MIGRATION, THE EXPORT BASE, AND COMMUNITY ECOLOGICAL STRUCTURE

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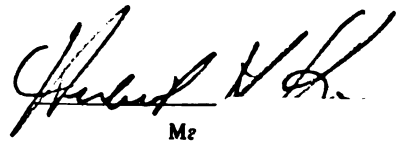

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ABSTRACT

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By

James Joseph Byrne

Studies by Lowry and others have shown that net migration in the United States has a high positive correlation with change in employment level. It is unclear, however, to what extent employment opportunities act as a "pull" for migration, and to what extent increased employment is merely an outgrowth of migration. In this three part investigation, a theoretical framework is developed for analyzing net migration which uses the concepts of the community "export base" and the "multiplier effect." These concepts are theoretically and operationally independent of the migration process, offering improved opportunities for understanding and prediction.

The overall conceptual scheme attempts to explain net migration in terms of differential manufacturing growth, and differential manufacturing growth in terms of community ecological characteristics. Communities with certain types of ecological characteristics are theoretically destined to expand because of their ability to attract new industry, while those with other characteristics are destined to stagnate. Specific ecological characteristics derived from the theory and examined are: population size, population potential, median income, population density, distance to nearest larger Standard Metropolitan Statistical Area, percentage employment in service industries, and climate. Units of analysis are Standard Metropolitan Statistical Areas.

In Part I of the study, existing methods of export base measurement, particularly the "index of surplus workers," are criticized, and an empirical test of the validity of the index is carried out. The index shows no correlation with net migration for 139 Standard Metropolitan Statistical Areas, 1950-60. It is concluded that the index is an inadequate measure of an area's export base; it measures not only export activity, but import activity as well.

In Part II, an alternate scheme of export base measurement is presented, in which local growth in particular export activities, especially in manufacturing payroll, is linked to net migration. Strong correlations with migration are found, so in Part III the seven ecological variables listed above are linked to manufacturing growth in a multiple correlation analysis. Population size and distance are the only variables with strong statistical relationships to change in manufacturing payroll. Jointly, change in manufacturing payroll, population size, and a climate index statistically explain 80 percent of the net migration variance. It is concluded that the export base approach is a potentially effective means of explaining net migration, but that the ecological variables used in the study are not effective in explaining the relationship between manufacturing growth and net migration.

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CHAPTER I

INTRODUCTION

Demography has often been praised as one of the most advanced of the social sciences, since its methodology is far more sophisticated than that of most other areas of social research, and there exists a much greater degree of quantification among its variables. There is one area, however, in which demography has lagged badly: in the development of comprehensive and integrated theory. As Rupert Vance (1952) has noted: "There is one area where demography is getting rather poverty-stricken and frayed at the edges. In the realm of high theory we have been living off our capital and borrowing from our associates." The situation has changed little in the twenty years since Vance spoke these words. This failure of demography is reflected in the disjointed nature of its theoretical formulations, which often consist of poorly defined concepts, unstated assumptions, empirical generalizations, fractured typologies, isolated models, and sets of propositions unrelated to specific observables. The "demographic transition," for example, which is one of the nearest approaches to demographic theory, is really only an empirical generalization. It gives one no logical basis for inferring that changes in birth and death rates of presently industrializing countries will be similar to those of Europe at a comparable stage of development.

There are a number of reasons for this unfortunate state of affairs, not the least of which may be the very sophistication of techniques, which may have resulted in a tendency to bypass systematic

theory development. The development of migration theory has been no more promising than in other areas of demographic theory. There has been a proliferation of concepts vis-a-vis migration, but they have not been combined into a comprehensive framework. Each researcher has limited himself to certain variables and ignored others. We have the concepts of intervening opportunities, of the P_1P_2/D Hypothesis, and so forth, but they have not been refined and related to a broad theoretical framework, or discarded as appropriate. The general pattern of migration theory has consequently been a collection of empirical generalizations and typologies. Ravenstein (1885: 199) set the pattern early with his laws of migration, which were an impressive contribution for his time, but which have since been little improved-upon. These laws specified that various characteristics of migration are universally prevalent. Examples of such laws as developed by Ravenstein are: "Each main current of migration produces a compensating counter-current," and "Migrants proceeding long distances generally go by preference to one of the great centers of commerce and industry."

Stouffer (1940) continued the tendency toward empirical generalizations, though he presumably injected a greater degree of precision by introducing the notion of proportionality: "The number of persons going a given distance is directly proportional to the number of opportunities at that distance and inversely proportional to the number of intervening opportunities." He likewise made other useful refinements.

Recently Lee (1969: 288-9) has built upon the earlier work of Ravenstein and others by developing a more comprehensive set of generalizations, including the following: "The volume of migration within a given territory varies with the degree of diversity of areas

included in that territory," and "The volume of migration varies with the diversity of people."

Work in this area has thus remained at the level of empirical generalizations, albeit increasingly sophisticated ones. Such generalizations are worthwhile, in that they provide evidence for the relevance of particular concepts and specify relations among them. As long as they remain unconnected to a formal body of theory, however, they are of limited value, since the specific conditions under which they operate are unknown and they cannot be used for prediction or deductive explanation.

At the present stage of theoretical development, it would be unrealistic for anyone to attempt the development of a full-fledged migration theory. The present study does make a few halting steps in that direction, by examining internal migration in the United States from a single theoretical framework, with variables derived from that theory. The theoretical framework used will be taken from the economics literature: that of the community "export base" and "multiplier effect."

It has long been recognized that economic factors play a crucial role in determining the patterns of internal migration among different regional areas of an industrial economy. Ravenstein (1885: 198), in his analysis of migration laws, commented that: "It does not admit of doubt that the call for labour in our centres of industry and commerce is the prime cause of those currents of migration which it is the object of this paper to trace." Later writers, including Stouffer, have given at least implicit recognition to the importance of economic factors in explaining migration.

Certain economic variables have empirically been found to be closely related to net migration; Lowry (1966), for example, discovered a high correlation ($r = .981$) between net migration and change in employment level among Standard Metropolitan Statistical Areas (SMSAs). The difficulty with studies like that of Lowry is that the presumed independent variable is measured over a time interval concurrent with that of the dependent variable. Lowry, for example, obtained the above correlation by relating net migration, 1950-60, with net change in civilian nonagricultural employment, 1950-60. For purposes of prediction, his results are of limited value, since it would be as difficult to predict changes in employment level as it would be to predict changes in net migration. Moreover, it cannot be ascertained to what extent employment opportunities are attracting migrants, and to what extent migrants are moving for noneconomic reasons but managing eventually to find some type of employment at their destination. It is thus not clear to what extent migration is acting as an independent, rather than a dependent, variable. No one has yet been able to develop an explanatory framework for migration based upon a comprehensive array of interrelated variables that are independent of the migration process. This has been due both to demography's atheoretical tendencies discussed above and to the lack of precise knowledge as to what variables and concepts are relevant. The latter in turn has been traceable to a paucity of empirical studies linking migration to spatial ecological characteristics. Several studies, discussed below, have attempted to isolate such characteristics, but these studies are few in number, and until it is known which ecological factors are consistently associated with net migration, a concise theoretical scheme cannot be developed.

Ecologically, net migration may be viewed as an equilibrium-maintaining variable (Hawley, 1950: 332). It responds to demographic imbalances which result, among other things, from differential economic growth among various regional areas within an economic system. The stronger potential for economic expansion in one area as opposed to another creates a migratory "pull."

There has been a sustained search among economists and demographers for a theory which would explain the tendency for certain areas of an economy to experience faster economic growth than others. The most common analytical framework for assessing economic growth potential has been that of the community export base. This approach regards the amount of local income derived from exports to other areas as the crucial element in explaining economic growth and hence net migration. This logic, while basically sound, suffers from a crudeness of measuring techniques, resulting partially from a lack of suitable data at the community level.

In view of the present status of migration theory and export base methodology, the plan and structure of the proposed study are threefold: (1) an analysis and testing of the deficiencies of present export base methodology; (2) development of an alternative approach to export base analysis, centering upon growth in the secondary sector of the economy; and (3) linkage of a number of community ecological characteristics to secondary sector growth. A conceptual framework will be developed to account for industrial mobility and net migration in the United States for the decade of the 1950s and to aid in the selection of relevant ecological correlates of this movement.

SIGNIFICANCE OF THE PROBLEM AND THE DISSERTATION

Of the three basic variables in the demographic equation, migration is unquestionably the hardest to predict. Mortality and fertility both occur in rather well-defined patterns by age and sex, and it is easy to specify the population at risk. Barring war or other major disaster, mortality can be anticipated and provided for by an ongoing society so that it does not exert a disruptive impact. The fertility level is more variable, and variations in this variable, such as the occurrence of a baby boom, can be more of a disorganizing influence. Fertility changes do not affect most social institutions until many years after they occur, however, so there is time to anticipate and provide for them to some extent. Migration, by contrast, is highly variable, cannot be well predicted, and can exert an immediate strain on the society both at origin and destination. Migration is very age- and sex-specific, so it can cause severe distortions in the age-sex structure at origin and destination, with resulting dislocation of the social structure. Similarly, the sheer volume of migration can cause numerous social problems and make assimilation difficult, particularly if the amount of migration is not anticipated in advance.

In view of the above, it is most important to find ways of anticipating the amount and direction of migration. By shedding light on the ecological characteristics of a given community which are linked to migration, the dissertation may enhance the predictability of migration. This would permit more accurate population projections and a higher probability of being able to prepare in advance for social dislocations caused by fast growth rates and a large migrant population.

The dissertation may also contribute to the advancement of migration theory. It will be the first study in which ecological characteristics have been selected for a multiple correlation analysis with migration on the basis of a specific guiding theoretical framework. In so doing, the study builds upon previous investigations which have already shown most of the variables in the present study to be important in migration analysis.

Methodologically, the study should advance export base analysis by treating the export base as an intermediate set of variables between migration and ecological influences, rather than as a structural characteristic of the local labor force. By finding those ecological factors which specifically increase local export income, one is presumably finding those factors which ultimately produce increased net migration.

Substantively, the dissertation links net migration variability directly to growth in the secondary sector of the economy, rather than to employment growth in general. By delineating specific types of employment which are associated with migration, one can better understand the nature of the process, and eventually, refined theories may be developed.

THEORY AND LITERATURE REVIEW

The export base concept is based upon the logic that an economic unit derives its income for potential expansion from the sale of locally produced goods and services to outside areas; to the extent that a given product is being produced and sold in greater amounts than required for local consumption, it is being exported in return for money income

to the area. Production of the product is therefore regarded as a "basic" activity. Goods and services produced for local consumption are in the nature of housekeeping activities which do not contribute to the area's income and are therefore "service" or "nonbasic" activities.

A region's growth potential is presumably a direct function of the size of its export business, since the ratio of basic to service workers in an area is assumed to remain fairly stable over the long run. An increase in export income gives rise to an increased demand for services, which is reflected in an expansion in service industries and attraction of migrants to fill the jobs thus created.

