equation

The employed should have a positive impact on income growth, while the unemployed have a negative impact. The sign on a migration variable in an income-change equation is an empirical question, and no strong a priori reason indicates the direction of the relationship between the out- and in-migration variables and the income- change equation. The same argument applies to natural civilian labor force increase. Greater natural CLE increase results in greater increase of both labor supply and demand. Therefore, the sign associated with that variable in the income-growth equation depends on which dominates the other. Unemployment growth is expected to negatively affect income growth, because excess labor supply reduces the existing wage rates or slows their growth (Blanchflower and Oswald, [21]).

If education increases labor productivity and therefore labor demand, a positive relationship should exist between education growth and income growth. The growth rate of the median contract rent variable, which is a proxy for amenities, is not expected to have a predictable sign in the income-growth equation. The sign depends on whether or not income and rents are compensating for variation in the attractiveness of these amenity variables. This means if the SMSA is considered an amenity-rich place, people would be willing to pay more for it, which causes both the endogenous rent and income variables to be positively related. However, if people are moving to the place for reasons other than job or amenity motivations, the resultant effect will depend on the interaction between the SMSA labor demand and supply. Finally, income is expected to increase with increased aimed forces personnel, because more military personnel boost labor demand.

The Employment-Growth Equations

The effect of out- and in-migration on employment is straightforward. Out-migration should reduce employment whereas in-migration should spur it. The employment-growth variable has been disaggregated to three components: manufacturing (MEMPG), government (GEMPG), and other (OEMPG). The latter refers to employment in all sectors except manufacturing and government. Because it is probably more export oriented than the other two components of employment change manufacturing should be least sensitive to in- and out-migration. Natural CLF growth should affect both the labor demand and supply positively, thus positively affecting employment in each sector.

Education growth should have a positive impact on each of the three specific types of employment growth. The growth of armed forces personnel is expected to have positive signs in the manufacturing; government, and other-sector growth equations because the more armed forces personnel, the more job opportunities for the civilian labor force members.

The Unemployment-Growth Equation

The way that the out- and in-migration rate variables affect unemployment growth is similar to their effect in the income-growth equation. The influence of each of the above disaggregated out- and in-migration variables depends on the interaction between labor supply and demand relationships and which shift dominates the other. As a result of in-migration of both CLF groups, the demand curve in the receiving areas shifts outward and the supply curve also shifts outward. If the demand shift dominates the supply shift, unemployment will fall; if the supply shift dominates the demand shift, unemployment will rise. The same argument applies to out-migration of both CLF groups, where labor demand in the sending areas shifts inward and labor supply also shifts inward.

Since the unemployment rates among the young civilian labor force members are relatively high, the natural CLF growth variable should have a positive effect in the unemployment-growth equation, even though an increase in the variable will increase labor supply and labor demand. For the above reason, we expect the supply shift to dominate the demand shift, and therefore unemployment to increase.

The effect of the income-growth variable in the unemployment-growth equation also depends on the relative demand and supply shifts and which dominates the other. The unemployment level is expected to have a negative influence on unemployment growth. The idea is that in areas with high beginning-of-period unemployment levels, the rate of wage growth will be lower, which in turn may attract more capital and encourage investment in the area. For a given civilian labor force size, demand for labor and other factors would increase and unemployment would decrease. Finally, higher rates of growth of the aimed forces should encourage more job opportunities for CLF members, and therefore, less growth of unemployment.

The Rental-Growth Equation

Following Graves [22] the median contract rent variable is used as a proxy for a host of amenities which might affect migration.(3) Some of these amenities, such as population density and crime rate, are endogenous amenities because they are a function of population size. Others are exogenous, such as various climatological variables. In his age-disaggregated system, Graves treats rent as an exogenous variable, whereas this study treats the variable as endogenous, due to its relationship with the population growth rate. Therefore, the final structural equation in the system is for the growth of median contract rent SMSAs with high income growth and high civilian labor force growth are expected to have high growth rates of rents. The growth of rents is positively related to income growth because high income growth suggests that people should be willing to pay more for rents. It is also positively related with CLF growth because more CLF growth means higher demand for housing and consequently greater growth of rents. Areas with high population density are expected to have high growth rates of rents. Areas with high violent crime rates are expected to have low growth rates of rents. This is because people have a tendency to move to and live in safe places, which reduces the demand for housing in high crime areas.(4) The level of median contract rent does not have a determinate sign in the rental-growth equation. Each of the temperature variance, average wind speed, and humidity variables is expected to be negatively related to the rental-growth variable because SMSAs that are characterized by a high level of any of these variables are less attractive, ceteris paribus. This means low demand for housing, and therefore, low rents. The opposite argument holds for cooling degree days. This variable is expected to be positive in the rental-growth equation because SMSAs with high cooling degree days (i.e., warmth) are more attractive, ceteris paribus.

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(3) Graves argues that the advantage of using such a proxy will give more degrees of freedom, reduce the omitted-variable bias, and decrease the probability of having a multicollinearity problem.

(4) People usually are more concerned about violent crime rates than about property crime rates, because property is insurable.

3. The Data

The spatial unit employed in this study is the Standard Metropolitan Statistical Area (SMSA). The sample employed in this study consists of 64 SMSAs in 32 states, grouped according to their location in the four main regions of the U.S.: Northeast, North Central (now called Midwest), South, and West. This study covers changes over three time periods, namely, 1950 to 1960, 1960 to 1970, and 1970 to 1980. The sample SMSAs have a 1980 population of at least one-half million, with one exception (paterson-Clifton-Passaic).

The data present several problems. The first is that for each of the three periods, the geographic definition of some SMSAs at the end of the period is different than at the beginning of the period because new counties were added to the definitions or, in a few cases, counties were deleted. All of the beginning-of-period data have been adjusted to match the end-of-period SMSA definition.

The Second problem is that in the 1950 and 1960 censuses, data for employment, unemployment, government employment, manufacturing employment, and armed forces personnel are listed for persons 14 years old and over, whereas in the 1970 and 1980 censuses, data for these variables are given for people 16 years old and over. The 1950 and 1960 data have been adjusted to match the 1970 and 1980 data.

The third problem is that the number of potential SMSAs for each time period is not the same. For the 1950-1960 period 62 SMSAs are included in the data set; for the 1960-1970 period, 64 SMSAs are included; and for the 1970-1980 period, 63 SMSAs are included. Two SMSAs (Greensboro and Anaheim-Santa Ana-Garden Grove) have been excluded from the 1950-1960 sample. The Anaheim-Santa Ana-Garden Grove SMSA is dropped because it was not a separate SMSA in 1960, but its spatial area is included with the Los Angeles-Long Beach SMSA. The Greensboro SMSA is dropped because no migration data are available for it for the 1950-1960 period. The Fort Worth SMSA has been excluded from the 1970-1980 sample because it was incorporated into the Dallas SMSA.

