DETERMINANTS OF METROPOLITAN NET-MIGRATION 1970-1975

by

Karl Melton

B. S., Kansas State University, 1976

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF ARTS

Department of Geography

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1978

Approved by:

Major Professor

ACKNOWLEDGMENTS

The writer acknowledges, with much appreciation, the friendship and support of the entire faculty of the geography department at Kansas State University. An extended appreciation of friendship goes to his graduate colleagues for making his education a personal and memorable experience.

To Dr. Stephen White, he expresses gratitude for his support and patience in the guidance of writing this thesis. He is grateful to the members of his thesis committee, Dr. Stover and Dr. Bussing for their assistance. Special thanks also goes to Sy Seyler for his concerned guidance as a graduate advisor.

Finally, he acknowledges his wife Peggy for her unending love, understanding and dedication toward a small goal in their life.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION AND BACKGROUND

This thesis is concerned with metropolitan net-migration. Specifically the study examines associations between various metropolitan characteristics and net-migration rates for 100 Standard Metropolitan Statistical Areas (SMSAs) in the United States (Appendix A). These metropolitan characteristics include social, economic, demographic, environmental and locational attributes and are viewed as determinants of metropolitan net-migration. The need for the present study stems from the fact that over seventy percent of the American population now reside in metropolitan areas and that historical concentration of the population has resulted in a dominant inter-metropolitan migration pattern. More importantly, a review of the literature reveals the lack of comprehensive migration analyses dealing with a wide range of both origin and destination characteristics. Past association analyses contain conflicting conclusions about the role of various metropolitan characteristics as determinants of migration rates. In light of previous studies, this thesis should contribute to the understanding of the migratory process.

Background

Metropolitan Growth

The most consistent trend in the redistribution of the American population is an increasing concentration of the population into metropolitan areas. This trend has continued to the point that over seventy percent of Americans live in metropolitan areas. The number of metropolitan areas has been increasing due to the growth of urban areas; as more urban places grow they meet definition requirements and are thus designated as "metropolitan". Likewise, as existing SMSAs grow, surrounding counties which accommodate that growth must be classified as metropolitan. Consequently, the SMSA can be used to demonstrate the consistent growth of the metropolitan population in America.[1]

In 1960, there were 212 SMSAs which contained fifty-six percent of the American population. By 1970 thirty-one more SMSAs were defined making the total number 243 which included sixty-five percent of the total population. In 1975 another thirty-three areas were included increasing the number of metropolitan areas to 276.[2] Studies involving metropolitan areas are examining the largest concentrations of populations and economic activity in the United States. Of more direct importance is the effect that the concentration of the American population has had upon changing the American migration patterns.

Changing Migration Patterns

Before 1940 the predominant form of migration in the United States was a rural-to-urban flow pattern. The transformation of the American way

1. Goheen, G. P., "Metropolitan Area Definition: A Re-evaluation of Concept and Statistical Practice." Internal Structure of the City, Edited by Bourne, L., (London: Oxford University Press, 1971), pp. 48-49.

2. Yeates, M., and C. Garner, The North American City, (New York: Harper and Row, 1976), pp. 34-35; Statistical Policy Division, Standard Metropolitan Statistical Areas, 1975, Office of Budget and Management, Washington, D.C. p. IV.

of life from agrarian to industrial was accompanied by a population increase through in-migration to urban areas and a consequential decrease in rural population growth rates through out-migration. Since this period, the concentration of the American population into SMSAs has brought about a different dominant migration pattern. Inter-metropolitan migration has replaced the rural-to-urban movement as the leading form of migration in the United States since the pre-World War II years.[3] Residential movement between SMSAs is now the modal form of macroscopic migration. As Adams notes, "...77 percent of the inter-county movers in 1960 were metropolitanites...".[4] The need to study metropolitan populations and their migrations results partially from two facts; (1) the American population is predominantly metropolitan and (2) the movement of the American population is largely within an inter-metropolitan lattice.

Previous Metropolitan Migration Research

Past research concerning metropolitan migration has been conducted by persons in a wide range of disciplines including geography, sociology, demography and economics. The following four points have been suggested in past research findings and are central to this thesis: (1) There exists a wide variability in both the magnitude and direction of migration flows between SMSAs;[5] (2) This variation in migration is accompanied by a

3. Adams, R., "U.S. Metropolitan Migration: Dimensions and Predictability", Proceedings of the Association of American Geographers, Volume 1, (July, 1969), p. 1; Wolpert, J., "Distance and Directional Bias in Inter-Urban Migration Streams", Annals of the Association of American Geographers, Volume 57, No. 3 (September, 1976), p. 615.

4. Adams, R., op cit., Footnote 3.

5. Greenwood, M. J., and D. Sweetland, "The Determinants of Migration Between Standard Metropolitan Statistical Areas", Demography, Volume 9, No. 2, (May, 1972), p. 666; Adams, R., op cit., Footnote 3; Galle and Williams, "Metropolitan Migration Efficiency". Demography, Volume 9, No. 4, (November, 1972), p. 657; Wolpert, J., op cit., Footnote 3, p. 612.

variation in the economic, social, demographic, environmental and locational characteristics of the urban areas;[6] (3) These characteristics of metropolitan areas are assumed to be associated determinants or predictors of the SMSAs' migration rates[7] and; (4) Future research concerning metropolitan migration should attempt to account for the variability of net-migration rates in terms of independent factors such as metropolitan characteristics.[8]

Regional differentiation of net-migration for SMSAs is often recognized in past research. A sociological study by Galle and Williams notes regional variations in metropolitan migration efficiencies ranging from -9.7 percent in the northeast to 19.6 percent in the west.[9] One conclusion of this study is that, "Region was found to have a major effect." A geographic study by Adams reveals that, "Regional variation of inter-metropolitan flows reflects greater numbers and closer spacing of eastern centers; but southern and western SMSAs generally have higher rates of

6. Roseman, C., and R. Groop, "A Geographic Analysis of Metropolitan Outmigration", Paper for the annual meetings, Midcontinent Regional Science Association, Manhattan, Kansas, (May 6, 1977), p. 1; Adams, R., op cit., Footnote p. 6; Greenwood, M. J., and D. Sweetland, op cit., Footnote 5, p. 672; Galle and Williams, op cit., Footnote 5.

7. Blevins, A. L., "Migration Rates in Twelve Southern Metropolitan Areas: A "Push-Pull" Analysis", Social Science Quarterly, Volume 50, No. 2, (September, 1969), p. 338; Brown, C., and J. Odland, and R. Golledge, "Migration, Functional Distance, and the Urban Hierarchy", Economic Geography, Volume 46, No. 3, (July, 1970), p. 472; Galle and Williams, op cit., Footnote 5.

8. Adams, R., op cit., Footnote 3; Brown, C., and J. Odland, and R. Golledge, op cit., Footnote 7; Galle and Williams, op cit., Footnote 5.

9. Galle and Williams, op cit., Footnote 5: The migration efficiency is the ratio defined by the net-migration rate divided by the total number of moves to and from that area, or

$$\text{Efficiency} = \frac{\text{net-migration rate}}{\text{total moves}} \times 100\%$$

migration, both in and out, despite their greater spatial separation."[10] Economists Greenwood and Sweetland conclude in their migration research that "A high degree of regionality is apparent...".[11] Last, Wolpert shows that metropolitan out-flow is more skewed toward the west than is the in-flow.[12] A specific consistency in this regional pattern of migration flows, is the identification of the northeastern SMSAs as places of out-migration, or origin regions, and the south and west as regions of in-migration, or destination regions. These studies, taken as a whole, show that various authors have observed regional variation in metropolitan migration rates.

Previous studies have also stressed that the variation of migration rates is accompanied by variability of the characteristics of origin and destination SMSAs. The characteristics are often viewed as the influencing factors in migration rates. Such urban characteristics as climate, socio-economic status, and population composition have each been found to be significantly associated with migration rates. Although the degrees of associations often vary from study to study, the use of such variables in explaining migration is rather common. The justification for the use of metropolitan characteristics is consistent with assumptions of models that abstract individual decisions to migrate. The individual is viewed as a potential migrant faced with an array of alternative destinations including the present location. This idea is related to the present research in that it is assumed that SMSAs vary markedly in their characteristics and that these factors will influence aggregate migration behavior as expressed in net-migration rates.

10. Adams, R., op cit., Footnote 3

11. Greenwood, M. J. and D. Sweetland, op cit., Footnote 5.

12. Wolpert, J., op cit., Footnote 3.

The recognition of the covariation of SMSA characteristics and their migration rates, has led to the use of the characteristics as determinants or predictors of metropolitan migration rates. Adams in his study of metropolitan migration predictability used twenty-one characteristics to show a generalized hierarchy of determinants.[13] Greenwood and Sweetland used such characteristics as distance, climate, income and government expenditures as their determinants of migration rates.[14] Finally, Galle and Williams conclude in their research on migration efficiency that place-characteristics are more consistent from region to region than variables that describe characteristics of the migrants.[15] Except for the goal of explaining migration differences, there is usually an inconsistency between studies as to the amount and type of characteristics used to explain migration. Often, because of these inconsistencies, the results and conclusions among studies have suggested that more systematic research will reveal certain characteristics of metropolitan areas as being more closely related to the migration experience.[16] Thus, future research using a wide range of characteristics is necessary for a greater understanding of metropolitan migration. As Adams states, "There is sufficient stability of locational and socio-economic factors to justify continued search for sets of regional and dynamic models to reduce prediction error."[17]

Research concerning metropolitan migration has been limited in three respects. First, the division of disciplines interested in metropolitan migration has resulted in the biased use of particular urban

13. Adams, R., op cit., Footnote 3.

14. Greenwood, M. J., and D. Sweetland, op cit., Footnote 5.

15. Galle and Williams, op cit., Footnote 5.

16. Ibid.

17. Adams, R., op cit., Footnote 5.

characteristics as the predominant explanation of migration variability. Sociologists and demographers for example, have stressed such variables as education, race, age, sex and housing.[18] Geographers often emphasize distance, size and locational characteristics,[19] while economists have stressed such variables as government expenditures, employment and income differentials.[20]

Table 1 compares the results of three studies done by economists, a geographer and sociologists respectively, using metropolitan characteristics in predicting migration. The third study by sociologists Galle and Williams found that population growth and industrial growth were significantly associated.

