REGIONAL GROWTH AND INTER-REGIONAL MIGRATION--THEIR PATTERN OF INTERACTION

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I. INTRODUCTION AND SUMMARY

The starting point for this study was recognition of considerable differences among previous studies of causes of regional growth and wage disparities in the United States.[1] The relative importance of commodity demand versus factor supply conditions has been assessed differently. Furthermore, previous studies have tended to focus on either one or the other of these two sides of the issue by treating either population growth or demand growth as exogenous.

Traditional trade theory suggests that regional wage levels should converge. Factor price equalization through regional specialization and trade is one mechanism for accomplishing this; inter-regional migration in response to wage differentials is another. Yet despite the fact that the U.S. economy closely approximates free trade and displays a high degree of factor mobility, substantial differences among regions in the level of income per worker have persisted.

In addition, there is no consensus as to the principal causes of regional differentials in employment growth. Some writers have emphasized labor supply conditions; others have emphasized the importance of demand--the sectoral pattern of national demand, as well as the regional pattern of demand resulting from population growth.

Since employment growth may affect migration into a region, and migration into a region may serve to stimulate employment growth, these competing hypotheses involve a circular relationship. Yet there has been little effort to formally treat the interaction between regional economic growth and inter-regional migration.

This paper describes a multi-equation model for empirical analysis of these questions and presents results achieved in applying the model to cross-section data measuring the performance of fifty-six large Standard Metropolitan Statistical Areas for the period 1955-1960.

Five equations are specified, one each for two categories of employment growth (manufacturing and "service" employment) and for three categories of migration (gross in-migration from contiguous states, long distance in-migration, and out-migration). Exogenous variables include "no-migration" population growth, metropolitan wage and income levels, the income level of the region surrounding the metropolitan area, climate, and an industrial composition index to reflect national demand for the area's products. Three-stage least-squares estimates are used to investigate simultaneous bias.

In general the results support the relations specified in the model. Coefficients are significant and have the proper sign. Manufacturing employment

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growth is deterred by high wage levels and stimulated by net population growth and a mild climate. Service employment growth is closely related to manufacturing employment growth and to population growth and income levels. In-migration responds to both employment growth and wage levels. Short distance or contiguous in-migration is significantly higher for metropolitan areas located in low income regions. Long distance in-migration is responsive to a mild climate as well.

The manufacturing wage level plays a key role as an exogenous variable in the model. The rationale for using it to help explain both employment growth and migration is straightforward; however, its use as an exogenous variable requires justification. Analysis of wage levels for the period in question revealed significant inter-metropolitan differentials as well as a highly stable pattern.

One of the most striking results is the responsiveness of out-migration to "prospective unemployment", defined as the total increase in population, less the increase in employment, assuming zero out-migration. The out-migration rate is very closely correlated with prospective unemployment ($t = 12.6$). Thus out-migration seems to be explicable largely in terms of "push" factors--wage and employment conditions at the origin.

The results corroborate the need for a simultaneous equation approach. Three-stage least-squares estimates increased the importance of employment growth as a determinant of in-migration and reduced the importance of population growth as a determinant of employment growth. The simultaneous equation estimates retain the wage level as the key explanatory variable.

An analysis of the pattern of inter-regional wage differentials is conducted, based on three factors: (1) inter-regional variations in the quality of the labor force, (2) inter-regional variations in the sectoral composition of manufacturing employment and (3) inter-regional variations in the capital-labor ratio. Each factor is shown to be significant, with sectoral composition the most important of the three, and they jointly explain 80% of the total wage variance. Correction for these factors serves to sharpen somewhat the result of the multi-equation model.

The central finding of the study is the apparent strength of the connection between regional employment growth and migration patterns, with the further inference that the former largely determines the latter and is itself significantly affected by regional wage levels. Whereas the traditional analysis assumes immobile (or exogeneously determined) productive factors and flexible wages, these findings support a different set of assumptions in which wages are relatively rigid and factor supply (via inter-regional migration) responds in a sensitive way to some combination of regional wage and employment growth differentials.

As mentioned at the outset, the problem of explaining regional growth patterns has sometimes been framed as a choice between commodity demand and factor supply as the principal factor. Borts and Stein have emphasized factor supply in the form of an elastic labor supply in less developed regions with high rates of population increase. Perloff et. al. have emphasized demand, through both the industrial composition effect and the benefits of agglomeration and 'access' in regions with growing populations. Fuchs has emphasized factor supply--resources, climate, and the price of labor. The results of this study are most akin to those of Fuchs. Each of the factors was shown to be significant but the key variable was clearly the regional wage variable.

II. AN EMPIRICAL ANALYSIS OF REGIONAL GROWTH AND MIGRATION

A multi-equation model is used to permit symmetric treatment of employment growth and migration. Five equations are specified, the dependent variables being two types of employment growth (manufacturing and "service") and three types of migration (short distance in-migration, long distance in-migration, and out-migration). In addition, three identity relationships are used.

1. SPECIFICATION AND RATIONALE OF THE MODEL

The Variables

The object of the model is to characterize, in structural terms, the factors accounting for differential rates of employment and labor force growth across regions in the United States. These two basic variables (growth of employment and growth of the labor force) are disaggregated into the following five dependent variables:

y_{1i} = Growth of manufacturing employment
y_{2i} = Growth of employment in service industries defined as total non-agricultural less manufacturing employment
y_{3i} = Gross in-migration from within the same or from a contiguous state, i.e. one having a common boundary with the state in which the given metropolitan area is located.
y_{4i} = Gross in-migration from non-contiguous states.
y_{5i} = Gross out-migration

Each of the above variables is defined as a five year proportional rate of change, based on the 1955 population of the given metropolitan area, for the period 1954/5 to 1959/60.

The following seven exogenous or pre-determined variables are defined:

x_{1i} = 'No-migration' population growth, i.e. the five year proportional increase in population assuming zero migration and abstracting from any impact on the natural rate of increase attributable to different rates of migration.
x_{2i} = Average hourly wage for manufacturing production workers at the start of the period.
x_{3i} = Industrial composition growth index, an average of national growth rates of three-digit S.I.C. manufacturing sectors, weighted by the sectoral composition of the individual metropolitan area at the start of the period.
x_{4i} = Per capita income in the metropolitan area.
x_{5i} = Per capita income in the contiguous area, with contiguous area defined as above.
x_{6i} = Total population at the beginning of the period.
x_{7i} = Mean January temperature index.

The following three additional endogenous variables are defined in terms of those already specified.

q_{1i} = 'Prospective' unemployment, i.e. that rate of increase in unemployment implied by the population growth, employment growth, and in-migration variables -- assuming a zero rate of out-migration.

q_{2i} = Net population growth.

q_{3i} = Growth of total employment, i.e. manufacturing plus service employment.