Development of the Export Base Logic

The export base concept arose within the framework of international trade, but was early recognized as applicable to smaller economic units. Cities in particular became targets for economic analysis through the export base technique because of their unified economic structure, their interdependence with other cities and with rural areas, the need for urban planning, and the availability of population and economic statistics for them.

Weimer and Hoyt (1939) built upon scattered beginnings and presented the first extensive development of the export base theoretical framework. Since that time, numerous refinements and criticisms have been made, such as a rejection of Hoyt's early notion that there is a one-to-one or other fixed relationship for all cities between the base and service sectors of the economy. A systematic discussion of the historical development of the urban base idea was given by

Richard Andrews (1953); later discussions of export base logic and methodology may be found in Pfouts (1960) and North (1961).

The export base approach, or selected aspects of it, has been subjected to severe criticism by a variety of writers. Blumenfeld (1955) condemned it for several reasons, including its failure to consider the role of imports, its apparent inapplicability to large communities (which have a consistently smaller proportion of export workers than small communities), its tendency to denigrate the role of service industries (which are usually seen as a mere byproduct of export activities), and its use of employment totals when it is really money income that is important. In the absence of more sophisticated techniques, however, and due to the paucity of detailed regional economic data, the export base approach has remained practically the only method of coping with economic growth measurement and analysis.

A refinement of the export base concept was the treating ofgrowth potential as a function of both the export base and of what D. C. North (1961) calls the "multiplier-accelerator" effect. The latter idea recognizes that growth potential is dependent not only upon the sheer size of the export base, but upon the disposition of income derived from exports. To the extent that export income flows directly out of the local economy in the purchase of imports it makes no contribution to economic growth; to have a beneficial effect, it must circulate through the local economy, so a well-developed tertiary sector is as important as a strong export sector.

A recent study by Karp and Kelly (1971) used this refinement of the export base logic, overcoming most of Blumenfeld's criticisms. The multiplier effect takes the role of imports into account, as

explained above; moreover, by treating services as equal in importance to exports, it makes the export base logic more applicable to large cities, which have a consistently higher percentage of service industries than small communities. Blumenfeld's most important remaining criticism is the use of employment totals rather than dollar income as a basis for measurement; this pertains to export base methodology and will be examined in Part I of the dissertation.

The Karp and Kelly study was also important in that it was the first one to link a community's export base specifically to migration patterns; this aspect of the study will also be discussed further below.

Export Base Methodology

A variety of techniques have been proposed for measuring the export base of an area. The two methods generally used are the location quotient and the minimum requirements technique. The location quotient compares the local percentage of workers in a given industry to the national percentage, according to the following formula:

$$\frac{\frac{e_i}{e_t}}{\frac{E_i}{E_t}}$$

Where: e_i = local industry employment
e_t = local total employment
E_i = national industry employment
E_t = national total employment

The extent to which the formula exceeds a value of one (i.e. extent to which the local percentage of employment in the industry is greater than the national percentage) indicates the degree to which the industry serves an export function for the local economy. The underlying assumption is that each area consumes its pro rata share of the nation's output of goods from each industry.

The minimum requirements approach is somewhat different; it is described by Karp and Kelly (1971:61) as follows:

> . . . a sample of area units is arranged according to class size and the percentage of the labor force employed in each of a number of industry categories is calculated for each of the areas in the sample. The figure for the area in each class with the minimum percentage employed in each category is obtained, and these minima are summed to obtain a figure that represents the gross nonbasic component of an area's employment in that particular size class. The remainder represents the gross export or basic employment for an area in that particular size class.

Pratt (1968) criticized the logic of the minimum requirements technique by showing that there is no sound reason for using minima rather than averages in apportioning workers to basic vs. service categories. He showed that the use of minima assumes an economy in which everyone exports goods and services, while no one imports; moreover, the values of the minima are totally dependent upon the level to which industrial categories are disaggregated. Even with these drawbacks, the minimum requirements technique was shown to make the same stringent and questionable assumptions of the location quotient. These assumptions include the dubious one that productivity and consumption levels are constant throughout the national economy. An unconvincing attempt to rebut these criticisms was made by Ullman (1968).

A variant of the location quotient, the index of surplus workers, developed by Mattila and Thompson (1955), appears to be the best available indicator of migration potential. This index reflects the number of workers in a given industry above the area's pro rata share; these are presumed to be export workers. The apparent advantage of this formula for migration analysis is that it assigns each industry a weight proportional to the number of workers in that industry, rather than assigning all industries an equal weight. As Mattila and Thompson (1955:221) pointed out, the latter weighting system assumes

that "all local industries are equally 'important' (i.e. afford equal employment opportunities) to the community." This is clearly not the case.

By computing surplus workers for each industry, then totaling them across industries, a measure of the area's overall export base is obtained, called the absolute form of the "index of total surplus workers," as represented by the following equation:

$$S = \sum \left[e_i - \frac{e_t}{E_t} E_i \right]$$

where S represents the absolute number of total "surplus workers" in the local economy, and the remaining terms are defined as in the formula above.

It is entirely possible that the index of total surplus workers in its absolute form is highly correlated with total local employment, since the potential range of variation in employment totals for each industrial category is directly proportional to the size of the local labor force. Total local employment will therefore be included in the present study as a separate variable, permitting an examination of its relationship with the index of surplus workers. In the event that the two are highly correlated, a "relative" form of the index of surplus workers, also developed by Mattila and Thompson, can be used. The latter is simply the absolute form divided by total local employment; in its "total" surplus workers form, it would be as follows:

$$S = \sum \left[\frac{e_i - \frac{e_t}{E_t} E_i}{e_t} \right]$$

The relative form should only be used if there is a high correlation between the index of surplus workers (expressed in absolute form) and total local employment, since the relative form treats surplus workers as a percentage of total local employment. As Sakoda (1966:5-6) pointed out:

> If there is no relationship between frequency in a category and the total number, the frequency itself can be used as an index. There would be no point in calculating a percentage. As a matter of fact, the use of the percentage would result in over correction so that where a correlation did not exist between frequency and N, a negative correlation would exist between A/N and N.

The advantage of the index of surplus workers for calculating the community export base is only apparent, however, and it will be the task of Part I (chapter III) of the dissertation to carry out a logical and empirical critique of this technique. The inadequacy of both the location quotient, as represented by the index of surplus workers, and the minimum requirements method, means that no suitable index yet exists for measuring the community export base.

Other Ecological Analyses of Migration

Many researchers have tried by one means or another to link ecological characteristics of areas to net migration patterns. Among these are Duncan and Reiss (1950); Ogburn (1937); Goodrich et al. (1936); Hawley (1949), Price (1950); Thomas (1960); and the U.S. Bureau of the Census (1947).

In the last twenty years, more sophisticated techniques of analysis have been introduced, such as those discussed by Bogue and Harris (1954). The first investigators to link migration patterns to the ecological characteristics of areas through multiple regression and correlation techniques were Bogue et al. (1957). In that study,

migration data for 1935-40, as reported in the 1940 census, were correlated with 16 independent variables, including such factors as population size, percent nonwhite, level of living, sex ratio, net reproduction rate, median age, and percent increase in different residence categories. The units of analysis were "state subregions," forerunners of State Economic Areas. Regression equations were computed for several metropolitan and nonmetropolitan areas; the equations succeeded in accounting for 49% to 92% of the variance, depending upon type of area. Some important variables were percent unemployed, sex ratio, and median age. This study showed that economic factors are an important factor in migration patterns: ecological characteristics in general were also shown to be significant, including social characteristics.

A later study by Anderson (1953) also linked migration patterns to social and economic characteristics of local areas. His analysis covered metropolitan areas in the northern and eastern United States only, for 1935-40. Four variables (percent unemployed, mean rent, logarithm of population size, and location) successfully explained about two-thirds of the total variance in each migration rate. Two of the four factors were economic in nature and one of them--percent unemployment--was the same variable found by Bogue et al. to be significant.

Watson (1959) correlated a large number of social and economic characteristics of SMSAs with gross and net migration, 1949-50. He found it important to distinguish between economic opportunity and level of living in analyzing areal economic variables. Migration varied directly with economic opportunity and inversely with level of living. The variables best explaining net migration in a regression analysis were: economic structure of the SMA, maturity, ecological location, and

amount of economic opportunity. Like Bogue et al., he found both social and economic variables significant; his scheme was much more effective at explaining gross migration (81% of the variance) than net migration (49% of the variance). His measure of economic structure of the SMA was percent employed in manufacturing, which he found to be negatively related to net migration (r = .41). As in previous studies, there was no established theory to guide Watson's choice of variables, so he was forced to rely on intuition and casting a wide empirical net.

A dissertation by Blanco (1962) attempted to locate, again through multiple correlation, the determinants of interstate migration in the United States. Some of the independent variables employed were: unemployment level, changes in unemployment, "prospective unemployment," wage rates, geographic distance between states, level of education, racial prejudice, climate, and movements of military personnel. "Prospective unemployment" is "the annual rate of change in unemployment which would be expected to occur if workers were not able to migrate between states." Changes in this factor accounted for 85% of the variance in the regional rate of total civilian migration among states; the remaining factors were unimportant.

Blanco's study suffers from the handicap mentioned in the introduction: since the independent variable and the dependent variable are measured concurrently, for 1950-57, predictability is not possible and the causal relationship is unclear. Also, the use of states as units of analysis may have clouded the relationships with some variables, because states are heterogeneous agglomerations of smaller units, rather than relatively integrated labor market areas.

The later study by Lowry (1966) attempted to build upon Blanco's results by refining her migration models and applying them to SMSAs, since SMSAs are the census unit most closely reflecting labor market areas. Lowry's variables included changes in the rate of natural increase, size of the local military establishment, school enrollments, employment level, and median income. In a multiple regression analysis, he found change in employment level to be the variable most highly associated with net migration, as previously mentioned. Overall, his regression analysis accounted for an impressive 97% of the variance.

As discussed previously, Lowry's results, like Blanco's, are not susceptible to clear interpretation because the independent variable is not operationally distinct from the dependent variable. In addition, Lowry and Blanco used net migration rates as the dependent variable, rather than the absolute number of migrants. This may not be the most desirable procedure; if the number of migrants is not highly correlated with population size, use of rates has the flaw outlined by Sakoda (1966) which was previously quoted.

A geographer, Herbert Kariel (1963) did a multiple correlation analysis of migration among those United States counties with a favorable net migration balance for the 1950-60 decade, linking net migration to four factors: change in the number of employees in manufacturing, median family income, proportion of professional, technical, and kindred workers, and size of the employed civilian labor force. He found all four variables significantly related to net migration, but only the last variable, size of labor force, statistically explained a substantial portion (44%) of the overall variance. Combined, the four factors explained 47% of the net migration variance.

The counties with the highest residuals were in the warmer areas of the country, which presumably reflected an "amenities" factor at work in attracting migrants, in addition to the economic variables used in the analysis. Kariel (1963:220) came to the general conclusion that:

> The amount of population growth due to net migration of an area appears to be more closely related to economic than to noneconomic factors. There is, nevertheless, some evidence to suggest that amenities, such as those which are associated with population agglomerations or a climate which is considered to be "desirable," tend to attract people to areas.

