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TOWARDS COMPREHENSIVE MIGRATION MODELING:  
A META-ANALYTIC APPROACH

by  
WAMUKOTA FRANCIS WAMBALABA


A dissertation submitted in partial fulfillment of the  
requirements for the degree of


DOCTOR OF PHILOSOPHY  
in  
URBAN STUDIES

Portland State University  
1993

TO THE OFFICE OF GRADUATE STUDIES:


The members of the Committee approve the dissertation  
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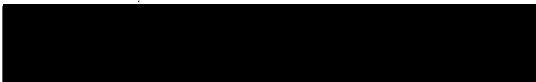
  
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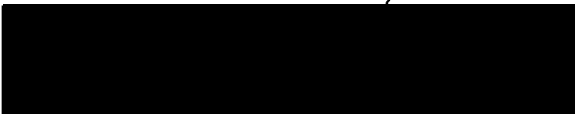
  
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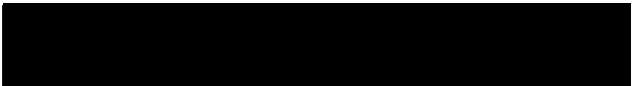
  
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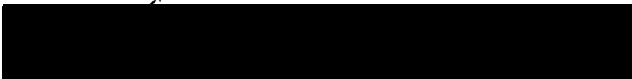
  
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AN ABSTRACT OF THE DISSERTATION OF Wamukota Francis  
Wambalaba for the Doctor of Philosophy in Urban Studies  
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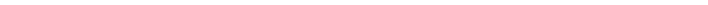
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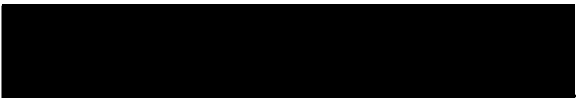
  
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In view of theoretical proliferations in migration studies, there is a need for a more comprehensive approach to migration modeling. A central problem identified in this study was the multitude of potential variables for migration research and the lack of established procedures for selecting among them. Several studies on migration have attempted to answer common migration questions, but with differing variables and therefore divergent conclusions. There is thus a strong potential for misinterpretation by researchers and policy makers. Partial theories of migration have been developed rather than a unified one. This study offers an objective process through which variables may be selected for purposes of migration model design or interpreting completed studies by researchers, policy makers and others.

Meta-analysis was used to develop a heuristic framework as an operational tool for selection of migration modeling options. Because meta-analysis uses past studies as its data, a wide range of previous literature was reviewed. The literature was derived from a number of disciplines, i.e., economics, sociology, geography, demography, and schools of thought within disciplines to move toward a unified modeling framework. The variables identified for meta-analytic procedure were further subjected to a factor analysis to identify the inherent variable constructs. The 1980 intra-state migration between counties in the state of Oregon was

used. The data were obtained from the IRS County to County Migration Records, the County and City Data Book, and the 1980 Census of Population. Seven clusters (constructs) emerged. They included: urban amenity, low mobility, individual mobility, negative amenity, low spatial mobility, mobility, and amenity. Each cluster was representative of a partial approach.

These clusters were then tested by a regression analysis by sorting them out into amenity, spatial, and mobility related variables. The two most frequently used techniques, i.e., the basic Ordinary Least Squares (OLS) and the gravity approach, were used with the same data as in factor analysis. Both OLS and the gravity approach produced a similar pattern of results. Thus, when mobility, spatial, and amenity variables were tested individually, their  $R^2$  was not as high as when variables were selected from each (in spite of having the same number of variables in each).

These findings have several implications. Thus a rationalized unified model, where each significant cluster is represented by a variable, allows parsimonious prediction of migration. A factor analysis is the key technique in pinpointing the minimal set of useful variables. The significance of this heuristic approach also has further implications. First, identification of an analytical structure for the development of a unified theory in migration studies. This heuristic is useful as an applied forecasting

device and an academic tool in policy areas. Secondly, it provides a framework that may be useful in other social sciences' development of theory.

This modeling heuristic has some caveats. Whether an OLS or gravity model specification is used, a factor analysis of potential independent variables is an essential step. In some cases, actual data for this factor analysis may be expensive and difficult to obtain. Variables representing all clusters may not be available: irreducible specification errors are implied. Also, factor analysis requires some qualitative interpretation to elaborate clusters, both in naming them and selecting those to appear in the reduced model. Hence, there is not a single specification from a given structure. Similarly, qualitative analysis is critical in phase 1 of the framework. However, in both of these instances, a wide coverage of literature provides reasonable insurance against subjective error.

## DEDICATION

In the last five and a half years, behind every step towards this accomplishment, there has been a strong, dedicated, supportive, and charming woman. Without her pressure, guidance, sacrifice and, above all, her prayers I would have not done it. She always managed to outmaneuver me out of all excuses for not pushing that extra mile. Thanks to my wonderful wife, Akosa Elizabeth Wambalaba.

Similarly, my Lord also heard innocent prayers from my little boys, Chemiati Khaoya (4 1/2 years old) and Otioli Wamakote (3 years old). For all those days, quality evenings and weekends, dinners together, and even folk tales that you sacrificed, I feel so blessed and privileged to be your Papa.

For everything else you have all done, the least I can do is to dedicate this dissertation to you, my wife and my children. God bless you all abundantly and always.



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Also thanks to my committee members: Dr. Nohad Toulan, your common sense and constructive criticism are well appreciated. Dr. Tom Potiowsky, your suggestions and references provided a wealth of new resources. Dr. Leonard Cain, your encouragement, challenges, and critical reviews were very timely. Thanks to Dr. Howard Wineberg's challenges, which facilitated my preparations. Also thanks for Dr. Crick's suggestions in the colloquium, his previous guidance, and representation of the graduate office.

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## TABLE OF CONTENTS

	PAGE
ACKNOWLEDGEMENTS . . . . .	iii
LIST OF TABLES . . . . .	x
LIST OF FIGURES . . . . .	xii
CHAPTER	
I INTRODUCTION . . . . .	1
The Study . . . . .	3
Common Reference Point . . . . .	4
Factor Analytic Procedure . . . . .	4
Meta-Analytic Technique . . . . .	5
Research Procedure and Objectives . . . . .	5
Methodology . . . . .	7
Procedural Overview of the Framework . . . . .	10
The Modeling Approach . . . . .	11
The Period and Source of Data . . . . .	11
Implementation of the Study . . . . .	12
Inherent Limitations . . . . .	13
II LITERATURE REVIEW . . . . .	16
The Synopsis . . . . .	17
The Scope . . . . .	18
Early Studies: 1858-1960s . . . . .	20
Ravenstein's Laws of Migration . . . . .	21
Bogue's Generalizations . . . . .	24
Lee's Multifactor Theory . . . . .	26

	vi
Theoretical Propositions . . . . .	29
The Gravity Hypothesis . . . . .	29
The Human Capital Hypothesis . . . . .	33
Theoretical Synthesis . . . . .	35
The Hypothetical Approach (Lowry) . . . . .	35
Typological Approaches . . . . .	37
Overview of Early Studies . . . . .	43
Recent Studies: 1960s-1990s . . . . .	44
Interdisciplinary Interest . . . . .	45
Variant Approaches . . . . .	47
Extended Scope Approaches . . . . .	55
Analysis of Literature . . . . .	60
Elements of Scientific Research . . . . .	61
Major Themes in the Literature . . . . .	67
Theoretical Developments . . . . .	69
Interpretational Aspects . . . . .	70
Summary . . . . .	73
III METHODOLOGY . . . . .	75
Overview . . . . .	75
Conceptual Analogy . . . . .	77
The Gravity Model Analogy . . . . .	77
Research Hypotheses . . . . .	81
Research Questions and Hypothetical Statements . . . . .	82
Explanatory Rationale . . . . .	83
Amenity Factors (Attractiveness) . . . . .	85
Mobility Factors (Propensity to Move) . . . . .	87
Allowance for Multiple Association . . . . .	88
Alternative Applicational Models . . . . .	89
Factor Analysis . . . . .	89
Markov Chain Model . . . . .	97

		vii
	The Gravity Model . . . . .	98
	Regression Analysis . . . . .	100
	Meta-analytic Procedure . . . . .	102
	Research Design . . . . .	103
	Explaining the Framework . . . . .	103
	Concluding Remarks . . . . .	107
IV	THE HEURISTIC FRAMEWORK . . . . .	108
	Components of the Framework . . . . .	109
	A Schematic Overview . . . . .	111
	Explaining the Framework . . . . .	111
	Operation of the Framework . . . . .	113
	Variable Specification Analysis . . . . .	114
	Enumeration of Research Variables . . . . .	114
	Enumeration of Variable Specifications . . . . .	117
	Factor Analytic Application . . . . .	127
	Variable Input . . . . .	128
	Data Manipulation . . . . .	131
	Explanations of the Results . . . . .	139
	Conclusions and Prospects for Future Developments . . . . .	142
V	A META-ANALYTIC EVALUATION . . . . .	144
	Variable Specification . . . . .	144
	Mobility, Amenity, and Spatial Classification . . . . .	145
	Mueller's Classification . . . . .	147
	Combined Classification . . . . .	150
	Model Specification . . . . .	152
	Model Selection . . . . .	153
	Markov Chain Model . . . . .	154
	The Gravity Model . . . . .	155
	Regression Model . . . . .	156

		viii
	Overall Analysis . . . . .	157
VI	MULTIPLE REGRESSION ANALYSIS . . . . .	158
	Model Selection . . . . .	159
	Model Specification . . . . .	162
	The Basic Model Approach . . . . .	162
	Variable Specification . . . . .	162
	Model Analysis . . . . .	165
	The Disaggregated Approach . . . . .	169
	Variable Specification . . . . .	172
	Analysis of the Results . . . . .	176
	Significance of the Results . . . . .	180
	Conclusions . . . . .	182
VII	SIGNIFICANCE OF THE FRAMEWORK AND CONCLUSIONS . . . . .	183
	Review of the Study . . . . .	184
	The Problem . . . . .	184
	The Framework . . . . .	184
	Organization . . . . .	186
	Challenges Experienced in the Study . .	188
	Contributions of the Framework Proposed . . . . .	189
	As an Explanatory Tool . . . . .	190
	Research Design/Interpretational Utility . . . . .	191
	Future Developments . . . . .	192
	Conclusions . . . . .	192
	REFERENCES . . . . .	195
	APPENDICES	
	A SUMMARY OF INMIGRATION MODELS . . . . .	209
	B SUMMARY OF OUTMIGRATION MODELS . . . . .	212

C	SUMMARY OF PLACE TO PLACE MODELS . . . . .	215
D	COMPARISON OF $R^2$ ACROSS STUDIES . . . . .	220
E	AGGREGATED STUDIES MODEL . . . . .	222
F	DISAGGREGATED STUDIES MODEL . . . . .	224
G	COMPARISON OF MOST USED MODELS . . . . .	226

## LIST OF TABLES

TABLE		PAGE
I	Summary of Early Studies . . . . .	22
II	Peterson's Typology of Migration . . . . .	38
III	Educational Differentials . . . . .	43
IV	Variant Approaches in Recent Studies . . . . .	46
V	Composite List of Potential Variables	
	Affecting Migration . . . . .	115
VI	Coding of Sampled Variables . . . . .	118
VII	Sampled Studies Coded by Author . . . . .	119
VIII	Unsorted Variable Frequencies . . . . .	121
IX	Most Frequently Used Variables . . . . .	123
X	Sorted Variables Frequencies . . . . .	125
XI	Mean and Standard Deviations by	
	Meansub Command . . . . .	132
XII	Principal Component Extraction . . . . .	133
XIII	Principal Component Factors . . . . .	135
XIV	Final Statistics . . . . .	136
XV	Varimax Rotated Factors . . . . .	137
XVI	Extraction Results . . . . .	140
XVII	Frequency Based on 72 Studies . . . . .	145
XVIII	Mueller's Subdivision of Migration Models . . . . .	147
XIX	Frequency from Mueller's Classification . . . . .	149



XX	Combined Classification Frequency . . . . .	151
XXI	Combined Classification Rank Comparison . . .	151
XXII	Comparison of Model Specification . . . . .	153
XXIII	Extraction Results . . . . .	163
XXIV	Amenity Factor Specifications . . . . .	166
XXV	Mobility Factor Specification . . . . .	167
XXVI	Spatial Factor Specification . . . . .	168
XXVII	Joint Factor Specification . . . . .	169
XXVIII	Gravity Model Approach Specification . . . . .	171
XXIX	Regression Analysis Results for Urbanization Factor . . . . .	173
XXX	Regression Analysis Results for Negative Mobility Factor . . . . .	174
XXXI	Regression Analysis Results for Disamenity Mobility Factor . . . . .	175
XXXII	Regression Analysis Results for Spatial Mobility Factor . . . . .	176
XXXIII	Regression Analysis Results for Joint Factors . . . . .	179

## LIST OF FIGURES

FIGURE	PAGE
1. The Poor to Excellent Continuum . . . . .	28
2. Mabogunje's Systems Approach . . . . .	40
3. Migrants' Educational Status . . . . .	42
4. Types of Migration Streams . . . . .	42
5. Migration Elements and Effects . . . . .	82
6. Basic Path-analytic Causal Diagram . . . . .	94
7. Orthogonal Path-analytic Causal Diagram . . . . .	94
8. Oblique Path-analytic Causal Diagram . . . . .	95
9. The Heuristic Framework . . . . .	110
10. The Scree Test . . . . .	134

## CHAPTER I

### INTRODUCTION

In 1876 William Farr remarked that migration appeared to go without any definite law (1876). On March 17, 1885, 10 years after Farr's remarks, Ravenstein presented his famous paper on The Laws of Migration at the Royal Statistical Society. Today, over a century since Ravenstein's presentation, scholars are still grappling with the issue of basic migration theory.

Thus Maamary's comments in his 1976 dissertation might have been an elaboration of Farr's remarks a century earlier:

Regardless of the substantial volume of research studies on the subject, the diverse disciplines dealing with it, and the many factors related to it, a review of the literature reveals that migration phenomena are still little understood, poorly conceptualized, and lack adequate theoretical orientation. . . . The majority of migration studies have [paid] little or no attention to a theoretical framework as a basis for research orientation or for the formulation of conclusions. (1976, pp. 1-2)

At this same time, but at a more modest level, Bouvier, Macisco, and Zarete noted that "the development of theories in migration has been limited, though several attempts have been made" (1976, p. 25).