Table 1

RESEARCH COMPARISONS

Research Authors	Principal Variables	Associations
Greenwood and Sweetland	Distance Income Government Expenditures	$R^2 = .57$
Adams	Mass Distance Growth Rate	$R^2 = .73$
Galle and Williams	Population Growth Industrial Growth Manufacturing Labor	$r = .83$ $r = .72$ $r = -.52$

Sources: Greenwood, M. J., and D. Sweetland, op cit., Footnote 5.; Adams, R., op cit., Footnote 3.; Galle and Williams, op cit., Footnote 5.

18. Long, L. H., "Migration Differentials by Education and Occupation Trends and Variations", Demography, Volume 10, No. 2, (May, 1973), p. 243; Zodger, A. V. and K. S. Seethanam, "Interdivisional Migration Differentials by Education for Groups of Selected SMSA's, United States, 1960", Demography, Volume 10, No.2, (May, 1973), p. 683; Galle and Williams, op cit., Footnote 5.

19. Wolpert, J., op cit., Footnote 3; Adams, R., op cit., Footnote 3; Roseman, C., and R. Groop, op cit., Footnote 6.

20. Greenwood, M. J. and D. Sweetland, op cit., Footnote 5.

A second problem is that past research has often limited the sample selection to large SMSAs. By limiting research to those metropolitan areas which have a population of 250,000 or more, the variation between migration and metropolitan characteristics for approximately fifty percent of the metropolitan areas is not accounted for.[21]

A third difficulty is the use of metropolitan characteristics to explain either out, in or aggregate migration but not all three in the same analysis. A study on metropolitan out-migration by Roseman and Groop used age, population size, unemployment, manufacturing and government employment as predictors. Their results reveal that certain variables such as manufacturing and age do predict out-migration but nothing is concluded as to their predictive ability for in-migration.[22] Considering these three limitations, future research should be concerned with; (1) A wider range of variables, or characteristics, for a comprehensive multivariate analysis to explain the differentiation of metropolitan net-migration, (2) A more comprehensive selection of sample SMSAs to include both a wider range of metropolitan sizes and migration rates and (3) The use of characteristics to analyze associations with both in and out-migration rates.

Problem Statement

The purpose of this thesis is to measure and compare five categories of metropolitan characteristics as determinants of metropolitan net-migration in the United States. By measuring associations, conclusions may be drawn about the relationships between metropolitan characteristics and their net-migration rates. Central to the problem is the recognition that the

21. Adams, R., op cit., Footnote 3; Greenwood, M. J. and D. Sweetland, op cit., Footnote 5; Galle and Williams, op cit., Footnote 5; Wolpert, J., op cit., Footnote 3; Blevins, A. L., op cit., Footnote 7; Zodger, A. V., and K. S. Seethanam, op cit., Footnote 18.

22. Roseman, C., and R. Groop, op cit., Footnote 6.

magnitude of metropolitan migration rates is regionally differentiated.

A multivariate regression analysis is preformed to explain the variation in metropolitan net-migration rates. The associations between social, economic, demographic, environmental and locational characteristics of SMSAs with their net-migration rates is examined. The following five objectives are achieved: (1) An aggregate (all sample SMSAs) level analysis of associations to explain the variation of net-migration rates, (2) An analysis of associations for SMSAs with positive net-migration rates, (3) An analysis of associations for SMSAs with negative net-migration rates, (4) A determination of residual SMSAs for which the selected characteristics did not explain their net-migration rates well and, (5) A comparison of the social, economic, demographic, locational and environmental determinants to reveal the category of variables that best explains net-migration rates. The accomplishment of these objectives will provide a comprehensive understanding about the covariation between metropolitan characteristics and migration patterns.

Justification

Geography is concerned with the description and analysis of the spatial organization and spatial interaction of humans and their activity. This thesis is concerned with observing the spatial organization of migration patterns and attempts to analyze and explain this spatial structure by focusing on the nature of places. The migration process is a human activity; a change of residence based upon a perception of the interaction between origin and destination characteristics as well as a complex decision-making process on the part of the potential migrant. Often migration studies are placed under the subfield of population geography. The main theme expressed by most population geographers has been areal differentiation, beginning with observation and identification of spatial distributions of populations and their attributes leading to relationships between both demographic and

nondemographic variables. Clarke, a British population geographer indicates that one of population geography's concerns is "...with demonstrating how spatial variations in the distribution, composition, migrations, and growth of populations are related to spatial variations in the nature of places."[23] The orientation of this thesis is directly related to these concepts; past observations of the spatial differentiation of metropolitan migration lead to the questioning of the causes of this differentiation.

Policymakers should be particularly interested in the determinants of metropolitan migration since many current social, economic and political problems of metropolitan areas are affected by population changes that influence the availability of resources to the metropolitan areas. As more comprehensive data become available, migration patterns associated with metropolitan characteristics should prove helpful to the policymaker's ability to predict growth and resource use.

Plan of Study

Chapter 2 of this thesis contains sections concerned with; sample selection, variable identification, methods of analysis and expected results. Chapter 3 analyzes the results of the research. Finally, Chapter 4 offers conclusions and implications about the results.

23. Clarke, J. I., Population Geography, (Oxford, London, New York: Pergamon Press, 1965), p. 2.

Chapter 2

METHODOLOGY

This chapter outlines and discusses the methods used to test the study hypotheses by identifying the following; (1) a sampling procedure that produces a sample of SMSAs with a wide variation in net-migration rates, (2) the dependent variable (net-migration) and the independent variables (metropolitan characteristics) assumed to be determinants of the net-migration rates and, (3) the methods of analysis used to measure the associations between the dependent variable and the independent variables. The chapter concludes with a discussion concerning the expected results of these associations.

Sample Selection

The following procedures were used to select a sample of metropolitan areas. The SMSAs were ranked from those having the highest net in-migration rate to those with the largest percentage of net out-migration.[1] The sample was determined by systematically selecting every other SMSA starting with the one having the largest net in-migration rate until fifty were selected (Appendix B). The procedure was repeated for the net out-migrating areas until fifty were selected. Fifty SMSAs for each positive and negative sample are necessary to obtain at least thirty units to assume normality of the distribution. Also, a sample size of fifty permits a wide range of migration rates that reflects the national pattern. This representativeness is necessary to present an accurate picture of the associations between migration rates and metropolitan characteristics.

1. Percent net-migration= $\frac{\text{total in-migrants - total out-migrants}}{\text{total population}} \times 100$

The negative migration rates range from - .1 percent for the Wilmington, Delaware SMSA to -14.2 percent for Lawton, Oklahoma. The population sizes for these areas vary from over seven million for Los Angeles, California to seventy-three thousand for Laredo, Texas. There is also a wide variation of positive rates ranging from .7 for Grand Rapids, Michigan to 38.1 for Fort Lauderdale, Florida. Population sizes for the positive areas range from over one-million for the Anaheim, California SMSA to fifty-eight thousand for Bryan, Texas. The range of net-migration rates for the total sample is 52.3. This sampling method fulfills the initial objective of a wide variation in both net-migration rates and SMSA sizes.

The sample SMSAs tend to conform with the regional variation of net-migration rates suggested by other studies[2] (Figure 1). For example, the Midwest, the Great Lakes and some Northeastern states contain most of the SMSAs that are experiencing negative rates. The fifty SMSAs experiencing positive net-migration, have a more uniform distribution. Regionally, these SMSAs can be found in the South and Southeastern United States as well as in the West and Southwestern regions. Recent studies have also viewed these areas as destination regions in the inter-metropolitan migration network.

Variable Identification

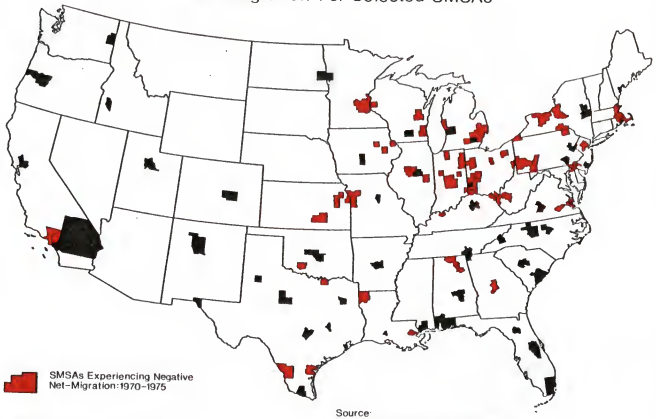
The dependent variable, or the variable whose variation is to be explained by other metropolitan characteristics, is the percent net-migration rate for each of the selected SMSAs for the period 1970-1975.[3] This particular measurement of migration was chosen from other alternatives such as migration efficiencies and absolute volumes for two reasons. First, these rates represent

2. Wolpert, J., "Distance and Directional Bias in Inter-Urban Migration Streams", Annals of the Association of American Geographers, Volume 57, No. 3, (September, 1976), p. 615; Morrison, P. A., and J. P. Wheeler, "Rural Renaissance in America?", Population Bulletin, (October, 1976), p. 5.

3. Bureau of Census, Population Estimates, July 1, 1974-1975, Washington, D.C.

Figure 1

Net–Migration For Selected SMSAs



Source:
Office of Management and Budget. Standard Metrogolitan Statistical Areas, 1975, Washington D.C., 1975.