The Equations

The full model, consisting of five equations and three identities, is shown in Table 1. A coefficient is designated for each included variable; excluded variables are indicated by a blank space. Columns 6-8 specify the three identities.

The three identify relationships are used to define the variables ql, q2, q3 in terms of x and y.

Thus q2i, net population growth, is seen to be 'No-migration' population growth, plus the two categories of in-migration, less out-migration. It should be noted that the identity relationships could be used to eliminate the q variables from the five equations to be estimated. The q variables are used simply as a device to constrain to equality the coefficients of the variables they comprise. Thus in Equations 3 and 4 the effect of using q3i (total employment growth, rather than yli and y2i (manufacturing and services employment growth respectively), is to impose an apriori constraint on the model that each of these types of employment growth have the same effect on in-migration.

There are of course a wide variety of variables and relationships which could be employed for the purpose at hand, and no particular specification can lay claim to being the correct one.

TABLE 1. SPECIFICATION OF THE MODEL

	Coefficients for each Equation							
Intercept or Variable	1	2	3	4	5	6	7	8
Intercept	b_{10}	b_{20}	b_{30}	b_{40}	b_{50}			
y1 (Grwth Mfg Employmnt)	-1*	c_{21}				-1		1
y2 (Grwth Svc Employmnt)		-1*				-1		1
y3 (Cntgs In-Mgrtn)			-1*			1	1	
y4 (Non-Cntgs In-Mgrtn)				-1*		1	1	
y5 (Out-Mgrtn)					-1*		-1	
q1 (Presctve Unemploymnt)					c_{56}	-1#		
q2 (Net Ppltn Grwth)	c_{17}	c_{27}					-1#	
q3 (Grwth Ttl Emplymnt)			c38	c48				-1#
x1 (No-Mgrtn Ppltn Grwth)						1	1	
x2 (Wage)	b_{12}	b_{22}	b_{32}	b_{42}	b_{52}			
x3 (Ind Cmpstn)	b_{13}							
x4 (Incme SMSA)		b_{24}						
x5 (Income Cntgs Area)			b_{35}					
x6 (Ppltn SMSA)			b_{36}					
x7 (Climate)	b_{17}		b_{37}	b_{47}	b_{57}			

*--Dependent Variable

#--Variable Specified by Identity

Given this wide variety, and given the fact that the variables which might be used typically display high cross-correlations, it is mandatory that the model be restricted to relations which are eminently plausible in theoretical terms. The model as specified does have the merit that each equation appeals to a straightforward interpretation in terms of apriori considerations. Each equation will be discussed in turn, after a few preliminary comments on the role of the wage level in the model.

The SMSA Aggregate Wage as an Explanatory Variable

It will be noted that the regional average production worker hourly wage in manufacturing is used as an explanatory variable and that it plays a central role in the model, appearing in each of the five equations. The rationale for doing this is straightforward, the hypothesis being that wage levels play a significant role in determining regional employment growth, with high wages serving as a deterrent to growth, and that they also play significant role in determining regional employment growth, with high wages serving as an inducement to in-migration. Use of the wage level as an explanatory variable requires some additional justification. Specifically, (1) Can the regional wage legitimately be regarded as fixed at a constant level for the five year period in question? (2) Can we meaningfully talk about an average regional wage which is aggregated across the industrial sectors of the region?

Data for 1954-5 indicates, for the 56 SMSA's to be used in estimation of the model, an unweighted average SMSA production worker hourly wage of $1.99, ranging from a high of $2.38 (Detroit) to a low of $1.56 (Chattanooga), with a standard deviation of $.21. It is conceivable, however, that disaggregation into sectoral wage levels would remove most or all of this apparent inter-regional variation. Perhaps the high wage SMSA's are simply those with a predominance of high wage sectors. If so, it would make little sense indeed to employ an SMSA wage aggregated across sectors in a cross-sectional model of the type which has been described. In order to address this question, we require an analysis of sectoral wage variance to test the relative importance of "sector effect" and "area effect."

Considering only the 56 SMSA's to be used in the sample, and considering each of the 20 two-digit S.I.C. sectors, there would be 1120 individual sectoral wages -- one for each sector in each SMSA. Since most sectors are not present in all SMSA's, the number actually reported on in the 1954 Census of Manufactures was somewhat less, 872 in fact.[2] Given these gaps in the data, the usual analysis of variance cannot be used because of the problem of unequal numbers of observations per cell. However, regression analysis using dummy variables can be performed in an analytically equivalent way.[3] For this purpose, the sectoral wage rates were cross classified by SMSA and by sector with SMSA and sector ranked (from high to low) by SMSA average wage level and sectoral average wage level, respectively. The data was then grouped into five categories of SMSA wage level and five categories of sectoral wage level, and the following regression equation was set up:

Area Effect Sector Effect

$$(1) \quad w_i = a_0 + b_1 x_{1i} + \ldots + b_4 x_{4i} + c_1 y_{1i} + \ldots + c_4 y_{4i}$$

Interaction Terms

$$+ d_1 z_{1i} + \ldots + d_{16} z_{16i} + u_i$$

where

w_i is the sectoral wage (total observations = 872).

x_{ji} are dummy variables with value 0 or 1, 1 denoting whether w_i belongs to the jth area

group,

y_{ki} are analogous dummy variables for sector groups,

z_{li} are dummy variables for interaction between the x and y terms. (Sixteen z variables are defined, one for each permutation of the four x and four y variables.)

Estimation of Equation 1 yielded a coefficient of determination of 0.70. In order to test the explanatory power of the area, sector, and interaction terms, a partial F-test was performed for each relevant group of coefficients. The results are depicted in Table 2.

TABLE 2. ANALYSIS OF SECTORAL WAGE VARIANCE

Source of Variation	Degrees of Freedom	F Ratio
Overall	24,847	81.2
Addition of Area Effect	4,847	25,6
Addition of Sector Effect	4,847	61.8
Addition of Interaction Terms	16,847	0,68

Although the results demonstrate the primary importance of the sector effect, they also reveal a very significant area effect. That is to say, the fact that a given sectoral wage is above average is significantly associated with whether other sectoral wages in the same SMSA are above average. Since the area effect terms were tested with the sector effect terms in the regression equation, the area effect is clearly not the result of certain SMSA's having predominantly high or low wage sectors.