The inconsistency of the migration data with the other data used in the model is also problematic. All the endogenous and exogenous variables refer to their levels in census years (1950, 1960, 1970, 1980), or to the changes during a ten-year period (1950-1960, 1960-1970, 1970-1980), whereas the census migration data refer to civilian labor force movements during five-year periods (1955-1960, 1965-1970, 1975-1980). Three options are available to solve this problem. Greenwood [23] offers two of these three options. The first is to make the migration variables compatible with the other variables by defining the migration variables over a 10-year period. This option would require the assumption that the migration movements that occurred between the first five years and the last five years of each decade were identical. This is the option used by Greenwood [23] in his earlier work. The second option is to make the other endogenous and exogenous variables compatible with the migration variables by defining these variables over a five-year period. This option would require the assumption that the changes that occurred over each 10-year period took place at a constant rate. Thus, it would be possible to find the five-year levels and changes for the other endogenous and exogenous variables. Even though the first option has some unknown bias, the second option is less desirable than the first because it requires the assumption that the 1950-1955, l960-l965, and 1970-1975 behavior of each variable except migration was identical to that variable's 1955-1960, 1965-1970, and 1975-1980 behavior, respectively. No strong reason suggests that migration differed over each of the two five-year periods while other variables did not.

The third option is similar to the first, but instead of multiplying all SMSA migration data by a constant equal to 2, these migration data can be multiplied by different adjustment factors depending on the region in which the SMSA is located. These different adjustment factors are derived as follows. First, regional in- and out-migration were calculated from *The Current Population Reports*, Series P-20, for the 1950-1960, 1960-1970, and 1970-1980 periods. In this source, the migration data are available based on yearly flows for the first two time periods, but for the 1970-1980 period are based on a five-year flow. The second step is to convert the above yearly flows to five-year flows by taking the average of the available yearly flows within a five-year period for each region. The third step is to calculate the regional adjustment factors for the three time periods. Each region's in-migration adjustment factor is defined as the total number of in-migrants to the region in the first five years of the period, divided by the total number of in-migrants to the same region in the last five years of the same period, plus one. The same definition is used to calculate the regional out-migration adjustment factors. We feel that this last option is more accurate than the two mentioned above, and therefore we have adopted it.(5)

Another problem is that the 1950, 1960, 1970, and 1980 income data are money median income of persons, and to put these in real terms they need to be adjusted for inflation. Therefore, all income data has been deflated by a consumer price index (CPI) deflator for all items based on the average of 1982-1984.(6) Previous studies have not made such an adjustment. Moreover, data for the 1980 median income of persons are not available. The only available income data for this year are for family median income and household median income. Using the 1950, 1960, and 1970 median income of families and persons and 1980 family median income, the 1980 median income of persons was estimate.(7)

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(5) The adjustment factors are given in the following Table.

Year	1950-1960		1960-1970		1970-1980	
Region	IM	OM	IM	OM	IM	OM
Northeast	1.815	1.916	1.930	1.853	1.956	1.926
N. Central	2.130	1.820	1.754	1.978	1.869	1.924
South	1.854	2.042	1.962	1.849	1.971	1.923
West	1.887	1.955	2.019	1.871	1.827	1.843

(6) All data related to the CPI deflator are obtained from the *Economic Report of the President*, February 1991, Table B-59 (p. 353).

(7) By running simple regressions, we get the following three linear relationships between median income of persons (PMI) and family median income (FMI):

1950 PM1 = -282.669 + 0.7l3609 FMI
1960 PMI = -392.279 + 0.586546 FMI
1970 PM1 = -507.172 + 0.486433 FMI

The ratio of the coefficient for 1960 median income of families to that for 1950 is 0.822, and the ratio of the corresponding 1970 and 1960 coefficients is 0.829. Assuming that the ratio of the 1980 median income =

The last problem is that unlike the 1960 and 1970 data, the 1950 data for the crirme rate variable (against both persons and properly) is available only for central cities and not SMSAs. This makes the measure of the crime rate variable in 1950 not compatible with the 1960 and 1970 measures. To deal with this problem we use the central city's crime rates for the 1960s and 1970s to match the 1950 data. Means and standard deviations for all variables for each period are shown in Table (1).

Table (1)
Sample Means and Standard Deviations

	1950-1960		1960-1970		1970-1980	
Variab1e	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
OMR	0.288	0.134	0.291	0.114	0.322	0.106
IMR	0.434	0.459	0.358	0.232	0.405	0.233
OMREM	0.271	0.125	0.275	0.106	0.303	0.099
OMRUN	0.018	0.009	0.015	0.008	0.019	0.010
IMREM	0.409	0.429	0.341	0.219	0.380	0.220
IMRUN	0.025	0.031	0.017	0.015	0.025	0.015
NMREM	0.139	0.349	0.325	0.212	0.077	0.161
NMRUN	0.007	0.024	0.002	0.009	0.006	0.011
CLBG	1.367	0.401	1.316	0.277	1.319	0.224
INCG (Real)	1.231	0.083	1.066	0.076	0.775	0.072
EMPG	1.371	0.409	1.323	0.276	1.293	0.235
MEMPG	1.513	0.858	1.329	0.866	1.143	0.284
GEMPG	1.801	1.041	1.745	0.484	1.315	0.261
OEMPG	1.326	0.360	1.288	0.238	1.372	0.248
UNEMPG	1.367	0.404	1.184	0.427	1.984	0.436
RMCRG	1.665	0.188	1.867	0.181	1.023	0.108
NATG	0.221	0.145	0.248	0.194	0.236	0.117
EDUG	1.075	0.048	1.086	0.050	1.046	0.028
ARMFG	1.944	1.435	1.395	0.911	0.785	0.349
UNEMPR	0.050	0.015	0.048	0.011	0.042	0.012
EMP	426338	601095	519261	674237	636289	696612
MEMP	129277	189222	151107	202065	166184	189218
GEMP	40765	60527	63345	81319	99689	110983
OEMP	256296	369144	304810	407574	370416	418117
CLF	450243	640024	546064	708902	664891	728452
UNEMP	23904	39873	26803	35620	28602	34056
INC (Rea1)	2175.48	294.82	2687.43	375.28	2850.92	355.25
RMCR	37.61	6.94	50.53	7.99	58.82	12.31
AGE	31.30	1.89	29.54	2.73	28.13	2.79

= of families to the 1970 value is equal to the average of those two (0.825), and multiplying by the 1970 coefficient, we get a coefficient for the 1980 median family income equal to 0.4015. Following the same process for the constant term, we obtain a synthetic linear relationship between median income of persons and median income of families as follows:

$$1980 \text{ PMI} = -679.788 + 0.4015 \text{ FMI}$$

This synthetic regression was then used to estimate 1980 median income of persons. Because of the large labor force influx of women and of the baby boom generation during the 1970s, this approach may overestimate PMI.