Similarly, it has been pointed out that the major problem in migration analysis is the lack of a sound theoretical basis upon which to frame a study (Willis, 1974). Mangalam has argued that

theoretical statements that do exist in contemporary literature . . . largely fail to provide a general framework within which the vast amount of existing facts from different migration studies can be integrated and given meaning. (1968, p. 1)

The significance of such sentiments has recently been echoed in the 1990s as well. Rogers and Belanger (1990) have indicated that without any antecedent framework, the potential exists not only for differences in the specification of the explanatory variables, but also differences in the specification of the migration variable which would essentially result in contradictory findings. And according to Schwarzweller,

there exists a proliferation of useful sociological theories, . . . numerous theories dealing with the cultural contact situation with the socio-psychological processes . . . [but] are often very difficult to translate into researchable terms and are rarely wholistic in their approach. . . . What research sociologists . . . need is a general theory of migration within which the specific problem at hand can be located and toward which the findings can be directed. At present, no major synthesizing effort exists. (1992, p. 1)

It is from this background that this dissertation was conceptualized. It stems from the need for a more structured analytical tool and conceptualization of migration literature that can enhance a more comprehensive

development of migration theory. Therefore, this study sets forth a heuristic framework through which such a theoretical development may be advanced and applied research may be facilitated.

### THE STUDY

This research proposes a heuristic framework that may enhance the development of theory in migration studies. This heuristic framework attempts to set a base structure from which the analysis and design of migration studies may proceed from common elements and follow a standard approach. On one hand, commonality of elements is expected to ensure variable representativeness in migration models. A standard approach, on the other hand, is vital for ensuring consistency between studies and respective interpretations. This research study was built on the assumption that the development of a comprehensive migration theory has been hindered by the lack of a standard procedure for specifying model variables. Consequently, the resulting proliferation in approaches has led to partial theories that need integration.

Three main procedures are proposed here as a source of integrating migration studies toward a common theory. These include a conceptual configuration of common reference points for all relevant variables, a factor analytic procedure for limiting model specification problems, and a

meta-analytic evaluation process and application on empirical studies for the development of theory. Each procedure is explained below.

#### Common Reference Point

The first procedure involved a conceptual configuration of common migration-related elements with similar variables. Thus it attempts to identify relevant migration variables from previous studies. Based on the context of these studies and previous classifications, a more general classification was derived. The purpose of such a classification was to simplify the grouping of migrational variables from a wholistic perspective with little loss in variable representativeness.

#### Factor Analytic Procedure

This procedure was used to eliminate the potential for statistical problems such as multicollinearity due to the selection of proxies that measure the same variable while ensuring variable representativeness. The application of factor analysis also created variable classifications. Unlike the previous classification (which was based on an autonomously logical characterization), factor analysis relies on endogenous association among variables to determine the inherent latent structure.

### Meta-analytic Technique

This technique was used on empirical studies to scientifically draw conclusions from the findings inherent in such studies. This ensured consistent results and was therefore suitable for establishing theory about a given phenomenon. In this study, it was anticipated that results derived from empirical studies that have utilized the above two procedures would be more attractive to a meta-analytic procedure.

To satisfy the demands of these procedures, this study therefore included a review and analysis of a diverse but relevant literature as part of the data. In spite of its orientation to a spatial economic perspective, this study attempts to capture as much interdisciplinary interest as possible.

### RESEARCH PROCEDURE AND OBJECTIVES

The main objective of this research study, therefore, was to enhance the development of theory in migration studies. The formulation of this heuristic framework was accomplished through a number of steps. The first step was the review of migration literature associated with "depth" (i.e., at model specification level), associated with "length" (i.e., from 1858 to 1992), and associated with "breadth" (i.e., across several disciplines).

The second step involved the analysis of this literature in order to identify any inherent structural compositions. This included the identification of all potential variables followed by their classification according to hypothesized categories assumed to have a common reference point. This step helped to explain how such a classification reinforces the historical trends, as will be observed in Chapter II, while accommodating for variations within individual objectives. From these findings, the third step was to conceptualize an operational framework using typological representations, factor analysis, and a meta-analytic evaluation.

Lastly, a sample of migration models and their relation to this framework are discussed. This includes the generation of a criterion and the selection of the regression analysis model for application purposes. The model specifications are demonstrated by using the U.S. Internal Revenue Service (IRS) Area to Area Migration and County Income Data for 1980 (IRS, 1990), the 1980 Census of Population (U.S. Bureau of Census, 1980), and the City and County Data Book for the (U.S. Bureau of Census, 1983) 1980 data on variables affecting intra-state migration among all the counties in the state of Oregon.

The data noted above are, of course, secondary at the county level. Here direct inferences of this work are to the county as a human ecological unit. Virtually all the



past models noted herein are based on area rather than individual data, and application of the approach offered is envisioned to be done by planning jurisdictions. By definition these are areal units.

### Methodology

The main thrust of this study is the development of a heuristic framework that provides basic guidelines by which a comprehensive theory of migration may be developed. A detailed explanation of the framework is reserved for Chapter IV. This framework was based on the assumption that any viable theory in social sciences requires a variety of procedures. The first procedure is to cover a wide range of literature on the subject to ensure a large representation of related aspects. It is also part of the data for a meta-analytic study. As will be elaborated in the methodology section in Chapter III, a meta-analytic approach involves a collection of findings from individual studies for the purpose of integrating, synthesizing, and making sense of them (Wolf, 1986, p. 5). Thus existing literature becomes part of the data for a meta-analytic approach.

In view of the fact that a research procedure was to be established by this framework, Chapter VI attempts a meta-analytic evaluation on both variable specification studies and model specification studies. Similarly, as an umbrella for all models and analysis in this study, a meta-analytic

approach is evidenced across other chapters by various tabular representations as well as discussive comparisons. Its associated statistical approach, however, is premature at the moment and therefore will be recommended toward the final stages of theory.

The survey of literature in this study therefore also represents a sample of useful data. Thus, out of this literature, an intuitively wholistic perspective was conceptualized to capture as wide range of migration aspects as possible. With such a conceptualization, a listing of migration variables encountered in literature was made, while ensuring that they were as comprehensive as possible. The conceptualization of migration into mobility, amenity, and spatial categories in this study was used to ensure such comprehensiveness.

In order to be of applicable use, such a multitude of diverse variables needed to be reduced to a few representative variables. A scientific procedure, such as factor analysis (which is usually used for such operations), was used here to create clusters of variables associated with one another. Each cluster or family of variables constitutes a unique characteristic that contributes toward a wholistic configuration of migration aspects.

Eventually, when enough select clusters of factor analyses at different ecological levels are done, it may be possible for the researcher with limited resources to

reference them when selecting variables and produce highly efficient models that are theoretically comprehensive. While the resources limit the amount of data that may be gathered, past factor analyses can be used to ensure the variables gathered are all needed and are a subset of a broader comprehensive set.

The composition of all these clusters was anticipated to provide a basis for a comprehensive theory. Otherwise, it was anticipated that any combination of select clusters in exclusion of others would leave out certain characteristics of a migration process. Such a composition would result in a partial theory that would be limited to only those aspects represented by select clusters.

The factor analytic procedure was therefore identified as the critical model and link towards a successful meta-analytic evaluation. It identifies areas to be represented in any forthcoming models or assists in the interpretation of existing studies (meta-analysis). Among the possible models that may utilize factor analytic results is the regression model. Without necessarily giving this model center stage, this study attempts to indicate how a regression model may fit into this framework, either towards a partial or comprehensive theory of migration.

### Procedural Overview of the Framework

A step-by-step procedure of this framework is outlined below.

1. Based on a wide range of existing literature, intuitively conceptualize a few simple aspects that capture a wholistic perspective of a migration phenomenon.

2. Identify all possible associated variables, especially by a survey of previous studies.

3. Utilize a factor analytic model as a scientific approach towards the identification of variable structures that would expose clusters or families of related variables, and also as a means of reducing the number of potential variables or proxies to be applied in further models.

4. In view of the various clusters identified by factor analysis, operationalize the framework in two respects. For example, a study may be considered to be a partial or comprehensive analysis depending on whether at least each cluster is represented in the model or not. This includes both the research design and the research interpretation process.

5. Evaluate further studies of similar nature (comprehensive or partial) through a meta-analytic approach to provide a strong basis for a theory (comprehensive or partial).

6. Continuously apply or further refine the hypothesized theory in its explanation of the migration process by repeating the above steps.

#### The Modeling Approach

It is emphasized in this introduction that the key model of this study was the factor analytic model and that the primary purpose of this study was to make a meta-analytic evaluation from previous literature so as to enhance the development of theory. Other pertinent models were used only at the auxiliary level. The heuristic framework proposed in this study therefore constitutes an operational guideline that sets a structure inclusive of various models that interactively lead towards a comprehensive development of theory.

#### The Period and Source of Data

This study relies solely on secondary data in a cross-sectional analysis. The period for model application of this study therefore is 1980 in both factor analysis and the auxiliary regression model. The county to county migration data were obtained from the IRS administrative records for the 1980 county to county migration flows in the state of Oregon (IRS, 1990). These are public records and are not directly traceable to any specific human subject. The other sources of these data include the 1980 Census of Population

(U.S. Bureau of Census, 1980) and the 1980 data from the City and County Data Book (U.S. Bureau of Census, 1983).

### Implementation of the Study

Efforts were made to ensure a comprehensive coverage of the literature in the field. A complete meta-analysis requires this. Three parameters were set. The first is the breadth of the literature. Starting with an economics perspective, this approach extends to other fields, including anthropology, geography, demography, sociology, and other related areas in social sciences. Second, from a chronological perspective, the literature in this field is surveyed from Carey's 1858 writings and 1885, when Ravenstein's laws of migration were introduced. Last, model specification is explored in depth.

To accomplish these objectives, the following resources were reviewed for recent and classic literature:

The Index of Economic Article

SAGE Urban Studies Abstracts

Social Sciences Index

Subject Index Articles (Journal of Economic Literature)

Index of Current Urban Documents

Follow-up of major citations in literature

This process was used to ensure that the review of literature was representative of the work that is pertinent to the objectives of this study.

The overall survey of migration literature is presented in Chapter II. The coverage includes a general overview of the early literature, the recent literature, and a general analysis of the overall context. Chapter III emphasizes methodology and the need for a simplified approach in migration literature. It provides a conceptual perspective of the approach that includes a basic analytical assessment, analogous representations, and pertinent schematic rationales.

The heuristic framework is derived in Chapter IV. This includes the analysis of specification variables, the typological representations, a factor analytic model, and finally the explanation about the framework. In Chapter V a meta-analytic evaluation is made, with the objective of identifying the underlying structure within current migration models as well as establishing the criteria for selecting an applicational model. The utility of this framework is explored in Chapter VI. Thus two approaches are discussed here, i.e., a basic aggregated regression model and a disaggregated regression model. Chapter VII elaborates on the significance of this study and exposes new areas for exploration.

#### INHERENT LIMITATIONS

Certain limitations were anticipated. First, access to some of the literature was difficult, especially the most

recent and the very early ones. In such cases, available secondary sources were used. Any development of operational models was also limited to accessible data. Interpretations are qualified as appropriately as possible.

Not all of the available model forms were utilized. Also, because this study was directed at the development of an analytical framework, other models were evaluated at only the basic level. Ultimately, the goal of developing a framework that is effective from theory to application favors the use of a modeling method that is generally available, in this case regression analysis.

Economic determinants of migration on other variables that could be readily capitalized ultimately emerged as the analytical nexus of this study. Those who are looking for approaches emphasizing social and individual behavioral motivations may find the models applied here not to be wholly satisfactory. Those who favor simultaneous or probabilistic models may feel these approaches have received abbreviated coverage.

Because this study uses secondary data, individual characteristics used will not reflect characteristics of specific migrants. Instead, it will reflect the average characteristics of the population. Therefore, even though a comprehensive model can be used by researchers to pick appropriate variables, such limitations by secondary data imply some restrictions on choice of variables.



However, as will be seen, the great bulk of migration modeling has been done using linear regression models with areal data. It is this large core of the total literature which is addressed by this work. Broad dissemination of migration modeling to applied areas such as planning is presently mitigated against by contradictory data problems. The heuristic will directly attack the first problem and help in reducing data search problems.

## CHAPTER II

### LITERATURE REVIEW

On March 17, 1885, at the Royal Statistical Society, Ravenstein presented his famous paper, "The Laws of Migration" (1885). These laws emphasized economic factors and employment opportunities. In 1889 Ravenstein bolstered these views in his follow-up paper in which he elaborated on the relationship between migration and distance (Maamary, 1976, pp. 5-6).

Deriving from these propositions, the study of migration in literature has evolved into more rigorous and diverse approaches. For ease of inference, one may associate Ravenstein's laws and the succeeding similar representations as the initial stage in migration studies. This stage was devoted to the formulation of principles governing migration flows. The next stage of this literature was a slight shift that consisted of scientific approaches that attempted to model migration studies. The first of these was the gravity model, noted as early as 1924 in Young's work (1924). This model is credited, however, to Stouffer and Zipf in the 1940s through the 1960s. The second approach was the human capital model, which was noted as

early as 1932 by the work of Hicks. This approach is similarly attributed to Sjaastad's more concrete proposition in the 1960s.

The early literature in migration studies therefore progressed from the formulation of migration principles into a scientific setting that mostly consisted of the gravity models and the human capital hypothesis. Out of these earlier studies more diverse models and approaches have been developed in the recent studies beginning in the late 1960s.

In most of the recent literature, the diversity in modeling stems partly from the diverse nature of migrational principles and partly due to deeper analysis in terms of variable specifications. Starting from the late 1960s a few variables have appeared repeatedly in literature with a counter-point of studies which attempt to include unique variables in their specifications. Such unique specifications have consequently overshadowed their common link to the overall migration equation. In view of such proliferations that often seem contradictory, many still wonder if there are any laws that govern migration.

#### THE SYNOPSIS

Thus, in spite of a long history of research into migration, particularly with regard to labor resources (Greenwood & Hunt, 1984; Harris & Todaro, 1970; Mueller, 1982; Muth, 1971; Nelson, 1959; Ravenstein, 1885; Sjaastad,

1962; Stouffer, 1940; to name a few), there is no reasonable evidence of a comprehensive approach that explains inter-regional migration. In some cases models are successful (Beals, Levy, & Moses, 1967; Greenwood & Hunt, 1984; Sommers & Suits, 1973), but few are robust. In other cases there seem to be inherent shortcomings in this field that reflect a tendency of model variations and limited generalizability.