As a first step towards justifying the treatment of wage levels as exogenous an examination was conducted of the pattern of changes in the inter-regional wage structure which occurred during the sample period, namely 1955-60. In order to do this the 1959-60 wage level was regressed on the 1954-55 wage level. Growth of manufacturing employment was then introduced into the equation, to test for the presence of a systematic relation between wage changes and employment growth. The results were as follows:

$$(2) \qquad w_2 = \underset{(0.12)}{0.15} + \underset{(0.06)}{1.31}w_1 \qquad R^2 = 0.90 \quad F(1, 54) = 245$$

$$(3) \qquad w_2 = \underset{(0.12)}{-.015} + \underset{(0.06)}{1.31}w_1 - \underset{(0.51)}{0.03}y \qquad R^2 = 0.90 \quad F(2, 54) = 245$$

where w_2 is the final wage, w_1, is the initial wage, and y is the growth in manufacturing employment. The numbers in parentheses are the standard errors of the estimated coefficients.

Using growth of total employment instead gives similar results:

$$(4) \qquad w_2 = \underset{(0.13)}{-.018} + \underset{(0.06)}{1.32}w_1 + \underset{(0.52)}{0.23}y_T \qquad R^2 = 0.90 \quad F(2, 53) = 247$$

These results indicate that for this particular period the pattern of inter-regional wage differentials was remarkably stable and that such changes as did occur were unrelated to the growth of either manufacturing or total employment -- this despite a general rise of about 30% in money wage levels.

These results provide at least a preliminary basis for using the aggregate SMSA wage level as an exogenous variable to characterize labor supply conditions for an SMSA as a whole. Let us turn now to consider the rationale of the equations in the model in greater detail. (Refer to Table I).

Growth of Manufacturing Employment

Equation 1 postulates that manufacturing employment growth is dependent on four factors: wage levels, population increase, climate, and an industrial composition effect. With respect to wage levels, there are three possibilities. High rates of employment may be associated with high wages, high rates of employment growth may be associated with low wages, or there may be no significant relation.

The relation specified in the model in effect postulates that high employment growth should be associated with low wages. This is what is sometimes referred to as the factor supply hypothesis, namely the notion that wage levels are largely autonomous in their behavior, responding only sluggishly or with a long time lag to fluctuations in labor demand and supply conditions, combined with the additional hypothesis that significant inter-regional wage differentials exist and partially explain the changing pattern of industrial location. That is to say, for instance, that in a slow growing region e.g. one experiencing a declining demand for some of its principal products, wages would not ipso facto fall but would largely maintain historical levels and national trends. Conversely, in a region experiencing a relative improvement in the quality of its labor force, e.g. from a convergence of regional educational standards, wages would not ipso facto rise. In order for such a characterization of the relation between wage levels and growth to be valid, it is not necessary that there be no response of wages to labor supply and demand changes -- simply that the response be slow vis-a-vis that of other variables in the system, namely the migration of labor and capital. Indeed the whole problem of determining the "causes" of inter-regional disparities in growth rates can be viewed as one of appropriately characterizing the relative rates of adjustment of various factors to disequilibria in the system. Regional disparities can persist only because of immobility and price rigidity of goods and factors of production. Both the immobility and the price rigidity are only partial -- in the long run rigid prices adjust and immobile factors move. (And industrial structure changes.) An explanation of the pattern of this adjustment can be little more nor less than a characterization of the relative rates of adjustment of the significant factors.

The treatment of wage levels as a pre-determined variable is suggested by the observed tendency of wages to behave rigidly, failing to rise or fall with cyclical fluctuations in employment. The model provides a partial test of this hypothesis: If in fact a significant correlation between wage levels and growth of employment is observed, and if the correlation is negative, this constitutes strong evidence for assigning a causal role to wage levels. If on the other hand a significant positive correlation were observed between wage levels and employment growth, this would constitute evidence that the direction of causation was to wage levels from demand factors, e.g. variations in population growth or migration rates or multiplier effects of rapidly expanding industries. If a positive correlation is observed, then we are not justified in treating wages as a pre-determined variable in the model.

The second variable in Equation 1 is the industrial compositon effect. This variable is designed to reflect the growth of demand for regional exports. It is a standardized growth rate for manufacturing employment in the given metropolitan area, namely the rate at which total manufacturing employment in the area would grow if each of its (S.I.C. 3-digit) manufacturing sectors

grows at the corresponding national rate. It can be argued that regional differences in the composition of manufacturing employment at the beginning of the period partially reflect regional differences in resource endowment to support the various manufacturing sectors. In the case of industries heavily dependent on raw material supplies, for instance, it is natural to assume that the initial locational pattern of the industry reflects the underlying pattern of raw material supplies and that relatively rapid national growth rates in such sectors would, ceteris paribus, favor locations in which such industries were already established. Converse effects would be expected for areas with an industrial composition predominant in sectors experiencing low or absolutedly declining growth rates. Even for sectors for which natural resources are not a major factor in the initial locational pattern, there are reasons to expect the composition effect to be significant. In the case of rapidly expanding sectors, not only do already existing firms enjoy the advantages of a head start, they have certain incentives to expand output in existing locations. It may be more economic to expand output by increasing the scale of operation of existing plants. Managerial and skilled technical personnel may resist movement to new regions. The significance of this variable depends jointly on the rate at which the national demand pattern is changing and on the capacity of the industrial structure to adjust. These factors may vary across manufacturing sectors; and the effect may not be symmetrical as between expanding and declining industries. Provided the model indicates a significant positive relationship between the variable and manufacturing employment growth, however, there seems little question that it does make a valid contribution to the explanation of regional growth differentials.

The third variable in Equation 1 is net population increase. The rationale for this variable is the obvious one that the impact of population change on final demand influences manufacturing employment growth via the derived demand for labor. This variable is at the heart of the simultaneous equation problem -- population change influences employment growth, but employment growth may in turn influence population growth, via migration. A positive coefficient is necessary for population change to have a meaningful significance in this equation.

Growth of Employment in Services

Equation 2 postulates that the growth of service industry employment is dependent on wages, per capita income in the metropolitan area, net population increase, and growth of manufacturing employment. The rationale for wages is the same as in the case of manufacturing employment growth, and the same reasoning applies regarding the necessity of a negative correlation to justify using wages as a predetermined variable.

Per capita income is included on the basis of the broadly based empirical generalization that the ratio of manufacturing to services expenditures declines with increasing income, at least for the range of high incomes found in U.S. metropolitan areas. In order for this variable to bear a meaningful interpretation it must be positively correlated with the dependent variable.

The third variable is growth of manufacturing employment. Assuming the market for service industries in a given area is primarily the local market, the fortunes of service employment growth may be significantly tied to those of manufacturing growth in the same area. (Since the market for manufactured goods is not local in nature, the converse is not likely to be true.) If an apparently significant relation does exist, it must be positive to be meaningful.

Contiguous In-Migration

Equation 3 postulates that in-migration from the 'contiguous area' is dependent on wage levels within the metropolitan area, on per capita income in the contiguous area, on the growth of total employment within the metropolitan area and on the population size of the metropolitan area. Wage levels and employment growth jointly characterize the 'drawing power' of different metropolitan areas and should be positively correlated with the rate of in-migration.