	1950-1960		1960-1970		1970-1980	
EDU	10.37	1.00	11.12	0.82	12.03	0.43
PDENS	1046.40	1878.57	1135.10	1787.22	1068.76	1752.30
CRRTP	953.57	659.03	1143.75	430.78	2932.09	810.42
HDD	2552.61	1220.82	2535.62	1227.90	2535.62	1227.90
CDD	833.86	606.21	809.57	591.22	809.57	591.22
TEMPV	32.545	6.678	32.292	6.929	32.292	6.929
AWDS	4.095	0.587	4.060	0.597	4.060	0.597
HUD	64.468	7.565	64.365	7.548	64.365	7.548

Table (A1) reports all data sources.

Table (Al)
Data Sources

		Table Number			
Variable[1]	Source	1950	1960	1970	1980
IMEM	Mobility for Metropolitan Areas	-	4	15	10
IMUN	(1960) (1970), and (1980).	-	4	15	10
OMEM		-	6	16	9
OMUN		-	6	16	9
EMP	Charactenstics of the Population				
UNEMP	Parts 2-52 (1950), (1960), and (1970).				
MEMP	General Social and Economic				
GEMP	Characteristics of the Pop., Parts 2-52				
ARMF	(1980).				
INC	Characteristics of the Pop., U.S.				
	Summary (1950).				
	Char. of the Pop., Parts 2-52 (1960).				
	General Social and Economic				
	Characteristics (1980).				
AGE	Characteristics of the Pop., U.S.				
EDU	Summary (1950), (1960), and (1970).				
POP	Number of Inhabitants				
PDENS	(1950), (1960), (1970), and (1980).				
ORRTV	Uniform Crime Reports				
CRRTP	for the U.S.A. (1950), (1960) (1970) and (1980).				
RMCR	General Characteristics of the Pop.,				
	U.S. Summary Census of Housing				
	(1950) and (1960).				
	Housing Characteristics for States,				
	Cities, and Counties, U.S. Summary				
	Census of Housing (1970).				
14-15 POP[3]	Number of Inhab. (1950) and (1960).				
14-15 EMP	Characteristics of the Pop., Parts 2-52				
14-15 UNEMP	(1950) and (1960).				

1. A complete definition of each variable is given in the Appendix.
2. For the Anaheim-Santa Ana-Garden Grove SMSA, The General Social and Economic Characteristics Book (1960). Table 86, is used to calculate the average weighted income.
3. 14-15 POP means 14- and 15-year-old population, and the same for EMP and UNEMP.

4. Methodology and Econometric Procedures

Any large simultaneous system such as that outlined above requires zero restrictions on a sufficient number of coefficients to allow the identification of the various equations of the model. In many cases these restrictions are, more or less, somewhat arbitrary. The methodological approach that we followed was to experiment with the model for the 1950s until the econometric estimates provided reasonable fits for the equations for this period. This form of the model was then maintained as the model was estimated for the 1960s and 1970s. This approach is equivalent to building a model based on 1950s data and then testing the model with data for the 1960s and 1970s.

As indicated earlier, the model consists of 17 equations in 17 jointly dependent variables and 19 independent variables. In order to estimate this system linear regression is ruled out because it would produce biased and inconsistent estimates. Three other methods of estimation were used. These are three stage least squares (3SLS), two stage least squares/Zellner's seemingly unrelated regression (2SLS/SUR), and finally, the estimation of a panel data model that is based on pooled observations. 3SLS method is preferable to 2SLS because 2SLS has greater asymptotic efficiency when equations are over-identified and equations disturbances are correlated. The only shortcoming of this method is that it accounts for the equations' disturbance correlation within each time period, but not among different time periods.

In this paper we are mainly concerned with two kinds of disturbance correlations. The first correlation, which is accounted for by the 3SLS method discussed above, is between disturbances of different equations, but of the same observation and time period. The second correlation, which is accounted for by the 2SLS/SUR method discussed next, is between two disturbances of different time periods, but for the same equation and observation. This means any other kind of disturbance correlation is assumed equal to zero.

Two stage least squares/seemingly unrelated regression (2SLS/SUR) method is based on doing the Zeilner's SUR in the context of a simultaneous- equations system. One way to do this is to apply both the 25L5 and the SUR methods. Applying the 2SLS method will account for the endogeneity in the system and then applying the SUR method will account for the disturbance correlation between different time periods. In order to apply the 2SLS/SUR method, a balanced data set is required; that is, each time period is required to have the same number of observations.[(8)]

The first step is to apply 2SLS to each of the three balanced data sets to obtain the predicted values of the right-hand-side endogenous variables of the model. Since each time period has the same endogenous and exogenous variables and the same number of observations, it is now possible to establish a single new data set that contains observations for each time period. In comparing this method of estimation

(8) For this study, one observation (the Fort Worth SMSA) is dropped from the 1950-1960 data set, three observations (the Anaheim-Santa Ana-Garden Grove, Fort Worth, and Greensboro SMSA) are dropped from the 1960-1970 data set, and two observations (the Anaheim-Santa Ana-Garden Grove and Greensboro SMSAs) are dropped from the 1970-1980 data set. Therefore, 61 observations are used for each of the three time periods. Schmidt [24] shows that the estimation of a seemingly unrelated regression may be done with unequal numbers of observations, but we prefer to use a balanced data set.

(2SLS/SUR) with the previous method (3SLS), we note that the 2SLS/SUR accounts for the disturbance correlation between time periods, and assumes a zero disturbance correlation between equations in a given time period, while the 2SLS does exactly the reverse. It accounts for the correlation between equations in a given time period, but assumes a zero disturbance correlation among time periods. The method that is more appropriate to estimate our system of equations depends on which of the above two correlations is more significant, which in turn depends on the results that will be discussed in the next section.

Our panel-data procedure is based on pooling cross-section and time-series data. The idea is to create one data set that has all observations (N) for the three time periods. Since each time period has a balanced number of observations equal to 61, we end up with 183 observations for each variable in the new data set. And since data are available for each observation (SMSA) over the three time periods, the practical question is whether or not the cross-section parameters of the statistical model remain constant over time. If they remain constant, then it is possible to pool the data from the three time periods to get more efficient parameter estimates. However, if the cross-section parameters shift over time, pooling is not an apporporiate procedure. Based on our statistical tests for pooling, we reject this procedure because to do so would misspecify the model.

5. The Empirical Results

The model employed in this study has been estimated in double-logarithmic form.(9) The Goldfeld-Quandt test for heteroscedasticity has been applied to the data of each equation, and the results show no evidence of such a problem. When a coefficient has an expected sign, a one-tail test at the 10-percent level of significance ($t \geq 1.29$) is employed, and when a sign is not specified or when an unexpected sign is obtained, a two-tail test at the 10-percent level of significance ($t \geq 1.67$) is employed. Therefore, when a coefficient is described as being significant, we mean it is significant at the 10-percent level or better.