#### THE SCOPE

In existing literature these problems are reflected at various levels. At the first level there are many approaches to the study of interregional migration. Some of these derive from the principles of traditional academic disciplines, e.g., economics, sociology, or demography. Cummings's (1985) classification and Muth's and Todaro's works on the relationship between migration and employment are representative of this group. Some focus on techniques (Clark, 1986; Masser & Gould, 1975). Some approach modeling in terms of causes and effects, while others focus on empirical correlations (Greenwood, 1975; Mueller, 1982; Sahota, 1968).

The second level is reflected in the multiplicity of variants within the approaches noted above. For example, technical approaches include systems models, economic models, spatial interaction models, sequential models

(Masser & Gould, 1975), gravity models, regression models, and Markov chain models (Clark, 1986). In fact, models that are virtually substantively identical, e.g., spatial interaction and gravity models (Haynes, 1985; Masser & Gould, 1975), are pursued as if they represented totally disparate approaches. This complicates not only operational modeling but also the identification of theoretical anchors.

Lastly, within any modeling approach, variables seem specified without any generalized systematic arguments and often show little recognition of antecedent work (Graves, 1979; Greenwood & Hunt, 1984; Liu, 1975; Nelson, 1959; Sahota, 1968; Schultz, 1971). Thus models seem to utilize variables that appear to be randomly chosen or highly specific to unique cases. As will be evident later, no reasonable common basis of modeling is in evidence except for replication studies. Again, most investigation into migration seems to proceed as if little relevant previous work has been done.

The present study attempts to deal with all three levels of problems. Emphasis is placed on the weak systematic structure and the consequent problems of comparability. The heuristic framework that is proposed here will therefore attempt to put pertinent elements of migration modeling into focus. Ultimately it will be demonstrated that all these approaches and models utilize a common pool of theoretical premises and a common reservoir of variables. These

commonalities are hypothesized to provide the basis for a more comprehensive approach to modeling interregional migration.

This literature review will attempt to account through most of these early studies. It will also provide a representative sample of recent ones. The general survey will be followed by an overall analysis of the major themes and general theoretical developments covered in this chapter.

#### EARLY STUDIES: 1858-1960S

According to Ogden (1984, p. 13), Ravenstein was one of the first scholars to suggest that clear "laws of migration" characterized migrants in terms of their origin, destination, and the nature of migration streams. These ideas were developed in three papers published in 1876, 1885, and 1889. His 1885 and 1889 papers are the most widely quoted in literature (Bouvier et al., 1976; Maamary, 1976; Ogden, 1984).

In this section, a review of Ravenstein's laws of migration will be identified as the foundation from which further principles have been developed in regard to migration studies. Second, from these principles, the nature of theoretical propositions associated with the above principles will be examined. Specifically, a review of the gravity hypothesis and the human capital hypothesis will be presented. Based on these hypotheses, some of the

theoretical syntheses that have been attempted in literature will be reviewed. A summary of these studies is tabulated in Table I.

#### Ravenstein's Laws of Migration

Ravenstein based his study on birthplace data for Britain in 1871 and 1881 and later on North America and Europe. His goal was to discover whether he could distinguish any organizing principles from the great mass of movements recorded in the data. From these studies, Ravenstein developed his "laws of migration" (cited by Ogden, 1984) as follows:

1. The majority of migrants go only a short distance.
2. Migration proceeds step by step.
3. Migrants going long distances generally go by preference to one of the great centers of commerce or industry.
4. Each current of migration produces a compensating countercurrent.
5. The natives of towns are more migratory than those of rural areas.
6. Females are more migratory than males within the kingdom of their birth, but males more frequently venture beyond.
7. Most migrants are adults; families rarely migrate out of their country of birth.

TABLE I  
SUMMARY OF EARLY STUDIES

Year	Scholar	Ideas
<u>Migration Principles</u>		
1885	Ravenstein	Laws of migration, i.e., general aspects governing migration.
1959	Bogue	Hypothetical generalizations derived from purported empirical research.
1966	Lee	Multifactor theory based on three categories of principles, i.e., volume of migration, streams and counterstreams of migration, and characteristics of migrants.
<u>Theoretical Propositions</u>		
The Gravity Hypothesis:		
1858	Carey	Association of social concepts to principles in physical sciences.
1924	Young	Empirical application of physical sciences to migration.
1940	Stouffer	Intervening opportunities in migration emphasizing alternative opportunities at destinations and origin.
1949	Zipf	Interactance hypothesis with a formulation based on population at origin and destination and the distance between.



TABLE I  
SUMMARY OF EARLY STUDIES  
(continued)

Year	Scholar	Ideas
The Human Capital Hypothesis:		
1932	Hicks	Differences in wages are the main cause of migration.
1962	Sjaastad Schultz	Emphasis on investments in migrational aspects and returns to migration.
1970	Harris & Todaro	Returns to migration in reference to developing countries.
<u>Theoretical Syntheses</u>		
Hypothetical Exposition:		
1966	Lowry	Synthesis of the gravity model and the human capital hypothesis.
Typological Exposition:		
1961	Peterson	A general typology of migration based on migratory forces.
1970	Maboguje	Variable interrelationships based on Systems Approach.
1976	Bouvier, Macisco, & Zarete	Migrational differentials emphasizing the strong implication of education variable in model specification.

8. Large towns grow more by migration than by natural increase.
9. Migration increases in volume as industries and commerce develop and transport improves.
10. The major direction of migration is from agricultural areas to areas of industry and commerce.
11. The major causes of migration are economic.

It is important to point out that most of the present migration literature revolves around these principles. As will be noticed in this research, most of these ideas have survived over time through years of refinement and conceptualization. Among the recent restatements of such hypotheses are Donald J. Bogue (1959) and Everett S. Lee (1966).

#### Bogue's Generalizations

Bogue's work (cited by Maamary, 1976) focused on migration streams in which he argued that empirical research has supported the validity of 12 generalizations as listed below.

1. The rate of immigration to a central point from each of other several points lying at a distance tends to vary inversely with the distance.
2. The rate of outmigration from a central point to each of several other central points lying at a distance tends to vary inversely with the distance.
3. The amount of interchange between any two areas is directly proportional to the product of the population of the two areas and inversely proportional to the distance between them.
4. Rates of migration between two areas tend to be directly proportional to the level of living

and inversely proportional to the distance between them.

5. If two areas are in different economic regions, the relationships between distance and the number of migrants may be different from the relationship within an economically integrated area.

6. 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.

7. The rate of migration between two communities varies with the type of community or origin and destination, the direction of migration, age, and other characteristics of the migrant.

8. The rate of immigration and outmigration in any community tends not to be independent of each other. A high rate of immigration tends to be accompanied by a high rate of outmigration.

9. A very high proportion of all migration streams is a flow between communities of the same type (urban to urban, farm to farm, etc.).

10. Migration streams tend to avoid areas of high unemployment and to flow with greatest velocity towards areas of low unemployment.

11. The size, direction, and net effect of migration streams are not invariable, either in time or place. Instead, they are highly sensitive to the social and economic changes that are occurring in the various communities of origin and destination.

12. The regional pattern of net migration tends to remain constant for several decades, presumably reflecting the continued action of redistributive forces. (Bogue cited by Maamary, 1976, p. 10)

Unlike Ravenstein's ideas, which were more general statements from observations at the time, Bogue's (1959) statements are tailored to a pattern close to a gravity-type model. This reflects the push/pull hypothesis implied in Ravenstein's writings. In spite of this attempt to narrow down Ravenstein's statements into a more focused applicational form, Bogue's hypotheses were still generalizations

of migration principles. The work of creating subcategories within these principles was, therefore, left for Everett S. Lee.

### Lee's Multifactor Theory

In 1966, Everett S. Lee attempted to create a classification of similar migration forces in a more streamlined conception, as described by Bouvier et al. (1976):

[Lee] derived certain self evident propositions and deduced some conclusions with regard to the volume of migration, the development of streams and counterstreams and most important . . . the characteristics of migrants. (p. 25)

Utilizing some ideas of Ravenstein and Bogue, Lee isolated four factors that he hypothesized underlie the decision to migrate, factors such as those associated with the place of origin, the place of destination, intervening obstacles between origin and destination, and a variety of personal attributes (cited by Ogden, 1984, p. 18). From these conceptions Lee further derived a series of hypotheses about the volume of migration, the development of streams and counterstreams, and the characteristics of migrants:

1. The volume of migration within a given territory varies with the degree of diversity of areas included in that territory.
2. The volume of migration varies with the diversity of people.
3. The volume of migration varies inversely with the difficulty of surmounting the intervening obstacles.
4. The volume of migration increases during periods of economic expansion, and decreases during depressions.

5. Unless severe checks are imposed, both the volume and rate of migration tend to increase with time.

6. The volume and rate of migration vary with the state of progress in a country and area. (Lee cited by Maamary, 1976, pp. 8-9)

As is evident from the principles of Ravenstein and, more so, Bogue, this segment, in which size of population plays a major role in migration, emphasizes elements of a gravity model. Lee's next segment (Lee cited by Maamary, 1976) emphasized migration streams and counterstreams:

1. Migration tends to take place largely within well defined streams.

2. For every major migration stream, a counterstream develops.

3. The efficiency of a stream is high if the major factors in the development of migration streams were push factors at the origin.

4. The efficiency of a stream and counterstream tends to be low if origin and destination are similar.

5. The efficiency of migration streams will be high if the intervening obstacles are great.

6. The efficiency of migration streams varies with economic conditions, being high in prosperous times and low in times of depression. (p. 10)

Unlike the first segment on volume of migration, this one emphasizes distance variables in terms of migration stock. The implication is that migration is not solely one individual's decision, but is influenced by those around the migrant and those at alternative destinations. Lee has gone further, however, indicating that individual characteristics also play a major role in migration. His third segment, on characteristics of migration, therefore focuses on qualities that have come to be considered as mobility factors:

1. Migration is selective . . . , migrants are not a random sample of the population at the origin.

2. Migrants responding primarily to pull factors at destinations tend to be positively selected (of high quality).

3. Migrants responding primarily to push factors at origin tend to be negative selected (of low quality).

4. Taking all migrants together, selection tends to be bimodal, forming a U-shaped curve along a poor to excellent continuum [see Figure 1].

5. The degree of positive selection increases with the difficulty of the intervening obstacles.

6. The heightened propensity to migrate at certain stages of life cycle is important in the selection of migrants.

7. The characteristics of migrants tend to be intermediate between the characteristics of the population at origin and destination. (Lee cited by Maamary, 1976, p. 11)

Lee's work may be distinguished from Ravenstein's and Bogue's works in two ways. First, he attempted to categorize migration principles around three major components, i.e., population volume, migration streams, and the migrant's characteristics. Second, characteristics of migrants were more explicitly stressed by Lee than by

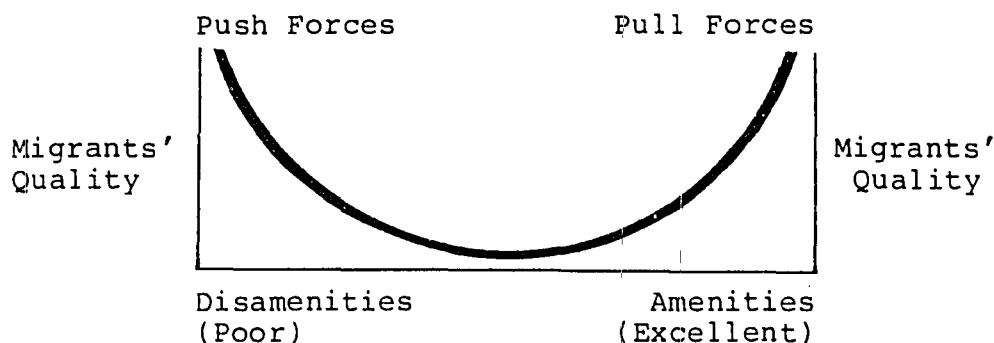


Figure 1. The poor to excellent continuum.

Ravenstein or Bogue. In general, however, this review uncovers an implicit trend in the development of migration principles. All of these generalizations have attempted to conceptualize some of the basic principles governing migration flows. From these principles, theoretical propositions have been generated. The ones most significant are accounted here.

#### THEORETICAL PROPOSITIONS

Among the earliest theoretical propositions on migration are the gravity and the human capital models. The gravity models stem from physical science for the purpose of rendering the social sciences fields a scientific capability of analyzing social phenomena. Among the major proponents of this approach are Samuel A. Stouffer (1940, 1960) and George Kingsley Zipf (1949). The human capital approach in migration literature has been attributed to, among others, Larry A. Sjaastad (1962), Theodore W. Schultz (1962), and for developing countries studies recognition has gone to Michael P. Todaro (1976).

#### The Gravity Hypothesis

The gravity hypothesis utilizes Newtonian physics to explain social sciences phenomena. Haynes and Fotheringham (1985, pp. 16-17) cite variants of this adaptation, such as Carey's (1858) attempts to develop social science concepts

with physical science principles, Ravenstein's (1885) and Young's (1924) empirical applications to migration, Reilly's (1929) Law of Retail Gravitation, and Stouffer's (1940, 1960) intervening opportunities model. In addition, Zipf (1949) used this concept to introduce his  $P_1 \cdot P_2 / D$  hypothesis. Huff (1959) used it to introduce his model on consumer behavior, and Wilson (1967) used it to introduce his entropy model.

In migration studies, the gravity hypothesis has been associated with the measurement and effect of distance in relative terms by integrating relative distance and relative scale or size to population migration. Ravenstein's association of distance to migration has already been observed. Two other hypotheses espousing this idea relate to Stouffer (1940) and Zipf (1949).

Stouffer's Intervening Opportunities. Samuel Stouffer, an American social psychologist, attempted to show that migration over a given distance is related to the number of opportunities at that distance and inversely related to the number of intervening opportunities. Thus distance is treated in socio-economic rather than geometric terms (Ogden, 1984, p. 21). The theory assumes that the number of persons going a given distance is directly proportional to the percentage increase in opportunities at that distance. In this case, opportunities were operationally measured in terms of houses and apartment vacancies (Maamary, 1976,



p. 7). Thus a mobile person will cease to move when he or she encounters an appropriate opportunity (Ogden, 1984, p. 22).