In using the number of employees rather than payroll data as his manufacturing variable, it is possible that Kariel missed capturing net migration variance due to the multiplier effect. In terms of creating job opportunities in service activities, the hiring of new manufacturing employees at twenty thousand dollars each, for example, would have a much greater impact than hiring them at eight or four thousand each, since they would be likely to spend much more money locally with the former salary than with the latter ones.

Recently, others have extended ecological analysis and correlation methods to the study of small urban places (Zuiches, 1970) and to State Economic Areas in West Virginia (Rutman, 1970). Zuiches found such factors as college enrollment and military labor force, which would reflect a strong local export base, to be positively related to the amount of in-migration, though the independent variable with the strongest relationship to in-migration was simply size of place.

The recent study by Karp and Kelly (1971), mentioned above, made a significant improvement in experimental design over those of Blanco and Lowry. The authors managed to account for a substantial portion of migration variance using determinants that were theoretically

and operationally independent of migration. In the first half of this two part study, 116 migration streams among seventeen large SMSAs, 1955-60, were correlated with six independent variables, some of which were derived from Zipf's model and the earlier work by Watson. They included distance, population of the destination SMSA, percentage of families under three thousand dollars in income, percent unemployment, and percent in manufacturing, plus an index of climate. The last three variables were measured for both origin and destination. In a stepwise regression analysis, six of the nine variables accounted for 71% of the variance. Climate had the highest single correlation ($r = .57$), and the economic factors were less important than size and distance.

In the second part of the study, the export base (minimum requirements technique) was used to assess potential for economic growth, along with several potential measures of the local multiplier effect, including population size, population potential, distance to the nearest larger SMSA, and percent employment in services. Using these variables, the authors were able to explain 60% of the net migration variance, 1955-60, among the 44 largest SMSAs.

The logic in using these factors to assess the multiplier effect is as follows: isolated communities with poor access to a larger community tend to develop a relatively diversified and self-sufficient economy, due to high transportation costs. As a result, income derived from the export base tends to be spent locally rather than for imports, compared to other communities. This contributes to growth in the service sector and further export base expansion.

The most recent export base-migration study was done by Karp (1971). He again examined variation in migration patterns as a response

to the potential for economic expansion. Using a different measure of the export base (index of surplus workers), Karp tested three hypotheses: the size of SMSA migration streams is proportional to: (1) population size, (2) extensity of the export base, and (3) distance. A significant relationship was found for the export base and distance; together they explained 59% of the variance in migration streams. He likewise found net migration associated with both these factors, the latter, distance, explained 51% of the net migration variance.

The Export Base: An Alternative Approach to Measurement

The export base is not a fundamental ecological characteristic. It is rather an economic mechanism through which ecological influences presumably operate. A strong export sector is created through industrial mobility to, and industrial growth in, a given local area, or through other economic shifts. One must look for more basic area characteristics, such as population size, climate, or location, to explain why a strong export base comes into existence. Hence, the export base could not provide a complete ecological explanation of migration in any case, even if some acceptable means of measuring it were available. Ecological characteristics must be specified which give rise to a strong export base. Part II (chapter IV) of the dissertation seeks to isolate those segments of the economy which reflect its export strength. Part III (chapter V) then attempts to link manufacturing growth, theoretically the most important export mechanism, to specific ecological characteristics.

The primary assumption of Part II is that at any single point in time SMSA population size is an accurate reflection of the strength

of its underlying export base. There is no particular type of employment structure which is especially conducive to subsequent in-migration. Specifically, the assumption of the index of surplus workers, that a heavy concentration of workers in one industry or group of industries produces a strong export base, is rejected. Detroit, for example, with its extreme specialization in the manufacturing and exporting of automobiles, is in no stronger a position to attract migrants than is San Francisco, with its highly diversified economy. It is instead assumed that each SMSA has attained its present size, rather than being larger or smaller, because it serves particular functions in the national economy, due to ecological or historical factors, which have dictated the extent of its growth.

Migratory "pulls" subsequent to any given point in time are induced by increases in export activities subsequent to that same point in time. This implies that to explain net migration one must first isolate those variables which define the export sector of the economy, then search out ecological factors which induce changes in such variables. For example, net migration is not necessarily correlated with present employment in manufacturing for a given area (in recent decades the correlation has been negative), but net migration is likely to be correlated with subsequent increases in manufacturing in the area, regardless of present manufacturing level.

It is here maintained that increased activity in the secondary sector of the economy is crucial, since this is the sector predominantly concerned with exports. By contrast, the primary sector has such a sophisticated technology and high productivity that it involves only a small and decreasing proportion of total output. Moreover, it

requires large amounts of land and is inapplicable to metropolitan areas, the present unit of analysis. The tertiary sector, on the other hand, is labor intensive almost by definition and forms an ever-increasing share of total employment and output. Services are performed primarily for a local market, however, rather than for export. Numerous exceptions exist, such as the performing of services for tourists or retirees, whose income is generally derived from outside sources, or the locating of state or national government activities in the local area, such as military bases or conservation projects. Changes in these latter types of service activities will be isolated insofar as possible and treated, along with changes in the secondary sector, as export activities. All other services will be regarded as local market activities, which do not lead to differential economic growth.

The objective of Part II is thus to isolate those community variables which contribute to export base variance. These factors will then be entered in a multiple correlation and regression analysis with net migration to determine their overall and joint predictive power. The factors isolated will be the four mentioned above. It is felt that measures of manufacturing, retirees, governmental activities, and military personnel come as close as presently possible to isolating the export sector of the economy on a comparative basis among SMSAs.

These factors may be criticized on grounds similar to those of Blanco's and Lowry's models. They are not ecological characteristics but changes in ecological characteristics; they would be as hard to predict as migration itself. This is a valid criticism, but if linked to migration, these factors do at least represent a refinement of Lowry's model. The first factor, for example, links migration

specifically to manufacturing growth, rather than to employment growth in general. Manufacturing is much more capital intensive than the rest of the economy and hence less mobile. For the short term, most types of manufacturing cannot increase locally in response to an inflow of migrants, due to the need for heavy capital investment, construction of new facilities, and so forth. Industrial mobility is rather the result of relatively long term planning, so that if manufacturing is related to migration over a period of just a few years, it is almost certainly acting as a "pull" for migration, rather than as an outgrowth of it. By contrast, the tertiary sector can increase almost overnight in response to a heavy inflow of migrants, because of two factors: (1) retail services are needed by the migrants and such services are well known for their ability to spring into (and out of) existence almost overnight; (2) most of the migrants themselves must find work, and if it is unavailable in manufacturing, they are likely to take jobs as salesmen or other service personnel, at sharply reduced rates of pay if necessary. The tertiary sector, except for those segments isolated as serving export functions, may therefore be viewed as a vehicle for absorbing those elements of the labor force displaced by increasing productivity in the secondary sector, as Lampard (1955) argued.

Industrial Mobility: Conceptual Scheme

Since secondary sector growth is expected to be the variable with the biggest impact on export growth and net migration, Part III of the dissertation will focus upon ecological characteristics associated with industrial expansion. Empirically, there have been two general trends in industrial mobility in recent decades: (1) local dispersion,

from central city to rural fringe areas;(2) national dispersion, from the northeastern sections of the country to the south and west.

The basic hypothesis of this part of the dissertation will be that both of the above trends have been governed by the goal of minimizing production and distribution costs (influenced in large measure by an increasingly sophisticated, well-developed, transportation and communications technology). Production costs may be further divided into the costs of land and labor (the remaining two factors of production, capital and entrepreneurship, are disregarded, since they tend to exist in an essentially national, highly fluid, market). Low labor costs should be reflected in low median income; low land costs should be reflected in low population density, following the argument of the early ecologists that competition for space increases land value. More specifically, low SMSA population density is likely to be associated with extensive areas of open land and possibly a large rural fringe area. Extensive space is required for building new, often highly automated, factories, employee parking lots, and storage areas.

Measuring the costs of distribution is somewhat more complex than measuring the costs of production. Industry has increasingly concentrated in the hands of a few giant firms, each one producing for an enormous national market rather than for a regional one. Such a huge market makes production in one central location less efficient than production in a number of smaller plants at scattered locations. Spatial dispersion has twin advantages: (1) it makes the firm less dependent upon the vagaries of any one location in terms of governmental regulations, labor market size, taxes, and similar factors which can determine

the fate of a corporation without being under its control; (2) it actually brings the firm closer to the market, because it tends to even the distribution between population and factories.

National dispersion, in terms of a model which treats reduced distribution costs through reduced market distance as the primary motivator, implies that the ideal ecological conditions for secondary sector growth would be found in a city: (1) with a large population size; (2) remote from other large population concentrations (long distance to larger SMSAs and low population potential); (3) where a well-developed manufacturing establishment is not already in existence (a high percentage of employment in services within the local labor force); (4) prefereably in a pleasant climate (discussed below). These five ecological variables, along with population density and median income, are hypothesized to show a high correlation with secondary sector growth.

Previous studies, such as Bogue et al. (1957) and Watson (1959), have hypothesized, and some have found, migration to be directly related to level of living. Often, level of living is not distinguished from economic opportunity, and it is assumed that a high level of living implies a high degree of economic opportunity. In the earlier stages of industrialization, when production is centered in a single region, this may be true. In a decentralization phase of industrial expansion, the opposite is more likely, however. In trying to reduce costs, industry may deliberately move to areas with a low median income; this appears to be the case in the recent trend of moves to the southern states, such as the moving of the furniture industry to North Carolina. Hence, job openings may occur most often in low income areas, and since it does little good to move to a high income area unless one can find

a job, migration may be inversely proportional to median income. It is so hypothesized in this study.

Climate is included partially because of Ullman's (1954) argument that "amenities" have become an important factor in regional growth. Retirees and tourists, as well as certain types of "footloose" service industries, such as research and development, tend to seek warm climates; heavier industries eventually follow as local populations increase. Additionally, there are definite cost advantages associated with a warm climate, such as reduced heating costs and the resulting ability to spread out large buildings over an extensive area. Fuchs (1962), for example, has argued that this latter advantage was important for settlement of the aviation industry in California. Finally, top corporation executives may make mobility decisions based upon their own preference for a pleasant location. Ullman (1954:129) noted that: "Officials of a large utility in Chicago have told me that one of their biggest problems in luring industry to Chicago is the unwillingness of executives to live in the city." During recent decades, the factors of decentralization, increasingly efficient transportation technology (including freeway building), and climate should presumably have reinforced each other in industrial mobility.

Since changes in the numbers of retirees, military personnel, and government workers are hypothesized to influence net migration considerably less than manufacturing growth, no specific hypotheses will be advanced linking them to ecological characteristics. It is noted in passing, however, that hypotheses could be generated by future research, linking them to migration. Such hypotheses could most usefully be formulated within a general theoretical framework of the type developed in this project to explain manufacturing growth in local communities.