The 2SLS/SUR estimates of the urban growth model discussed above are presented in Table (2) for the 1950-1960 period, Table (3) for the 1960-1970 period, and Table (4) for the 1970-1980 period. For comparative purposes, the OLS coefficients of determination (R2s) are presented at the bottom of each table. For the 1950-1960 decade, the R2s range from 0.98 (IMREM equation) to 0.38 (GEMPG equation); for the 1960-1970 decade, they range from 0.98 (UNBMPG equation) to 0.57 (RMCRG equation); and in the 1970-1980 decade, they run from 0.95 (UNEMPG equation) to 0.16 (GEMPG equation).

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(9) Except for the dummy variables. Moreover, in order to be able to transform all the data to logarithms, a one has been added to the values of some variables, such as net migration of both CLF groups, to get rid of the minus sign values.

Table (2)
Two-Stage Least Squares/Seemingly Unrelated Regression Estimates
(2SLS/SUR): 1950-1960*
equation for

End. Var.	OMREM	OMRUN	IMREM	IMRUN	INCG	MBMPG	GEMPG	OEMPG	UNEMPG	RMCRG
OMR			0.198a	0.188a		-0.058	0.110	-0.094a		
IMR	0.212a	0.058				0.280a	0.091	0.622a		
QMREM									0.167a	
QMRUN									-0.609a	
IMREM									-0.547a	
IMRUN									1.013a	
NMREM					0.060a					
NMRUN					-0.078a					
EMPG	-0.205a	-0.079	0.529a	0.195a						
UNEMPG	0.176	0.791a	-0.109	1.153a	0.083c					
INCG	-1.680b	-1.563b	-1.670a	-0.775c					0.054	0.176
NATG					0.011	0.008	-0.236c	0.005	0.134a	
CLFG										0.065a
RMCRG	1.750a	1.036c	2.171a	0.758c	0.904a					
Exo. Var.										
CLF	-0.132a	0.076c	-0.018	-0.045						
UNMPR	-0.080	0.522a	0.283a	0.830a						-0.690a
INC	0.576c	-0.607b	-1.587a	1.062a	-0.204	0.135	1.004a	0.467a		
MEMP						-0.014				
GEMP							-0.155a			
OEMP								-0.033a		
AGE	-1.360a	-0.835c								
EDU	0.526	0.589c								
EDUG					0.308a	0.812c	1.156	0.599a		
ARMFG					-0.004	0.030	-0.047	-0.028c	0.006	
RMCAR	1.157a	0.814a	1.586a	0.834a	0.401a					-0.434a
PDENS										0.022c
CRRTV										0.026a
TEMPV										**0.213b**
AWDS										0.090
HDD										0.079c
CDD										-0.011
HUD										**-0.192b**
D1	4.475C	1.848	4.565a	4.837a	-0.170	0.566	-4.600c	-2.476a	-0.785a	2.838a
D2	0.069	-0.147	-0.092	-0.442a	-0.011	-0.099	0.044	0.218a	0.184a	-0.082b
D3	-0.308'	-0.300^2	0.027	0.161b	-0.050b	-0.055	0.256c	-0.107^2	-0.098	0.127
D4	0.326	0.015	0.239a	0.335a	0.0822	0.2032	0.394'	0.117	0.022	0050b
OLS RZ	0.82	0.89	0.98	0.97	0.74	0.85	0.38	0.89	0.97	0.71

* a indicates absolute t ≥ .96; b indicates absolute 1.69 ≤ t < 1.96; c indicates absolute 1.29 ≤ t < 1.69.

Table (3)
Two Stage Least Squares/Seemingly Unrelated Regression Estimates
(2SLS/SUR): 1960-1970*
equation for

End.Var.	OMREM	OMRUN	IMREM	IMRUN	INCG	MEMPG	GEMPG	OEMPG	UNEMPG	RMCRG
OMR			0.431	0.562		0.303a	0.433a	-0.357a		
IMR	0.184a	0.271a				0.401a	0.375a	0.326a		
OMREM									-0.766a	
OMRUN									0.088	
IMREM									-0.238a	
IMRUN									0.853a	
NMREM					0.084b					
NMRUN					-0.237a					
EMPG	-0.133a	-0.276a	0.296a	0.008						
UNEMPG	0.218b	1.017a	-0.714	0.193	0.007					
INCG	-0.694c	0.913c	1.712a	-0.782					0.258c	0.283
NATG					0046b	0.299	0.312a	0.282a	0.313a	
CLFG										0.051a
RMCRG	-0440	1.870a	0.331	0.782c	0.668a					
Exo. Var.										
CLF	-0.071C	-0.047	-0.104a	-0.071C						
UNEMPR	-0.096	0.616a	-0.532	0.511a					-0.842a	
INC	0.9212	0.400C	0.176	-0.378	0.117b	-0.205	0.479a	-0.208C		
MEMP						0.094a				
GEMP							-0.070b			
OEMP								0.016		
AGE	0.4972	-0.237								
EDU	0.418	0.281								
EDUG					0.120	-0.165	1A75b	-0.003		
ARMFG					O 0.018	0.049	0.090C	0.1182	-0.118a	
RMCR	0.7502	0.949	0.256	-0.204	0.1682	0.161				
PDENS										0.012
CRRTV										0.003
TEMPV										0.070
AWDS										-0.012
HDD										-0.046
CDD										-0.072
HUD										-0.135
D1	5.613a	0.355	-1.641	2.233	1.237a	0.994	-3.000b	1.438C	0.209	0.926C
D2	0.136	0.201	0.4182	0.215C	0.003	0.380	0.064	0.001	0.0918	0.075
D3	-0.068	-0.091	-0.038	0.155	0033b	-0.095	-0.049	0.110	0.009	-0.08
D4	0.052	0.173b	0.012	-0.042	-0.084	0.05	0.069	0.005	0.0892	0.1172
OLS R^2	0.87	0.90	0.92	0.93	0.77	0.78	0.67	0.79	0.98	0.57

* a indicates absolute t ≥ 1.96; b indicates absolute 1.69 ≤ t < 1.96; c indicates absolute 1.29 ≤ t < 1.69.