In Stouffer's analysis, the role of distance was not only significant in physical terms but also psychologically. This associated distance with being away from the family, friends, familiar environments, one's own customs, etc. Hence the more of these factors, the more costly is the migration option, and therefore the less likely is the actual migration. Stouffer referred to this psychological distance as the "intervening opportunities."

Zipf's Hypothesis. George Kingsley Zipf introduced the  $P_1 \cdot P_2 / D$  hypothesis, which relates migration to distance (D) and population (P) size (Zipf, 1949). This hypothesis is based on three basic assumptions:

1. The rate of immigration to a central point from each of other central points lying at a distance tends to vary inversely with the distance.
2. The rate of outmigration from a central point to each of several other points lying at a distance tends to vary inversely with the distance.
3. The amount of interchange between any two areas is directly proportional to the product of the population of the two areas and inversely proportional to the distance between them.

This hypothesis has undergone several modifications, such as adjusting the distance element with an exponent to indicate proportional effects ("distance decay or friction of distance"), adding an exponent on population elements to allow for other propelling and attracting variables on interaction, and finally a scale parameter or constant ( $k$ ) to make the overall equation proportional to the "rate characteristic" of the phenomena being modeled (Haynes & Fotheringham, 1985, p. 16). Ultimately, the model has been transformed from a basic  $P_1 \cdot P_2 / D$  model to a more sophisticated  $kP \cdot P_j / d_{ij}$  model.

In the final analysis, however, this model is still essentially descriptive and predictive for aggregate migration flows (Mueller, 1982, p. 8). It is based on the same logic as that of Stouffer's intervening opportunities. In this case, the population size plays a major role, and by implication the larger the population at the destination, the higher the probability of tracing friends, relatives, and similar customs that a migrant is familiar with, and therefore the higher the chances of immigrating there. Large populations at the origin may be inferred to have less cohesion or weak ties and therefore constitute a more mobile population.

Both of these examples (Stouffer and Zipf) exhibit a representative trend in gravity models. These models were closely followed by the human capital models.

### The Human Capital Hypothesis

The human capital hypothesis originates from the neo-classical economics theory, as expressed by Hicks (1932), that "differences in net economic advantages, chiefly differences in wages, are the main cause of migration" (p. 76). Thus under the Marshallian period-analysis of markets, regional differential wages result from regional changes in demand for labor. The wage disparities are therefore eliminated by the equilibrating force of migration.

A similar equilibrium is achievable under the Keynesian period-analysis where changes in demand for labor results in regional differentials in employment rates. In this case, migration will continue until all employment rates are equalized. In a neoclassical sense, therefore, regional disparities in per capita income are essentially eliminated by the responsiveness of migration to wage or employment differentials (Mueller, 1982, p. 8).

Similarly, in his analysis of economic foundations of immigration, Massey (1992) reviews two conceptions, i.e., that immigration is caused by wage differentials between sending and receiving nations, and secondly, that pressures for emigration stem from a lack of economic development in sending regions. He puts the human capital approach in a clearer perspective by referring to both macro- and micro-economic theories as follows:

Macroeconomic theory holds that wages are determined by the balance of labor supply and demand within regional markets. If there is relative scarcity of workers in one market and relative abundance in another, wages will be high in the former and low in the latter. Migration represents an equilibrating mechanism between the two regions. If the high wages are sufficient to cover the costs of interregional movement and adjustment, workers from the low wage area move to the high wage area. The increased supply of workers from a low wage area creates an upward pressure there. The process continues until, at equilibrium, the wage differential between the two areas equals the costs of interregional movement and adjustment. . . . The corresponding microeconomics of this larger process have been developed in classic articles by Sjaastad and Todaro which conceptualize migration as a cost/benefit decision. Potential migrants figure the total future increase in earnings they can expect as a result of migrating to a higher-paying job, weighted by the probability of obtaining that job and discounting by a factor reflecting the lower utility of earnings in the future. From these expected gains they subtract expected costs. If the balance between anticipated gains and costs is positive, a person decides to migrate. (1992, p. 14)

Sahota (1968, pp. 219-220) attributes the concept of human capital to Schultz and Sjaastad, both of whom he identifies as members of "the Chicago School." Here, migration depends on the costs and returns on investments in human capital. Costs may be direct expenditures (such as income foregone) or indirect (such as psychic). The returns consist of future streams of expected incomes from the better opportunities. Therefore, investment in migration has higher payoffs similar to payments from investments in education, health, or company stocks.

In reviewing the supplementary issue of the Journal of Political Economy (1962, Vol. 5), which was dedicated to the human capital concept, it is evident that credit goes to Sjaastad's work as the most embracing in relation to human capital migration literature. A more detailed review of his work is discussed later in this chapter. Similar credit is owed to John Harris and Michael Todaro for their work in developing countries. In the same vein, a detailed review of this work is also appropriately reserved for later in this chapter. However, the substance of this concept is that migration is a rational process through which migrants aim to maximize their economic welfare.

#### THEORETICAL SYNTHESIS

Drawing from the above theoretical propositions, some of the early literature has attempted to synthesize the various approaches in a more comprehensive analysis. These range from the hypothetical approaches of Lowry to typologies such as those of Peterson, Mabogunje, and Bouvier et al. These studies are reviewed below.

##### The Hypothetical Approach (Lowry)

Among the early hypothetical approaches, the most cited is that of Lowry (1966), who attempted to synthesize the gravity model with the human capital model. In 1964 Lowry argued that an urban land use model that was built around

two gravity model structures with residential and retail service feedbacks relates the distribution of population to residential zones from an initial distribution of basic employment by zone. Further, in 1966 Lowry synthesized the gravity model with the human capital hypothesis in which he "viewed migration as the key link between regional economic growth and regional population growth, that is, as a behavioral response to economic opportunity" (Lowry cited by Mueller, 1982, p. 8). This model was of the following form:

$$M_{ij} = k(U_i/U_j \cdot W_j/W_i \cdot L_i L_j / D_{ij})$$

where

- $M_{ij}$  = migration from i to j
- $U_i$  &  $U_j$  = unemployment rates at i and j
- $W_i$  &  $W_j$  = wage rates at i and j
- $L_i$  &  $L_j$  = labor forces at i and j
- $D_{ij}$  = intervening distance between i and j
- $k$  = a scale parameter

The inherent argument of this representation was that, once the neoclassical equilibrating effects of migration have eliminated any differential wages and differential unemployment rates, further migration would only be a random interchange of people based on population sizes and the intervening distance between the two points. A further perspective of this analysis was that economic conditions at the origin and destination would have a symmetrical effect

on migration. Lowry's later application of the model, however, led him to believe that the economic conditions at the origin were less significant.

### Typological Approaches

Unlike Lowry's hypothetical approach, the typological analyses involve some logical schematic representation of the migration process. The first of these representations is that of Peterson (1961), who attempted to classify various types of interaction, types of migrations that are associated with certain types of migratory forces, and classes of migration. Mabogunje's (1970) typology represented migration from a systems approach where all pertinent elements are accounted for. And lastly, Bouvier et al. (1976) utilized a typological approach to develop a framework based on educational differentials before and after migration within a specific environment.

Peterson's Typological Approach. Because of the difficulties with formulating "theories" and "laws" on social phenomena, Peterson (1961) argued that empirical regularities do not always hold. He therefore proposed a typology that relates the various conditions under which migration takes place to their probable effects. Using a push/pull hypothesis as his guiding framework, Peterson distinguished between migration that he referred to as "innovating" and that which may be called "conservative." He also used the

migrant's level of aspiration to arrive at five broad classes of migration, i.e., primitive, forced, impelled, free, and mass migration, as shown in Table II.

Mabogunje's Systems Approach. In his study of rural-urban migration in Africa, Mabogunje (1970) viewed migration as a complex chain of interdependent forces at both origin and destination. These forces are part of a system of interrelated elements including the economic (such as wages, prices, consumer preferences, degrees of commercialization and industrial development), social welfare (such as education, health, recreation), institutional (such as government policies, agricultural practices, marketing organization,

TABLE II  
PETERSON'S TYPOLOGY OF MIGRATION

Type of Interaction	Migratory Force	Class of Migration	Type of Migration	
			Conservative	Innovative
Nature and man	Ecological push	Primitive	Wandering/ranging	Flight from the land
State (or equivalent) and man	Migration policy	Impelled/forced	Flight/displacement	Coolie trade/slave trade
Man and his norms	Higher aspirations	Free	Group	Pioneer
Collective behavior	Social momentum	Mass	Settlement	Urbanization

NOTE: From Maamary, 1976, p. 27.



population movement), and technological (such as transportation, communication, mechanization). Unlike the linear cause-and-effect approaches, here the system is circular, interdependent, and self-modifying, in which changes in one part have ripple effects on the whole.

In this system (see Figure 2), the first element is the potential migrant who is impacted by a stimulus from the environment. The second element consists of two control subsystems in which institutional forces such as family encouragement or restraint on mobility affect the flow of migrants, or the occupational and residential opportunities in which the degree of assimilation of migrants is determined. The third element is the adjustment mechanism, evidenced either in response to the migrants' exit/entry or their response to new social groups (Ogden, 1984, pp. 23-24).

The underlying assumptions are that migration channels are associated with questions of cost, distance and direction. Also, once established, the migrant maintains ties to home and provides information as positive or negative feedback. In essence, the systems approach underscores the fact that the decision to migrate is part of an interlocking series of causes and effects.

Bouvier's Migrational Differentials Approach. Similar to the works of Peterson and Mabogunje is Bouvier et al.'s differentials approach (Bouvier et al., 1976). In trying to

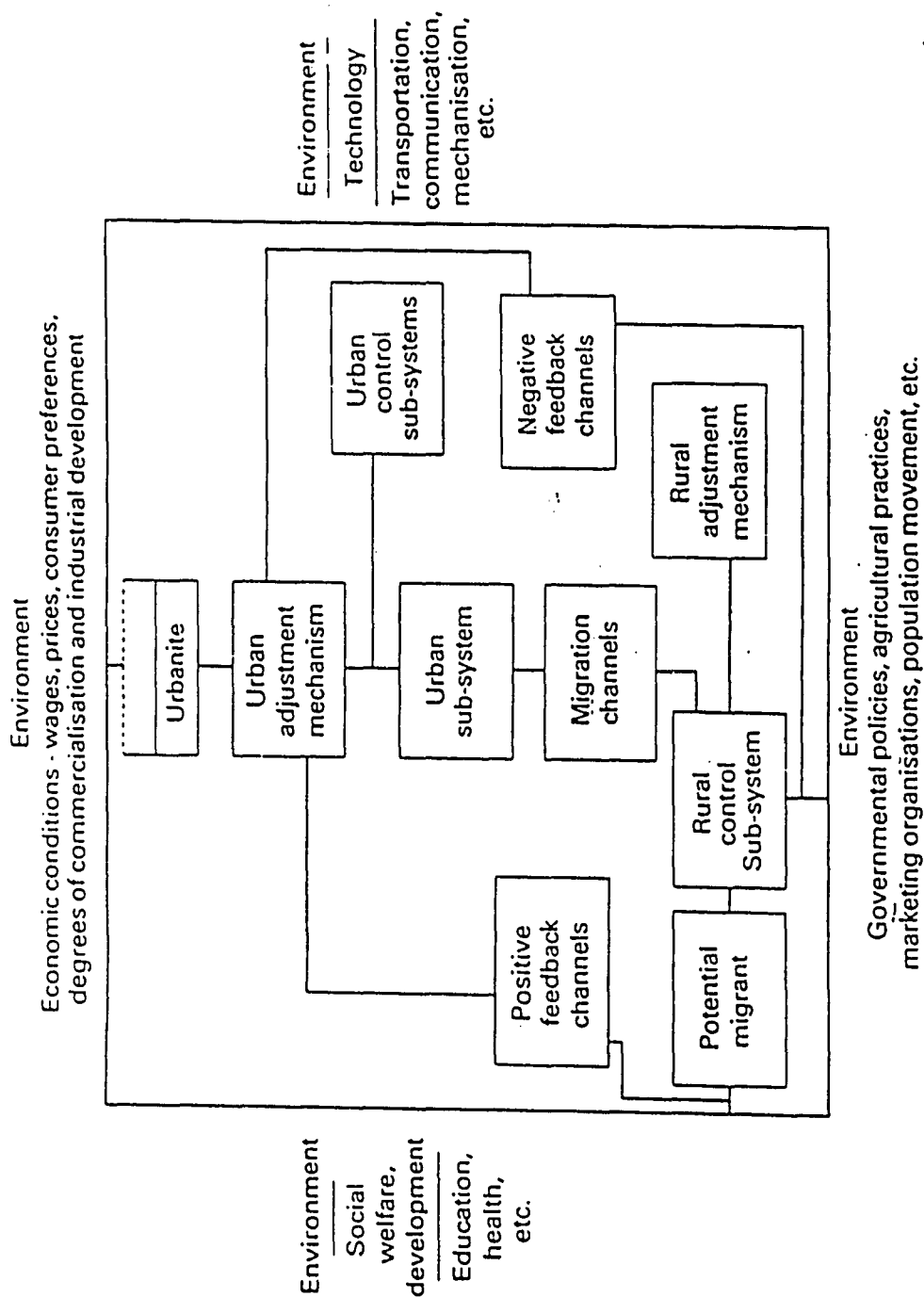


Figure 2. Mabogunje's Systems approach. From Ogden, 1984, p. 22.

explain migration flows, Bouvier et al. attempted to formulate a broad theory based on migrants' characteristics and other variables. The argument was that any individual's characteristics may be used both directly and as a surrogate of other variables to explain the migration process. Any of several alternative personal attributes may be as applicable as the education variable which they chose to apply. The education variable therefore also functions as a surrogate for other social variables. Thus education tends to correlate with age, occupation, income, and even fertility/mortality rates.

The framework of Bouvier et al. starts with the migrants' educational status chart at both origin and destination, as shown in Figure 3. Next, they aimed at showing types of migration streams, based on the belief that it is possible to develop a theory of migration differentials that is applicable anywhere at any time. Figure 4 and Table III help to explain the place and time frame requirements.

The implication in Table III is that, in a traditional society, a rural to rural migrant will tend to have a lower educational status relative to stayers and natives. In contrast, a rural to urban migrant will tend to have a higher educational status at origin but lower educational status at the destination relative to stayers and natives, respectively. The second line under traditional society

Origin	Destination	
	Lower	Higher
Lower	LL	LH
Higher	HL	HH

Where

LL = lower education of a migrant at both origin and destination relative to stayers (non-migrants at origin) and natives (residents at destination), respectively.