CHAPTER II

METHODOLOGY

UNITS OF ANALYSIS

SMSAs are the units of analysis in all three parts of the dissertation. Those SMSAs are included which were originally defined by the United States Bureau of the Budget (1961), with one exception: some of the data used in the study are not directly available for SMSAs, but must instead be aggregated from county data. Since SMSAs in New England are composed of city and township units rather than counties, data cannot be obtained for them, and they have been omitted from the study. Also, only SMSAs in the contiguous 48 states are included.

There are compositional differences between the 1950 SMAs and the 1960 SMSAs. Some SMAs were divided into two or more separate SMSAs, outlying counties were sometimes added to SMSAs, and new SMSAs were added, due to population growth. In order that the 1950 data be strictly comparable with the 1960 data, adjustments have been made so that the 1950 data reflect the same areal units as the 1960 data.

DATA

Data have been gathered from several sources, but primarily from tabulations of the United States Census, 1950 and 1960, as indicated in the United States Bureau of the Census (1952; 1957; 1962; 1963) reports. Because the study is a comparative one among SMSAs, with information required for vast numbers of persons, census data is the only feasible source. The main drawback in using such data is that they were originally

gathered for purposes other than testing the hypotheses of the present investigation; several of the measures are far from pure. A prominent example is the use of the number of persons over 65 as a surrogate for retiree income. Many persons over 65 continue to work, while others may have no income. Also, there is much variation in income size among the elderly. Nevertheless, it is expected that this crude indicator, the best available, will give an acceptable estimate of the impact of retirees on a comparative basis. A thorough description of the manner in which the census data were originally aggregated, with a careful specification of sources, omissions, and inclusions for each variable, is given by the United States Bureau of the Census (1957:XV-XXXI).

The Dependent Variable

There are three possible means of getting migration data from census records, each with its own set of advantages and handicaps. The residual method requires population data from two censuses, 1950 and 1960, plus accurate fertility and mortality data. Births are subtracted and deaths added to the difference in population size between the two censuses; the resulting figure is net migration, as obtained from the following equation:

$$NM = P_2 - P_1 - B + D$$

where P_1 is population size at the earlier census, P_2 is population size at the later census, B represents births, D represents deaths, and NM is net migration. From this method, only net figures can be obtained, and all the errors of both censuses, as well as fertility and mortality errors, are retained in the migration estimate. Multiple moves are not picked up by this method, nor indeed, by the other two methods. The second method is derived from a question on the census form concerning state of birth.

Data from this method can of course be aggregated only by states, a rather gross category, and migration patterns for short time periods cannot be analyzed. The third method is place of residence at a fixed past date. This is similar to the state of birth method, except that it covers a shorter time period. Both of the latter methods are vulnerable to lapses in the respondent's memory, and are not easily aggregated into migration figures for SMSAs. The residual method is the most suitable method for the present study, so it is the one used. All three methods are more thoroughly discussed by Shyrock (1964).

Some problems are encountered by the use of the residual method: in Chapter IV, the problem is the relatively long length (ten years) of the migration interval. An adjustment of the data is required, which will be discussed in that chapter. A second problem is the fact that the residual method does not allow a breakdown of net migration into its components of in-migration and out-migration. Since there is considerable evidence (Lowry, 1966; Lansing and Mueller, 1967; and Beale, 1970) that the factors influencing in-migration may differ from those influencing out-migration, it would be preferable to analyze changes in these components separately.

A third problem with the residual method is the one mentioned above: the errors of both censuses, as well as in vital events registration, are retained in the net migration estimate. Presumably, SMSAs are large enough that the errors tend to cancel each other out and hence do not represent serious distortions.

The net migration variable used is simply the absolute amount of population change due to migration as measured in persons. This variable will then be correlated with population size; if the correlation is high (about .70 or above), then net migration rate will be used as the

dependent variable. Otherwise, the first variable will be used.

This procedure is necessary because there is no inherent justification for using a migration rate, since population size does not represent the population at risk for in-migration. It therefore should not be controlled unless it is empirically shown to be highly related to net migration, according to the logic of Haenszel (1967) and Sakoda (1966:5), discussed in chapter I.

An underlying assumption of the investigation, focusing upon net migration and linking it to manufacturing growth, is that net migration represents a process somewhat different than gross migration. In an industrial economy, an individual may migrate for any number of reasons, but he is unlikely to remain at his destination permanently unless he is able to find work (provided he is not independently wealthy, a confirmed pauper, or drawing a pension). Net migration is thus sharply limited by economic growth, while gross migration is not. The latter, which Watson (1959) found to have a high correlation with both its components of in-migration and out-migration, tends to represent "population turnover," which is affected not only by growth but by other influences, such as local age structure, and the local size of certain organizations such as the military services which have a tendency to transfer personnel frequently to different locations.

In attributing the majority of differential economic growth among metropolitan areas primarily to manufacturing growth, it is assumed that rural to urban migration is the basic factor in net migration totals, while urban to urban migration is the basic factor in gross migration totals. Though urban-to-urban migration forms the largest set of flows, SMSAs to a considerable extent merely exchange residents, since there are large streams in both directions (Miller, 1967; Bacon, 1971).

ANALYSIS OF THE DATA

Partial and multiple correlation will be the data analysis methods. Since all variables are measurable on interval scales, the Pearson product moment correlation will be used in calculating the correlations. It is assumed that all correlations are linear.

Data will be analyzed separately within each of the three parts of the study. In Part I, zero order correlations among various pairs of variables will be examined. In Part II, a multiple correlation equation will reveal the ability of the four selected export base variables to jointly explain variation in net migration. Partial and multiple correlation in Part III will indicate the ability of the selected ecological variables to explain variation in manufacturing growth can reduce the latter's correlation with net migration.

Since it is just a statistical technique for revealing patterns of common variance, multiple correlation cannot of course produce a causal interpretation for the observed relationships among variables. It can, however, indicate whether the theoretical framework presented in chapter I is consistent with empirical fact. The mere size of correlation coefficients likewise has no causal implications, as Braschler (1971) points out in criticizing Wendt and Varian (1970), because correlations may be spurious. A good statistical fit does not imply that a cause and effect relationship exists. There is no way of absolutely proving or disproving any theory at a single stroke, but repeated statistical analyses can shed light on the theory's strong points and inadequacies, and it is for this purpose that multiple correlation methods are used in the present study. Discussions of the

advantages and limitations of multiple correlation analysis are scattered throughout the literature. Among the significant articles are those by Cohen (1968), Gordon (1968), Blalock (1963), and Fennessey (1968).

CHAPTER III

A TEST OF THE SURPLUS WORKERS INDEX

The general hypothesis of this chapter is that existing methods of measuring an area's export base are inadequate. Pratt has already shown that one of the two major methods of measuring the export base--the minimum requirements technique--is unsatisfactory. This chapter provides an empirical test of the other major method--the location quotient, as represented by the index of surplus workers--to show that it too is inadequate. In its absolute form, the index reflects total labor force size; in its relative form, it reflects degree of specialization in the local economy, which in turn tends to be an inverse measure of population size.

As indicated previously, the method will be to correlate the index of surplus workers with net migration. If export base theory is correct, an accurate measure of the export base should be highly correlated with net migration, since a strong export base is conducive to economic growth; it creates a demand for labor which can only be filled under normal circumstances by migration of workers from other areas. If a given export base measure is not strongly correlated with net migration, one of two things is implied: (1) export base theory is invalid; (2) the measure is a poor one. In the present case, the latter explanation is much the more likely, for reasons cited in chapter I.

THE MIGRATION VARIABLE

If migration is measured over too short a time interval, it may not reflect an area's full potential for attracting migrants, since

substantial lag effects are possible. If the migration interval is too long, extraneous variables become increasingly important. Given the lack of a registration system for migration in the United States, it is not possible to determine the most probable lag interval between the build-up of economic potential and the migration response. A study in British labor mobility (Makower, Marschak, and Robinson, 1939) indicated a lag of six to eighteen months. Assuming this amount of lag, and the likelihood that economic growth would tend to be a self-sustaining process occurring over a period of years, rather than an instantaneous one, a five year migration interval seems appropriate. Unfortunately, net migration estimates are available for SMSAs only for ten year intercensal periods (United States Census Bureau, 1962), obtained by the residual method.

Five year net migration figures are available for State Economic Areas, however, from place of residence data on the 1960 census (United States Census Bureau, 1963). Persons five years of age and older are classified by place of residence in 1960 and place of residence in 1955 for each State Economic Area. This information provides a matrix of migration flows, from which net migration can be calculated. Since these data are for 1955-60, they are not directly useful, though, because export base data are available only for a census year (1950). The desired migration period is therefore 1950-55.

Since 139 SMSAs are coterminous with metropolitan State Economic Areas, it is possible to obtain estimates of net migration, 1950-55, for such SMSAs (which represent nearly two-thirds of all SMSAs) by subtracting the five year State Economic Area totals from the ten year SMSA totals. The export base can then be calculated from 1950 census data. The 139

SMSAs in this case are obtained by matching State Economic Areas with SMSAs, both as defined for the 1960 population census. (United States Bureau of the Budget, 1961; United States Bureau of the Census, 1963)

SMSAs excluded by this process include those which: (1) are located in New England, since in this area SMSAs are built up from towns while State Economic Areas are built up from counties; or (2) are located on the border of two or more contiguous states, since a state boundary divides such SMSAs into separate State Economic Areas; or (3) contain more than one State Economic Area because their area is heterogeneous economically.

As a check on the importance of the time interval, migration data are also analyzed for the 1950-60 ten year interval. This should provide insight into the degree to which selection of one specific migration interval rather than another affects the results. Also, to check on Lowry's findings concerning the high positive relationship between net migration and employment growth, a variable is included which measures each SMSA's growth in employment, 1950-60, relative to the overall growth in United States employment during that period. (United States Department of Commerce, 1965-66). Seven variables are thus included in the analysis.

OPERATIONAL HYPOTHESES

There are four specific hypotheses to be tested in this chapter:

Hypothesis 1: The absolute form of the index of surplus workers is directly proportional to total local employment.

Total local employment will be calculated as the sum of employment totals in each of eleven broad industrial categories used in labor force

data for the 1950 census. Data are reported for SMSAs by the United States Bureau of the Census (1953) for nine major industrial categories: agriculture; mining; construction; manufacturing; transportation, communications, and public utilities; wholesale and retail trade; finance, insurance, and real estate; business and personal services, excluding private households; and professional and related services. Two additional categories, entertainment and recreational services, and public administration, are aggregated from county data listed in the United States Bureau of the Census (1952). The "industry not reported" category, as well as the categories of "forestry and fisheries" and "personal services in private households," are omitted from the analysis. These categories are not readily available for SMSAs, and being small, are unlikely to significantly affect the SMSA employment structure.

Hypothesis 2: The relative form of the index of surplus workers is inversely proportional to population size.

Population size is reported in the United States Bureau of the Census (1953).

Hypothesis 3: The relative form of the index of surplus workers is unrelated to net migration.

Hypothesis 4: Net migration is directly proportional to change in employment level.