Table (4)
Two-Stage Least squares/Seemingly Unrelated Regression Estimates
(2SLS/SUR): 1970-1980*
equation for

End.Var.	OMREM	OMRUN	IMREM	IMRUN	INCG	MEMPG	GEMPG	OEMPG	UNEMPG	RMCRG
OMR			0.086	0.202[a]		0.001	0.055	-0.054c		
IMR	0.255a	0.178a				0.199a	0.047	0.189a		
OMREM									-0.082c	
OMRUN									-0.068c	
IMREM									-0.595a	
IMRUN									0.839a	
NMREM					0.276a					
NMRUN					-0.257a					
EMPG	-0.596a	-0.472a	0.162c	0.026						
UNEMPG	-0.181b	0.519a	-0.412a	0.546a	0.029					
INCG	0.123	2.770a	-0.443c	-0.577a					-0.088	0.006
NATO					0.043	0.024	0.062	0.028	0.021	
CLFG										0.040c
RMCRG	1.581a	1.931a	1.802a	1.720a	-0.194					
Exo. Var.										
CLF	-0.087a	-0.012	-0.214a	-0.205a						
UNEMPR	-0.157b	0.582a	-0.556a	0.425a					-0.863a	
INC	-0.384c	0.359	-0.908a	-0.993a	-0.428a	-0.130	-0.104	0.027		
MEMP						0.045c				
GEMP							-0.092			
OEMP								0.044a		
AGE	-0.646a	-0.388c								
EDU	1.626a	-0.073								
EDUG					-0.708b	-0.585	0.740	-0.382		
ARMFG					-0.013	0.008	-0.039	0.005	-0.004	
RMCR	0.844a	1.247a	1.357a	1.067a	-0.185c					-0.380a
PDENS										0.004
CRRTV										0.018
TEMPV										0.041
AWDS										0.048
HDD										-0.024
CDD										-0.022
HUD										-0.082
D1	-1.148	6.884a	2.361	4.503b	3.971a	1.691c	1.668	0.211	0.010	1.905a
D2	0.138b	0.085	-0.178c	-0.178C	-0.059c	-0.032	0.295b	-0.008	0.023	-0.059
D3	-0.059c	-0.178	-0.108	-0.050	0.069a	-0.060	-0.096	-0.005	0.067	-0.075a
D4	-0.030	-0.138b	-0.254a	-0.160a	0.028	0.023	-0.009	-0.007	-0.070	0.036
OLSR^2	0.89	0.91	0.88	0.89	0.63	0.80	0.16	0.87	0.95	0.67

* **a** indicates absolute $t \geq 1.96$; b indicates absolute $1.69 \leq t < 1.96$. c indicates absolute $1.29 \leq t < 1.69$.

The Migration Equations

The results of each individual decade support the hypothesis that out- or in-movement encourage migration in the opposite direction. More employed (unemployed) in-migrants result in more employed (unemployed) out-migrants. The reverse is also true. For the three time periods, all 12 coefficients of OMR and INIR in the four disaggregated migration equations have expected signs and 10 are highly significant.

Both employed and unemployed migrants are responsive to employment opportunities in their migration decisions. For all three time periods, the coefficients of the employment-growth variable in each in-migration equation are positive and in each out-migration equation are negative, as expected. The greater rates of employment growth significantly encourage both employed. and unemployed in-migrants in the 1950-1960 period, and only the employed in-migrants in the 1960-1970 and 1970-1980 periods. Moreover, greater rates of employment growth significantly discourage both CLF groups of out-migrants in the 1960-1970 and 1970-1980 periods, and only the employed out-migrants in 1950-1960. The result of an expected negative sign on the employment-growth variable in each of the six out-migration equations can be viewed as an improvement on some earlier studies that either did not find the expected sign for the employment-growth variable in each out-migration equation, such as Greenwood [13] or that failed to include such a variable in the out-migration equation, such as Olvey [10].

Since the net-migration equation is defined as the difference between the in-migration and out-miration rate equations, from Tables 2, 3, and 4 it is possible to compute a coefficient for the rate of employment-growth variable in the net-migration equation for every time period. For example, in the 1950-1960 period, the coefficient of the employment-growth variable in the employed net-migration equation equals the coefficient of IMREM (0.529) less the coefficient of OMREM (-0.205), or 0.734. It is also possible to compute a coefficient for the net-migration variable in the total employment-growth equation. This coefficient is calculated by subtracting the OMR coefficient from the IMR coefficient for each of the three disaggregated employment-growth equations. The resultant numbers are then summed to get a coefficient for the net-migration variable in the total employment-growth equation. Table (5) shows the calculated coefficients of employment growth in the employed net-migration equation, and the coefficients of net migration in the employment-growth equation for the 1950-1960, 1960-1970, and 1970-1980 periods.(10)

Table (5)
Coefficients of Employment Growth and Net Migration

Time Period / The Change	1950-1960	1960-1970	1970-1980
$\frac{\delta NM}{\delta MPG}$	0.73	1.043	0.75
$\frac{\delta EMPG}{\delta NM}$	1.04	2.20	0.43

The 1950-1960 calculated coefficients for both the employed net-migration and the employment-growth equations are consistent with Muth's [8] results, which are based on 1950s data. As mentioned earlier, he estimated the employment-growth

(10) The coefficient of the employment growth variable is calculated for the employed CLF net migration equation so as to compare it with other studies, such as Muth (1971) and Greenwood and Hunt (1984), where migration data for employed civilian labor force members were used.

coefficient in the net-migration equation in a logarithmic form and found it equal to 0.67, which means for each 100 incremental jobs in the area, 67 are filled by migrants. This study shows that 73 of 100 incremental jobs were filled by employed migrants during the 1950-1960 period. Moreover, Muth finds that the coefficient of the net-migration variable in the employment-growth equation is equal to 1.0, and this study finds this coefficient equal to 1.04, which is almost the same. This means that during the 1950-1960 period, both studies suggest that employment increases by about the migrant's contribution to total employment. For the 1960-1970 period the calculated coefficient on the employment-growth variable in the employed net-migration equation is consistent with Greenwood and Hunt [17] whose estimates are based on the 1958-1978 period. Their results show that for each 100 incremental jobs in the average area, about 45 are filled by migrants. This study shows that for the average of their time period, about 43 of these 100 incremental jobs will be filled by migrants. This means that both migrants and indigenous residents accommodate local incremental employment. For the coefficient of the employed net-migration variable in the employment-growth equation, Greenwood and Hunt and this study both find that migrants result in an increase in employment above their own contribution to it, but the two studies differ in the magnitude of this increase. Greenwood and Hunt's coefficient was 1.29, whereas this study's coefficient is 2.20.

Like Greenwood [23] and unlike several earlier migration studies that found a poor performance of the unemployment variable in a migration equation, our unemployment variables perform reasonably well. Over the three decades, 24 unemployment coefficients on both rates of growth and levels are estimated. Of these 24, 14 coefficients have the anticipated sign and 12 of these are significant. The coefficient on each of the EMP and UNEMP has the anticipated sign and is significant in six of 12 instances. Moreover, seven of these 12 expected signs and significant coefficients are in the out-migration equations, whereas five are in the in- migration equations. Each of the 1950-1960 and 1960-1970 periods has five of the 14 coefficients with an anticipated sign, and the 1970-1980 period has the remaining four.

During the 1950-1960 period, the income-growth and income-level variables have the anticipated sign in both out-migration equations. Greater rates of income growth and higher levels of income significantly discouraged out-migration of both employed and unemployed CLF members. During the 1960-1970 period, such levels significantly discouraged out-migration of both CLF groups, whereas such rates of growth significantly discourage out-migration of the employed CLF only. The income-growth variable has a significant coefficient and anticipated sign in the employed in-migration equation, and the income level has an anticipated sign only in the same equation. During 1970-1980 only the income levels significantly discouraged out-migration of employed CLF members. This study's findings concerning the income variable are consistent with Greenwood [23]. Both studies give little support to the several earlier studies that suggest that income is a major determinant of migration. In Greenwood's study, only six of 16 income-growth and level variables are both of the expected sign and statistically significant. In this study, only nine of 24 such variables are both of the expected sign and significant.