LH = lower education of a migrant at origin relative to stayers, but a higher education status than natives at destination.

HL = higher education status at origin and destination relative to stayers and natives, respectively.

HH = higher education status at both origin and destination relative to stayers and natives.

Figure 3. Migrants' educational status. From Bowvier et al., 1976, p. 27.

Origin	Destination	
	Lower	Higher
Rural	RR	RU
Urban	UR	UU

Where

RR = a rural to rural migration stream

UR = an urban to rural migration stream

RU = a rural to urban migration stream

UU = an urban to urban migration stream

Figure 4. Types of migration streams. From Bowvier et al., 1976, p. 28.

TABLE III  
EDUCATIONAL DIFFERENTIALS

Stages of Societal Development	Place of Origin	Place of Destination	
		Rural	Urban
Traditional	Rural	LL	HL
	Urban	*	*
Industrial	Rural	*	HL
	Urban	*	HH
Post-industrial	Rural	*	*
	Urban	LH	HH

NOTE. Bouvier et al., 1976, p. 31.

\*Indicates an event that rarely occurs.

shows that an urban to rural or urban to urban migration is rare in a traditional society and hence has an asterisk. Similarly, the rest of the table should be interpreted in the same way.

In essence, this analysis narrows the approach to migration studies. Thus it moves from formulation of migration principles, as evidenced in early studies, to variable specifications, as will be evident in the later studies.

#### Overview of Early Studies

Thus, in regard to Bouvier et al.'s work and from the theoretical synthesis in this literature, specific variables

have been identified and their interactive relationships in a migrational environment exposed. Starting with Lowry, it has been observed that a migration model may be represented by a combination of a gravity model and the human capital model. In contrast, Peterson not only identified general forces behind migration but also listed the associated type of migration in his typology. Mabogunje's work therefore appears as a further extension of such typologies, but emphasized the interrelationship of individual migration forces from a systems approach.

From these broad theoretical perspectives, Bouvier et al. narrowed their analysis to the role of individual migration variables. Specifically, they focused on individual characteristics, with emphasis on education. They felt that education was a surrogate for several other variables and attempted to analyze its implications in a rural/urban migration context. With some underlying common principles, but reflecting some diversity in these early studies, it was incumbent upon the more recent studies to magnify the differences as they sought to test and analyze specific components of migration principles.

#### RECENT STUDIES: 1960S-1990S

So far it has been shown in the early literature how Ravenstein developed the various laws of migration. A similar pattern has also been evident in Lee's analysis, as well

as in the generation of new concepts to explain the migration process. These new concepts were observed to have attempted to exploit the scientific approach to problem analysis. The two approaches identified were the gravity model and the human capital model. The later part of these early studies attempted to explore a theoretical synthesis of these models as well as identify migrational forces and their interrelationships.

In most of the recent literature, this same line of approach is embraced. However, the level of refinement has been deepened to the level of model specifications. Thus some of the models have tended to be confined in scope while others have attempted to be as comprehensive as possible (see Table IV). In this section, a sample of recent studies is reviewed. Some are identified as being partial for using limited variables. Others are identified as comprehensive for using diverse variables. Part of such a difference may be attributed to disciplinary interests. Part of it simply reflects shortcomings in the present developments in migration theory.

#### Interdisciplinary Interest

The literature on migration intertwines throughout all social science disciplines. Migration is a central part of the human social structure and thus has been explored by anthropologists, demographers, economists, geographers,

TABLE IV  
VARIANT APPROACHES IN RECENT STUDIES

Approach	Dominant Scholar	Variables
<u>Confined Scope</u>		
Regional economic conditions	Greenwood	Income/employment
Gravity	Stouffer	Distance/population
Human capital	Sjaastad	Education cost/income
Selectivity	Kuznet	Age/education
<u>Extended Scope</u>		
Behavioral Immigration Outmigration Place to place mobility	Mueller	Personal attributes
Quality of life	Liu	Personal/social

historians, political scientists, planners, and sociologists, among others. Demographers, economists, geographers, and sociologists seem to have generated some similarities in their interest on this field. A number of common factors and premises have tended to intertwine throughout their theoretical and analytical structures, especially as pertains to the migrants' individual characteristics, the socio-economic conditions, and the regional factors. This commonality will be evident in the following literature.



### Variant Approaches

This section also examines a variety of approaches as they relate to both interdisciplinary premises and those specific to individual disciplines in terms of confined and extended scope. Among the confined scope literature, this analysis will include the gravity and the human capital models along with the economic and selectivity approaches. The extended scope approach will include the behavioral and the quality of life oriented analysis.

Confined Scope. Some recent literature has attempted to focus on specific issues. On the one hand, this has been due to a specific issue intended for a specific study, such as determining the effect of wages or unemployment to migration, the educational or age level effect on migration, or even the significance of climate on migration direction. On the other hand, this may have been due to an intended verification or expansion on a previous specific case of study. Some of the most common areas of focus have been regional economic conditions, gravity-type models, human capital models, and models focusing on selectivity issues.

Regional Economic Conditions. The dominant variables in both early and recent literature on migration have been related to economic conditions. Credit for use of this approach goes to Michael Greenwood. The most ubiquitous variables have been those associated with income and employment. For example, Muth (1971) argues as to whether

differential rates of migration are induced by differential growth in job opportunities . . . employment, [or whether] differential changes in employment are induced by differential rates of immigration. (p. 295)

Greenwood, a widely published scholar on migration, has also emphasized employment and income variables. Greenwood, Hunt, and McDowell (1986) used a unique set of data

to estimate the . . . linkages between employment changes and net employment migration, . . . [and thus found that] in an average year, two extra jobs attract one additional net migrant, and one additional net migrant has a direct effect on area employment of almost 1.4 jobs. (p. 223)

In their attempt to use business cycles, Haurin and Haurin (1988) measured the effect of unemployment on net migration by separating the endogenous from the exogenous factors. Jun and Chang (1986) have also used employment growth on migration by categorizing it into contiguous and noncontiguous migration flows. All these differing approaches have shown a significant relation between employment and migration.

Similarly, income opportunities have played a major role in a variety of studies (e.g., Barber & Milne, 1988; Cushing, 1989; Feder, 1982; Gordon, 1988; Schachter & Althaus, 1989). Besides income and employment opportunities, economic variables have been used to explain regional migrations, e.g., Shefer (1987) on the effect of agricultural price support policies in Korea; Fox, Herzog, and Schlottman (1989) on the effect of metropolitan fiscal

structures; Nelson and Wyzan (1989) on public policy and local labor demand in Sweden; Henderson (1982) on consumer amenities and interregional welfare differences; Fournier, Rasmussen, and Snow (1988) on the elderly responses to economic incentives; Hoenack, Peris, and Weiler (1984) on general economic incentives on population migration to non-metropolitan areas; and a multitude of related papers. The underlying rationale of all these papers is that economic opportunities play a major role in migration, especially in terms of direction similar to the push/pull hypothesis.

In regard to noneconomic conditions, additional relevant literature reports on the effect of climate (Graves, 1979), location-specific amenities (Knapp & Graves, 1989), amenities and topography (Cushing, 1987a), and comparative regional advantages on patterns of migration (e.g., Klaasen, 1973; Sommers & Suits, 1973).

Gravity-type Models. As has been noted earlier, the gravity model has been very popular in migration studies over time. Stouffer is specifically credited for his hypothesis on intervening opportunities. In recent studies, this approach has been taking on different shapes to accommodate different factors. Gallaway (1967) compares the influence of income and distance on migration. Schwartz (1973) takes this farther by attempting to interpret the effect of distance in terms of psychic costs and decrease in distance in terms of information. Boots and Kanaroglou

on the other hand, attempt to utilize "discrete choice models of migration" by emphasizing the relative location of zones in their study (1988, p. 495). But a number of papers have also attempted to focus on Stouffer's intervening opportunities in different ways. For example, Wadycki (1974) emphasized alternative opportunities available to a migrant within a given radius of distance.

In a similar vein, Dunlevy and Gemery (1977) have focused their study on the "migrant stock" by making inferences from a variety of papers, e.g., Greenwood (1969, 1970), Vedder and Gallaway (1972), and Levy and Wadycki (1973) in which the effect of family and friends is accounted for by the migrant stock variable. Cushing (1986, p. 66) attributes this variable to "place to place" studies and further develops more "complex specification of space." Rogers and Belanger (1990), however, narrow their approach to the place of birth or "native dependence" and show that return migration is very significant due to informational factors and retirement purposes. Foot and Milne (1984) have alternatively attempted an extended multiregional gravity model that they claim to have recently advanced by citing the works of Ballard, Gustely, and Wendling (1980); Isserman, Deaumont, Plane, and Rogerson (1981); and Milne (1981).

Human Capital-type Models. The idea of human capital has been attributed in most literature to Theodore Schultz

and Larry Sjaastad, whom Sahota (1968) referred to as the "Chicago School." Indeed, an entire supplementary issue of the Journal of Political Economy (1962, Vol. 5) was specifically compiled to deal with the concept of human capital. Schultz (1962) covered some overall reflections on investments in humanity. Becker (1962) aimed at estimating the returns from college and high school education. Stigler (1962) covered the costs and returns on information searching for a job. Mincer (1962) treated "training on the job" as an investment that employees make in themselves. Mushkin (1962) put emphasis on health factors. And lastly, Weisbrod (1962) examined the benefits of education.

The most significant contribution to this concept in understanding of migration, however, was Sjaastad (1962). In this paper he emphasized differences in earnings in two contexts: first, as concerns the direction and magnitude of the response of migrants to labor earning differentials over space; and second, as concerns the connection between migration and equalizing of interregional earnings of comparable labor. This analysis took into consideration private costs of migration (money and nonmoney costs), private returns to migration (money and nonmoney returns), and private versus social costs and returns.

This line of thought has also been attempted by Harris and Todaro (1970) in their study of developing countries. Their focus was on a two-sector analysis of migration--

unemployment and development. The thrust of their paper was the inclusion of expected earnings from migration. Bowles (1970) underscored the importance of economic incentives, the effects of schooling, age, and the significance of racial differences on migration. Further extensions of this analysis include Farber (1983), who analyzed postmigration earnings profiles through application of human capital and job search models. Similarly, Herzog (1983) focused on migrant information, job search, and the remigration decision. One of the most recent developments in human capital analysis with regard to migration is Dierx (1988) in his estimation of a human capital model of migration in which he attempts to fill the gap between theoretical analysis and empirical applications by developing a model that permits empirical specification. This is accomplished in two ways, i.e., by developing "an index of characteristics that uniquely define a specific location" and by developing "location specific human capital" (p. 99).

In essence, the human capital-type models attempt to represent migration as a rational decision based on self-interest to improve a migrant's own well-being but which requires some investment at the initial stage.

The Selectivity Approach. According to Sahota (1968), this concept is associated with "the Harvard School of Thought" and attributed to Simon Kuznet. The approach attempted to demonstrate the relationship between internal

migration and economic development in regard to the selectivity of people by implying that migrants come from select groups. These groups are generally

dynamic risk taking beings, . . . [who] adapt themselves to the unfamiliar environment. . . . Their very rootlessness may promote their adjustments to new environments. (Sahota, 1968, p. 220)

These select groups may be characterized by their educational level, their age, ethnicity, gender, marital status, and other individual or family characteristics.

The education variable was used in a large number of human capital studies. The educated tend to be more marketable; they have access to more information about different opportunities; and they have been acculturated to be more adaptive to new environments.

The age factor is another differential that has been widely used in association with migration. In most demographic studies, it has been shown that the most active stage of migration is approximately between ages 15 and 45 together with tied migrants of 5 years old and below. The peak age, however, was demonstrated to be age 25 (Ogden, 1984, p. 28).

Other studies have focused on how age acts to discourage other workers from changing jobs and therefore induces their probability to migrate (Gallaway, 1969). A similar study attempted to show how age is associated with lagged

migration, i.e., the friends and relatives effect (Morgan & Robb, 1981).

A significant amount of literature has been written on the effect of ethnicity upon migration, especially in the United States between whites and nonwhites in their response to growth in income at various destinations (Greenwood, 1976). Similarly, Dorkoosh (1982) found that white migrants paid more attention to the level of expected earnings, while black migrants were especially concerned with the growth in income and employment rates. Stevens (1967) pointed out the importance of recognizing local industrial composition in the methods of job search between whites and blacks. Blacks tend to go to those firms where they have reason to believe there are other blacks. On a regional scale, this has been evidenced by a trend where, in the 1965-1970 period, the black migrant flow was towards the Northeast and Midwest and out of the South. The 1975-1980 data, however, have shown the reverse streams and counterstreams (McHugh, 1987).

In his later study, McHugh (1988) goes farther to show that the stock measure is the strong determinant of black migration where the behavioral process channelizes black migration streams, including information flows through familial and social networks and return migration. Some have focused on the problem of assimilation in metropolitan areas (Persky & Kain, 1970), while others have attempted to



analyze "a life cycle analysis of migration and climate by race" (Graves, 1979, p. 135).

Several other studies have focused on gender and marital status, wherein single women were shown to be more mobile and families with children tend to be less mobile (Krieg, 1990; Maxwell, 1988; Mincer, 1978; Sandell, 1977). Other studies attempt to characterize migrants by their recent migration records. Thus a previous migrant tends to be more mobile due to less attachment to the new destination, to have a stronger urge to return to old environments, or to have a better knowledge of other alternative destinations due to a previous decision-making process (DaVanzo, 1978, 1983).

In short, selectivity studies tend to emphasize personal attributes as significant elements towards the decision to migrate. In general, therefore, it has been evident that confined scope studies tend to focus on certain limited variables for analysis. This differs from extended scope studies, which attempt to be comprehensive.

#### Extended Scope Approaches

Unlike the confined scope literature, whose focus has tended to be on limited variables or specific to a given problem, the literature in this section attempts to provide a comprehensive theory or explanation of interregional migration. Two sources will be explored as a representative

sample of literature in this approach. These studies include behavioral analysis and the quality of life study.

Mueller's Behavioral Analysis. Mueller's (1982) interest was to investigate the interrelationship among population changes, economic conditions, and regional development policy. He viewed the process of migration as an essential key to this interrelationship, and he therefore specifically set out to investigate the worker's decision to migrate. In his survey of the existing literature, he classified various models into four groups: immigration models, outmigration models, place to place models, and mobility models.