K. Melton

the percent of the total SMSA population attributable to migration over a five year period. This per capita comparison is something which absolute volumes do not take into account because it controls for SMSA size. Second, past research findings suggest the use of net-migration rates instead of migration efficiencies for this type of analysis. Galle and Williams in their research on migration efficiencies conclude that, "...net migration rates might just as well be used in the analysis of rates of growth due to migration;...".[4]

The independent variables are those which explain the variation in the dependent variable. These independent variables represent characteristics of the selected SMSAs. The selection of these independent variables is based upon their importance in similar past research concerning determinants of migration rates. The value of using variables from past research is that there is a basis for comparing research findings about the associations between migration rates and metropolitan characteristics. This study however uses several types of variables in a more comprehensive analysis than what is found in the literature.

The thirty-one independent variables used in this research are categorized according to their use by interested disciplines. The five categories of variables to be used as determinants of metropolitan net-migration include economic, social, demographic, locational and environmental attributes (Appendix C).

Thirteen variables are categorized as economic characteristics and represent the largest category. In general these variables are measurements of income levels, employment percentages, utility rates and tax differentials. The large number of these variables reflects the common usage of economic attributes as determinants of migration in past research. The economic

4. Galle and Williams, "Metropolitan Migration Efficiency", Demography, Volume 9, No. 4, (November, 1972), p. 675.

motive to migrate is usually viewed as the most influential determinant.[5]

The second category contains variables which are social characteristics. The six attributes in this category are indicative of educational levels, housing conditions, minority levels and crime statistics. Past research has often included these variables because they relate to metropolitan desirability. Also it is noted that people of different social status have different migration propensities. Individuals with higher educations and those employed in professional occupations are viewed as more mobile.[6]

The third category of variables represents the demographic character of the selected SMSAs. These six variables include such attributes as age structure, population size and density, growth rates and sex structure. These characteristics have been used as determinants on the basis that migrants are not representative of the total population. Generally individuals of younger age groups are viewed as potentially more mobile.[7]

Two locational characteristics are included in the fourth category of variables. These locational characteristics are the distance to the nearest SMSA and an accessibility potential which takes into consideration both distance and population size. Locational variables have been used frequently as determinants of migration based on the hypothesis that distance is a deterrent to migration; migrants are more likely to move short distances than longer distances.

The last category of variables includes four environmental characteristics; the number of yearly days clear, the yearly mean hourly wind speed,

5. Shaw, P., Migration Theory and Fact, (Regional Science Research Ins: Philadelphia, Pennsylvania, 1975), p. 107.

6. Long, L. H. "Migration Differentials by Education and Occupation: Trends and Variations", Demography, Vol. 10, No. 2, (May, 1973), p. 257.

7. Shaw, P., Op cit., Footnote 5, p. 18.

the yearly normal total inches of precipitation and the annual monthly heating degree days. Environmental and climatic characteristics have been used in past migration research because they are associated with the desirability of metropolitan areas. A recent example of such perception is the development of the cognitive region of the "sunbelt". This region contains a belt of Southwestern and Southeastern SMSAs that are preceived to have desirable environmental characteristics.

In summary, the variables to be used in this analysis include a dependent variable (net-migration) and thirty-one independent variables reflecting various economic, social, demographic, locational and environmental metropolitan characteristics. While past individual studies have focused upon a few but not all of these variables, this study undertakes a comprehensive analysis by utilizing all of the selected variables.

Methods of Analysis

The main objective of the analysis is to examine the associations between net-migration rates and thirty-one characteristics for 100 selected SMSAs. These associations will be examined for, a) the entire sample, b) the SMSAs having positive net-migration rates and c) the SMSAs having negative net-migration rates. Each of the three analyses will contain the simple correlation values obtained for each of the independent variables and their association with net-migration. The simple correlations will be followed by the results of the stepwise multiple-regression[8] and the significance of each category of metropolitan characteristics in explaining the variation in net-migration rates. Each analysis concludes with a discussion of unexplained variation through the examination of residuals from regression. Completion of these objectives will draw conclusions concerning the most important net-

8. University of California at Los Angeles, BMD Biomedical Computer Programs: BMD02R Stepwise Regression, (Berkely and Los Angeles: University of California Press, 1973), p. 305.

migration determinants.

The stepwise multiple-regression is appropriate for measuring associations between variables and for the descriptions of relationships between variables so that prediction of one variable can be made based upon the values of other variables.[9] The multiple-regression routine measures the covariation between the dependent variable and the independent variables. The nature of the variation between the two can be measured so that the statistical significance of relationships can be estimated. The stepwise approach to regression will be used to determine how much of the total variation in the dependent variable can be explained by all of the independent variables acting together. The analysis will reveal the characteristics most significantly associated with net-migration at each step as well as partial correlations so that the associations between the dependent and independent variables can be measured while the entering variables have been controlled. The routine will also be capable of measuring the degree to which net-migration is over-predicted or under-predicted for each SMSA. By mapping these residuals, it is possible to come to conclusions about the regional patterns of over-prediction and under-prediction. These regional patterns may lead to hypotheses about which factors, outside of the selected variables, account for the unexplained variation.

Expected Results

It is expected that the results of the analyses will reveal a difference in those determinants most strongly associated with positive net-migration rates, and those associated with negative net-migration rates or the aggregate net-migration rates. Specifically, it is expected that the positive net-migration rates will be positively associated with environmental

9. Blalock, A. M., Social Statistics, (New York: McGraw-Hill, 1972), p. 361.

and locational characteristics and negatively associated with economic and social conditions. The negative net-migration rates are expected to be negatively associated with environmental and locational characteristics and positively associated with social and economic variables. These hypotheses are based on the recognition of the high in-migration rates for SMSAs in the Southeastern and Southwestern United States, as well as the recognition of the older, denser, industrial SMSAs of the Great Lakes and Midwestern states as areas of negative net-migration.

Chapter 3

THE ANALYSIS OF RESULTS

Three phases of analysis are discussed in Chapter 3. Simple correlations and multiple-regressions are used to measure the associations between thirty-one metropolitan characteristics and net-migration rates for aggregate net-migration (total sample), a postive net-migration sample and a negative net-migration sample. The results reveal that net in-migration, net out-migration and aggregate net-migration are responses to different determinants.

Analysis of Aggregate Net-Migration

The independent variables are ranked by the degree of their correlation with net-migration (Table 2). Correlation is a measurement of the strength of the independent variables' association with net-migration. The possible range of the r values is from a perfect negative association of -1 to a perfect positive association of +1.

Table 2

SIMPLE CORRELATION VALUES FOR THE AGGREGATE NET-MIGRATION SAMPLE

Variable	r
Previous Migration Rate	.58
Construction Employment	.54
Residences Prior to 1950	-.53
Accessibility Potential	-.46
Manufacturing Employment	-.45
Heating Degree Days	-.40
Total Crime Index	.31
Professional Employment	.30
College Educated	.28
Government Employment	.25
Per Capita City Debt	-.23
Yearly Wind Speed	-.23
Distance to Nearest SMSA	.22
Industrial Electrical Rates	-.21

All Correlations significant at the .05 level.

The variable most highly correlated with aggregate net-migration is the previous decade net-migration rate (+.58). This result suggests that thirty-four percent, (r^2 x 100), of the variation in the net-migration rates can be explained by past rates but a large percentage of variation is still unexplained. Therefore it is important to use other variables other than past rates to predict future migration rates. Percent of the labor force in construction is the second most significant independent variable followed by the percent of residences built prior to 1950. The negative relationship suggests that as migration rates become positive the percent of housing built before 1950 decreases. Three other significantly associated variables are; the accessibility potential, the percent of the labor force in manufacturing and the heating degree days. The values drop in association after the first

fourteen variables to the lowest r value of -.05 for percent females. Table 2 stops at the fourteenth variable since the other variables have r values that are not significant at the .05 level. All variables and their r values can be found in Appendix D. for comparison.

The results of the stepwise multiple-regression routine present a different perspective of the total sample (Table 3). The stepwise regression enters each independent variable according to the amount of added variation in the dependent variable that it can explain. The independent variables are ranked according to their entrance into the regression equation for the aggregate net-migration rates.

Table 3

STEPWISE MULTIPLE-REGRESSION FOR THE AGGREGATE NET-MIGRATION SAMPLE

Variable	r	R^2	Increase in R^2
Previous Migration Rate	.58	.336	.336
Construction Employment	.54	.508	.172
Accessibility Potential	-.46	.556	.048
Natural Growth Rate	.06	.582	.026
Total Crime Index	.31	.600	.018
Per Capita City Debt	-.23	.616	.016
Owner Occupied Housing	-.08	.627	.011
College Educated	.28	.650	.023
Low Income Level	-.15	.667	.017
Population Density	-.07	.673	.006
Population Size	-.14	.678	.005
Residential Electrical Rates	-.07	.682	.004
Heating Degree Days	-.40	.687	.005
Percent Negro	.10	.695	.008
Days of Sunshine	.17	.699	.004
Yearly Precipitation	.10	.705	.006

The first variable to enter the equation is the previous decade net-migration rate (Table 3). This variable alone accounts for approximately thirty-four per cent of the variation in net-migration at the aggregate level. The construction employment percentage is the second variable to enter and increases the explained variation to about fifty-one percent. The next four variables to enter the regression equation are the accessibility potential, the natural growth rate, the total crime index and the per capita city debt. Together the first six characteristics explain sixty-two percent of the variation. The last variable to be included in the table is the yearly precipitation and each variable entered subsequently increases the R^2 value less than .005. These sixteen variables explain about seventy-one percent of the variation while all thirty-one characteristics explain seventy-two percent of the variation in metropolitan net-migration. Compared with past studies (Table 1), this amount of explained variation is consistent with the highest value obtained by Adams but considerably higher than that obtained by Greenwood and Sweetland. The principal variables are consistent in many cases. Independent factors such as past growth rates and distances are significant in past research that relate these characteristics to net-migration rates.