Per capita income in the contiguous area is included as indicative of the supply of potential migrants who would be motivated by the opportunity for higher pay in the metropolitan area compared to their current status. This variable in effect characterized the rural hinterland of metropolitan areas in terms of the relative increase in living standards afforded by movement into the city. The separation of in-migration into 'contiguous' and 'non-contiguous' components on the basis of this particular definition in terms of state boundaries is of course arbitrary. However the usefulness of the separation and the aptness of the manner of separation depend ultimately on the results. If the two types of in-migration respond to different sets of variables, then the distinction is justified. It might be possible to improve the results somewhat by a more refined definition of contiguous area, e.g. that within a radius of 250 miles, but such a definition would involve a sizeable data collection cost and a large improvement is not likely. The areas defined in the present way differ in size for different parts of the country, but the differences is not extreme.

Per capita income is obviously only one of a large number of variables which could be used for the purpose of characterizing the metropolitan 'hinterland'. Such variables include the ratio of rural to urban population, the ratio of urban to rural income, or some combination of such variables. Preliminary examination of the data indicated, however, that such variables tend to be highly collinear with per capita income and as a general measure of motivation to leave the farm it is probably as good as any. It should be negatively correlated with migration rates.

The use of population size of the SMSA as one of the explanatory variables in this equation requires a more detailed justification. Each of the five prime dependent variables (two types of employment growth, two types of in-migration, and out-migration) is measured in ratio form, i.e. the absolute change (over the five year period) deflated by the 1955 population of the given metropolitan area. In the case of the other four variables, i.e. all those except contiguous in-migration, use of the ratio form seems best to avoid problems of heteroscedasticity. For instance the magnitude of random cross-section fluctuations in employment growth would be expected to be a function of the number employed. And insofar as employment growth is uniformly affected by differential wage rates it would seem apriori that the impact would be uniform on proportional growth rather than on absolute increase. In other words a 5% differential in wage rates should have a larger absolute effect on a large city than on a small one. Similar reasoning applies to the industrial composition and per capita income variables in the employment equations. With respect to in-migration from distant areas, the reasoning in support of the ratio form is that the direction of causation is essentially from the metropolitan area to the potential migrants. That is to say the number of migrants coming into a city from distant areas is primarily a function of the number of employment opportunities within the city, suitably characterized as to attractiveness by wage levels. Thus the model seeks to explain in-migration from distant areas solely in terms of the characteristics of the receiving metropolitan area. This being the case the proportional form is

appropriate for the non-contiguous in-migration. Similar reasoning applies to the out-migration equation.

For in-migration from the contiguous area the situation is different since differential migration rates are conceived as being significantly affected by the characteristics of the contiguous area so metropolitan areas located in regions of relatively low income confront a larger supply of potential in-migrants. If these individuals tend to move within their contiguous area, rather than longer distances, the use of the proportional form for the contiguous in-migration equation would introduce an upward bias. That is to say if the absolute number of short distance migrants arriving in a given city are not solely a function of the city's drawing power but is also a function of the rate of shorter distance migration in the city's region, then the fact that the city was a large one would not imply that it would receive a proportionately larger number of in-migrants. The size of the city would probably have some effect on the number, but not a proportionate effect. This constitutes an argument for estimating this equation in absolute form. To do so would introduce a different sort of problem, however, since the use of a number of identity relationships in the model necessitates that each of the basic dependent variables be estimated in the same form, be it absolute or ratio. (Net in-migration cannot be defined as a linear combination of the other variables if some types of migration are defined in ratio and others in absolute form.) Since on balance the ratio form seems most appropriate the approach adopted is to estimate each of the dependent variables in ratio form but to compensate for the resulting bias in Equation 3 by introducing population as an additional independent variable. This compromise has one redeeming feature in that the validity of the underlying reasoning can be checked by comparing the effect on each equation of introducing city size as a variable. If the above reasoning is valid, the effect on Equations 1, 2, 4 and 5 should be insignificant whereas the effect on Equation 3 should be to improve the performance of the other variables in the equation.

Non-Contiguous In-Migration

Equation 4 postulates that non-contiguous in-migration is a joint function of employment opportunities and wage levels. Non-contiguous in-migration should be positively correlated with both variables.

Out-Migration

Equation 5 postulates that out-migration is a joint function of wage levels and 'prospective unemployment'. The wage variable is the same one used in the other equations and, if wage levels significantly affect out-migration rates the correlation should be negative.

The prospective unemployment variable is defined as the increase in the labor force (proxied by net population increase) minus total employment increase, assuming a zero rate of out-migration. It is a measure of the increase in unemployment which would occur if out-migration dropped to zero while all the other variables held constant. Thus prospective unemployment is a measure of the impetus to out-migrate implied by the other variables, namely employment growth, in-migration, and natural population increase.[4]

As in the case of non-contiguous in-migration the premise is that out-migration rates are primarily the result of differential opportunities and conditions of employment across metropolitan areas. In this case, however, the explanatory variables relate to the migrant's area of origin rather than destination. This presents no real problem provided it is legitimate to assume that potential out-migrants in different metropolitan areas face a common set of alternatives, irrespective of their present location. The validity

of such an assumption depends on whether the factors affecting the migrant's choice of destination are sensitive to distance. For instance, information as to job opportunities is undoubtedly a significant factor, however it may may be very sensitive to distance in a range say from 500 to 2500 miles. On the other hand, certainly some of the costs and nuisances associated with moving increase with distance, although such factors may not figure significantly in the choice of destination relative to other considerations, e.g. differential levels of income.

Data: Sources and Problems

The Appendix contains a discussion of how each variable was defined. The principal sources were the 1960 Census of Population, the 1954 Census of Manufactures, the Annual Survey of Manufactures for the years concerned, and County Business Patterns.

The choice of the 1955-60 time frame was dictated by the availability, for that period only, of gross migration data by metropolitan area. The fifty-six SMSA's included in the sample represent all those for which the requistite data was available, the principal data constraint being the sectoral employment data used for the industrial composition variable and for one of the wage correction indices. This data was reported only for SMSA's with manufacturing employment of at least 40,000 in 1954.

The principal difficulty with the data is the limitation to only the largest of the SMSA's and the limitation to one particular time period. The last half of the fifties represents at best a sluggish upward movement of the economy, with a significant under-employment condition throughout. Furthermore, the larger SMSA's represent less than average employment growth rates. For comparison on this point, the average (unweighted) manufacturing employment growth rates were calculated for the SMSA's in the sample and for an additional 110 SMSA's for the period 1954-59. This analysis revealed a mean increase of 12% for the combined groups, with a mean of 5.1% for the SMSA's in the sample and 15.5% for the 110 additional SMSA's used for the comparison. The disparity is not as great as might appear since the standard deviation for the combined sample was 30% but it is clearly significant.