Large SMSAs (with high levels of CLF) were less attractive to both employed and unemployed in-migrants in each decade. The coefficients on the CLF variable in each of the in-migration equations are significant and of the expected sign in the 1960-1970 and 1970-1980 periods. As in Greenwood [23]. this variable has a negative sign in each out-migration equation.

The coefficients on the age variable in each out-migration equation are negative in each period. This variable has significant coefficients and expected signs in the 1950-1960 and 1970-1980 periods on both the employed and unemployed out-migration equations, and only on the employed out-migration equation for the 1960-1970 period. The education variable in the same out-migration equations has the anticipated positive sign for the three periods. These coefficients are significant in the unemployed out- migration equation for the 1950-1960 period, and in the employed out-migration equation for the 1970-1980 period.

The empirical results of the migration equations tend to support the hypothesis of Graves [22], that rents are a major determinant of migration. For the above three time periods, 10 of the 12 coefficients on each of the rent-level and rent-growth variables are highly significant. During the 1950-1960 and the 1970-1980 periods, both variables have a positive sign and significant coefficients in each migration equation. The in- and out-migration of the employed and unemployed CLF were greater in areas with high levels of rent and in areas where rent was growing more rapidly. The strong positive results for RMCRG and RMCR variables in both the employed and unemployed in- migration equations could be explained by the fact that during the above two time periods, those areas with high levels and growth rates of rent were amenity-rich places, which encouraged in-movement. The same results in the employed and unemployed out-migration equations could be explained by the fact that during the same periods, those areas with high levels and growth rates of rents were characterized by their high cost of living, and that encouraged some out-movement. (11) In general, SMSAs with high levels and growth rates of rent experienced high in- and out-migration flows of both employed and unemployed CLF members.

The Employment-Growth Equations

Nine in-migration and nine out-migration variables were estimated in the different employment-growth equations for the three time periods. All nine of the in-migration variables have the anticipated positive sign and seven are also significant Six of the nine out-migration variables have the anticipated negative sign and five of these are significant. With few exceptions, these results show the important role of migration variables, especially in-migration, in causing employment growth in large SMSAs. Combining this with the previous result that shows the dependency of migration on employment growth provides strong evidence to the mutual nature of the relationship between migration and employment growth.

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(11) The notion is that those (presumably lower income, on average) unwilling to pay the high, and growing, price for amenities get a utility gain from selling their homes and moving to lower amenity places. Moreover, the in-migrants could cause reduced levels of amenities that matter greatly to particular people (e.g., pollution or congestion).

The rate of natural increase of CLF has an expected, positive sign in each of the three employment-growth equations and in each period, except for government during the 1950s. During the 1960s, greater rates of natural CLF increase significantly encouraged manufacturing, government, and other employment growth. These results, as in Greenwood [23] are qualitatively similar to those for in-migration.

Two of three estimated coefficients in the 1950s for each of the income-level and education-growth variables tend to have a significant coefficient and positive sign. The two income-level coefficients are in the government and other employment-growth equations, while the two education-growth coefficients are in the manufacturing and other employment-growth equations. For the 1960s, the income-level and education-growth variables have significant and positive coefficients on the government employment-growth equation only. The growth of armed forces personnel has a positive sign in the manufacturing employment-growth equation for each decade.

In each of the three decades, areas that had a relatively large share of government employment tended to have a slow rate of growth of that specific type of employment, whereas areas with a relatively large share of manufacturing employment tended to have faster growth rates of that kind of employment especially in the last two decades. Other employment growth shows a strong tendency to grow less rapidly in the 1950s and more rapidly in the 1970s in areas that have a relatively large share of that specific type of employment.

The Unemployment-Growth Equation

As expected, SMSAs with higher in-migration rates of employed CLF members experienced less rapid growth of unemployment during each time period, whereas those with higher in-migration rates of unemployed experienced a more rapid growth during the same periods. For each time period, the coefficients on the employed in-migration rate variable in the unemployment-growth equation are both negative and significant, and the coefficients on the unemployed in-migration rate variable in the same equation are both positive and significant. These results suggest that the employed people have a significant negative impact on unemployment, while the unemployed people have a significant positive impact on unemployment during each time period. Higher out- migration rates of both employed and unemployed CLF members significantly reduced the SMSAs growth rates of unemployment in the 1960-1970 and 1970-1980 periods for the employed CLF group, and in the 1950-1960 and 1970-1980 periods for the unemployed group. This result of the negative relationship between unemployment and out-migration of unemployed means that more unemployed people leaving the SMSA results in lower unemployment-growth rates, whereas the same relationship for the employed out-migrants means more employed people leaving the SMSA will have the same result of lower unemployment-growth rates.

During the 1960s and 1970s, but not during the 1950s, higher rates of income growth tended to decrease unemployment growth. This result lends little support to Todaro's [25] argument of a positive relationship between unemployment and wages. It supports our earlier argument that the relationship between them is expected to be negative. This means areas with high levels of unemployment tended to have low wages, especially in the 1960s.

The coefficient on the natural growth of CLF variable in the unemployment-growth equation is positive, as expected, for each period and significant for the 1950-1960 and 1960-1970 periods. This result, as in Greenwood [12] reflects the tendency of new labor force entrants to experience relatively heavy unemployment during these two periods. The beginning of the period level of unemployment variable has a negative sign and significant coefficient in each time period. Thus, during each decade SMSAs with high levels of unemployment at the beginning of the period had a slower growth of unemployment The rate of change of armed forces personnel has a negative sign for the 1960-1970 and 1970-1980 periods, but is significant for the former period only. This result suggests that greater rates of growth of armed forces personnel reflect lower rates of CLF growth, and therefore lower unemployment-growth rates during that period.

The Rental-Growth Equation

While the income-growth variable has a positive sign in this equation for each time period, its coefficient is not significant.(12) However, the positive coefficient on the civilian labor force growth variable is both expected and highly significant. SMSAs that had high rates of CLF growth experienced a more rapid growth of rent than those with low rates of CLF growth. During the 1950-1960 and 1970-1980 periods, SMSAs with higher levels of rent at the beginning of the period had a slower growth of rent for both decades. For both periods, the coefficient on the rent-level variable is both negative and highly significant. This slow growth of rent could be attributed to the low income growth and/or the growth in endogenous disamenities. The low income growth rates, especially in the 1970s, and the large growth in some endogenous dismantles, resulted in less movement to nice places, which are characterized by their high rent levels. For the 1960-1970 period, the rent-level variable is positive and significant. This means the beginning of period level of rent had increased the growth of rent during that period. The population-density variable has an expected positive sign coefficient in each time period, but is significant for the 1950-1960 period only. This suggests that SMSAs with high population per square mile had rapid rental growth, especially during the 1950s.(13)

The Income-Growth Equation

Employed people are expected to have a positive impact on income growth, whereas the unemployed are expected to have a negative impact. The empirical results show that during each decade, net migration of employed CLF members tended to significantly encourage income growth, whereas net migration of unemployed CLF members tended to significantly discourage such growth. For each decade, the

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(12) The sign of the income growth variable in the rental growth equation reflects offsetting production and consumption effects. A positive sign means production amenities dominate, whereas a negative sign means consumption amenities dominate.