Data on employment level changes, 1950-60, are found in the Office of Business Economics (1965-66). Verification of this hypothesis confirms a relationship between net migration and general employment growth, replicating Lowry's findings. Succeeding hypotheses will link net migration specifically to measures of the community export base.

RESULTS

The zero-order correlation matrix is given in Table 1. There is a substantial correlation of .64 between the 1950 export base and net migration, 1950-55. The correlation between the export base and total local employment is .99, however. This indicates that in its absolute form the export base is so strongly affected by labor force size that it is nothing more than an alternative indicator of the latter variable, strongly confirming Hypothesis 1 that the absolute form of the index is directly proportional to total local employment. When the influence of total employment is removed by using the relative form of the index, the latter's correlation with net migration plummets to -.01, a completely random linear relationship. This finding confirms Hypothesis 3, that the relative form of the index of surplus workers is unrelated to net migration. A similar conclusion is reached for Hypothesis 3 if a ten year migration interval is used, rather than the five year one, though the initial correlation is lower (.35), due to the longer interval. Hypothesis 2, that the relative form of the index is inversely proportional to population size, is not supported by the findings, since the two have an essentially random -.09 correlation. Population size is highly correlated with total local employment (.99), and in controlling for the latter, the former is also controlled.

Total relative employment growth, 1950-60, correlates highly (.93) with net migration, 1950-60, confirming Lowry's results on the close relationship between employment growth and net migration, and thus confirming Hypothesis 4 as well. A summary of the above findings for the first four hypotheses is presented in Table 2.

Table 1. Simple Correlation Matrix and Basic Statistics for Part I

Variable Number[a]	Variable Number							Mean	Standard Deviation
	1	2	3	4	5	6	7		
1	1.00	-	-	-	-	-	-	28752.8	63068.5
2	.99	1.00	-	-	-	-	-	168012.6	403325.4
3	-.02	-.09	1.00	-	-	-	-	0.18	0.06
4	.99	.99	-.09	1.00	-	-	-	449584.5	1027955.4
5	.00	.04	.03	.06	1.00	-	-	14103.4	67768.1
6	.35	.38	.02	.40	.93	1.00	-	48.8	150.8
7	.64	.67	-.01	.68	.76	.93	1.00	40182.4	114677.5

[a]Variables are as follows: (1) absolute form of the index of total surplus workers, 1950; (2) total local employment, 1950; (3) relative form of the index of total surplus workers, 1950; (4) population size, 1950; (5) change in employment total, 1950-60, relative to total United States employment total; (6) net migration, 1950-60; (7) net migration, 1950-55.

Table 2. Summary of Results for Hypotheses 1 to 4

Hypothesis Number	Hypothesis Supported
1	Yes
2	No
3	Yes
4	Yes

It is evident from these findings that either economic growth potential is not an accurate predictor of migration or that the index of total surplus workers is not a suitable measure of an area's potential for economic growth. For reasons given in the next section, the latter is much the more likely explanation.

DRAWBACKS OF THE SURPLUS WORKERS INDEX

According to Mattila and Thompson's line of reasoning, the total surplus workers formula represents the number of export workers in an area's economy. There is an inherent weakness in the formula, however: for each surplus worker in a local industry, there must be a corresponding "deficient" worker in some other local industry. Overall, total surplus workers must equal total "deficient" workers, so that the formula really measures the degree of specialization (that is, the degree of deviation of the area's employment profile from the profile of the nation as a whole), rather than local export strength, for cities of roughly comparable population size. An increase in export strength (that is, an increase in surplus workers) can occur only at the expense of a decrease in self sufficiency, since the combined sum of basic and service workers must equal total local employment, th denominator of the index.

Algebraically, the requirement that total surplus workers in any area must equal deficient workers can be shown as follows, using only the assumptions that $\Sigma e_i = e_t$ and $\Sigma E_i = E_t$, with S equal to the combined total of surplus workers and "deficient" workers:

$$S = \sum \left[e_i - \frac{e_t}{E_t} E_i \right]$$

$$= \Sigma e_i - \frac{\Sigma E_i}{E_t} e_t$$

$$= e_t - \frac{\Sigma E_i}{E_t} e_t \quad \begin{matrix}(\text{since } E_t \text{ is constant for} \\ \text{all } E_i)\end{matrix}$$

$$= e_t - e_t$$

$$= 0$$

Thus, if industries with less than their pro rata share of workers ("deficient" workers) are included in the calculations, total surplus workers invariably sum to zero. Effectively, this assumes that an increase in service workers weakens the community export base, when in fact the opposite is true, as implied by the "multiplier effect."

A simple hypothetical example will illustrate the above weakness of the index. Suppose that a local economy has 5000 workers, divided into four industrial categories, as shown below, along with the corresponding figures for the hypothetical national economy:

$e_{i1} = 1200$	$E_{i1} = 40{,}000$
$e_{i2} = 200$	$E_{i2} = 130{,}000$
$e_{i3} = 3000$	$E_{i3} = 68{,}000$
$e_{i4} = 600$	$E_{i4} = 12{,}000$
$e_{i5} = 5000$	$E_t = 250{,}000$

Surplus workers in each of the four industries are as follows: $S_1 = 400$, $S_2 = -2400$, $S_3 = 1640$, and $S_4 = 360$. Total surplus workers thus equal $400 + 1640 + 360 = 2400$. Likewise, there are 2400 "deficient" workers in the local economy; in this case, they all happen to be in industry 2.

Suppose now that the local economy manages to greatly increase its production in industry 2, to the extent that 5000 new workers are attracted from other geographic areas and employment in this industry skyrockets locally from 200 to 5200. Recalculating the surplus workers

formulas gives the following totals: $S_1 = -400$, $S_2 = 0$, $S_3 = 280$, and $S_4 = 120$. Total surplus workers now equal 400, and there are 400 deficient workers. Thus a dramatic increase in industry 2 employment, which has eliminated the 2400 "deficient" workers in that industry, has actually caused the local number of total surplus workers to decrease from 2400 to 400, even though employment in all industries remained constant, except for industry 2, in which employment increased. Mathematically, this peculiar result occurred because the increase in industry 2 employment caused a corresponding increase in total local employment, so that all formulas had to be re-calculated on a new larger base. Logically, such a result challenges the validity of the location quotient as a reflection of an area's export base, since, as explained below, an increase in service workers actually tends to strengthen, not hinder, the local economy.

Pratt found the minimum requirements technique deficient from both a logical and empirical standpoint, for reasons discussed in chapter I. The present study reveals that, as a measure of the community's overall export base, the location quotient suffers from an equally severe internal contradiction: since it is based on employment totals, it assumes that an increase in service workers weakens the local export base, when in fact the opposite is true. An increase in surplus workers actually strengthens the export base, because it helps insure that export income will be spent locally rather than for imports. Export dollars only promote economic expansion to the extent that they remain in the local economy to create new jobs rather than flowing back out in the purchase of imports.

Ironically, to the extent that its assumptions of equal consumption and productivity levels throughout the economy are true, the total surplus workers index measures not only the amount of export activity but the amount of import activity as well. Since the method must logically assume that each worker in every industry is supported by a proportionate number of workers in every other industry, the absence of such workers in the local area (a high total surplus workers index) implies that they are located in some other area; hence their services must be imported. For each city, the amount of exporting consequently equals the amount of importing ("surplus" workers equal "deficient" workers), and the index of total surplus workers is meaningless as a measure of the local export strength. It appears that any measure based on employment totals, rather than dollar flows representing the value of exports and imports, is subject to this fatal flaw.

Mattila and Thompson (1955:226) found that there is much variation among major United States cities in the ratio of surplus to service workers, ranging from a low of 1:1.99 in Chicago to a high of 1:4.47 in Philadelphia. As Blumenfeld (1955:121) asks: "Are we to believe that one "basic" worker supports two "nonbasic" workers in Chicago and four and one-half in Philadelphia?" Actually, the implication is that Chicago does a great deal more exporting and importing than Philadelphia; the index of total surplus workers measures both variables. Part II of this project therefore addresses itself to an alternative means of analyzing an area's export base and linking it to migration.

CHAPTER IV

A REVISED EXPORT BASE APPROACH

Since no suitable index of an area's export base exists, and since the more complicated input-output matrix approach has not been perfected by economists, the only choice left is to find another means of assessing the community export base.

The export base will be treated here as a function of four variables: changes in governmental employment, the number of military personnel and retirees, and the level of manufacturing activity (payroll shift).[1] Increases in these variables create money income for a community, which, if spent locally, leads to a still stronger export base and an ever-expanding cycle of economic growth. The four indicators of these export base variables selected for use are: change in the number of employees in public administration, change in labor payroll, change in the number of persons over 65 years of age, and change in the number of military personnel.

PROCEDURE

A multiple correlation analysis will be carried out which will include the four independent variables and net migration. In this and the succeeding chapter, the full sample of 188 SMSAs, as defined by the Bureau of the Budget (1961) is available for use, since net migration can appropriately be measured over a full ten year interval.

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[1]In the tables reporting the results of data analysis, the underlined words will be used to refer to the corresponding variable.

One variable, size of labor payroll in 1947, has a certain amount of missing data. Payroll figures are not published for any county in which aggregate totals may reveal information concerning the operating budget of any individual manufacturing establishment. Figures for counties which are dominated by one or a small number of establishments are thus withheld from publication. Fortunately, only a handful of SMSAs are so affected. In two SMSAs, payroll information is not given for the county in which the central city of the SMSA is located. These two, Durham, North Carolina, and Lawton, Oklahoma, are omitted from the calculations, reducing the overall samplesize to 186. In four other SMSAs, Amarillo, Denver, Knoxville, and Richmond, data are withheld only for one of the peripheral counties. Rather than omit these SMSAs for lack of complete information on a single item, an estimate is made of payroll size in each of the affected counties. This estimate is based on the assumption that payroll per employee is the same in the county without published data as in the rest of the SMSA. The following formula is used:

$$\frac{\text{Employees}_X}{\text{Employees}_Y} = \frac{\text{Payroll}_X}{\text{Payroll}_Y}$$

where X refers to the entire SMSA and Y refers to the SMSA minus the county in question. Luckily, complete figures on the number of employees are published for every county with missing payroll data.

OPERATIONAL HYPOTHESES

Five hypotheses will be tested in this chapter:

Hypothesis 5[2]: Net migration is directly proportional to manufacturing growth.

[2]Hypotheses are numbered consecutively throughout the dissertation.

Manufacturing growth will be measured by change in labor payroll, 1947-58. This time period is used because the Census of Manufactures was conducted in 1947 and 1958, rather than in 1950 and 1960. Payroll data will be used because export income rather than export employment is the basis of export base theory.

Hypothesis 6: Net migration is directly proportional to increases in the number of retirees residing in the community.

Retirees will be measured in terms of the absolute number of persons 65 years or older in the SMSA in 1950, subtracted from the number in 1960. All retirement income is effectively export income, since retirees perform no local economic functions, as a group.