The inability to include these smaller SMSA's is particularly frustrating since the growth disparity appears to be consistent with the relationships postulated in the model, there being a well established inverse relation between city size and hourly earnings.[5] On the other hand, differences by SMSA size in the pattern of internal change (e.g. suburbs vs. central city) may significantly affect the relationships postulated in the model.

The use of County Business Patterns for data on total employment introduces a bias due to expanding coverage of the social security statistics on which the data is based. However, it seems unlikely that this would cause serious distortions in the results. If the amount of the bias is proportional to the size of the SMSA labor force, which is the most plausible assumption, the net effect would be the same as multiplying each observation on that variable by a constant factor. This of course would change the size of the estimated coefficient by a corresponding inverse factor but would leave the rest of the equation, including the residuals, unaffected.

2. REGRESSION RESULTS

Ordinary-Least-Squares

Table 3 shows the results obtained from the preliminary ordinary-least-squares estimates of the model.

In general the results seem to strongly support the structural relations implied in the specification of the model. The coefficients are significant in nearly all cases and in all cases they have the proper sign. The coefficients of determination are high for cross-section data of this type.

Taking Equation 1 first, growth of manufacturing employment is seen to be significantly affected by wage levels, by the presence of a favorable industrial composition (vis-a-vis national demand), by the growth of the local market as measured by net population increase, and by a mild climate. High wages are seen to deter growth, whereas all the other variables exercise a positive influence. The R-square statistic for this equation (.44) is low relative to the other equations. Part of the difficulty in obtaining a good fit for manufacturing employment growth may be attributable to the length and dates of the time period employed. During the period in question national employment in manufacturing did not grow rapidly, in fact it declined slightly on average. The (unweighted) mean growth of manufacturing employment for the metropolitan areas in the sample was a decline of slightly less than 1%, as contrasted with a 2% increase for service employment. Such a disparity is not atypical, however the low rate for manufacturing employment during this period may increase the difficulties of explaining its pattern.

Equation 2 portrays growth of employment in services as being positively correlated with growth of manufacturing employment, with low wage levels, with high income levels, and with net population growth. The R-square for this equation is respectably high (.62)

Equation 3 implies that in-migration from contiguous areas is positively related to high wages in the metropolitan area and negatively related to income levels in the contiguous area. This is what we would expect, assuming that migration patterns are in fact determined by differential income opportunities. Such in-migration is also a positive function of the growth of total employment, and a negative function of city size -- both results having been anticipated.

Climate was also included as an explanatory variable in this equation. The sign is the expected one, however the significance of the estimated coefficient is questionable.

Equation 4 explains 'long distance' in-migration into a given metropolitan area as a function of wage levels, employment opportunities, and climate. It is instructive to compare the results of this equation with those of Equation 3. The comparison strongly supports the separation of in-migration into its 'contiguous' and 'non-contiguous' components. Not only are both city size and contiguous area income significant variables in Equation 3, their inclusion actually increases the significance of the other variables. By contrast, neither was significant in Equation 4. Comparison of these two equations also suggests that the drawing power of high wages and job opportunities are relatively more important for long-distance in-migrants. This is a result which can be anticipated on apriori grounds, since in general we would expect the destination of persons migrating over relatively long distances to reflect more precisely the attributes which 'draw' migrants than the destinations of short-distance migrants. Similar reasoning applies to the influence of climate, which turns out to be a highly significant factor in Equation 4.

The results of Equation 5 seem to support the hypothesis that differential rates of out-migration may be explained largely in terms of 'push' factors, namely wage and employment conditions at the origin. The prospective unemployment variable is very closely correlated with the rate of out-migration. The wage variable is significant, its presence improves the precision

TABLE 3. REGRESSION RESULTS: ORDINARY-LEAST-SQUARES

Intercept or Variable	Estimated Coefficient and t-Statistic Equation 1	2	3	4	5
Intercept	0.0062	0.0113	0.0578	-.2019	0.0993
y_1 (Grwth Mfg Emplymnt)	-1.0	0.137 (1.85)			
y_2 (Grwth Svc Emplymnt)		-1.0			
y_3 (Cntgs In-Mgrnt)			-1.0		
y_4 (Non-Cntgs In-Mgrtn)				-1.0	
y_5 (Out-Mgrtn)					-1.0
q_1 (Prspctve Unemplymnt)					0.420 (12.6)
q_2 (Net Ppltn Grwth)	0.137 (3.30)	0.090 (4.87)			
q_3 (Grwth Ttl Emplymnt)			0.602 (4.48)	0.988 (5.69)	
x_1 (No-Mgrtn Ppltn Grwth)					
x_2 (Wage)	-.023 (2.38)	-.030 (4.33)	0.037 (2.45)	0.084 (4.34)	-.032 (2.53)
x_3 (Ind Cmpstn)	0.174 (2.98)				
x_4 (Incme SMSA)		0.010 (4.25)			
x_5 (Incme Cntgs Area)			-.040 (2.89)		
x_6 (Ppltn SMSA)			-.008 (4.21)		
x_7 (Climate)	0.040 (1.66)		0.036 (0.90)	0.160 (3.55)	-.020 (0.61)
R-Square	.44	.62	.56	.60	.81

of the unemployment variable, and it has the proper sign, i.e. high wages deter out-migration. Climate is not a significant factor.

Simultaneous Equation Bias

As noted throughout, a central concern of the study has been to shed some light on the nature of the interaction between employment growth and migration. Previous studies have generally assumed one or the other of the two to be exogenous, an assumption that is open to considerable question. A principal advantage of the multi-equation formulation used here is that it provides a basis for examining which way the causation runs, rather than assuming the answer. It is therefore of considerable interest to note the effect on the results, if any, of correcting for simultaneous equation bias using the three-stage least-squares procedure.

We may ask the basic question as follows, "Do people chase jobs, or do jobs chase people?" The ordinary-least-squares estimates indicate a two way causal relationship -- on the one hand Equation 1 and 2 indicate that employment growth is enhanced by population growth ('Jobs chase people'): on the other hand Equations 3, 4, and 5 indicate that migration patterns respond

in a remarkably sensitive way to employment growth ('People chase jobs'). However these ordinary-least squares estimates may be biased. The three-stage estimates should, in theory, reduce such a bias if it exists.

Unfortunately the data falls short of what is desirable. For one thing the sample size of 56 is less than desirable. More importantly, the fact that we are limited to examining five-year rather than annual rates of migration and employment growth diminishes the prospects of uncovering the simultaneous equation bias since the period of adjustment may be much closer to one year than to five. Nonetheless, there is a definite pattern in the changes in coefficients as we go from ordinary-least-squares to the three-stage estimates. These results are shown in Table 4.