(13) This would be even more true if the rent variable were defined as rent per square foot, rather than the measured median gross contract rent.

employed net-migration rate variable has a positive sign and highly significant coefficient, and the unemployed net-migration rate variable has a negative sign and highly significant coefficient. This is one of the major findings of this study, which has never been shown before.

In the 1950s, 1960s, and 1970s the coefficients on the income-level variable have a negative sign and are highly significant in this equation for each decade. As expected, areas with higher levels of income at the beginning of the period had a slower growth of income for each decade. The variable for unemployment growth has a positive coefficient for the first and second decades, and it is significant for the first decade only. Higher rates of natural CLF increase tended to significantly decrease income growth during the 1960-1970 period, which is expected. Moreover, such rates tended to increase it during the 1950-1960 and 1970-1980 period. The coefficient on the education-growth variable is positive and significant for the 1950-1960 period. The coefficient on the same variable is of a negative sign and significant for the 1960-1970 period.

SMSAs with rapid rent growth tended to have high income growth during the 1950-1960 and 1960-1970 periods. The sign of the rent-growth variable in the income-growth equation is positive and highly significant during these two periods. This finding suggests that many production amenities exist in these SMSAs that cause demand for labor to increase and, consequently, the wage level to rise. This higher wage induces people to move into these SMSAs, which increases the demand for housing and, consequently, rents. People face these higher rents, but they are compensated by the wages. The rent-level variable has a positive-sign and significant coefficient in the income-growth equation during the 1950-1960 period, and this has the same implications as the RMCRG variable explained above. Moreover, this rent variable has a negative-sign and significant coefficient in this equation during the 1960-1970 and 1970-1980 periods. This result could be attributed to consumption amenities which lead to a negative relationship between wages and rents because, as people move in, wages decrease and rents increase.

6. Summary and Conclusions

This study examines both the determinants and consequences of the migration of civilian labor force members characterized by their employment status in over 60 large U.S. metropolitan areas. Specifica1ly, it examines the effect of employed and unemployed migrants on employment growth, sector-specific employment growth, unemployment growth, income growth, and amenities, as well as the effect of these various factors on the two types of civilian labor force migrants.

Two different methods of estimation have been applied. The first is 3SLS and the second is 2SLS/SUR, both of which account for the endogeneity or simultaneity issue in the system. In addition, the first method accounts for the disturbance correlation between equations in a given time period and the second accounts for the disturbance correlation between time periods for a given equation. The preferable method to estimate this kind of system is the 3SLS/SUR, which is supposed to account for both kinds of disturbance correlations, but it is not applied here because of program limitations. Rather, we use 2SLS/SUR where the three time periods are estimated as a system. Previous studies have applied either linear regressions. 2SLS, or 35L5. Therefore, applying the 25L5/SUR method is considered to be a step forward.

The empirical results of the 25L5/SUR method strongly support the mutual causation hypothesis that employment and migration are jointly dependent in the 1950-1960, 1960-1970, and 1970-1980 periods. Greater rates of employment growth encouraged both employed and unemployed in-migrants and discouraged out-migration of both CLF groups. Moreover, higher rates of out-migration tended to discourage SMSA employment growth, whereas higher rates of in-migration tended to encourage SMSA employment growth in each time period. The finding of an expected negative sign on the employment growth variable in each out-migration equation is an improvement on some earlier studies that either did not find that anticipated sign or failed to include the employment growth variable in the out-migration equation.

The results support the desegregation of some key endogenous variables. Characterizing CLF migration by employment status shows that the magnitude of the influence of some factors on employed in- and out-migrants differs from the magnitude of the influence of the same factors on unemployed in- and out-migrants.

SMSAs with higher in-migration rates of employed CLF members experienced less-rapid growth of unemployment during each time period, whereas those with higher in-migration rates of unemployed CLF members experienced a more rapid growth during the same periods. The results of this study suggest that the employed people have negative impact on unemployment growth, while the unemployed people have a significant positive impact on unemployment growth during each time period. SMSAs with high levels of unemployment at the beginning of the period had a slower growth of unemployment in each time period.

One of the major new findings of this study is that during the 1950s, 1960s, and 1970s, net migration of employed CLF members tended to significantly encourage income growth, whereas net migration of the unemployed tended to significantly discourage such growth. This means that areas with higher in-migration rates experienced a more rapid growth of income, while those with higher out-migration rates experienced slower income growth rates. Moreover, areas with higher levels of income at the beginning of the period had a slower growth of income for each decade. SMS As with rapid rent growth tended to have high income growth during the first two decades.

In order to push this study forward, the following suggestions are provided. First, employ an estimation technique such as 35L5/SUR that takes into account the endogeneity and all kinds of disturbance correlations. Second, expand the data set to four decades as soon as the 1990s' migration data come out. Third, use a different characterization for the migrants, such as characterizing them by age, sex, education level, income, etc. Fourth include more exogenous and endogenous amenity variables. Finally, expand the sample to include smaller places, to guarantee that employment and amenity orientation biases are accounted for.

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Appendix A

A) The Endogenous Variables:

QMR = out-migration rate; that is, a certain adjustment factor times the number of individuals classified as civilian labor force (CLF) members in 1960 (1970) (1980) who reside in the SMSA in question on April 1, 1955 (1965) (1975), but elsewhere on April 1, 1960 (1970) (1980), divided by the 1950 (1960) (1970) CLF of the SMS A.

IMR = in-migration rate; that is, a certain adjustment factor times the numbcr of individuals classified as (CLF) members in 1960 (1970) (1980) who reside in the SMSA i'i question on April 1, 1960 (1970) (1980), but elsewhere on April 1, 1955 (1965) (1975), divided by the 1950 (1960) (1970) CLF of the SMSA.

OMREM = out-migration rate of employed CLF; that is, a certain adjustment factor times the number of employed CLF members in 1960 (1970) (1980) who reside in the SMSA in question on April 1, 1955 (1965) (1975), but elsewhere on April 1, 1960 (1970) (1980), divided by the 1950 (1960) (1970) CLF of the SMSA.

OMRUN = out-migration rate of unemployed CLF; that is, a certain adjustment factor times the number of unemployed CLF members in 1960 (1970) (1980) who reside in the SMSA in question on April 1, 1955 (1965) (1975), but elsewhere on April 1, 1960 (1970) (1980), divided by the 1950 (1960) (1970) CLF of the SMS A.