Inmigration models included a set of job-vacancy models, structural models, simultaneous equations models, and alternative opportunities models. The underlying basis of these models is their emphasis on the choice of destination which is influenced by economic factors. The outmigration models, in contrast, attempt to test Lowry's contention that economic factors at the origin play an insignificant role in migration and thus emphasize factors such as outmigration rate and gross outmigration. He classifies two groups of models in this category as the propensity models and the simultaneous equations models.

Mueller's place to place models are also classified into two groups, i.e., the allocation models, which include the friends and relatives approach, the alternative

opportunities approach, and the disaggregate approach; and the origin-destination models, which mainly focus on the gravity variables in terms of the human capital approach. Lastly, his mobility models are subdivided into the behavioral mobility models, mobility and employment status models, and the mobility and employment status of wives. For a detailed representation of these individual models and their pertinent specifications, see Appendices A through C.

Based on this literature, Mueller attempted to formulate a comprehensive theory while at the same time filling in the two major gaps he had found in the previous literature: (a) the failure to formalize the behavioral rules of potential migrants and (b) the small role in interregional migration studies that potential migrants' personal attributes have in their decision to move.

In Mueller's model, therefore, he first examines the potential migrant from a neoclassical perspective--a human capital approach. This is done by identifying place-specific attributes, i.e., the economic and amenity attributes of alternatives. The potential migrant translates these attribute into a preference function in the form of a utility function.

Secondly, given the differences in each migrant's preferences, Mueller attempted to identify reasons for different migratory choices. Examples in this case include differences in lifetime incomes, which depend on cognitive

abilities, training, skills, etc. Next are the observable attributes of potential migrants that include (a) nontransport costs and job turnover and (b) nontransport costs and residential turnover. Thirdly, nonobservable attributes of potential migrants and alternatives such as nurture, experiences, attitudes towards tradition, and other social ties are considered. Based on this configuration, Mueller developed a model to capture all these attributes and used the regression model to analyze the data.

Liu's Quality of Life Analysis. Unlike Mueller, who analyzed previous literature in order to accommodate the various approaches, Liu's set out to define the various attributes of the quality of life (QOL) that are associated with an individual's decision to migrate. Once the attributes were defined, Liu then attempted to quantitatively measure the variables which he applied in a regression model to analyze the results.

The variables used to compute the QOL index were very diverse. A general overview is given here (see Appendix D for details). Nine categories are defined as follows (Liu, 1975):

1. Individual status, including existing opportunity for self-support, individual capabilities, and opportunity for individual choices.
2. Individual equality, including race and sex differentials and socio-economic discrimination.

3. Living conditions, including general conditions, facilities, and social and environmental conditions.
4. Agriculture, including farming income, farm value, and other farm assets.
5. Technology, as measured by its promotion and encouragement and by general human resources.
6. Economic status, including income, unemployment, manufacturing, construction, banking, education, technology, and agriculture.
7. Education, as measured by different levels, expenditures, sizes, etc.
8. Health and welfare, as measured by medical care and welfare provisions.
9. State and local governments, including informed citizenry, professionalism of administration, and performance of administration.

Through the study of Liu's QOL index, it is evident that recent migration studies have attempted to capture every conceivable variable in every possible quantitative analysis. However, it is also evident that these analyses have either explicitly or implicitly and either intentionally or unintentionally been responsive to migrational principles previously sampled from earlier studies.

## ANALYSIS OF LITERATURE

The previous sections traced through the early studies from Ravenstein's writings in the 1870s to the development of various laws and principles of migration by the 1960s. Further developments included theoretical attempts and analytical syntheses. Recent studies from the 1960s to the present were also covered and a variety of approaches were noted. These seemed to stem from attempts to rationalize various principles advanced earlier as well as follow-up on recent studies. However, the overall appearance of these recent studies seemed to emphasize their variant objectives while underplaying any notion of a wholistic approach and the commonality inherent in their content.

In view of the massive amount of literature heretofore covered in this chapter and the implicit necessity for a more structured approach, a heuristic framework such as will be proposed here is long overdue. This section will attempt to accomplish three objectives. The first one is to position migration literature in the context of theoretical developments in social sciences. The purpose here would be to acknowledge the historical trends towards theory while identifying opportunities for a larger perspective and the interrelationships between competing approaches.

The second objective is the identification of the underlying rationale for the heuristic framework. This is

assisted by a simplified analogy based on the developments in the gravity model and the economists' classification of the factors of production. The third objective is to provide an intuitive hypothetical basis from which to develop the framework proposed in this research.

Similarly, an attempt is made to re-examine migration literature from a wholistic perspective. Thus, rather than focusing on individual leaves or branches, the focus starts with the forest. This approach accommodates the variant approaches in recent migration studies while enhancing the trend in the early studies towards a more concrete straightforward framework of analyzing migration studies.

#### Elements of Scientific Research

From a historical perspective, the development of migration principles by Ravenstein and others of that period was a crucial step in the field of migration studies. Once these were explored at length, objective theoretical developments were inevitable. These theories helped to condense variant principles into more specific models.

Hypothetical Aspects. One of the tenets of scientific research is to focus on the verification of facts. Unlike the physical sciences, this tenet is difficult to achieve in social sciences. Hence generalizations, norms, and, at best, frequency have become the closest measures of social science phenomena. However, in the face of a strong

tendency towards quantitative analysis, social scientists have turned to various means to collect relevant information through observations, questionnaires, interviews, or existing documentation (Moser & Kalton, 1972, pp. 238-247). The information gathered is then transformed into numerical quantities for statistical analysis (Champion, 1981, pp. 1-14). From this numerical information, various frequencies may be determined from which some hypotheses may be advanced.

Hypotheses, therefore, become the crucial part of the scientific approach due to three major reasons:

They are working instruments of theory. . . .  
[They] can be tested and shown to be probably true  
or probably false. . . . [They can] enable man  
to get outside himself [because the results stand]  
apart from man's values and opinions. (Kerlinger,  
1973, p. 20)

In view of this background, it becomes clear from our historical analysis of migration studies that the main thrust of the literature by Ravenstein (1885), Lee (1966), and Bogue (1959) was about the principles of migration. Evidence presented in the previous chapter indicates that these principles were diverse in nature. Ravenstein (1885, 1889) stated at least 11 hypotheses about migration, Bogue (1959) accounted for 12, and Lee's (1966) classification consisted of at least 19 hypotheses. These hypotheses, among others, have become the general guidelines or



principles that have governed the development of theory in migration studies.

It is fitting that the next stage in migration literature was the attempt to narrow down the hypotheses into more comprehensible, yet simple, forms.

Migration Theories. Once the hypotheses were formulated, the next logical step was to organize those hypotheses into theory. As early as the 1920s these hypotheses were subjected to some sort of theoretical analysis. Young (1924) attempted the application of a gravity model to migration as early as 1924, and by 1949 Zipf had developed his  $P_1 \cdot P_2 / D$  model on migration.

The gravity model was not initially based on observed human behavior but on physical science premises. However, with modifications the gravity model has become one of the major pillars of migration studies. Its emphasis is on the relative characteristics between origins and destinations and the distance between them. This conceptualization captures a variety of factors advanced in the previous hypothesis in a simpler way. Most credit on this work has gone to Zipf (1949), Stouffer (1960), and Lowry (1966).

In 1932 Hicks used neoclassical economic theory to express the significance of economic advantages in relation to migration. The human capital theory was born with emphasis on differential individual and regional characteristics. In this case, characteristics of individual potential

migrants were matched with characteristics at destinations. Among those given credit in this work are Sjaastad (1961, 1962), Schultz (1962), and Harris and Todaro (1970).

Variance in Objectives. As has been evident, most researchers in migration studies have a given set of objectives to accomplish. Some may focus on the effect of income, employment, climate, education, race, or distance. Others may focus on a combination of variables to fit a specific objective, such as verifying a specific previous study. A good sample of this analysis is shown in Appendices A through C, adapted from Mueller's attempt to classify various migration models.

Mueller's classification utilized immigration models, outmigration models, place to place migration models, and mobility models. By using five categories of independent variables (economic opportunity, amenity, fiscal, spatial structure, and propensity to migrate), Mueller subdivided immigration models into three types--job vacancy, structural, and simultaneous equations. It may be observed in Mueller's table (see Appendix A) that individual groups of models seem to suit certain categories.

To cite an example of variance in objectives, Mueller's table shows studies such as those of Glantz (1973) and Mazek (cited by Mueller, 1982, p. 24) as emphasizing job vacancy. Correspondingly, while all of Mazek's variables come from the economic opportunity category, those of Glantz come from

both economic opportunity and amenity categories. None of them utilized variables from the fiscal, spatial structure, nor propensity to migrate categories. As noted earlier, such findings are valid in their intent, but the novice user may simply draw a misleading general conclusion from their findings. Similar attributes may be said of his outmigration models, such as in Trott's (1971) study where all the variables were of economic opportunity.

Thus by classifying all of Mueller's table of variables into three groups (amenity, mobility, and spatial) it becomes evident that immigration models had little emphasis on mobility factors. Outmigration models almost totally ignored spatial factors, while the place to place models used more spatial variables than any other groups but almost none of the mobility variables.

Need for a Synthesis. It is not surprising that there are variant findings and variant objectives in migration literature. On the one hand, variation in objectives has been due to variant principles in migration. Some studies have the objective of pursuing individual principles or a combination. Others attempt to study an existing phenomenon that happens to reveal a certain underlying configuration of principles. On the other hand, variation in objectives has been due to recent refinement in specifications that has itself resulted from the availability and better measurement of data. In both cases the results have tended to be about

differences in findings. In view of such proliferations, it is necessary that migration literature have a common base of reference. There is need for a focus or synthesis of a more simple, yet widely, representative structure.

A good example is that of Lowry (1966). In his work he attempted to synthesize the gravity model objectives and the human capital model objectives into a single model. Other examples include Mueller's and Lee's classifications, as has been noted. However, the recent proliferation of models underscores the need for a more formal common base that is more representative and yet still simple. Thus, in order to develop a better theory of migration, this common base must be established and must account for as many of the migration principles as possible. Such a common denominator will serve as a central point of reference from which variant model designs may be developed. Similarly, interpretation of existing literature is enhanced with such a reference point.

It is therefore vital that migration studies attempt to draw analogies from other disciplines to develop such a basis for objective migration theories. Two such important analogies are discussed in Chapter III in reference to the gravity model and the economists' classification of the "factors of production."

### Major Themes in the Literature

Three major themes have been observed to run across most of the literature so far covered. These include the role of place specific variables, the role of distance, and the characteristics of migrants.

Place Specific Variables. Starting with Ravenstein's writings, it was clear how the attractive and propulsive nature of a place may contribute to the push/pull hypothesis in migration. These effects are captured in his laws of migration enumerated earlier as number 3 and numbers 8 through 11. The gravity models also captured this element in terms of the size of both the origin and destination having an effect on the rate of migration flows. Similarly, the human capital hypothesis was found to embrace place specific variables, especially in terms of actual or expected earnings of potential migrants at alternative destinations in comparison to the place of origin. In the theoretical synthesis it was noted that Lowry's hypothesis included the income and unemployment variables at both origin and destination in his gravity model, while Lee's volume of migration and streams and counterstreams stressed origin and destination variables. Similarly, the typologies of Peterson, Mabogunje, and Bowrier underscored the significance of these regional differences.

Among recent studies, the gravity model, the human capital model, and economic and noneconomic conditions

approaches utilize place specific variables extensively. The selectivity approach stands alone in not employing them. Even in the two samples of the extended scope analysis that have been reviewed, place specific variables were found to be dominant. This applies to Mueller's behavioral analysis and even more so to Liu's QOL index.

The Role of Distance. The effect of distance was covered by Ravenstein through the early studies and remains an important issue today. Distance was used to explain migration. Indeed, the central logic of the various gravity models is the role of distance. Some take direct measurement in miles. Others use Stouffer's approach of intervening opportunities, which may include friends and relatives, cultural similarities, information availability, and other similar indicators. Other proxy variables have included the cost of travel and frequency of interaction, among others.

Migrant Characteristics. Kuznet's identification of young individuals who are rootless, dynamic, and risk taking exemplifies the selectivity hypothesis. Indeed, from Ravenstein to the present literature, among the major variables in migration have been age, gender, and educational level. As we have seen with most of the recent works, other related differentials have included ethnicity, marital status, family size, previous migration history, etc. These

variables are dominant in the selectivity literature and in the human capital and behavioral analysis approaches.

### Theoretical Developments

The theoretical developments that we have so far observed may be analyzed in two approaches: first, in terms of the historical context and, second, in terms of the model proliferations.

Historical Context. From a historical perspective we have seen the development of the laws of migration from as early as 1885 with Ravenstein's writings. The main thrust of this literature was aimed at capturing the underlying principles that govern people's decisions to migrate, the direction of migration, and the associated process of migration. By the time of Young's (1924) empirical applications of the gravity model to migration, the thrust of the literature had become one of objective analysis and the application of physical sciences' approach to the social science phenomena. During this period, distance and factors associated with distance were easily amenable to this sort of application, such as Stouffer's (1940, 1960) intervening opportunities. But starting in the late 1960s the literature has tended to emphasize specification issues, such as choice of variables and model design. Some have focused on a limited scope approach, while others have attempted a more comprehensive approach to modeling.

In short, the historical analysis of migration literature runs from formulation of principles to scientific approach and then to specification issues.

Model Proliferations. Some variables are widely utilized in migration studies. Similarly, theoretical approaches and model specifications have become more diverse.

In reference to the historical perspective, one may infer that Ravenstein's laws offered a multitude of potential models. However, by the time of quantitative analysis, such as the introduction of the gravity model, most migration studies seemed to have narrowed down the number of potential alternative models. But over time, new models have appeared to fill the gaps left by the gravity model. Among them are the human capital and selectivity approaches. Within each of these various models further proliferations have been and are taking shape. This is due partly to inherent differences in principles of migration (referred to earlier), partly to refinement of model specifications, and partly to different applicational situations.

#### Interpretational Aspects

In view of the variant principles inherent in migration studies, as in other sciences, it is not surprising that different studies have come up with differing findings. This has been due mainly to differences in each study's



objectives and hence differing model specifications. However, the nature and content of these studies have stemmed from a common point of reference without being so explicit. It is from this point of reference that the need for a synthesis is underscored here.