First note that Equation 2 undergoes a significant shift in that the growth of manufacturing employment coefficient jumps from 0.137 to 0.652, implying that service employment is closely tied to manufacturing employment growth. Secondly, note that the wage coefficient increases significantly in Equation 1, from -.023 to -.032, and that the coefficient of the population growth variables falls for both Equations 1 and 2. These changes imply that wage levels are more important and labor supply less important than in the ordinary-least-squares estimates.

The migration equations are affected in a similar way. That is, in both Equations 3 and 4 the coefficient of the growth of total employment variable increases as a result, that of Equation 4 from a value of 0.988 to 1.473. In Equation 5, all three coefficients increase in moving to the three-stage estimates.

These changes are not very large, but insofar as they are significant their direction is unmistakable. They clearly imply that, as between employment growth and migration, the farmer holds the better claim for being treated as an exogenous variable . . . i.e. people chase jobs, rather than the other way around.

Migration

One of the most interesting aspects of the results is the apparent extent to which migration patterns are explained by labor market conditions specifically the growth of employment and the wage level. Equation 5, in particular, 'explains' a surprisingly large portion of out-migration in terms of adjustment to the labor market conditions within a given SMSA. It is of interest to compare these results with those of I. S. Lowry who has analyzed the 1955-60 migration data, using a gravity model to explain place to place migration flows.[7] Lowry selected at random 800 origin/destination pairs from the approximately 8000 in the census matrix. For explanatory variables he used size of labor force, unemployment rates, and wage levels -- with a separate variable in each case for origin and destination -- and airline distance from origin to destination. The dependent variable was migration from origin to destination, and a log-linear relationship was employed. Using this formulation, Lowry obtained a coefficient of determination of 0.56 with unemployment at destination, labor force size at origin and destination, and distance as the significant variables. (Unemployment at origin, and wage rates at both origin and destination were not significant.) Use of an expanded version which partitioned the labor force into civilian and military components gave a coefficient of determination of 0.68 and allowed the wage rate at destination to emerge as significant.[8]

An apparent implication of these findings, as Lowry points out, is that " . . . the volume of out-migration from any SMSA is unrelated to labor-

TABLE 4. REGRESSION RESULTS: THREE-STAGE LEAST-SQUARES

Intercept or Variable	Estimated Coefficient and t-Statistic Equation 1	2	3	4	5
Intercept	0.044	-.0113	0.0551	-0.217	0.106
y_1 (Grwth Mfg Emplymnt)	-1.0	0.6518 (5.95)			
y_2 (Grwth Svc Emplymnt)		-1.0			
y_3 (Cntgs In-Mgrtn)			-1.0		
y_4 (Non-Cntgs In-Mgrtn)				-1.0	
y_5 (Out-Mgrtn)					-1.0
q_1 (Prspctv Unemplymnt)					0.4308 (7.84)
q_2 (Net Ppltn Grwth)	0.123 (2.88)	0.0235 (0.99)			
q_3 (Grwth Ttl Emplymnt)			0.6475 (3.89)	1.4734 (6.94)	
x_1 (No-Mgrtn Ppltn Grwth)					
x_2 (Wage)	-.0318 (3.33)	-.0097 (1.11)	0.0375 (2.50)	0.0984 (4.96)	-.0343 (1.67)
x_3 (Ind Cmpstn)	0.0406 (0.95)				
x_4 (Incme SMSA)		0.0088 (3.45)			
x_5 (Incme Cntgs Area)			-.0388 (3.10)		
x_6 (Ppltn SMSA)			-.0072 (4.22)		
x_7 (Climate)	0.020 (0.92)		0.030 (0.73)	0.110 (2.21)	-.030 (0.56)

market conditions in that SMSA; but that the choice of destinations does reflect a knowledge of and interest in labor-market conditions there."[9] Lowry goes on to relate this finding to an observation by Perloff that there is an inherent assymmetry between in-migration and out-migration situations. For a given SMSA between in-migration and out-migration situations. For a given SMSA with favorable income and employment opportunities the attraction works on potential in-migrants in all other areas. For a given SMSA with unfavorable income and employment opportunities, however, the necessary out-migrants must all be drawn exclusively from the given SMSA. Perloff reasons that the latter type of adjustment may prove difficult to make. By contrast, the large potential supply of in-migrants should eventually remove disparties arising from above average income and employment opportunities in a given area.

Given the default of labor market conditions in explaining out-migration, Lowry postulates that various population characteristics, e.g. age distribu-

tion, explain the observed differential rates of out-migration, although data for testing this hypothesis for the 1955-60 period is not available. In contrast to Lowry's findings, the results reported here indicate a highly significant relation between out-migration rates and local labor market conditions, as characterized by 'prospective unemployment.' This apparent difference calls for some comment.

One difference is that whereas Lowry uses the average annual rate of actual unemployment, I have used the prospective rate for the entire period, namely the level of unemployment which would have accumulated by the end of the period had no out-migration taken place. This difference may fully account for the discrepancy. I am relating out-migration to an index of the total pressure to out-migrate, whereas Lowry is relating out-migration to an index of the residual pressure, i.e. the residual level of unemployment after actual out-migration is taken into account. It may be argued that the former method is better adapted to testing whether local labor market conditions influence out-migration rates. There is no apriori reason why SMSA's with unemployment problems should be those with high gross out-migration rates. If for instance, as seems likely, such cities have low-migration rates, just the opposite might be true. If on the other hand we characterize the local labor market as the joint result of employment growth and labor force growth (including in-migrants), there is much stronger reason to expect high gross out-migration rates to coincide with prospective unemployment. The results of Equation 5 give support to the hypothesis that local labor market conditions -- so characterized -- do in fact explain most of the inter-metropolitan variation in out-migration rates.

Equations 3 and 4 support Lowry's findings that income and employment opportunities at the destination significantly affect migration patterns, with the additional implication that these factors (plus climate) are considerably more important for longer distance moves. Since Lowry employed origin/destination pairs, he was able to incorporate distance as a separate variable in his equation, and it did emerge as significant. I have resorted to a rough separation of short and long distance migrants by distinguishing those from within the same or a contiguous state from those from non-contiguous states. The results of Equation 3 and 4 leave little doubt that such a distinction is useful. Not only does the separation allow for those (low income) regions of the country where significant rural/urban movements are still taking place, it also brings into much sharper focus the influence of income and employment opportunities in shaping the pattern of long distance moves. Both wages and employment growth are seen to exert a much stronger influence in Equation 4 (Non-contiguous in-migration).

The Role of Wage Levels

Both the ordinary-least-squares and three-stage estimates of the model assign a significant role to the wage level of an SMSA in influencing both the rate of employment growth and the gross rates of migration. High wages seem to deter employment growth. This effect may be partially offset by the higher gross-migration rates which result -- since high rates of gross-migration can contribute to regional labor force quality.