The significance of each category of characteristics in explaining the variation in net-migration rates at the aggregate level also vary (Table 4). The thirteen economic variables explain forty-four percent of the variation in net-migration. The percent of construction employment, percent of professional employment and the per capita city debt are the three most important variables. The demographic category is the second highest. Together the six variables explain forty percent of the variation in net-migration with the previous decade net-migration rate, population size, and age structure contributing the majority of the explanation. The locational and environmental categories are the lowest determinants of net-migration explaining only twenty-one and

Table 4

CATEGORY SIGNIFICANCE FOR
AGGREGATE NET-MIGRATION

Category	Significant Variables	Multiple R^2
Economic	Construction Employment Professional Employment Per Capita City Debt Low Income Level Manufacturing Employment Government Employment	.44
Demographic	Previous Migration Rate Population Size Age Structure Population Density Natural Growth Rate	.40
Social	Residences Prior to 1950 Total Crime Index College Educated Owner Occupied Housing	.33
Locational	Accessibility Potential	.21
Environmental	Heating Degree Days Yearly Wind Speed	.18

eighteen percent respectively. The low amount of explained variation for these last two categories was not expected based upon other findings in past research. The dominance by the economic variables in explaining aggregate net-migration was also not expected but is quite apparent. The first four economic variables explain more variation than the total of variables in any other category.

The residuals from regression are calculated by dividing the

computed migration rate by the actual value and multiplying it by 100 percent.[1] Each location's net-migration rate can therefore be interpreted as being either over-predicted or under-predicted by the selected independent variables. Residuals ranging from one percent to nineteen percent were considered SMSAs whose net-migration rate was under-explained by the regression equation (Table 5). The over-explained residuals range from 490 percent to 173 percent (Table 6).

Table 5

RESIDUALS FOR THE AGGREGATE SAMPLE SMSAs WITH UNDER-PREDICTED NET-MIGRATION RATES

Standard Metropolitan Statistical Area	Residual Value
Fargo-Moorhead, North Dakota-Minnesota	1
New Bedford-Fall River, Massachusetts	1
Huntington-Ashland, Kentucky-Ohio-West Virginia	1
Owensboro, Kentucky	3
McAllen-Pharr-Edinburg, Texas	6
Fort Wayne, Indiana	9
Des Moines, Iowa	11
Erie, Pennsylvania	13
Huntsville, Alabama	14
Appleton-Oshkosh, Wisconsin	14
Lafayette-West Lafayette, Indiana	15
Topeka, Kansas	16
Muncie, Indiana	16
Provo-Orem, Utah	17
Minneapolis-St. Paul, Minnesota-Wisconsin	19

1. Residuals = $\frac{\text{Predicted Value}}{\text{Actual Value}}$ x 100%; where perfect prediction is 100 percent and residuals greater than 100 are over-predicted while residuals less than 100 will be under-predicted. Assuming normality, it is expected that sixty-eight percent of the sample units will fall within one standard error of regression of the predicted value. Extreme residuals for this study are based upon the assumption that approximately thirty percent of the sample is not within one Standard error of regression.

Table 6

RESIDUALS FOR THE AGGREGATE SAMPLE SMSAs WITH OVER-PREDICTED NET-MIGRATION RATES

Standard Metropolitan Statistical Area	Residual Value
Wilmington, Delaware-Maryland-New Jersey	490
Milwaukee, Wisconsin	476
Biloxi-Gulfport, Mississippi	458
Grand Rapids, Michigan	357
Asheville, North Carolina	300
Newport News-Hampton, Virginia	300
Jackson, Michigan	300
Columbia, Missouri	278
Syracuse, New York	232
Steubenville-Weirton, Ohio-West Virginia	229
Indianapolis, Indiana	222
Spokane, Washington	203
Dubuque, Iowa	200
Corpus Christi, Texas	188
Pensacola, Florida	173

The distribution of the under-explained SMSAs is similar to that of the over-explained SMSAs (Figure 2). The under-explained residuals are located generally in the Mid-West and upper Great Lakes states with some dispersed throughout the Southeast and West. The over-explained residuals reveal a similar pattern with high numbers of SMSAs in the Great Lakes states. This pattern of residuals shows the ability of the regression equation to predict the Southern metropolitan areas more accurately than the metropolitan areas of the north.

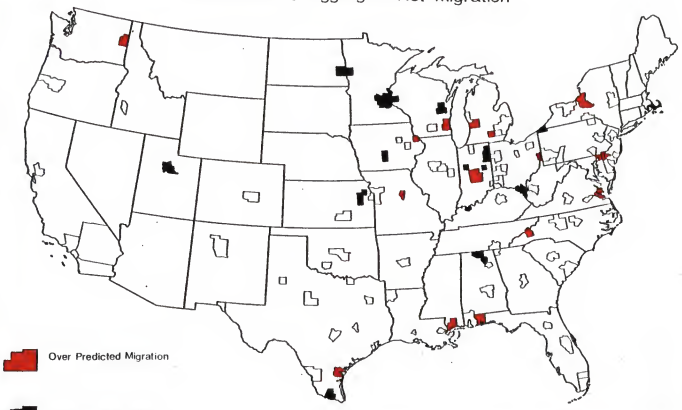
In summary, it is apparent that aggregate net-migration rates are highly related to such metropolitan characteristics as construction employment, previous decade net-migration rates, accessibility potentials, residences built prior to 1950 and the natural growth rate. It may be argued that variables such as construction employment and residences built prior to 1950, have strong associations indicating in-migration but are not variables that actually predict whether an area will experience in-migration. Obviously, metropolitan areas experiencing in-migration will have higher demands for new housing and services. Other variables such as the accessibility potential are better termed determinants since they affect the propensity to migrate. Other unexpected associations with the total crime index which recorded a significant positive relationship with net-migration indicating that as migration rates become positive the crime index increases.

Analysis of Positive Net-Migration

The largest r value for the fifty SMSAs experiencing positive net-migration is -.60; a significant negative association between net-migration and the percent of residences built prior to 1950 (Table 7). As the positive net-migration rate increases, the percent of housing built before 1950 decreases. The direction of this association is obvious since one would expect that those areas which are experiencing higher rates of in-migration,

Figure 2

Residuals For Aggregate Net-Migration



will contain newer residences. Therefore its classification as a determinant of net in-migration should be questioned because of the direction of causation. Two other characteristics highly associated with in-migration are the previous net-migration rate and the percent of the labor force employed in construction. Only nine of the thirty-one independent variables are significant at the .05 level.

Table 7

SIMPLE CORRELATION VALUES FOR THE POSITIVE NET-MIGRATION SAMPLE

Variables	r
Residences Prior to 1950	-.60
Previous Migration Rate	.58
Construction Employment	.50
Heating Degree Days	-.41
Total Crime Index	.39
Per Capita City Debt	-.36
Manufacturing Employment	-.35
Professional Employment	.33
Accessibility Potential	-.32

All correlations significant at the .05 level.

An examination of the results from the stepwise multiple-regression reveals some similar results as in the simple correlation coefficients (Table 8). Again the variables are ranked according to their entrance into the regression equation. The variable which adds the most explained variation, is the percent of residences built prior to 1950. This one characteristic explains thirty-six percent of the positive net-migration rates. The next variables to enter are the previous decade net-migration rate and the percent of the labor force in construction. Again, as in the case of the simple correlation results, one should question the direction of causation between these variables and positive net-migration. Other variables that enter the

Table 8

STEPWISE MULTIPLE-REGRESSION FOR THE POSITIVE NET-MIGRATION SAMPLE

Variable	r	R^2	Increase in R^2
Residences Prior to 1950	-.60	.357	.357
Previous Migration Rate	.58	.441	.084
Construction Employment	.50	.525	.084
Per Capita City Debt	-.36	.566	.041
Manufacturing Employment	-.35	.589	.023
Natural Growth Rate	.03	.610	.021
Percent Negro	.08	.626	.016
Heating Degree Days	-.41	.668	.042
Professional Employment	.33	.704	.036
Days of Sunshine	.09	.728	.024
Population Size	.16	.742	.014
Government Employment	.16	.757	.015
Yearly Wind Speed	-.23	.764	.007
Age Structure	.18	.771	.007
Total Crime Index	.39	.779	.008
Housing Owner Occupied	.02	.785	.006
Education Employment	.12	.790	.005
College Educated	.21	.806	.016
Unemployment Rate	-.03	.820	.014
Distance to Nearest SMSA	.02	.826	.006

regression equation early are; the per capita city debt, the percent of the labor force in manufacturing and the natural growth rate. In all, the thirty-one metropolitan characteristics account for eighty-seven percent of the variation in the positive net-migration rates. Table 8 stops at the twentieth variable entered, because at this point the level of explanation reaches eighty-three percent with subsequent characteristics contributing less than .5 percent variation each.

The positive analysis yields similar results as found in the aggregate analysis (Table 9). Again the highest explained variation occurs with the economic category. The main variables in this category include the construction employment rate, the professional employment percentage and the per capita city debt. The thirteen variables account for fifty-six percent of the variation by themselves. The social and demographic characteristics each explain forty percent of the variation. The principal variables are the percent of residences built before 1950 and the total crime index for the social attributes while population size and the natural growth rate contribute the most explained variation within the demographic category. The categories that explain the least are the environmental and locational attributes respectively. This result does not support the expected association between in-migration and environmental factors. Instead, the predominance of the economic factors is quite apparent with the first three variables explaining more than any other category.

The under-predicted residuals range from twenty percent to forty-eight percent of the actual net-migration rate, revealing a less extreme range than in the aggregate analysis (Tables 10 and 11). The over-predicted residuals range from 472 percent to 225 percent of the actual rate. For the positive analysis, the majority of the extreme residuals are over-predicted.