Variance in Specifications. A novice reader or user of migration studies may find the literature very conflicting in its findings. Some of the literature may seem to imply that the main factor associated with migration has to do with regional differential wages (e.g., Feder, 1982; Greenwood, 1969; Olivey, 1970). For others it may be interpreted as being due to differential regional unemployment rates (e.g., Greenwood & Hunt, 1986; Haurin & Haurin, 1988; Jun, 1986; Muth, 1971) or even regional differences in climate (e.g., Cushing, 1987b; Graves, 1979; Liu, 1975).

Similarly, some studies at one extreme may seem to emphasize distance as the most critical factor rather than regional differentials (e.g., Cushing, 1986; Gallaway, 1967; Schwartz, 1973; Stouffer, 1960; Zipf, 1949). At another extreme, one may likely interpret some of the literature as emphasizing an individual migrant's characteristics as the most significant determinants of migration, characteristics that include education (Bouvier et al., 1976; Greenwood, 1976, 1976; Olivey, 1970), age (Gallaway, 1969; Morgan, 1981), race (Doorkoosh, 1982; Greenwood, 1976; McHugh,

1987)), as well as several other individual related variables.

The significance of these samples is the supposed variance among the different findings and the potential conclusions. Thus, is it income differentials versus unemployment differentials between regions that influence migration flows? Or is it education versus age or race differentials? Even in a less precise specification, should we compare distance related variables and regional differentials or even the individual differentials? This is the dilemma of a novice user of migration literature. Each finding seems to emphasize the significance of certain variables and therefore differs from one finding to another. But does this mean that variant findings imply unreliability of these studies? On the contrary, most of these studies are valid in their own configuration. The problem is not about variance in findings, but in the novice user's attempt to generalize from individual findings. Given that most of these findings are specific to individual objectives of those studies, one has to consider those individual objectives first and interpret them in that specific configuration. Or better yet, the author and user of such literature may use a common reference point such as the one to be advanced in this study.

## SUMMARY

This analysis of migration literature has identified a pattern towards theoretical analysis of migration. Starting with William Farr's (1876) challenge that migration appeared to have no definite laws, this survey has identified an evolution of trends in the development of migration theory. Two stages were identified in this survey. The first stage focused on the development of principles governing the process of migration and spanned from Ravenstein's (1885) laws of migration to the human capital theory attributed to Sjaastad (1962).

The second stage focused on the development of models and variable specifications. These studies attempted to capture as much of what was implied in the migration principles as possible. However, without a common reference point it was evident that the proliferation of these studies, along with their more detailed specific nature, created a fuzzy integration of all the pieces. It was from this perspective that this study was conceived and designed in order to identify the underlying similarity between different studies and across different stages.

In the analysis of literature, therefore, and with a perspective of the nature of scientific research, three structures were hypothesized as providing common reference points from which the analysis of migration literature may

commonly be analyzed. These structures were identified as place specific variables, the role of distance, and the characteristics of migrants. These "rule of thumb" common reference points are discussed further in the following chapters.

## CHAPTER III

### METHODOLOGY

#### OVERVIEW

In this chapter, alternative and pertinent analytical models associated with migration studies are explored. The initial step involves a conceptual analysis. Three cases are used to demonstrate the significance of previous or existing hypotheses in other fields. These include conceptual analogies, the gravity model analogy, and an analogy from economists. Based on these conceptual analogies, a research hypothesis is developed. In this case, the migration phenomena are conceptualized in a logical configuration that would be more suitable for formulating research hypotheses.

The next step is to focus on the alternative application models. Similarly, a factor analytic model will be discussed. Further models that may benefit from factor analytic results will also be discussed. A proposed meta-analytic model will be discussed in terms of further development of theory in migration studies.

In developing this heuristic framework, therefore, four major phases may be identified. First will be a conceptual

analysis that will emphasize simplicity and comprehensiveness in the selection of variables. Phase 2 of this framework will constitute a tabular analysis of previous studies. Specifically, it will involve identification and frequency count of variables used in previous studies. Phase 3 will translate the logic inherent in phase 1 and the criteria established in phase 2 to develop a more objective method for specifying variables. This will rely on the application of the factor analytic model in the selection of variables for further analysis. The fourth phase, which is a continuation of phase 3, will suggest and explain the use of meta-analytic procedures for the final development of migration theory.

Overall, an attempt is made to re-examine migration literature from a wholistic perspective. Thus, rather than focusing on individual leaves or branches, the focus starts from the forest. This approach accommodates the recent variant approaches in migration studies while enhancing the trend evidenced in the early studies towards a more concrete, straightforward framework of analyzing migration studies. Therefore, this analysis will emphasize developments in both theory and formulation of migration principles. Similarly, it will underscore the variance in research findings and variances in objectives.

### CONCEPTUAL ANALOGY

Conceptualization by analogy is not a new phenomenon. It is vital in a field such as migration that needs to undergo some streamlining transformations. Several cases prevail in support of this line of approach. For example, in some cases certain institutional and sometimes physical transformations have been better explained by analogies. For example, Rostow's explanation of the stages of development was presented as being associated with an airplane's process from taking off to being airborne (Rostow, 1971). Similarly, Brinkman (1981) has used logistic surges to explain the transformation of cultural elements and therefore changes in societal culture.

### THE GRAVITY MODEL ANALOGY

The gravity model serves as an effective example of how analogical translations may become central to an adopting field. This model has become a classic tool for analysis in migration since its adoption from the Newtonian physical sciences. It is undisputed among students of migration that there is an inverse relationship between distance and the rate of migration. It is also undisputed that the rate of migration tends to vary directly with the size of place of origin and size of destination.

The only snag in this translation has been in the tailoring of exponents to individual situations. Being a social science phenomenon as it is, no single specific level of measurement is assured to be more correct than others. However, the available estimates are usually reasonable enough so that valid conclusions may be drawn. The major lesson from this gravity model analogy and the other preceding analogies is that sometimes a discipline may be enriched by drawing analogies from other disciplines and improvising them into its own context. This research will utilize such opportunities by redefining some of the concepts that will be applied in the framework.

Like their counterparts in economics, students in migration literature, too, have defined principles and laws, as stated in Chapter II. However, our survey of literature has shown that no definite specification of factors has prevailed. Without such a specification, the tendency for proliferation of studies, and thus their findings, is inevitable. Consequently, any effort towards a general theory of migration is likely to be frustrated.

Economists have generally emphasized three main factors of production: land, labor, and capital. To a greater extent, the entrepreneur and technology have been offered as further factors of production. The essence of such classification is to simplify the analysis by narrowing down the number of potential variables for consideration. For



example, instead of considering each individual's contribution to a firm's productivity, or a given classification such as the loading crew, the female workers, or by race, economists usually assign these groupings to the labor factor of production. From here related research may then be carried out to determine each component's contribution to productivity. The vital link to each of these individual studies, however, is that they branch from a common set of criteria, that of a labor factor.

Similarly, the capital factor and land factors of production are so defined. For example, the capital factor, as the physical factor, includes infrastructure, machinery, and furniture, among others, while reserving the concept of liquid capital for financial assets. The land factor of production ranges from the physical land to the natural resources on land, in water, and in the air. Regardless of unavoidable overlaps, without any reasonable rules governing the classification of such factors, there would be a variety of potential specifications for a production function. Each specification would be valid in its own configuration, but the findings would be conflicting at a general level. For example, whereas some researchers would emphasize the significance of a specific machine's effect on productivity (e.g., a computer), others may find that it is the transportation network that affects productivity. At the other extreme some would attempt to compare the capital and labor

factors. As the case may be, each of these scenarios is not a complete representation of a production function in that either the comparison has been made within one factor (capital) or between only two factors (labor and capital) to the exclusion of other potential variables. Hence, at best, consequent findings from such studies can only be interpreted within that context without major generalizations on productivity.

Since this factor classification is generally accepted by economists, it makes it easier to design and verify a production model. It also enhances interpretation of findings and thus policy-making decisions. A similar assessment of the migration function is likely to enhance migration studies design, verification, and interpretation of pertinent functions as well as contingent policy-making decisions.

In so doing, this will provide a common reference point from which individual studies may take their cue. For example, an examination of unemployment levels or the wage rates or distance by themselves as determinants of migration are too partial to utilize for the purpose of a general theory in migration. Similarly, further consideration of each individual partial study to generate a general theory will be too complicated. Hence, there is need for a more simplified approach in migration studies. The next section, therefore, will attempt to apply the logic in this analogy

to conceptualize migration phenomena into a simpler but comprehensive hypothetical configuration.

#### RESEARCH HYPOTHESES

In attempting to examine the framework's variable specifications, relevant research questions and hypothetical statements need to be identified. Similarly, the rationale for such hypothetical statements needs to be identified. The starting point for such hypotheses may be obtained from previous literature.

In the early studies (see Table I) several hypotheses were identified. Few similar attempts were identified among the more recent studies, especially in Mueller (1982) and Liu (1975) (see Figure 3). From these earlier studies (e.g., Lee, 1966) and from recent studies (e.g., Mueller, 1982), it is evident that classifications may be more simplistic but still fairly representative of the other similar hypotheses in their categories. However, since Mueller's analysis was confined to labor related factors, it is limited in terms of comprehensiveness, especially in comparison with Lee's hypothesis.

In his analysis, Lee isolated four factors that underlie the decision to migrate: (a) the place of origin; (b) the place of destination; (c) intervening obstacles between origin and destination; and (d) a variety of personal factors. With slight modification of Lee's hypothesis

(i.e., combining origin and destination attributes into a general amenity factor), this study will hypothesize three classifications as the starting point for the heuristic framework. These include mobility, amenity, and spatial factors, as are identified in Figure 5.

#### Research Questions and Hypo- thetical Statements

The primary research question here is whether a configuration may be derived from migration studies in a comparably similar form, such as the economist's specification of factors of production. Thus, is there any logical or structural basis on which variables used in migration studies may be conceptualized and categorized in a less clustered and

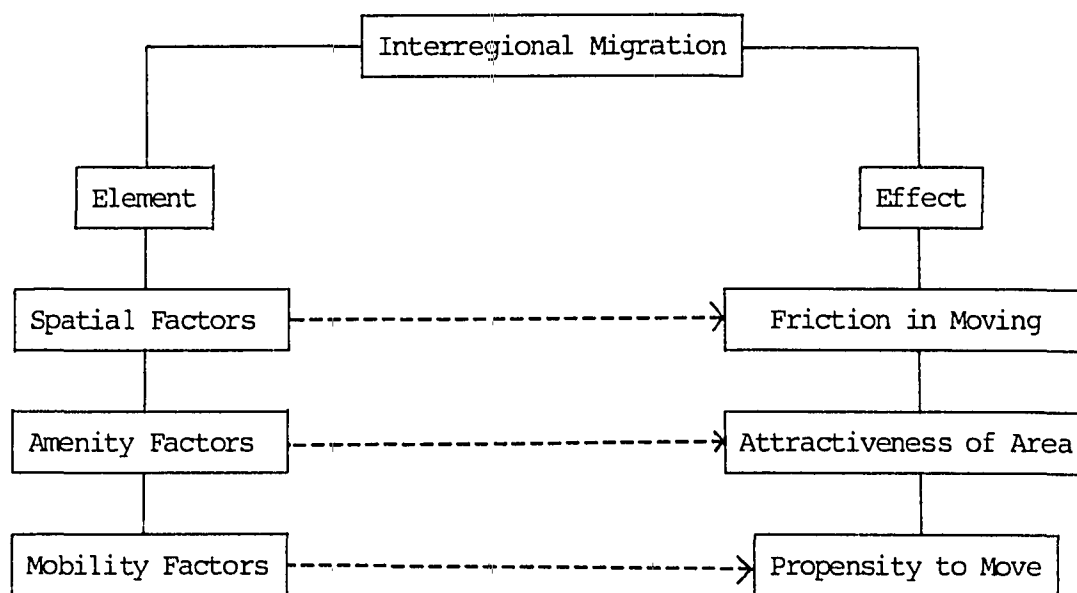


Figure 5. Migration elements and effects.

more coherent form? It is the contention of this work that this is not only possible but also that previous works have inadvertently utilized or implied utilization of this configuration without realizing it. The research hypotheses to be explored, therefore, are as follows:

1. Migration variables may be categorized into fewer factors, but remain representative enough of the migrational phenomena.
2. This classification will accommodate a reasonably large share of all the possible variables affecting population migration.
3. Each category of factors has a distinctive core of significant variable that form clusters around mobility, amenity, and spatial aspects, but with some overlap.

#### Explanatory Rationale

In Figure 5 interregional migration is shown to be responsive to both specified factorial elements and the consequential effects.

Spatial Factors (Friction). Variables in this category tend to be distance oriented. The major components of this element include physical distance (in miles), accessibility (in terms of network links), and social distance (which refers to cultural differences and the absence of relatives and acquaintances). The consequential effect of such an

element is the friction caused in the migration process. The implication is that migration is discouraged by long distances, inaccessible alternatives, and alien destinations.

Whereas the distance variable is the core of this factor, lack of network links means a higher cost of transportation in terms of time and/or money. It also means less information about available opportunities. From the human capital perspective this implies lower estimated returns from migration. Social distance may be reflected in terms of isolation hardship and negative feedback as reflected from return migrants (see Mabogunje's systems approach, Figure 2).

In essence interpretation of spatial factors should be limited to the questions of feasibility. Thus, is it feasible to go to region "j," and is it feasible to stay in region "j" (i.e., to feel at home)? Models that rely strictly on distance variables alone, such as Losch's system of markets (cited by Haynes & Fotheringham, 1985, p. 35), will tend to map out spheres of influence. For our case, as migrants move farther away from their region, social distance tends to increase. Also, social distance increases faster the smaller the region of origin and, especially, destination. Similarly, from an infrastructural perspective, accessibility tends to decrease with the size of the region (density).

Distance has played a major role in most migrational models, and in some cases it has been treated as the principal variable. Among the related models is the now popular gravity model adapted from Newtonian science. Further applications in this field have included definitions and use of social distance as a variable. Thus, in his 1959 paper, Nelson emphasized the value of information from friends and relatives in cities as well as in their "welcome arms" as a social distance variable. Masser (1975), in his analysis of interregional migration in Uganda, underscored the importance of both the physical and social distance (tribal) in migrational streams. Haynes and Fotheringham (1985) have shown that gravity models could be applied alongside Stouffer's (1940) intervening opportunities, as a distance related factor for consideration. Hence the spatial factor encompasses variables that are critical to migrational friction.