Extent of tourism is probably a significant export base variable, but no satisfactory census data exist for measuring it. In any event, it is likely to be highly correlated with the number of retirees, since retirees and tourists favor the same type of environment, such as Florida. Tourism will therefore not be included as a separate variable in the study.

Hypothesis 7: Net migration is directly proportional to changes in the amount of governmental activity in the community.

Governmental activity should be reflected in the number of workers employed in public administration in the community. This category includes federal, state, and local government employees involved in predominantly governmental functions, such as administrative or legislative activities. It should capture the substantial governmental growth on all levels that has been occurring in recent decades, and which has undoubtedly benefitted some areas more than others.

Hypothesis 8: Net migration is directly proportional to change in the size of the United States military establishment in the community.

Changes in this variable should be reflected by changes in the absolute number of military personnel in each SMSA, 1950 to 1960. Number of military personnel is determined by subtracting the size of the civilian labor force from the total labor force.

Hypothesis 9: Changes in the level of manufacturing payroll, government activity, military personnel, and retirees jointly account for a substantial portion of the statistical variance in net migration.

It is not to be expected that net migration can be completely explained in a statistical sense by this or any other set of variables. It is well-established that migrants move for a wide variety of reasons (for example, Lansing and Mueller, 1967), and that patterns of migration vary widely among different areas. Since most migrants must fit into the economic structure at their destination in order to remain there permanently, however, it is reasonable to expect that net migration, as opposed to gross migration, would vary to a considerable extent with those factors which govern economic growth. This hypothesis will therefore be regarded as confirmed if the above four export variables do not show excessively high correlations with each other, if each variable explains a substantial amount of net migration variance independent of the other three, and if jointly they explain statistically the majority of the net migration variance.

RESULTS

Since each of the variables except manufacturing payroll is expressed in terms of absolute numbers of persons, a sixth variable, population size of each SMSA in 1950, is included in the analysis, to determine how closely the independent variables are correlated with simple population size.

As indicated in Table 3, the simple correlation between net migration, 1950-60, and population size, 1950, for the 186 SMSAs is .42. Using Sakoda's logic, this amount of relationship is definitely too low to justify using a net migration rate as the dependent variable. The absolute amount of net migration is therefore retained as the dependent variable.

Table 3. Simple Correlation Matrix and Basic Statistics for Part II

Variable Number	Variable	1	2	3	4	5	6	Mean	Standard Deviation
1	Net Migration	1.00	-	-	-	-	-	43.4	133.6
2	Payroll Shift	.74	1.00	-	-	-	-	132562.3	299334.5
3	Retirees	.59	.88	1.00	-	-	-	14765.7	32016.0
4	Administration	.71	.71	.74	1.00	-	-	2511.1	4522.4
5	Military	.51	.33	.24	.51	1.00	-	1924.1	5395.2
6	Population	.42	.86	.96	.68	.18	1.00	441760.9	942206.2

As can also be seen in Table 3, each of the four export base variables is highly related to net migration, the correlations ranging from .51 to .74; payroll shift has the highest correlation with migration. Three of the four independent variables, payroll shift, retirees, and administration, are highly interrelated, however, with intercorrelations ranging from .71 to .78, so that each one can be expected to have only a small correlation with the migration variable independent of the other two. Likewise, each of the three is rather strongly related to population size ($r = .68$ to $.96$).

Retirees has such a strong correlation with population size (.96) that it may be regarded as nothing more than an alternative indicator of the same variable. Possibly, most of the differential increase in persons over 65 during the decade was due to population aging rather than to net migration.

The high intercorrelations among the independent variables suggest that they may be an interdependent complex rather than a set of distinguishable factors, or that each variable is actually measuring the same general phenomenon, perhaps metropolitanization. Statistically they are likely to be an ineffective combination of variables to use in a multiple correlation analysis, because of their high intercorrelations.

Proceeding nevertheless with the multiple correlation analysis, it can be seen, in Table 4, that the independent variables account for a substantial portion of the net migration variance (R^2=.68). As expected, removing any one of the variables does not cause much of a reduction in the amount of variance explained. Removing military causes the multiple correlation coefficient of determination to drop from .68 only to .66, while removing retirees or administration likewise produces only a slight drop. The effect of payroll shift is somewhat greater. Hypothesis 9 must be rejected, since this combination of variables is ineffective in jointly explaining the net migration statistical variance. Table 5 summarizes the evaluation of hypotheses.

The correlation between payroll shift and migration is an impressive .74. Previous investigations, using changes in the number of manufacturing employees or other measures to reflect manufacturing increases, have not found such a high correlation. It is possible that previous studies failed to reflect a multiplier effect, since such other measures usually involve numbers of people rather than dollar increases in local income.

Table 4. Multiple Correlation of Export Base Variables with Net Migration

Variable	Regression Coefficient	Coefficient Standard Error	Beta Weight	Partial Correlation Coefficient	R^2 Delete[a]
Intercept	-12.52929	6.42016			
Payroll Shift	.00036	.00004	.81	.55	.55
Retirees	-.00190	.00041	-.45	-.32	.65
Administration	.01140	.00212	.39	.37	.63
Military	.00369	.00126	.15	.21	.67
		$R = .83$	$R^2 = .68$		

[a]Final column represents the value that R^2 would assume if the variable listed in the corresponding row were deleted from the analysis. The addition of each variable except military is statistically significant to at least the .01 level, according to an F test of significance. (Draper and Smith, 1966:67-69).

Table 5. Sum of Results for Hypotheses 5 to 9

Hypothesis	Variable	Simple Correlation Coefficient	Hypothesis Supported
5	Payroll Shift	.74	Yes
6	Retirees	.59	Yes
7	Administration	.71	Yes
8	Military	.51	Yes
9	Combined Relationship		No

In summary, Hypotheses 5 through 8, concerning the relationship of each of the four independent variables to the dependent variable, are all individually confirmed. Hypothesis 9, concerning their effectiveness as joint predictors, is rejected. The practical and theoretical implications are less clear-cut, as will be discussed in the following section.

DISCUSSION

The high correlation between migration and the manufacturing variable suggests that the latter may be a good measure of the export base. It is reasonable to argue that a causal link exists between these two variables. Given the capital intensive nature of most types of manufacturing, and the resulting inability to respond to population shifts in a short period of time, it is probable that manufacturing growth acts predominantly as a cause, rather than an effect, of migration in any causal relationship.

Based upon the findings of the present chapter, the manufacturing variable is the best single predictor of net migration. Not only does it have the highest correlation, but the manufacturing industry employs many more persons in SMSAs than either public administration or the military establishment, so that manufacturing shifts are likely to have a stronger impact upon the local economy, and ultimately upon migration patterns. The impact of retirees and tourists is also likely to be less than that of manufacturing, except in special cases such as Saint Petersburg.

From the high correlations among all of the independent variables, except the one reflecting changes in the military establishment, with

population size, it is evident that the largest increases in manufacturing, the number of elderly persons, and of governmental employees in public administration, all occurred in large population centers during the decade of the 1950s. Net migration was generally greatest in large cities as well, and it is possible that the relationship between the independent variables and the dependent variable is to an extent just an artifact of population size. Manufacturing payroll, for example, may have increased in large cities primarily because of unionized wage increases and inflationary pressures, which are usually greatest in large cities, while the net-inflow of migrants was due to the appeal of large cities or other factors. In any event, a thorough analysis of the ecological factors associated with manufacturing changes and with differential net migration may help clarify these questions. This will be done in the next chapter.

CHAPTER V

ECOLOGICAL FACTORS ASSOCIATED WITH MANUFACTURING SHIFTS

The fact that the manufacturing variable correlates highly with net migration lends some support to a "pull" theory of migration based upon differential growth of economic opportunities. Such opportunities presumably arise in response to the potential for economic development, which in turn is produced by a strong export base. Expansion of industry in a given area creates new jobs in manufacturing; the income derived from such jobs that is spent in the local economy creates further economic growth and additional jobs in the service sector.

It is hypothesized that in the United States in recent decades industry has expanded primarily through a national decentralization of already-existing industries. Decentralization of productive facilities may minimize distribution costs for those companies selling in a national market, since there is presumably a point beyond which a division of labor in one location has sharply diminishing returns.

The ecological characteristics of a region which make it attractive for industrial expansion are probably many and varied. Seven specific ecological factors, derived from the theoretical framework of chapter I, will be evaluated in the present chapter in terms of their statistical relationship to manufacturing growth or decline. They are: population size, distance to nearest larger SMSA, population potential, amount of employment in service industries, climate, population density, and median income. The logic behind the selection of these variables involves the general hypothesis that these factors indirectly promote a

high degree of net in-migration, by attracting industry. Job openings in manufacturing and in an expanding service sector in turn attract migrants.

The same sample of 186 SMSAs used in chapter IV are again used in the present analysis, with the same adjustments made to the 1947 payroll data.

OPERATIONAL HYPOTHESES

Seven remaining hypotheses will be tested in this chapter, according to the logic of the industrial mobility scheme presented in chapter I.

Hypothesis 10: Manufacturing payroll growth is directly proportional to the distance to nearest larger SMSA.

Industry should be attracted to areas isolated from other centers of industrial production. Distance is measured in terms of airline miles between SMSAs (United States Department of Commerce, 1961).

Hypothesis 11: Manufacturing payroll growth is directly proportional to population size.

Larger cities have a greater market for the products of industry.

Hypothesis 12: Manufacturing payroll growth is inversely proportional to population potential. Industry is presumably decentralizing away from the high population potential areas of the northeastern regions.

Population potential is a measure of the distribution of population over territory in relation to a given point. As Duncan (1957:367) interprets the measure: "If potential at L_o figures out at 350,000, this means that, 'on the average,' a person at L_o is within a mile of 350,000 other persons." For the United States in 1950, the measure is essentially an indicator of regional location, with low values in the south and west.

Hypothesis 13: Manufacturing payroll growth is inversely proportional to median income. The relationship is expected to be an inverse

one because of the argument that industrial mobility is toward areas of low labor costs, so these are the areas with employment opportunities.

Median income is for families in 1949, as given in the United States Bureau of the Census (1953).

Hypothesis 14: Payroll growth is directly proportional to climate.

The climate index will be an adaptation of a measure used by Karp and Kelly (1971:24-26): mean January temperature divided by mean July temperature. Presumably people (and industries) seek moderate temperatures, in the form of cool summers and warm winters.

Hypothesis 15: Manufacturing payroll growth is directly proportional to percentage employment in service industries. Industries may be expected to move toward areas where large manufacturing concentrations are not already in existence.

This variable is measured as a residual category which includes all activities other than resource-extracting activities and manufacturing.

Hypothesis 16: Manufacturing payroll growth is inversely proportional to population density. Areas with ample room for large new physical plants for industry should attract more industry.