As discussed above, however, the three-stage estimates suggest that deterrence of employment growth is the dominant influence of the wage differentials -- since migration patterns seem to be much more heavily affected by growth of employment opportunities than vice versa, and since the effect of the high wages on employment growth is clearly an adverse one. This set of conclusions implies that high wage SMSA's face poor prospects for growth.

By treating the wage level as fixed, we are also assuming, implicitly at least, the absence of a compensating decline in wage levels to restore the growth prospects. Thus a high wage SMSA with only average or less than average demand not only faces poor growth prospects, the situation has a long term character.

Clearly a prolonged stagnation in employment growth could lead to cumulative adverse effects not provided for in the model -- decline in the quality of the region's capital stock, and decline in the quality of the region's labor force. A low rate of investment will adversely affect the quality of the capital stock insofar as technological innovation is embodied in investment. Net out-migration will adversely affect the quality of the labor force insofar as migration is selective. Though there is no way of estimating the quantitative significance of either of these factors, there can be little question as to their direction.

III. CONCLUSIONS AND IMPLICATIONS

Whereas traditional analysis assumes immobile (or exogenously determined) productive factors and assumes flexible wages, attention has been given here to the opposite case where wages are relatively inflexible and factor supply (via inter-regional migration) responds in a sensitive way to some combination of regional wage and employment growth differentials. Given high rates of inter-regional migration, and given some rigidity in the wage pattern, it is argued that the factor price equalization mechanism is likely to be of little importance and that the pattern of national demand growth is likely to be of significant importance. A principle objective of the study has been to develop a framework for empirical analysis which would allow a more symmetric treatment of these factors.

Results of the empirical analysis support this approach to the problem. Not only is the rate of inter-regional migration large, with magnitudes comparable to the no-migration population growth rates, the rates vary widely across SMSA's, and the rates are highly correlated with both employment growth and wage levels. In addition, there was shown to be a strong three-way interaction among in-migration, out-migration, and employment growth. The factors affecting in-migration and out-migration were shown to be asymmetric to some extent, with, for example, the income level of the surrounding region being a significant determinant of the rate of in-migration to a given SMSA. There is also asymmetry of the type identified by Perloff, which derives from the fact that for an SMSA with favorable employment opportunities, the attraction works on potential in-migrants in all other areas, whereas for an SMSA with unfavorable employment opportunities the necessary out-migrants must all be drawn from within the given area. This asymmetry, combined with the interaction among migration and employment growth, attests to the importance of using gross rather than net migration rates in this type of analysis.

The simultaneity inherent in these relationships was corroborated by the use of the multi-equation approach. For the particular time period under consideration, the results suggest that the strongest line of causation runs from commodity demand through labor demand to migration patterns, although the reverse sequence retained some significance as well. Since the time period of the sample represented a mild recession in the U. S. economy, there is a question as to whether this pattern holds true for other periods, e.g. 1960-65 or 1965-70. The hypothesis can be tested only as the migration data becomes available. In any event the importance of explicitly recognizing the simultaneity problem seems to be established.

A similar qualification pertains to the role in the model of the regional wage level, which exhibited remarkable stability over time combined with significant variation across regions in the sample studied. The wage level emerged as a significant determinent of both employment growth and migration. The former of these two relations was strengthened by correction for simultaneity; it was also strengthened by correction for factors indicative of labor productivity. Changes in the wage level, which have sometimes been postulated to be of significance, were not only small but unrelated to other variables in the model. Whether this pattern and suggested role of inter-regional wage differentials holds true for expansionary periods in the economy is certainly questionable. But again, an adequate test of the hypothesis must await migration data to allow a comprehensive model. The wage emerged as highly significant in the current model only after the other relevant variables were incorporated.

The nature of regional interaction implied by these findings may portend problems of stagnation for certain metropolitan areas, specifically those which by virtue of historical development patterns now exhibit high wage levels without the compensating help of an industrial structure with predominantly fast growing sectors or above average population growth. These characteristics hold for example for many of the older industrial areas in the Manufacturing Belt.

It seems likely that a significant part of the problems faced by such areas are explicable in terms of the causal factors suggested by the model. Primary among these causes is the existence of a high wage level, creating a disincentive for new investment and a consequent lack of growth of employment opportunities.

In the absence of migration in response to this situation, the result would be major unemployment problems in such areas, which ultimately would depress the wage level, at least to some extent. Given a wage setting mechanism which resisted downward pressure, however, the long term prospect would be for continuing high rates of unemployment.

In the presence of inter-regional migration, on the other hand, the results suggest a more subtle kind of problem, but one whose adverse effects may be comparable in the long run and one whose solution may be somewhat more elusive.

Consider the case in which there are large flows of inter-regional migration, with a pattern that is highly sensitive to the regional pattern of employment opportunities. The migration flows are beneficial in that they prevent massive general unemployment from accumulating in any given area. The adjustment is neither immediate nor perfect, and certain labor categories may be less able to adjust than others, e.g. the unskilled negro labor force. But in general out-migration rates will rise and in-migration rates will fall so as to accomplish the major parts of any required adjustment. The results of the model, particularly Equation 5, support such a characterization of large U.S. metropolitan areas.

The obvious difficulty with migration as the solution to the unemployment problem is the implication that investment rates will continue to be low, with consequent adverse effects on the quality of the capital stock, and that the quality of the region's labor force may decline as well. Insofar as the more energetic, better educated, and potentially more productive members of the labor force tend to be more mobile, a net loss of labor force members through migration will further reduce the productivity of the labor force and the

attractiveness of the area to investment. The problem here is that a region which is losing employment growth because of high wages, and hence losing labor as well can go on and on in this posture, since there is no corrective mechanism. Clearly this kind of continuing erosion of a metropolitan area's competitive position can mean a serious and long term problem.

Nor do there appear to be any effective solutions short of a direct attack in the form of wage subsidies -- probably on an indefinite basis and at prohibitive cost politically if not economically. As Borts and Stein concluded in their study, there is little prospect that external economies and agglomeration effects will appear in such areas as the result of government-subsidized investment since such effects are typically associated with the development of newer areas which have not reached a certain size. "They are hardly likely to occur in the well-developed industrial complex of an older depressed area."[11]

The implication is that the stimulus achieved by subsidies or public expenditures in the form of "seed capital" will be temporary only, and that continuing public support will be required to alleviate the problem on a long term basis.

The relevance of the above reasoning depends essentially on the validity of the assumptions that regional wage levels vary significantly -- from the perspective of the investor -- and that they maintain a relatively rigid pattern, responding neither to regional differentials in growth nor to changes in labor force productivity. These assumptions seem to be well justified for the period in question. It must be remembered that the period was one of less than full employment, however, and a different period may exhibit different behavior. The extremely high gross rates of inter-regional migration and the apparent responsiveness of this migration to employment opportunities suggest the assumption will hold valid in the full employment case as well. Such migration means a highly elastic labor supply and the more elastic the labor supply the less pressure for wages to rise as employment grows.