In general, the residuals are located in the South and Southwestern United States (Figure 3). Disperse residuals are located in the Northeast,

Table 9

CATEGORY SIGNIFICANCE FOR
POSITIVE NET-MIGRATION

Category	Significant Variables	Multiple R^2
Economic	Construction Employment Professional Employment Per Capita City Debt Per Capita Property Tax Government Employment Education Employment	.56
Social	Residences Prior to 1950 Total Crime Index Owner Occupied Housing College Educated	.40
Demographic	Previous Migration Rate Population Size Age Structure Natural Growth Rate Population Density	.40
Environmental	Heating Degree Days Yearly Wind Speed Days of Sunshine Yearly Precipitation	.23
Locational	Accessibility Potential	.12

Table 10

RESIDUALS FOR THE POSITIVE SAMPLE SMSAs WITH
UNDER-PREDICTED NET-MIGRATION RATES

Standard Metropolitan Statistical Area	Residual Value
Lubbock, Texas	20
Mobile, Alabama	31
Chattanooga, Tennessee-Georgia	39
Allentown-Bethleham-Easton, Pennsylvania-New Jersey	44
New Bedford-Fall River, Massachusetts	44
El Paso, Texas	45
Oklahoma City, Oklahoma	48

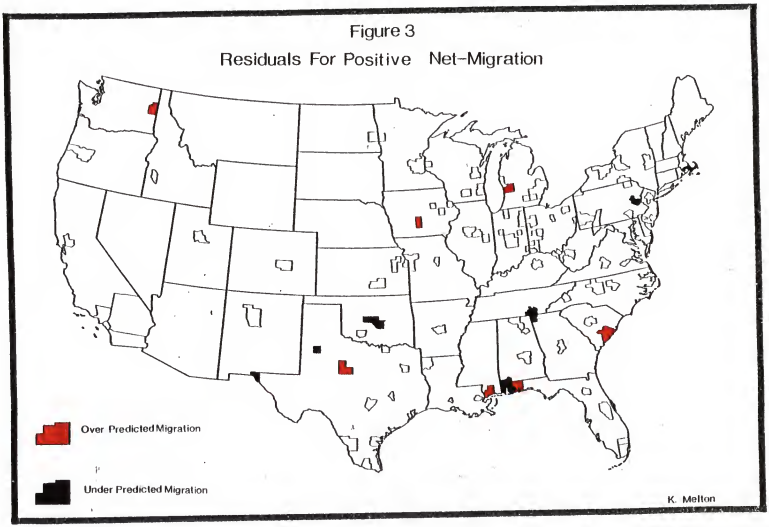
Table 11

RESIDUALS FOR THE POSITIVE SAMPLE SMSAs WITH
OVER-PREDICTED NET-MIGRATION RATES

Standard Metropolitan Statistical Area	Residual Value
Abilene, Texas	472
Grand Rapids, Michigan	386
Biloxi-Gulfport, Mississippi	366
Des Moines, Iowa	358
Spokane, Washington	265
Pensacola, Florida	232
Charleston-North Charleston, South Carolina	225

Figure 3

Residuals For Positive Net-Migration



Iowa, Washington, and Michigan. This pattern corresponds with the distribution for all of the SMSAs experiencing positive net-migration. Over-predicted residuals tend to be concentrated mostly in the deep south and mid-west areas, while under-predicted metropolitan areas are located in the Southwest and Northeast United States.

In summary, positive net-migration is associated with variables such as residences prior to 1950, previous decade net-migration rates and construction employment. These variables are again questioned as actually causing net-migration. The lack of environmental associations are quite evident. Heating degree days was the only variable from that category that was significant at the .05 level. In comparison with the aggregate analysis, it is apparent that the net in-migration rates were more highly associated with the selected metropolitan characteristics since the total explained variation increased from seventy-two to eighty-seven percent.

Analysis of Negative Net-Migration

Table 12 contains the simple correlation coefficients for the independent variable with the negative net-migration rates. The highest correlation is for percent females (+.46), followed closely by the industrial electrial rate (+.45). The government employment variable has the third largest correlation coefficient of -.36. Two environmental attributes are somewhat significant; heating degree days (-.36) and days of sunshine (-.34). The last variable in Table 12 is the unemployment rate which has a simple r value of -.26. All other variables are insignificant at the .05 level.

Table 12

SIMPLE CORRELATION VALUES FOR THE NEGATIVE NET-MIGRATION SAMPLE

Variable	r
Percent Females	.46
Industrial Electrical Rates	.45
Government Employment	-.36
Heating Degree Days	.36
Days of Sunshine	-.34
Owner Occupied Housing	.31
Residences Prior to 1950	.29
Unemployment Rate	-.26

All correlations significant at the .05 level.

The variable entering first in the stepwise multiple-regression is the percent females. This variable explains twenty-two percent of the variation in out-migration rates (Table 13). Again, it is out-migration that may be causing the change in sex structure and not sex structure that is determining out-migration. After this variable the added explained variation drops rapidly. The next variable is industrial electrical rates which adds approximately thirteen percent to the explained variation. The relationship between net out-migration and industrial electrical rates (+.45) presents an example of causality; the increase in industrial electrical rates may be related to out-migration of industries and employed individuals to areas of lower rates. The next three variables, heating degree days, yearly precipitation and the distance to the nearest SMSA, add four, four and six percent respectively. In all, the thirty-one metropolitan characteristics explain sixty-six percent of the variation in the negative net-migration rates.

The amount of explained variation attributed to each of the five categories of independent variables varies greatly. Overall, the significance of each category is lower for the negative analysis than for the aggregate

Table 13

STEPWISE MULTIPLE-REGRESSION FOR THE NEGATIVE NET-MIGRATION SAMPLE

Variable	r	R^2	Increase in R^2
Percent Females	.46	.216	.216
Industrial Electrical Rates	.45	.343	.127
Yearly Precipitation	.20	.387	.044
Distance to Nearest SMSA	.09	.424	.037
Heating Degree Days	.36	.480	.056
Accessibility Potential	.09	.499	.019
Government Employment	-.36	.513	.014
Population Density	.08	.526	.013
Low Income Level	-.17	.543	.017
Percent Negro	-.19	.550	.007
Owner Occupied Housing	.31	.556	.006
Income	.25	.563	.007
Residential Electrical Rates	.24	.569	.006
Days of Sunshine	-.38	.576	.007
Manufacturing Employment	.19	.584	.008
Per Capita City Debt	.14	.592	.008
Unemployment Rate	-.26	.597	.005
Yearly Wind Speed	-.02	.603	.006

or positive analyses (Table 14). Again economic attributes explain the greatest variation in negative net-migration. The principal economic variables in this case are; industrial electrical rates, percentage of government employees and percentage of construction employment. The second most significant category is the demographic category. Demographic variables explain twenty-nine percent of the variation in out-migration with the percentage of females, population size and the population density as the principal variables. The social and environmental attributes each explain twenty-one percent of the

Table 14

CATEGORY SIGNIFICANCE FOR
NEGATIVE NET-MIGRATION

Category	Significant Variables	Multiple R^2
Economic	Industrial Electrical Rates Government Employment Construction Employment Unemployment Rate Professional Employment Per Capita City Debt Education Employment Low Income Level	.38
Demographic	Percent Females Population Size Population Density Previous Migration Rate	.29
Social	Owner Occupied Housing Residences Prior to 1950 College Educated Housing Lacking Plumbing Percent Negro	.21
Environmental	Heating Degree Days Yearly Precipitation Days of Sunshine	.21
Locational	Accessibility Potential Distance to Nearest SMSA	.03

variation. The principal variables for the social category include the percent of housing that is owner occupied, the percent of residences built prior to 1950 and the percent of the population with college educations. The environmental category contains three principal variables; the yearly heating degree days, yearly precipitation and days of sunshine. Lowest in contribution is the locational category. This category contains two variables which together only explain three percent of the variation in negative net-migration rates.

The range for under-explained residuals is from thirteen percent to sixty-three percent (Table 15). The range for over-explained residuals is from 256 percent to 1650 percent (Table 16).

In general, the distribution of residuals is similar to the distribution of metropolitan areas experiencing negative net-migration rates with a concentration in the Mid-west and Great Lakes states (Figure 4). By examining the distribution of the over-explained and under-explained residuals a more definite pattern is apparent. The over-predicted SMSAs are more dispersed than the under-explained metropolitan areas which tend to be concentrated in the Mid-west. Over-predicted areas are generally located on the East Coast with scattered areas in the Great Lakes states and South. This pattern tends to indicate that some of the older industrial areas recognized as out-migrating areas are being over-predicted.

Table 15

RESIDUALS FOR THE NEGATIVE SAMPLE SMSAs WITH UNDER-PREDICTED NET-MIGRATION RATES

Standard Metropolitan Statistical Area	Residual Value
Kansas City, Missouri-Kansas	13
Boston, Massachusetts	18
Charleston, West Virginia	48
Fort Wayne, Indiana	50
Waterloo-Cedar Falls, Iowa	52
Cincinnati, Ohio-Kentucky-Indiana	56
Akron, Ohio	63

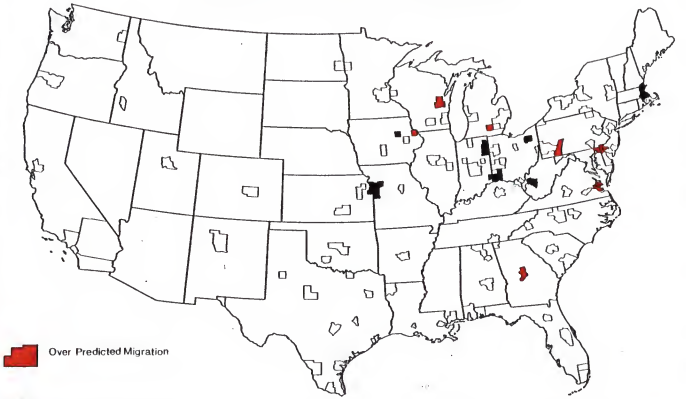
Table 16

RESIDUALS FOR THE NEGATIVE SAMPLE SMSAs WITH OVER-PREDICTED NET-MIGRATION RATES

Standard Metropolitan Statistical Area	Residual Value
Newport News-Hampton, Virginia	1650
Wilmington, Delaware-Maryland-New Jersey	870
Dubuque, Iowa	406
Macon, Georgia	294
Appleton-Oshkosh, Wisconsin	288
Johnstown, Pennsylvania	276
Jackson, Michigan	256

Figure 4

Residuals For Negative Net-Migration



Summary of the Results

In comparing the three analyses, one point stands out above all others; the determinants of metropolitan net-migration vary greatly in explanatory power depending upon their use as determinants for either aggregate rates, positive rates or negative rates (Appendix D). Thirty-one independent variables explain eighty-seven percent of the positive net-migration sample, seventy-two percent of the variation in the aggregate rates and sixty-six percent in the negative net-migration sample. Therefore as determinants, the selected metropolitan characteristics vary in association with specific migration streams. The metropolitan characteristics do a much better job of explaining in-migration than out-migration.