RESULTS

The zero-order correlation matrix is contained in Table 6. Only population size and distance show a high correlation with manufacturing payroll shifts (.86 and .73, respectively). Of the remaining five independent variables, just two are significantly related to payroll shift, and these, population density and median income, have correlations too low (.26 and .29) to have practical significance. Moreover, they are in the opposite

direction to the one hypothesized. Statistically, four of the seven hypotheses in this chapter are thus confirmed (Table 7), but most of the explained variance in payroll shift is accounted for by population size and distance, as will be seen below. Moreover, the latter two concepts have a rather high intercorrelation (.82), so they are likely to be an ineffective combination to use as independent variables in a multiple correlation equation. Their high intercorrelation is to be expected, since a large population size implies that one must generally travel a greater distance to find an even larger one.

Table 6. Simple Correlation Matrix for Ecological Variables and Net Migration

Variable Number	Variable	Variable Number 1	2	3	4	5	6	7	8	9
1	Population	1.00								
2	Distance	.82	1.00							
3	Potential	.20	.09	1.00						
4	Services	-.03	.18	-.62	1.00					
5	Climate	.00	.12	-.43	.42	1.00				
6	Density	.34	.20	.31	-.10	-.06	1.00			
7	Median Income	.26	.12	.19	-.21	-.47	.18	1.00		
8	Payroll Shift	.86	.73	.13	-.07	.06	.26	.29	1.00	
9	Net Migration	.42	.51	-.21	.16	.35	.00	.15	.74	1.00

The final row of the Table 6 matrix indicates that the relationship of each variable to net migration cannot be predicted by knowledge of its relationship to payroll shift shown in the row immediately above. Three of the seven ecological variables (population potential, services,

Table 7. Basic Statistics and Summary of Results for Hypotheses 10 to 16, Concerning Relationships of Ecological Variables to Manufacturing Payroll Shifts.

Ecological Variable	Mean	Standard Deviation	Hypothesis	Simple Correlation Coefficient	Hypothesis Supported
Distance	138.8	270.6	10	.73	Yes
Population	441760.9	942206.2	11	.86	Yes
Potential	312.2	121.4	12	.13	No
Income	3198.1	511.9	13	.29	No
Climate	0.47	0.14	14	.06	No
Services	68.5	12.4	15	-.07	No
Density	423.8	1132.0	16	.26	No

and climate) have a stronger relationship to net migration than to payroll shift. Climate in particular shows a fairly substantial (.35) correlation with net migration and a random (.06) linear correlation with payroll shift. This pattern of relationships clashes with the theoretical framework of the study, which hypothesizes that each of the seven ecological variables influences net migration primarily through its effect upon manufacturing growth; in such a case, the correlation of each of the variables with payroll shift should be higher than its correlation with net migration. The relatively high correlation of climate with net migration lends support rather to a non-manufacturing growth theory. The relation of population size and distance to net migration is as expected; the correlations are high (.42 and .51), but lower than their correlations with payroll shift. In the case of population and payroll shift, there appears to be a multicollinearity problem. The latter two variables do have a clearly distinguishable relation to net migration, however.

The multiple correlation analysis in Table 8 shows that the seven ecological variables jointly account for a substantial 77% of the payroll shift variance, but as Table 9 shows, these same variables account for only 43% of the net migration variance, unless payroll shift is included as an independent variable. The higher correlation of the ecological variables with payroll shift than with net migration is as expected. However, the partial correlation between the latter two variables is a very high .86, implying that there is a substantial relation between these two variables that is left unexplained by the seven ecological variables.

Additional Multiple Correlation Analyses

As indicated above, several of the ecological variables do not have a significant relationship to payroll shift, and inclusion of them

Table 8. Multiple Correlation Analysis of Seven Ecological Variables with Payroll Shift.

Variable	Regression Coefficient	Coefficient Standard Error	Beta Weight	Partial Correlation Coefficient	R^2 Delete
Intercept	-97805.99	157439.40			
Climate	305188.95	99721.67	.14	.22	.76
Potential	-117.45	139.19	-.05	-.07	.77
Distance	138.95	77.87	.13	.13	.77
Median Income	75.12	25.43	.13	.21	.76
Population	0.24	0.02	.74	.60	.64
Density	-8.08	10.55	-.03	-.06	.77
Services	-3446.68	1149.72	-.14	-.22	.76

$R = .88$ $R^2 = .77$

Table 9. Multiple Correlation Analysis of Seven Ecological Variables and Payroll Shift with Net Migration

Variable	Regression Coefficient	Coefficient Standard Error	Beta Weight	Partial Correlation Coefficient	R^2 Delete
Intercept	-291.511	56.988			
Climate	246.554	36.993	.26	.45	.81
Potential	-0.013	0.048	-.01	-.02	.85
Distance	0.119	0.028	.24	.30	.84
Median Income	0.037	0.009	.14	.28	.84
Population	0.00013	0.00001	-.95	-.69	.72
Density	-0.008	0.004	-.07	-.16	.85
Services	1.046	0.426	.10	.18	.85
Payroll Shift	0.00060	0.00002	1.35	.86	.43

$R = .92$ $R^2 = .85$

in the multiple correlation equation probably distorts the correlations of the remaining variables, or at least adds nothing to the equation. The analysis is therefore redone, using only those variables which are both substantively and statistically significant. This includes just population size and distance, since these are the only two ecological variables whose relationship to manufacturing shifts is both statistically significant and sufficiently high to warrant further examination.

These two variables explaining 74% of the variance in payroll shift (Table 10), but it is population size which contributes substantially more to the explained variance of payroll shift. The partial between the latter two variables is .66, while the partial between distance and payroll shift is only .11. It may therefore be concluded that the combination of ecological variables chosen for this investigation does not support the theoretical structure presented; population size alone statistically explains about as much of the variance in payroll shift as any combination of the variables. This, of course, provides no basis for drawing conclusions about the causal relationships among the variables, since the particular choice of variables to be included in the analysis strongly influences the pattern of observed partial correlations. Moreover, the ecological variables are rather highly intercorrelated, and as Gordon (1968) shows, the sizes and patterns of correlations among the independent variables affect their relationship to the independent variable.

As shown in Table 11, population size and distance are much less effective in explaining the variance of net migration than in explaining the variance of payroll shift (26% versus 74%); in addition, distance has the higher correlation (.32) to net migration. With distance, held constant, population has a perfectly random relation to net migration.

Table 10. Multiple Correlation Analysis of Population Size and Distance with Manufacturing Shifts

Variable	Regression Coefficient	Coefficient Standard Error	Beta Weight	Partial Correlation Coefficient	R^2 Delete
Intercept	3049.88[a]	12596.82			
Distance	104.97[a]	71.56	.09	.11	.74
Population	0.29	0.02	.78	.66	.54
	R = .86	R^2 = .74			

[a]Coefficient not statistically significant.

Table 11. Multiple Correlation Analysis of Population Size and Distance with Net Migration

Variable	Regression Coefficient	Coefficient Standard Error	Beta Weight	Partial Correlation Coefficient	R^2 Delete
Intercept	8.55[a]	9.57			
Distance	0.25	0.05	.50	.32	.17
Population	0.0000012[a]	0.000015	.01	.01	.26
	R = .51	R^2 = .26			

[a]Coefficient not statistically significant.

The fact that population size and distance explain less of the variance in net migration than in payroll shift is to be expected in terms of the present theoretical framework, which hypothesizes that these variables exert their influence on migration through their ability to attract industry. The size of the difference, however, suggests that the model is incomplete or incorrect. The results imply that other ecological factors, not included in the analysis, are important in promoting manufacturing growth, as it relates to migration. This is suggested by the figures in Table 12, which contains the multiple correlation analysis of population size, distance, and payroll shift with net migration. The inclusion of distance and population in the calculations should sharply reduce the first order correlation of payroll shift with net migration. Instead, the correlation actually rises, to .83; with payroll shift held constant, population size shows a strong negative relationship to net migration. Apart from their function as centers of economic opportunity, as reflected in manufacturing payroll growth, larger cities apparently tended to repel migrants rather than attract them. This may be due to an amenities factor, combined with societal affluence: cities in the 1950s were well recognized as centers of congestion, crime, and pollution. At the same time, many persons were taking increasing advantage of social security and retirement plans to settle away from the larger cities.

The final column of Table 12 implies that distance contributes only a modest amount to the multiple correlation of these variables with net migration. With distance removed, population size and payroll shift still have an R^2 of .73 with net migration, while with population size removed, R^2 drops to .55, and with payroll shift removed, it plummets to .26.

The latter two variables alone account for a remarkably large proportion of the overall net migration variance (73%), compared to previous studies. Watson's (1959) four independent variables (economic structure, SMSA maturity, ecological location, and amount of economic opportunity) could jointly explain only 49% of the net migration variance, and other studies have seldom accounted for more net migration variance. Net migration is apparently a complex variable that has traditionally not correlated highly with gross social and economic variables. The multiple correlation results of payroll shift and population with net migration is given in Table 13.

As previously revealed by Table 7, climate and net migration have a substantial intercorrelation, but climate does not correlate highly with payroll shift. Climate is therefore included in a final multiple correlation analysis, along with population size and manufacturing. As shown in Table 14, these variables statistically account for a full 80% of the net migration variance. Like population size, therefore, climate makes a substantial contribution to the variance of net migration, independent of its relation to payroll shift.

Effects of Wage Inflation

The last finding of the investigation concerns the relationship of a large initial payroll to subsequent manufacturing payroll increases and to net migration. In using aggregate payroll in dollars as an indicator of industrial mobility, there is the danger that inflation and unionized wage increases may produce substantial increases in payroll that are not actually due to manufacturing mobility or growth. Those SMSAs with a large initial payroll would show the largest such inflationary increases, and this factor could conceivably distort the

Table 12. Multiple Correlation Analysis of Distance, Population Size, and Payroll Shift with Net Migration

Variable	Regression Coefficient	Coefficient Standard Error	Beta Weight	Partial Correlation Coefficient	R^2 Delete[b]
Intercept	3.45638[a]	5.319966			
Distance	0.18069	0.030364	.37	.40	.73
Population	-0.00016	0.000012	-1.10	-.71	.55
Payroll Shift	0.00063	0.000031	1.42	.83	.26
	$R = .88$	$R^2 = .77$			

[a]Coefficient not statistically significant.
[b]Increments to R^2 significant for each variable at .01 level or greater (See Table 4, Footnote a).

Table 13. Multiple Correlation Analysis of Population Size and Payroll Shift with Net Migration

Variable	Regression Coefficient	Coefficient Standard Error	Beta Weight	Partial Correlation Coefficient	R^2 Delete[b]
Intercept	9.60764[a]	5.688116			
Population	-0.00012	0.000011	-.84	-.63	.54
Payroll Shift	0.00065	0.000034	1.46	.82	.17
	$R = .85$	$R^2 = .73$			

[a]Coefficient not statistically significant.
[b]Increments to R^2 significant for both variables at .001 level or greater (See Table 4, Footnote a).

analysis. This possibility is enhanced by the finding that payroll in 1947 correlates .95 with population size, 1950, and .81 with change in labor payroll, 1947-58. However, payroll in 1947 correlates only .29 with net migration, in contrast to the correlation of .74 between payroll shift and net migration. This suggests that the strong statistical relationship between payroll shift and net migration may be due to real shifts in manufacturing, rather than simply to inflation and similar factors. Indeed, with payroll shift, the other independent variable, held constant, payroll in 1947 has a negative relationship (-.78) to net migration, as shown in Table 15, while payroll shift retains its high partial of .90.