IMREM = in-migration rate of employed CLF; that is, a certain adjustment factor times the number of emDloyed CLF members in 1960 (1970) (1980) who reside in th & SMSA in question on April 1, 1960 (1970) (1980), but elsewhere on April 1, 1955 (1965) (1975), divided by the 1950 (1960) (1970) CLF of the SMSA.

IMRUN = in-migration rate of unemployed CLF; that is, a certain adjustment factor times the number of unemployed CLF members in 1960 (1970) (1980) who reside in the SMSA in question on April 1, 1960 (1970) (1980), but elsewhere on April 1, 1955 (1965) (1975), divided by the 1950 (1960) (1970) CLF of the SMS A.

NMREM = net migration rate of employed CLF; that is, the in-migration rate `ninus the out-migration rate of the employed CLF.

NMRUN = net migradon rate of unemployed CLF; that is, the out-nligration rate minus the in-migration rate of the unemployed CLF.

EMPG = rate of employment growth; that is, the ratio of the 1960 (1970) (1980) to the 1950 (1960) (1970) level of employment of the SMSA.

MEMPG = rate of manufacturing employment growth; that is, the ratio of the 1960 (1970) (1980) to the 1950 (1960) (1970) level of manufactunng employment of the SMSA.

GEMPG = rate of government employment growth; that is, the ratio of the 1960 (1970) (1980) to the 1950 (1960) (1970) level of government employment of the SMSA.

OEMPG = rate of other employment growth; that is, the ratio of the 1960 (1970) (1980) to the 1950 (1960) (1970) level of other employment of the SMSA; where other employment is employment net of manufacturing and government employment INCG = rate of income growth; that is, the ratio of the 1959 (1969) (1979) to the 1949 (1959) (1969) median income of persons residing in the SMSA on April 1, 1960 (1970) (1980), and on April 1, 1950 (1960) (1970), respectively.

UNEMPG = rate of unemployment growth; that is, the ratio of the 1960 (1970) (1980) to the 1950 (1960) (1970) level of unemployment of the SMSA, where both levels are measured on April 1.

RMCRG = rate of renter-occupied median contract rent; that is, the ratio of the 1960 (1970) (1980) to the 1950 (1960) (1970) renter-occupied median contract rent.

NATO = rate of natural increase of the CLF; that is, the difference between CLF growth rate and net migration, measured between 1950 and 1960 (1960 and 1970) (1970 and 1980).

B) THE EXOGENOUS VARIABLES:

EDUG = rate of education growth; that is the ratio of the 1960 (1970) (1980) to the 1950 (1960) (1970) median number of years or school completed by persons 25 years of age and over.

EDU = median number of years of school completed by persons 25 years of age and over in 1950 (1960) (1970).

INC = median 1949 (1959) (1969) income of persons residing in the SMSA in 1950 (1960) (1970).

CLF = civilian labor force of the SMSA in 1950 (1960) (1970).

AGE = median age of the population of the SMSA in 1950 (1960) (1970).

UNEMPR = rate of unemployment; that is, the ratio of the unemployment level prevailing in the SMSA on April 1, 1950 (1960) (1970) to the civilian labor force of the SMSA in 1950 (1960) (1970).

ARMFG = rate of change of armed forces personnel; that is, the ratio of the 1960 (1970) (1980) to the 1950 (1960) (1970) number of armed forces personnel in the SMSA.

MEMP = percentage (or share) of the SMSA's 1950 (1960) (1970) employment in manufacturing.

GEMP = percentage (or share) of the SMSA's 1950 (1960) (1970) employment in government

OEMP = percentage (or share) of the SMSA's 1950 (1960) (1970) employment in other sectors (employment net of manufacturing and government).

CRRTV = violent crime rate per 100,000 inhabitants; that is, the ratio of the number of offenses known to the police against people in 1950 (1960) (1970) to the SMSA's 1950 (1960) (1970) population, and multiplied by 100,000.

RMCR = specified renter occupied median contract rent in 1950 (1960) (1970).

PDENS = population density or population per square mile of land in the SMSA in 1950 (1960) (1970); that is, the ratio of the SMSA population in 1950 (1960) (1970) to the SMSA land area in square miles in 1950 (1960) (1970).

TEMPV = average annual temperature variance (0F); that is, the difference between July's daily maximum temperature and January's daily minimum temperature, for 1941-1970 mean values.

AWDS = average annual wind speed; that is, the sum of average wind speed rates in January and July, divided by 2, for 1941-1970 mean values.

HDD = average heating degree days; a historical measure of cold for 1941-1970.

CDD = average cooling degree days; a historical measure of warmth for 1941-1970.

محـددات ونتائج الهجـرة الداخليــة في الولايات المتحدة الأمريكية

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المستخلص : يقوم هذا البحث بدراسة المحددات والنتائج المترتبة علـى هجـرة القـوى العاملـة بين أكثر من ٦٠ مدينة أمريكيـة خـلال ثلاثـة عقـود بـين ١٩٥٠-١٩٨٠ وهـي الفـترة الـتي توفرت عنها بيانات الهجرة الداخلية في أمريكا .

في هذا البحث تم تطوير واختبار نموذج مكون مـن ١٧ معادلـة آنيـة تشـمل الهجـرة إلى الداخل والخارج ومستوى العمالة في كل من القطاع الحكومي والقطاع الخـاص والقطاعـات الأخرى ، وأيضاً مستوى البطالة وعدد من العوامل الأخرى التي يعتقد الباحث أنها مؤثـرة في اتخاذ قرار الهجرة للعامل الأمريكي من مدينة لأخرى .

وتبرز أهمية البحث في اختلافه عن جميع الدراسات السابقة في هذا المجال على النحو التالي:

أولاً : تصنف الدراسة المهاجرين من القوى العاملـة حسـب مسـتوى العمالـة والبطالـة، بالإضافة إلى إدراج هذه الخصائص كمتغيرات داخلية في النموذج .

ثانيًا : يتضمن النموذج الآتي عددًا من عوامل الرفاهية المؤثـرة في قـرار الهجـرة وكذلـك يستخدم مستوى الدخل والإيجارات في كل مدينة كمتغيرات داخلية .

ثالثًا : تستخدم الدراسة مقاييس للهجرة أكثر دقة من المســتخدم في الدراسـات السـابقة وكذلك طريقة تقدير قياسية للنموذج لم يتم استخدامها من قبل .

أخيراً تجدر الإشارة إلى أن النتائج الإحصائية لهذه الدراسة تدعم فرضيــة السـببية المتبادلـة بين الهجرة ومستوى التوظف ، وتوضح أن الهجـرة مـن العوامـل الرئيسـية في زيـادة مسـتوى التوظف في المدن الأمريكية وأن الأخير من الحوافز المشجعة والدافعة للـهجرة . وبصفـة عامـة يمكن القول بأن النتائج الإحصائية لهذا البحث تتصف بأنها قويـة ومتفقـة تمامـاً مـع التوقعـات النظرية المسبقة .