Specifically, the most significant variables associated with in-migration, tend to be those variables which are indicative of growth and metropolitan age, thus the high correlations with residential age and construction employment. Out-migration on the otherhand, is less predictive than in-migration with variables such as industrial electrical rates, percent females and yearly precipitation as determinants reflecting a variety of categoric attributes. Aggregate migration rates tend to be associated with a mixture of both in and out-migration determinants to include previous decade net-migration rates, construction employment and the accessibility potential.

Most categories of independent variables have higher rates of explanation for the positive net-migration sample than for either the negative or aggregate samples. One exception is the locational category which has its highest R-square in the aggregate analysis. Consistently, the economic category is the most important, explaining fifty-six percent, forty-four percent and thirty-eight percent for the positive, aggregate and negative analyses respectively. This domination of the economic variables may be due to the fact that this category contains at least twice as many variables as

each of the other categories, but actually only three to four of the significant economic variables explained the majority of the variation. The locational category which contains only two variables contributes the least in all three analyses. The demographic and social categories are quite consistent from each analysis except for the negative analysis which recorded considerably lower values. The environmental attributes, although rather low in explanation are also consistent.

In each analysis residuals were computed indicating that not all of the variation in net-migration rates is accounted for and that the positive net-migration analysis has a better explanation than each of the negative and aggregate analyses. The patterns of the distributions for the residuals generally reflect the distribution of the sample SMSAs for the positive and negative samples. The aggregate residuals produce a more distinct pattern revealing that the regression equation does a good job of predicting net-migration in southern metropolitan areas and a poorer job for the northern SMSAs.

Chapter 4

SUMMARY AND IMPLICATIONS

This thesis examines the significance of thirty-one economic, social, demographic, environmental and locational attributes as determinants of metropolitan net-migration rates for 100 Standard Metropolitan Statistical Areas. The need for this research stems from the fact that seventy percent of the American population is concentrated in metropolitan areas and this consolidation has resulted in a dominant inter-metropolitan migration pattern. More importantly, a review of past metropolitan migration studies reveals a lack of comprehensive analyses dealing with a wide range of both origin and destination characteristics. Past studies provide conflicting conclusions about the role of various metropolitan characteristics as determinants of migration rates.

Associations between various metropolitan characteristics and net-migration rates for 100 SMSAs were examined by stepwise multiple-regression. The results were analyzed for (1) All sampled SMSAs net-migration rates, (2) SMSAs having positive net-migration rates and (3) SMSAs having negative net-migration rates. Each of the analyses contained the simple correlation coefficients, coefficients of determination, and residuals from regression. In addition the amount of explained variation by each category of variables was examined to arrive at conclusions about the most significant categories of determinants.

Findings

The positive net-migration analysis explained the largest amount of variation in net-migration rates. Thirty-one variables explained eighty-seven percent of the change in net in-migration. Characteristics such as percentage of residences built prior to 1950, previous decade net-migration rate, per-

centage of construction employment and per capita city debt are the primary explanatory variables. The aggregate analysis revealed an explained variation of seventy-two percent. Entering into the regression equation early were; previous decade net-migration rate, percentage of construction employment, accessibility potential and natural growth rate. The negative net-migration analysis recorded the lowest amount of explained variation (sixty-six percent). Four variables to enter the regression equation early were; percent females, industrial electrical rates, yearly precipitation and distance to the nearest SMSA. In each analysis economic attributes of metropolitan areas explained the most variation in net-migration rates. The demographic category was the second most significant with social variables contributing the third most explanation. Environmental and locational attributes consistently recorded the lowest percentage of explained variation. Maps of the computed residuals for the positive and negative analyses suggest that the spatial distribution of the unexplained variation represents the distribution of the sample SMSAs. Mapping of the residuals for the aggregate analysis reveals a distinct pattern; southern metropolitan areas are well predicted by the thirty-one independent variables while the majority of the unexplained variation exists in the northern metropolitan areas.

As expected, the amount of explained variation by the total thirty-one metropolitan characteristics varied (twenty-one percent), between the positive and negative analyses. Besides this difference in explained variation, positive and negative net-migration are responses to different determinants. In general, positive net-migration tends to be associated with those characteristics which are indicative of growing metropolitan areas. A high positive relationship (+.50) with construction employment and a high negative relationship (-.60) with residential age supports this point. Negative rates are associated with a wide range of variables such as the percent females (+.46) and industrial electrical rates (+.45). The aggregate analysis reveals high associations with

variables that indicate growth trends such as the previous decade net-migration rate (+.58), construction employment (+54) and the residential age variable (-.53).

One unexpected association occurred between environmental characteristics and net-migration rates. Past studies have associated in-migration with environmental determinants, indicating that potential migrants move to more "pleasing" environments.[1] The well documented "sunbelt" is such an example of the relationship between in-migration and environmental factors. The results support the notion that metropolitan areas with "bad" environments are sources of out-migration and that metropolitan areas with more "pleasing" environments are areas of in-migration. Although this positive relationship is supported, the results also reveal that environmental "push" factors of bad environments are stronger than the "pull" factors of pleasing environments.

Implications

Comparisons with past research reveals that the findings of this study contribute to the predictability and understanding of the migratory process. For instance, the highest multiple R^2 by selected past studies was .73 found by Adams[2] (Table 1). Findings of Adams' research shows a .72 multiple R^2 on the aggregate level, .87 for the positive analysis and .66 for the negative analysis. These findings are consistent with the highest value obtained by Adams but considerably higher in all analyses for the other past studies. Past research has also biased the selection of metropolitan characteristics as

1. Morrison, P. A., and J. P. Wheeler, "Rural Renaissance in America?", Population Bulletin, Population Reference Bureau, Volume 31, No. 3, (October, 1976), p. 21.; Rogers, T. W., "Migration Attractiveness of Southern Metropolitan Areas", Social Science Quarterly, Volume 50, No. 2, (September, 1969), p. 324.

2. Adams, R., "U. S. Metropolitan Migration: Dimensions and Predictability", Proceedings of the Association of American Geographers, Volume 1, (July, 1969), p. 5.

determinants according to the interests of the discipline. The present study however, contributes to the idea of the use of a wide range of variables as determinants since the findings reveal that different migration streams are associated with considerably different categoric variables. Although it can be argued that biased research is important to investigate the role of specific variables in predicting net-migration, it is felt that accuracy of metropolitan net-migration prediction only can be achieved through using an array of metropolitan characteristics.

Present and future implications of these findings are that policymakers need to be aware of the significant difference between the predictability of in-migration and out-migration for planning and resource allocation purposes. Obviously, if in and out-migration rates are responses to different determinants, then this should be taken into account. By examining differences in metropolitan characteristics it may be possible to determine the future population growth or decline of metropolitan areas. Further, these policymakers must be aware of the complexity of the type of variables used as determinants. The multi-characteristic approach to the explanation of net-migration rates indicates that one disciplinary category cannot explain the totality of net-migration variation. Therefore it is suggested that future research that is interested in migration prediction should aim at more comprehensive analyses by; (1) continuing to use a large array of alternative determinants for examining their predictive power and (2) using these determinants to predict in and out-migration. Through these practices more comprehensive and suitable models of migration prediction and behavior may be developed.

Problems and Suggestions

One methodological problem should be outlined here to assist those interested in pursuing future research in this area. Extreme net-migration rates in the sample disproportinately influence the slope of the line of

regression and thus the predictive equation. Often precise associations between two variables are biased by such extreme values. It is suggested that future studies might examine the effect of removing such extremes from the selected sample. Often, as in this research, there are only a few extreme cases. This procedure may eliminate the biasing effect on the regression equation and present a clearer picture of association for the majority of the sample.

Another important problem is the noticeable difference between those independent characteristics that reflect a clear causal relationship with net-migration and those that are merely associated with net-migration rates. For instance, net in-migration rates are highly associated with such variables as residential age, construction employment and previous net-migration rates. It may be argued that these characteristics are indicative of growth areas and obviously in-migration, but logically they can not be viewed as actually causing in-migration. Instead it is more appropriate to assume that in-migration is the determinant in this case. The negative net-migration analysis contained high associations with characteristics such as percent females (+.46), industrial electrial rates (+.45) and government employment (-.36). Except for the percent females, the association of these variables is more causative than in the previous case. They may in fact be viewed as actual determinants and not characteristics that indicate population declines through out-migration as does the percent females variable. Therefore it is suggested that future research should be concerned with the direction of causality between migration rates and independent variables because of the effect that this problem may have upon prediction.

A final suggestion entails the use of alternative determinants. One area of possible alternatives includes the use of cognitive values as determinants of metropolitan net-migration rates. Individual potential migrants base leaving a current origin and moving to another destination on certain perceptions

of advantages and disadvantages in those areas.[3] Many studies consider migration behavior on an aggregate level and do not directly take into account individual decision making processes. It is feasible therefore to suggest that perceptions of metropolitan areas may be used as alternative determinants.