The results obtained in this study indicate the conceptual framework is a good one and that additional analysis is desirable. The basic limitation has been data availability. As better data becomes available, further study is indicated in four areas.

(1) Inclusion of a larger number of SMSA's, preferably all of them. This would not only increase the sample size but also provide some insight into how these behavior patterns vary for different sizes of SMSA. The Fuchs study of wage differentials revealed significant variation in wage level by city size, and the pattern remained after correction for labor force quality. The SMSA's used in the study did not reveal such variation, but only the largest SMSA's used included -- because of data limitations.

(2) Repeat the analysis for a period during which the economy is undergoing rapid expansion and also for a period of sustained high employment levels to examine how and to what extent the behavioral patterns are sensitive to this factor.

(3) Repeat the analysis on the basis of one or more annual -- as opposed to five year -- periods, to determine whether the resolution of the simultaneity problem can be improved.

(4) Refine the variables and incorporate new variables. Defense spending is probably the most important omission. A refinement of the mi-

gration data to account for several categories of migrant, e.g. black vs. white and skilled vs. unskilled, would also be useful.

Most if not all of these extensions will be possible in the near future as the new population census becomes available.

APPENDIX

REGRESSION DATA

Variable	Description
y_1	Growth of Manufacturing Employment--Increase in manufacturing employment from 1954/5 to 1959/60, as a proportion of SMSA population in 1955. Source: U.S. Department of Commerce, Bureau of the Census, Annual Survey of Manufactures, 1961 (Washington: G.P.O., 1963), Table 1.
y_2	Growth of Employment in Services--Growth of Total Employment (Column 8) less Growth of Manufacturing Employment (Column 1).
y_3	Contiguous In-Migration--Gross in-migration to the SMSA from within the same or a contiguous state during the period 1955 to 1960, as a proportion of SMSA population in 1955. Source: U.S. Department of Commerce, Bureau of the Census, Census of Population: 1960. Subject Reports: Mobility for States and State Economic Areas (Washington: G.P.O., 1963), Tables 28 and 30.
y_4	Non-Contiguous In-Migration--Same as 3, except that only migrants from non-contiguous states are counted. Source: Same as 3.
y_5	Out-Migration--Gross out-migration from the SMSA during 1955 to 1960, as a proportion of SMSA population in 1955. Source: Same as 3.
q_1	Prospective Unemployment--Total increase in population, assuming no out-migration, less increase in employment, during the period 1955 to 1960, as a proportion of SMSA population in 1955. Defined as No-Migration population Growth (Column 9), plus total in-migration (Columns 3 and 4), less Total Employment Growth (Column 8).
q_2	Net Population Growth--Defined as net increase for the period 1955 to 1960, as a proportion of 1955 population. Source: Census of Population: 1960. Vol. I, Part I, Table 31.
q_3	Growth of Total Employment--Total increase in employment, as a proportion of 1955 population, defined over the period 1953-56 to 1959-62. Source: United States Department of Commerce, Bureau of the Census. County Business Patterns (Washington: G.P.O., 1953, 1956, 1959, 1962).
x_1	No-Migration Population Growth--Population increase which would have occured during 1955 to 1960, assuming no migration. Defined as Net Population Growth, (Co-

Variable	Description
	lumn 7), plus Out-Migration (Column 5), less total in-migration (Column 3 plus Column 4).
x_2	Wage Level--Average SMSA hourly wage for manufacturing production workers based on annual data averaged between 1954 and 1955. Source: Annual Survey of Manufactures: 1961, Table 1.
x_3	Industrial Composition Index--An average of national growth rates of 3-digit S.I.C. sectors, weighted by each SMSA's sectoral employment in 1954. Thus $x_{2i} = \sum_j w_{ij} r_j$ where w_{ij} is the percentage of total manufacturing employment in Sector j in SMSA i, r_j is the national average proportionate increase in Sector j, 1954 to 1958. (Note: The Standard Industrial Classification was changed substantially for some sectors in 1957. 1958 data was revised to conform with the old S.I.C.) Source: Census of Manufactures: 1954, Table 5; Census of Manufactures: 1958; Table 5.
x_4	Income, SMSA--Median income for families, 1959. Source: Census of Population: 1960, Vol. I, Part 2, Table 139.
x_5	Income, Contiguous Area--Median per capita income, weighted by state population, in the own state of the metropolitan area and in each state having a common boundary with that state. Source: Census of Population: 1960, Vol. I, Part 2, Table 134.
x_6	Population, SMSA--Estimated 1955 population, based on geometric mean of 1950 and 1960 census data. Source: Same as 7.
x_7	Climate--Mean January temperature index. Source: United States Department of Commerce, Weather Bureau, Climatological Data National Summary Annual 1960. Vol. II, No. 13 (Asheville: 1961).

FOOTNOTES

[1]Among the more important of these: George H. Borts and Jerome L. Stein, Economic Growth in a Free Market (New York: Columbia University Press, 1964); Victor R. Fuchs, Changes in the Location of Manufacturing in the United State Since 1929 (New Haven: Yale University Press, 1962); Harvey S. Perloff, Edgar S. Dunn Jr., Eric E. Lampart, and Richard F. Muth, Regions Resources, and Economic Growth (Baltimore: The Johns Hopkins Press, 1960); Richard A. Easterlin, "Long Term Regional Income Changes: Some Suggested Factors, "Papers and Proceedings of the Regional Science Association, Volume IV (1958); Frank Hanna, State Income Differentials 1919-1954 (Durham: Duke University Press, 1959).

[2]U. S. Department of Commerce, Bureau of the Census, United States Census of Manufactures 1954, Volume III, Area Statistics (Washington: G. P. O., 1957) Table 5.

[3]Arthur S. Goldberger, Econometric Theory (New York: John Wiley & Sons, 1964), 231.

[4]For an example using prospective unemployment to explain net out-migration, based on state rather than SMSA data, see Cicely Blanco, "Prospective Unemployment and Interstate Population Movements," Review of Economics and Statistics, XLVI (1964), pp. 221-2.

[5]Victor Fuchs, Differentials in Hourly Earnings by Region and City Size, 1959, National Bureau of Economic Research (New York: Columbia University Press) p. 10.

[6]U. S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1962 (Washington: G. P. O., 1962) p. 12.

[7]I. S. Lowry, Migration and Metropolitan Growth: Two Analytical Models (Los Angeles: Chandler, 1966).

[8]Ibid., 14-23.

[9]Ibid., 22.

[10]Fuchs, Differentials in Hourly Earnings, 44-5.

[11]Borts and Stein, op. cit., 195.

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