DISCUSSION

Though the export base approach to migration analysis undertaken in this investigation appears promising, the present attempt to find community ecological correlates of the export base must be regarded as largely unsuccessful. Either mobility decisions are made independently of ecological characteristics at the destination, or else the important ecological characteristics are not included in the present study. In any event, the results do not support the theory of industrial mobility presented in chapter I. Only three ecological variables, population size, distance, and climate, have substantial correlations with net migration, and these correlations are largely independent of the relationship between manufacturing and net migration. If a cause and effect relationship among climate, distance, population size, and net migration exists, it is apparently independent of any local attraction for industry. It may be that a warm climate contributes in unexamined ways to an area's export base, such as by attracting tourists, who can

Table 14. Multiple Correlation Analysis of Climate, Population, and Manufacturing Payroll Shifts with Net Migration

Variable	Regression Coefficient	Coefficient Standard Error	Beta Weight	Partial Correlation Coefficient	R^2 Delete[a]
Intercept	-109.52489	15,8630310			
Climate	254.73440	32.2450034	.27	.51	.73
Population	-0.00011	0.0000093	-.79	-.67	.64
Payroll Shift	0.00063	0.0000294	1.40	.84	.29
		R = .89	R^2 = .80		

[a]Increments to R^2 significant for each variable at .001 level or greater (See Table 4, Footnote a).

Table 15. Multiple Correlation Analysis of Manufacturing Payroll 1947 and Manufacturing Payroll Shifts with Net Migration

Variable	Regression Coefficient	Coefficient Standard Error	Beta Weight	Partial Correlation Coefficient	R^2 Delete
Intercept	4.83619	4.58635			
Payroll 47	-.00032	.00001	-.89	-.78	.54
Pay Shift	.00064	.00002	1.45	.90	.08
		R = .91	R^2 = .82		

expand an area's service industry, or by attracting "footloose" service industries like research and development firms.

The effect of population size, which is negative with payroll shift held constant, may be due to an amenities factor in which migrants avoid the congestion and inconvenience of the larger cities when possible. Distance has a pattern of correlations similar to population size, but weaker. Distance is a mixed measure of population size and metropolitan dominance, and these two aspects of the distance measure may exert opposing tendencies. Long distance migrants usually have a main population center as their destination, while the amenities factor referred to in the previous paragraph may encourage migrants more generally to avoid large cities.

Median income, population density, and population potential may have mixed effects in attracting industry. An area with low median income, for example, might appeal to industry in terms of low potential production costs, but be undesirable from the standpoint of distribution costs, since areas with low median income are generally remote from the largest population centers. A similar argument would apply to the lack of significant findings for population potential. The population density variable depends to a large extent on the amount of outlying rural territory included in a given SMSA, and this may make it a completely arbitrary and unreliable variable; some SMSAs, especially in western states, include enormous stretches of rural territory, while others extend only a short distance beyond the urbanized area.

The low correlation of percent employment in services with net migration and manufacturing shifts is more difficult to explain, since high service employment is a characteristic of both large cities and

southern and western states, all areas of expected attractiveness for industry. Industry is supposedly decentralizing away from the large cities of the northeast, so this variable too probably has mixed effects.

It must be concluded that the variables used in the present investigation are excessively crude indicators for the most part, and they may blur any important relationships that do exist; furthermore, some are susceptible to multiple interpretations. This is a common problem with census data used for research. In any event, the theoretical structure of Part III of the dissertation is not supported.

On the positive side, three ecological variables are remarkably effective in predicting net migration. These variables, which are largely independent of the migration process, are capable, in the present instance at least, of predicting much more variance in net migration than are ecological measures used in previous studies. They have a correlation with net migration in combination that is not a great deal lower than the one found by Lowry for "change in employment level," a much more causally ambiguous and hard-to-interpret variable. The Table 14 multiple regression equation thus predicts 80% of the net migration variance among SMSAs, 1950-60. The same equation, expressed in different terms, implies that an increase of .01 in the climate index is associated with an increase of 2500 in net migration; an increase of ten thousand dollars in manufacturing payroll is associated with an increase of six in net migration; and a decrease of ten in population size is associated with an increase of one in net migration. SMSAs most likely to attract large numbers of migrants during the decade were ones which were small in size, able to attract new industry, and located in a warm climate.

CHAPTER VI

SUMMARY AND EVALUATION

In a discussion of multiple correlation techniques, Guttman (1941:292) once pointed out that: "There is nothing in the statistical theory of prediction as such that warrants any interpretations of the effect of one or more variates on one or more other variates in any type of regression, be it multiple, partial, or other." It is well to bear this comment in mind in drawing theoretical conclusions from the present study. No theory has been either proven or disproven; the results are merely consistent with certain theoretical interpretations and not with others.

Another point that it is well to remember is that the investigation analyzed census data for a period during which there were general increases in most of the indicators used. National population size and urban population size were steadily increasing, inflation was occurring, more persons were being employed in service activities, and so forth. These influences alone were enough to insure positive correlations among many of the variables, so the mere fact that a relationship is statistically significant does not mean that it has practical significance. The question of practical significance is a matter of individual judgment by the researcher and the reader. For this reason, and even more importantly, for the reason cited in the ensuing paragraph, no significance tests were performed in connection with the present investigation.

Statistical significance tests were not appropriate in the present investigation, because, with minor exceptions, the complete universe of SMSAs was used in the analysis, rather than a sample. Such tests might have been included for the benefit of those who feel that worthwhile conclusions can be drawn from them, such as in the case of their being a sample from an infinite hypothetical universe. The author agrees with most of the criticisms voiced in the volume by Morrison and Henkel (1970), however, and felt that their inclusion was inappropriate.

CONCLUSIONS

Remembering these caveats and problems of inference, the major conclusions of the investigation may be summarized as follows:

1. For most purposes, present export base methodology is deficient. The index of total surplus workers, like the minimum requirements technique, is unsatisfactory as a reflection of the overall community export base.

2. An alternative approach to export base measurement, based upon the measurement of differential manufacturing growth, is very promising.

3. Net migration analysis based upon the use of a "multiplier effect," in conjunction with an export base theoretical framework, is likewise promising. This is implied by the superiority of changes in labor payroll, compared to measures of the number of manufacturing employees used in previous studies, in predicting net migration.

4. The theory of industrial mobility presented in the present investigation is not supported. Community ecological characteristics statistically explaining the high correlation between change in labor payroll and net migration could not be found. Mobility choices are

either: (a) unrelated to ecological characteristics of the proposed destination; (b) governed by ecological considerations not included in the present study; or (c) too complex or variable to be detected by the rather gross indicators used herein.

5. In spite of the absence of theoretical support for the proposed theory of industrial mobility, ecological factors theoretically and operationally independent of the migration process were found capable of statistically explaining a large proportion of net migration variance. The three factors of climate, population size, and change in labor payroll for manufacturing had a multiple correlation of .89 with net migration.

Generally then, an evaluation of the results of the study leads one to conclude that while present export base methodology is inadequate, the alternate scheme proposed herein for measuring the export base and linking it to net migration is in some manner deficient as well. The hypothesized high correlation was found between change in labor payroll and net migration, strongly supporting an export base theoretical framework, but the combination of community ecological variables could not be unearthed which would statistically explain the majority of variance in both net migration and change in labor payroll. Some possible explanations for this are mentioned above. It is possible that a different choice of variables and operational definitions would produce a better reflection of the export base and provide clearer insight into the nature of the economic growth process.

Since change in labor payroll was highly related to net migration, it appears that manufacturing growth may indeed act as an initiator of economic growth, and that an analysis of other local or regional characteristics may lead to a better understanding of the factors which attract

industry and lead to a self-sustaining growth cycle.

Of course this process, even if better defined and understood, could be restricted to a particular stage of economic development. The same technological breakthroughs which have led to an ever-increasing percentage of the labor force into tertiary sector employment may eventually reduce the significance of the secondary sector to such an extent that an entirely new pattern of growth dynamics will emerge.

On the whole, the findings of the study indicate that an export base approach to analysis may be fruitful in future research in accounting for patterns of population growth due to net migration. It seems likely that manufacturing growth is intimately linked to migration; further analysis of ecological factors potentially leading to industrial differential growth is definitely warranted.

FUTURE RESEARCH POSSIBILITIES

Further constructive research could take any of several directions. Since it is not presently clear what ecological variables contribute to industrial mobility, a case study of one or several SMSAs with differing migration patterns would undoubtedly help to indicate what factors are important in attracting industry and producing a large amount of migration. For example, a detailed comparative analysis of a half dozen SMSAs with high, medium, and low amounts of migration, focusing upon ecological structure and the degree and type of industrial expansion, would be beneficial. Of course there is the unavoidable problem in such studies that case studies are of questionable generality, but they can help one to get insights and a better grasp of underlying processes.

A second avenue of future research would be to obtain information from industrial executives on why they relocate in one community rather than another. This type of study could provide direct clues concerning the ecological variables considered important by those making the actual mobility decisions. Unfortunately, such studies are fraught with methodological problems. In particular, there is an apparent tendency for executives to give "socially desirable" responses on questionnaires inquiring about such moves, such as lower production costs, when the executives may have other private reasons for choosing a particular area, such as a good school system or other amenities. Power relationships may be at least as relevant as ecological ones.

A third possibly helpful type of research would be an analysis of local dollar flows, such as the economists' input-output matrix method, to get a clearer notion of what types of investment and what types of economic structure lead consistently to economic growth and high rates of net migration. This kind of analysis can be very informative, though it tends to be extremely expensive. The only thorough study of this type known to the writer was done by Fortune (1936) magazine for the city of Oskaloosa, Iowa.

Other comparative studies similar to the present investigation, testing a wider array of ecological variables for their association with differential manufacturing growth and net migration, would be constructive. There is still a relative dearth of such investigations, as there was thirteen years ago when Watson (1959:19) commented:

> Thus, it is clear that both case studies and comparative studies are required, the former to provide depth and the latter broad scope. To date there have been many excellent case studies but practically none of the other variety, and the urgent need for comparative studies of metropolitan migration remains.

A particularly useful type of comparative study would be one which breaks migration into its components of in-migration and out-migration, according to Duncan's (1966) suggestions. This could not be done in the present study for lack of data, but as mentioned previously, the factors influencing in-migration may differ considerably from those influencing out-migration. It may therefore be an improvement in methodology to analyze migration in terms of its component parts. This may soon be possible as a result of continuing census improvements; census data for SMSAs in particular is being gathered in greater detail.

A final research strategy which would perhaps be the most effective of all would be to overcome census data limitations by gathering data specifically on the variables desired through a separate survey. One example of such an improved strategy is that of Taeuber (1967) in his"residential histories" approach to migration measurement, which links an ecological analysis to actual movements of individuals, rather than merely inferring individual movement patterns from gross census totals.

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