This study presents a comprehensive approach to the prediction and evaluation of metropolitan net-migration. Through the use of a wide range of variables for analyzing aggregate net-migration, positive net-migration and negative net-migration the research presents a comprehensive picture of the determinants of metropolitan net-migration.

3. White, S. E., "Action Space, Human Needs and Interurban Migration", The Professional Geographer, Volume 29, No. 1, (February, 1977), p. 50.

BIBLIOGRAPHY

Adams, J., "Directional Bias in Intra-Urban Migration", Economic Geography, Volume 45, No. 4, (October, 1969). pp. 302-323.

Adams, R., "U.S. Metropolitan Migration: Dimensions and Predictability", Proceedings of the Association of American Geographers, Volume 1, (July, 1969), pp. 1-6.

Belvins, A. L., "Migration Rates in Twelve Southern Metropolitan Areas: A "Push-Pull" Analysis", Social Science Quarterly, Volume 50, No. 2, (September, 1969), pp. 337-353.

Blalock, A. M., Social Statistics, (New York: McGraw-Hill, 1972).

Brown, C., Odland, J., Golledge, R., "Migration, Functional Distance, and the Urban Hierarchy", Economic Geography, Volume 46, No. 3, (July, 1970), pp. 472-485.

Bureau of Census, Population Estimates, July 1, 1974-1975, (Washington, D. C.: Government Printing Office, 1974).

Clarke, J. I., Population Geography, (Oxford, London, New York: Pergamon Press, 1965).

Clayton, C., "Interstate Population Migration and Structure in the United States, 1935 to 1070," Professional Geographer, Volume 29, No. 2, (May, 1977). pp. 177-181

Davies, W., "Latent Migration Potential and Space Preferences", Professional Geographer, Volume 18, (September, 1966).

Demko, G. J., Rose, H. M., Schnell, G. A., "The Geographic Study of Population", Population Geography: A Reader. (New York: McGraw-Hill, 1970), pp. 1-5.

Desbarats, J., "Estimating External Constraints to Migration", Professional Geographer, Volume 29, No. 3, (August, 1977). pp. 282-289

Gale, S., "Explanation Theory and Models of Migration", Economic Geography, Volume 49, No. 3, (July 1973).

Galle, Williams, "Metropolitan Migration Efficiency", Demography, Volume 9, No. 4, (November, 1972), pp. 665-681.

Goheen, C. P., "Metropolitan Area Definition: A Re-evaluation of Concept and Statistical Practice." Internal Structure of the City, Edited by Bourne, L. S., (London: Oxford University Press, 1971), pp. 47-58.

Greenwood, M. J., Sweetland, D., "The Determinants of Migration Between Standard Metropolitan Statistical Areas", Demography, Volume 9, No. 4, (November, 1972), pp. 665-681.

Haynes, K., and D. Paston, and P. Schninning, "Intermetropolitan Migration in High and Low Opportunity Areas: Indirect Tests of the Distance and Intervening Opportunities Hypotheses", Economic Geography, Volume 49, No. 1, (January, 1973).

Kinschenbaum, A., "City-Suburban Destination Choices Among Migrants to Metropolitan Areas", Demography, Volume 9, No. 2, (May, 1972), pp. 321-335.

Lee, E., "A Theory of Migration", Demography, Vol. 3, (1966), pp. 45-57.

Long, L. H., "Migration Differentials by Education and Occupation Trends and Variations", Demography, Volume 10, No. 2, (May, 1973), pp. 243-258.

Masnick, G., "Employment Status and Retrospective and Prospective Migration in the United States", Demography, Volume 5, No. 1, (1969), pp. 655-663.

Morrison, P. A., Wheeler, J. P., "Rural Renaissance in America?" Population Bulletin, Population Reference Bureau, Volume 31, No. 3, (October, 1967).

Myers, P. "Interstate Migration and Per Capita Income Growth, 1965-1970", Proceedings of the Association of American Geographers, Volume 7, (1975).

Roseman, C., "Migration as a Spatial and Temporal Process", Annals of the Association of American Geographers, Volume 61, No. 3, (September, 1971), pp. 589-598.

Roseman, C., Groop, R., "A geographic Analysis of Metropolitan Out-migration", Paper presented at the annual meeting, Midcontinent Regional Science Association, Manhattan, Kansas, (May 6, 1977).

Rogers, T. W., "Migration Attractiveness of Southern Metropolitan Areas", Social Science Quarterly, Volume 50, No. 2, (September, 1969), pp. 324-345.

Schwind, P., "A General Field Theory of Migration: United States, 1955-1960", Economic Georgaphy, Volume 51, No. 1, (January, 1975).

Shaw, P., Migration Fact and Theory, (Philadelphia: Regional Science Research Inst., 1975).

Statistical Policy Division, Standard Metropolitan Statistical Areas, 1975, Office of Management and Budget, Washington D. C.

University of California at Los Angeles, BMD Biomedical Computer Programs: BMD02R Stepwise Multiple-Regression, (Berkely and Los Angeles: University of California Press, 1973).

White, S. E., "Action Space, Human Needs and Interurban Migration", The Professional Geographer, Volume 19, No. 1, (February, 1977), pp. 47-52.

White, S. E., "Residential Preference and Urban In-Migration", Proceedings of the Association of American Geographers, Volume 6, (1974), pp. 47-50.

Wolpert, J., "Distance and Directional Bias in Inter-Urban Migration Streams", Annals of the Association of American Geographers, Volume 57, No. 3, (September, 1976), pp. 605-616.

Wolpert, J. "Behavioral Aspects of the Decision to Migrate", Papers and Proceedings of the Regional Science Association, Vol. 15, (1965), pp. 159-169.

Yeates, M., Garner, C., The North American City, (New York: Harper and Row, 1976).

Zodgekar, A. V., Seethanam, K. S., "Interdivisional Migration Differentials by Education for Groups of Selected SMSA's, United States, 1960", Demography, Volume 10, No. 2, (May, 1973), pp. 243-258.

APPENDICES

APPENDIX A

THE DEFINITIONAL CONCEPT OF THE METROPOLITAN AREA

Accompanying a continuous concentration and growth in population, the pattern and scale of the nation's metropolitan area has also changed. These changes in growth and scale have been recognized by both the Bureau of Census and the Bureau of Budget and Management who, since the first census in 1790, have introduced new areal classifications to accommodate the urban transformation. The evolution of these areal definitions may serve as an example of how the urban concentration has taken place and its relationship to present day migration patterns.

The concept of a metropolitan area was created in 1910 when places were designated as Metropolitan Districts. The District was defined for every city over 200,000 inhabitants and marked the first use of an urban definition other than the corporate boundaries of a city. Although it was modified only slightly up to 1950, the Metropolitan District was criticized for weaknesses in both definitional and operational criteria. Academic evaluation found the unit lacking in its ability to facilitate statistical research and the definitional basis of population density was found inadequate. As a consequence, the Standard Metropolitan Area, (SMA), was developed.

The Standard Metropolitan Area was defined, "...so that a wide variety of statistical data might be presented on an uniform basis."[1] The areal classification was based upon counties with central cities of 50,000 or more and all contiguous counties that were metropolitan in character with social and economic

[1]Goheen, G. P., "Metropolitan Area Definition: A Re-evaluation of Concept and Statistical Practice." Internal Structure of the City, Edited by Bourne, L.S., (London: Oxford University Press, 1971), pp. 49.

intergration. In this sense the SMA included not only urban areas, but also larger areal entities consisting of a population that was metropolitan in character. An extension of the SMA was introduced in 1960 as the Standard Metropolitan Statistical Area, (SMSA). The revision was to include "statistical" so the character and purpose of the area may be defined. The primary goal of the SMSA has been to facilitate research and the utilization of statistics concerning an uniform area which is useful in analyzing metropolitan problems.

APPENDIX B

SAMPLE SMSAs
AND NET MIGRATION RATES

Positive Net-Migration Sample	Net-Migration Rate
Fort Lauderdale - Hollywood, Florida	38.1
Orlando, Florida	24.3
Bryan - College Station, Texas	18.0
Gainesville, Florida	17.9
Boise City, Idaho	16.7
Austin, Texas	15.3
Anaheim - Santa Ana - Garden Grove, California	14.8
Colorado Springs, Colorado	12.9
Miami, Florida	11.8
Albuquerque, New Mexico	9.7
Columbia, South Carolina	8.9
Raleigh - Durham, North Carolina	8.4
Bloomington - Normal, Illinois	8.1
Atlantic City, New Jersey	7.9
Eugene - Springfield, Oregon	7.7
Little Rock - North Little Rock, Arkansas	7.6
Provo - Orem, Utah	6.9
Tyler, Texas	6.3
Vallejo - Fairfield - Napa, California	6.2
Montgomery, Alabama	5.6
Lafayette, Louisiana	5.2
El Paso, Texas	5.1
Lexington - Fayette, Kentucky	4.8
McAllen - Pharr - Edinburg, Texas	4.8
Columbia, Missouri	4.2
Ann Arbor, Michigan	3.8
Charleston - North Charleston, South Carolina	3.6
Lynchburg, Virginia	3.6
Pensacola, Florida	3.4
Riverside - San Bernardino - Ontario, California	3.3
Allentown - Bethlehem - Easton, Pennsylvania - New Jersey	3.2
Portland, Maine	3.2
Hamilton - Middletown, Ohio	3.0
Galveston - Texas City, Texas	2.9
Lancaster, Pennsylvania	2.8
Lubbock, Texas	2.6

Positive Net-Migration Sample	Net-Migration Rate
Spokane, Washington	2.6
Oklahoma City, Oklahoma	2.5
Asheville, North Carolina	2.4
Madison, Wisconsin	2.3
Fargo - Moorhead, North Dakota - Minnesota	2.2
New Bedford - Fall River, Massachusetts	2.1
Des Moines, Iowa	1.7
Chattanooga, Tennessee - Georgia	1.7
Greensboro - Winston - Salem - Highpoint, North Carolina	1.7
Mobile, Alabama	1.4
Biloxi - Gulfport, Mississippi	1.2
Abilene, Texas	1.1
Albany - Schenectady - Troy, New York	.8
Grand Rapids, Michigan	.7

Negative Net-Migration Sample	Net-Migration Rate
Lawton, Oklahoma	-14.1
Petersburg - Colonial Heights - Hopewell, Virginia	- 7.8
Sherman - Denison, Texas	- 6.8
Wichita, Kansas	- 6.2
Dayton, Ohio	- 6.1
Champaign - Urbana - Rantoul, Illinois	- 5.6
Newark, New Jersey	- 5.4
Akron, Ohio	- 5.2
Los Angeles - Long Beach, California	- 5.1
Topeka, Kansas	- 4.9
Loredo, Texas	- 4.9
Pittsburgh, Pennsylvania	- 4.5
Muncie, Indiana	- 4.2
Detroit, Michigan	- 3.9
Springfield, Ohio	- 3.8
Huntsville, Alabama	- 3.7
Cincinnati, Ohio - Kentucky - Indiana	- 3.7
Corpus Christi, Texas	- 3.6
Mansfield, Ohio	- 3.6
South Bend, Indiana	- 3.5
Lima, Ohio	- 3.5
Kansas City, Missouri - Kansas	- 3.0
Muskegon - Norton Shores - Muskegon Heights, Michigan	- 2.9
Charleston, West Virginia	- 2.7
Steubenville - Weirton, Ohio - West Virginia	- 2.7
Binghamton, New York - Pennsylvania	- 2.5
Waterloo - Cedar Falls, Iowa	- 2.5
Rochester, New York	- 2.3
Cedar Rapids, Iowa	- 2.3
Owensboro, Kentucky	- 2.2
Gadsen, Alabama	- 2.1
Huntington - Ashland, West Virginia - Kentucky - Ohio	- 2.1
Lafayette - West Lafayette, Indiana	- 1.9
Fort Wayne, Indiana	- 1.7
Milwaukee, Wisconsin	- 1.7
Shreveport, Louisiana	- 1.7
Syracuse, New York	- 1.6
Indianapolis, Indiana	- 1.4
Peoria, Illinois	- 1.3

Negative Net-Migration Sample	Net-Migration Rate
Minneapolis - St. Paul, Minnesota	- 1.2
Jackson, Mississippi	- 1.0
Macon, Georgia	- .9
Johnstown, Pennsylvania	- .9
Appleton - Oshkosh, Wisconsin	- .8
Rochester, Minnesota	- .8
Erie, Pennsylvania	- .7
Dubuque, Iowa	- .5
Boston - Brockton - Haverhill - Lowell - Lawrence, Massachusetts	- .4
Newport News - Hampton, Virginia	- .2
Wilmington, Delaware - New Jersey - Maryland	- .1

APPENDIX C

SELECTED INDEPENDENT VARIABLES
AND SOURCES

Economic Characteristics:

Median Family Income[1]
Residential Electrical Rates[2]
Industrial Electrical Rates[2]
Percent of Families Below the Low Income Level[1]
Percent of Unemployment in the Labor Force[1]
City Debt Per Capita Income[1]
Per Capita Property Taxes[1]
Government Expenditures Per Capita[1]
Percentage of the Labor Force Government Employed[1]
Percent Employed in Professional and Managerial[1]
Percent Employed in Educational Services[1]
Percent Employed in Manufacturing[1]
Percent Employed in Construction[1]

Social Characteristics:

Total Criminal Index Per 100,000 Population[3]
Percent of Housing Owner Occupied[1]
Percent of Population Negro[4]
Percent of Population that Has Completed Four Years of College or More[1]
Percent of Housing Lacking Some or all of Plumbing[4]
Percent of Housing Built Prior to 1950[1]

Demographic Characteristics:

Median Age[1]
Population Size[1]
Population Per Square Mile[1]
Percent of Population Female[1]
Percent Natural Increase[4]
Previous Decade Percent Net-Migration Rate[1]

1. United States Department of Commerce, County and City Data Book, (Washington, D. C. 1972)

2. Residential and industrial electrical bills are based upon 1,000 KWH usage. Federal Power Commission, Typical Electrical Bills. (Washington, D. C. January, 1974).

3. Department of Justice, Source book of Criminal Justice Statistics, (Washington, D. C. 1974).

4. United States Department of Commerce, 1970 Census of Population and Housing: United States Summary, (Washington, D. C. 1970).

Locational Characteristics:

Distance to Nearest SMSA in Miles[5]
Acessibility Potential[6]

Environmental Characteristics:

Number of Yearly Days Clear[7]
Yearly Mean Hourly Wind Speed[7]
Yearly Normal Total Inches of Precipitation[7]
Annual Monthly Heating Degree Days[7]

5. Distance was measured from map prepared by; Statistical Policy Division, Standard Metropolitan Statistical Areas, 1975, Office of Budget and Management, Washington, D. C.

6. Gould, P., White, R., Mental Maps, (Great Britan: Hazell, Watson & Viney LTD, 1974), p. 26.

7. United States Department of Commerce Weather Bureau, Local Climatological Data; With Comparative Data, (Washington, D. C. 1960).

APPENDIX D

SIMPLE CORRELATIONS BETWEEN INDEPENDENT VARIABLES AND NET-MIGRATION

Independent Variables	Aggregate Net-Migration Sample	Positive Net-Migration Sample	Negative Net-Migration Sample
Median Family Income	-.15	.02	.25
Residential Electrical Rates	-.07	.01	.24
Industrial Electrical Rates	-.21*	-.08	.45*
Low Income Level	.09	.04	-.17
Percent Unemployed	-.10	-.03	-.26*
Per Capita Debt	-.23*	-.36*	.14
Per Capita Property Tax	-.10	.01	.14
Government Expenditures	-.08	-.02	.09
Government Employment	.25*	.16	-.36*
Professional Employment	.30*	.33*	-.01
Education Employment	.09	.12	.09
Manufacturing Employment	-.45*	-.35*	.19
Construction Employment	.54*	.50*	.01
Total Crime Index	.31*	.39*	-.09
Owner Occupied Housing	-.08	.02	.31*
Percent Negro	.10	.08	-.19
College Educated	.28*	.21	.02
Housing Lacking Plumbing	-.05	-.17	-.03
Residences Built Prior to 1950	-.53*	-.60*	.29*
Age Structure	.07	.18	.18
Population Size	-.14	.16	-.09
Population Density	-.07	.09	.08
Percent Females	-.05	-.18	.46*
Natural Growth Rate	.06	.03	-.16
Previous Decade Net-Migration Rate	.58*	.58*	.04
Distance to Nearest SMSA	.22*	.02	.09
Accessability Potential	-.46*	-.32*	.09
Days of Sunshine	.17	.02	-.34*
Yearly Wind Speed	-.23*	-.23	-.02
Yearly Precipitation	.10	.13	.20
Heating Degree Days	-.40*	-.41*	.36*

*Correlations significant at the .05 level.

DETERMINANTS OF METROPOLITAN NET-MIGRATION 1970-1975

by

Karl Melton

B. S., Kansas State University, 1976

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF ARTS

Department of Geography

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1978

This thesis is concerned with metropolitan net-migration. Specifically the study examines the associations of thirty-one metropolitan characteristics with net-migration rates for 100 Standard Metropolitan Statistical Areas in the United States. These metropolitan characteristics include social, economic, demographic, environmental and locational attributes and are viewed as determinants of metropolitan net-migration. The need for the present study stems from the fact that over seventy percent of the American population now reside in metropolitan areas and that historical consolidation of the population has resulted in a dominant inter-metropolitan migration pattern. More importantly, a review of the literature reveals a lack of comprehensive migration analyses dealing with a wide range of both origin and destination characteristics. Past association analyses contain conflicting conclusions about the role of various metropolitan characteristics as determinants of migration rates. In light of previous studies, this thesis should contribute to the predictability and understanding of the migratory process.

Stepwise multiple-regression is used to measure the degrees of association between net-migration rates and the thirty-one selected metropolitan characteristics. Stepwise multiple-regression permits prediction of a dependent variable based upon the values of independent variables. Regression analyses are performed for; a) the entire sample, b) SMSAs having positive net-migration rates and c) SMSAs having negative net-migration rates. Each of the three analyses include the simple correlation values for each of the independent variables with net-migration as well as coefficients of determination, partial correlations and residual values.

The results show that the determinants of metropolitan net-migration vary greatly in explanatory power for each analysis. Thirty-one independent variables explain eighty-seven percent of the positive net-migration sample with characteristics such as percentage of construction employment and percentage of residences built prior to 1950 as primary explanatory variables.

The aggregate analysis reveals an explained variation of seventy-two percent. The previous decade net-migration rate and the percentage of construction employment are the most important variables. The negative net-migration analysis recorded the lowest amount of explained variation (sixty-six percent), with characteristics such as percent females and industrial electrical rates as the explanatory variables. In each analysis economic attributes of metropolitan areas explained the most variation in net-migration. The demographic category is the second most significant with social variables contributing the third most explanation. Environmental and locational attributes consistently recorded the lowest R-squares. Maps of the computed residuals for the positive and negative analyses suggest that the spatial distribution of the unexplained variation represents the distribution of the sample. Mapping of the residuals for the aggregate analysis reveals a distinct pattern; southern metropolitan areas are well predicted by the thirty-one independent variables while the majority of the unexplained variation exists in the northern metropolitan areas.

Present and future implications of the findings suggest that policymakers need to be aware of the significant difference between the factors that best predict in-migration and out-migration. By examining differences in metropolitan characteristics it may be possible to determine the future population growth or decline of metropolitan areas. Further, policymakers must be aware of the complexity of the type of variables used as determinants. The multi-characteristic approach to the explanation of net-migration rates indicates that no one particular disciplinary category can accurately explain net-migration variability.