#### Amenity Factors (Attractiveness)

Variables in this category tend to emphasize specific conditions at regions of origin and destination that influence people's decisions to migrate. Amenity specific variables may be categorized in terms of natural resources, such as mineral and climatic resources; investment resources, such as an irrigation project or military installation; or institutional resources, such as regional tax

structures or labor laws. Some studies have emphasized the influence of these factors on the migration process (Graves, 1979; Greenwood & Hunt, 1984; Klaasen, 1973; Sommers & Suits, 1973; Webber, 1984).

From a strictly amenity perspective, interpretation of variables in this category is only relevant in determining local characteristics. Their significance lies in their determination of a region's relative advantage. Findings from such a study would be useful for administrative purposes for individual organizations such as government, business and other institutions, or for individuals. The intent here would be to determine the strengths and weaknesses of a particular region and the consequent impact. Here comparison between regions is possible only in aggregate terms, such as by use of hedonic models, rather than on the basis of individual variables (i.e., it is not possible to isolate individual variable effects from the whole).

The inherent assumption is that people aim at maximizing their welfare by migrating to regions that will benefit them most. In this case migration is treated as an investment expenditure that is expected to yield a higher return in the future (Barnum & Sabot, 1976; Caldwell, 1969; Cummings, 1985; Harris & Todaro, 1970; Ominde, 1968; Ravenstein, 1885; Schultz, 1962; Sjaastad, 1962). Hence the amenity factor constitutes variables that affect a migrant's choice of



destination (enticing/attractive variables) and decision to depart (propulsive variables).

Mobility Factors (Propensity to Move)

In this category the variables focus on the characteristics of individuals as determinants of their propensity to migrate. Here individual differentials are used to determine the likelihood of an individual's decision to move. Pertinent models in this category attempt to measure the probability of an individual's mobility as characterized by the level of education, age, gender, marital status, race, family size, etc.

From a purely selectivity perspective, variables in this category, if applied alone, attempt to explain the migrational elasticities with respect to changes in spatial environmental conditions. Regions exemplifying populations that are very mobile, such as the young and educated, are likely to experience population instability. This may apply both in response to either a growing or declining economy within the region or other similar factors.

Among some of the examples emphasizing the mobility factor are Lee's (1966) work on volumes of migration and on development of streams and counterstreams, with major emphasis on the characteristics of migrants. And Bogue (1959) has argued that only the age differential has withstood the test of general applicability. In his 1976 dissertation,

Maamary emphasized the importance of the individual decision-making process in migration by emphasizing the migrant's characteristics and distance related factors. Both Bouvier et al. (1976), in general, and Barnum and Sabot (1976), specifically on Tanzania, echoed the significance of the education variable on migration. In essence the mobility factor encompasses all the variables that measure an individual's probability to migrate holding the spatial and amenity factors constant.

#### Allowance for Multiple Association

Whereas the hypothesized classification attempts to emphasize three main underlying structures, some individual constituent variables may have multiple associations with several other factors. For example, the variable "migrant stock, which denotes the proportion of recent migrants to the destination "j," may variously be representative of a spatial factor (cultural distance), a mobility factor (migrational probability), or/and an amenity factor (attractive force). In such cases, therefore, an educated rationale based on the nature of the research question should influence the treatment of such variables. However, such multiple associations may become apparent only with the help of a framework such as this one which, by taking a wholistic approach, enables a researcher to observe variables from differing perspectives. In so doing, misuse of

partial findings as if they were representative of comprehensive studies is minimized.

In view of this potential for multiple association, an effort will be made to explain any such inconsistencies should they appear. Such an effort is consistent with standard procedures for a factor analytic approach, which is one of the models that would usually be applied in similar studies and will be utilized in this study.

#### ALTERNATIVE APPLICATIONAL MODELS

In this section, five potential applicational models will be evaluated: factor analysis, Markov chain analysis, the gravity model, regression analysis, and a meta-analytic model. It is anticipated that a more objective development of a comprehensive theory in migration studies will require a combination of these models.

##### Factor Analysis

This section identifies the factor-analytic model as the next step that may enhance objectivity in migration studies. Because of its anticipated significance in this study, a fairly elaborate review of this model is made here. Factor analysis will attempt to scientifically identify inherent variable configuration in migration studies. Unlike the intuitive conceptualization and hypothesis proposed earlier (based on previous literature and logical

associations), this approach is based on objective analysis. Whereas the former approach is useful in ensuring basic representativeness, the latter is more technical. The theoretical premises of factor analysis will be explained here, while its application will follow in the next chapter.

In order to understand the link between this model and the framework being developed here, a short background of the factor analytic model is necessary. Four areas to be covered include an introductory note to factor analysis, the historical development of factor analysis, some basic principles or foundations of factor analysis, and the process of obtaining factor analysis solutions.

Introductory Note to Factor Analysis. Factor analysis refers to a variety of statistical techniques whose common objective is to represent a set of variables in terms of a smaller number of hypothetical variables (Kim & Mueller, 1986, p. 9). This is based on the assumption that some underlying factors, which are smaller in number than the number of observed variables, are responsible for the covariation among the observed variables (Kim & Mueller, 1986, p. 12). Hence an examination of the interrelationships among the variables is called for. A factor analytic approach may then be used to determine whether these observed correlations can be explained by the existence of a small number of hypothetical variables.

The two main approaches are exploratory and confirmatory factor analysis. In the former, factor analysis may be used as an expedient way of ascertaining the minimum number of hypothetical factors that can account for the observed covariation. In the latter, a researcher may anticipate or hypothesize that there is a given number of underlying dimensions and further hypothesize which variables belong to which dimension (Kim & Mueller, 1986, p. 9). In some cases, both approaches are used together, specifying the number of factors (dimensions) without anticipating which variables represent each.

Besides ascertaining the underlying factor structure, "factor analysis is also often used as a heuristic device . . . based on previous research or strong theory" about the underlying dimensions" (Kim & Mueller, 1986, p. 10).

In this study an exploratory factor analysis will be utilized for the purpose of identifying the various correlations of various variables. However, some elements of confirmatory factor analysis will prevail in the form of explaining the relationship between the hypothesized variable structure and the factor configurations. Factor analysis differs from other statistical methods in that "it goes further, both to determine the degree of association and to pick out essential wholes among the influences at work" (Cattell, 1952, p. 11). Thus, according to Cattell,

factor analysis is a wholistic method in that it aims to discover and deal with the more massive functional and organic whole instead of losing research perspective in a mass of atomistically conceived variables. . . . and in the role of an explanatory method . . . like a radar turned upon fog [factor analysis] necessarily reveals to us whatever organization or structure is present. . . . [And starting with measurements on several variables] a factor analyst can thus . . . arrive at a highly structured answer that there are say, five factors at work. (pp. 18-21)

Development of Factor Analysis. Factor analysis stemmed from earlier studies by psychologists in their attempt to find functionally unitary traits in mental testing. Thus it became apparent that their attempt for discovering functional unities in mental testing, in which a multitude of tests for alleged special abilities were used, was met by an opposing hypothesis that most of these tests were measuring much the same thing, namely, general intelligence. According to Cattell, the first formal and adequate statement of factor analysis was presented by Charles Spearman in 1904 (cited by Cattell, 1952, p. 24), wherein he demonstrated that a single factor could be found running through most mental tests, i.e., intelligence, as a single general factor among all tests of cognitive ability.

But in the 1920s Thurstone went a step farther. Instead of concentrating on a single factor, he focused on searching for as many factors as might exist and thus inaugurated multifactor analysis (cited by Cattell, 1952, p. 49). The significance of this procedure is its

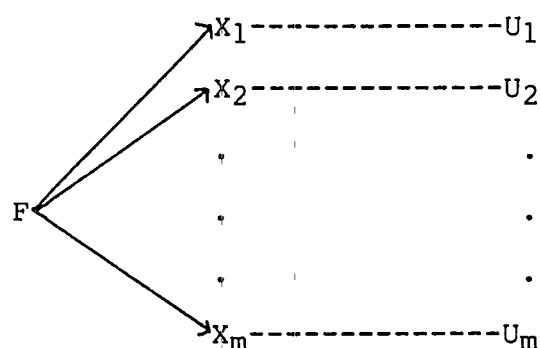
parsimony. First, it represents many variables through a handful of common factors. Secondly, it distributes these factors to give the simplest explanation (Cattell, 1952, p. 51). In recent years factor analysis has become accessible to a wider circle of researchers primarily due to the development of high speed computers and packaged programs such as SPSS (Kim & Mueller, 1986, p. 7).

Foundations of Factor Analysis. Factor analysis attempts to specify a number of dimensions inherent in a given cluster of variables. Three possibilities include a one common factor dimension with many variables, a two common factor dimension (the orthogonal case), and similarly, a two common factor dimension (the oblique case).

In a one common factor dimension, all variable correlations have one factor in common. Thus, for each  $X$  variable there is only one unique factor  $U$  and one common factor  $F$ , as shown in Figure 6.

In a two common factors dimension (an orthogonal case) the covariance in the observed variables is accounted for by two common factors that are uncorrelated, as shown in Figure 7. As can be seen,  $F_1$  and  $F_2$  account for the covariance across all  $X$ s, but  $F_1$  and  $F_2$  are uncorrelated.

Unlike the orthogonal case above, in a two common factors (oblique case) dimension, both  $F_1$  and  $F_2$  are correlated, as shown in Figure 8.



Where

$F$  = a common factor to all  $X_1, X_2, \dots, X_m$

$U_1$  = a unique factor to  $X_1$  and so on.

Or in other words

$X_1$  = a weighted sum of  $F$  and  $U_1$

$X_2$  = a weighted sum of  $F$  and  $U_2$ , etc.

Figure 6. Basic path-analytic causal diagram.  
From Kim and Mueller, 1986, p. 23.

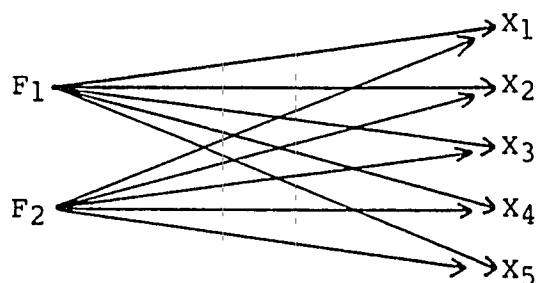


Figure 7. Orthogonal path-analytic causal diagram.  
From Kim and Mueller, 1986, p. 25.



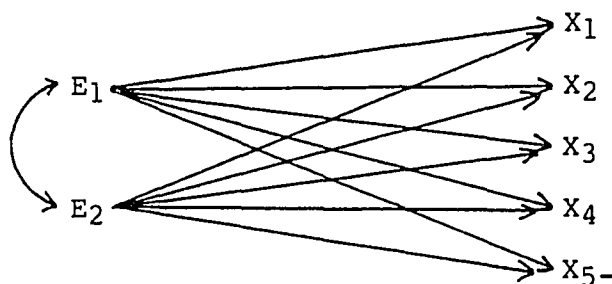


Figure 8. Oblique path-analytic causal diagram.  
From Kim and Mueller, 1986, p. 29.

Obtaining Factor Analysis Solutions. There are four major steps in applying exploratory factor analysis to actual data: (a) data collection and preparation of a covariance matrix; (b) extraction of the initial factors; (c) rotation to a terminal solution; and (d) interpretation and construction of factor scales and their use and further analysis. Confirmatory factor analysis is similarly applied, except that in this case the researcher must specify the number of anticipated factors based on previous knowledge or hypothesis. The various steps, which will be applied in the next chapter, are therefore detailed here.

The first step is to collect the relevant data on a subject of study. A covariance matrix is then derived that represents an entity mode (objects of cases) arranged in a row and the variable mode represented by different columns.

For exploratory analysis, the process of extracting initial factors attempts to find the number of factors that can adequately explain the observed correlations

(covariations) among the observed variables. However, for confirmatory analysis this process attempts to confirm the hypothesized number of factors. By using computer programs, one of the several methods may be chosen, such as maximum likelihood or least squares.

Rotation to a terminal solution is also handled by the computer with the researcher's specifications about the particular desired rotation method. Generally in any given rotation the first factor accounts for as much variance as possible, the second factor accounts for as much as possible of the residual variance left unexplained by the first factor, and so on. Up to a certain point, at the scree, the variance diminishes to zero.

The main motivation behind the use of factor analysis is in achieving data reduction and obtaining factor scales that can be used as variables in a different study (Kim & Mueller, 1986, p. 50). Most programs produce coefficients (weights) to represent the underlying factor. Most of these may be identified from the computer output.

In view of this background, the next logical step would be the application of factor analysis and the interpretation of the model. In this study a framework will be developed to utilize findings from such an analysis in the selection and specification of variables in migration models. Some of the beneficiary models include Markov chain models, gravity

models, and the regression models. These models are explained next.

### Markov Chain Model

The Markov chain model in migration studies has been described as a demographic accounting model (Clark, 1986, p. 61), which is discussed as a description of the process of change. This model is usually used for predictive purposes. Thus, by preparing a table representing a certain category of migrants, a transition probability matrix may be developed for use in the prediction process. A typical equation is of the form

$$P_{t+1} = M \cdot P_t$$

Where

$M$  = a square transition matrix, the elements of which constitute probabilities of moving between discrete regions

$P_t$  = an initial column probability vector, the elements of which represent the probability of being in each of the regions at the beginning of the period

$P_{t+1}$  = the derived probability vector, the elements of which represent the probability of being in each of the regions at the end of the period

An example of the type of questions that might be addressed by such a model is "To what extent will individuals born in one region redistribute themselves across other regions?" This model is therefore a significant tool for demographers in analyzing the changing patterns of population distribution. However, a step further is the explanation of the motives that underlie these migrational flows. Given the multitude of competing potential alternative migrational variables, the framework proposed in this study would be a handy tool to rely on for determining the underlying variables. Such underlying variables may be used as corresponding weights for particular locations of particular migrant cohorts in order to strengthen the model's predictive power.

The shortcoming of this combination, however, is that the proposed framework may sometimes have to be applied either after or concurrently with the application of the Markov chain model. Hence, in such cases, the framework's utility may not be as high towards a comprehensive theory.

#### The Gravity Model

The evolution of the gravity model was accounted for in Chapter II. The basic model is of the form

$$T_{ij} = P_i P_j / D_{ij}$$

Where

$$T_{ij} = \text{interaction between two regions, } i \text{ and } j$$

$P_i$  = population of region  $i$   
 $P_j$  = population of region  $j$   
 $D_{ij}$  = distance between regions  $i$  and  $j$

Further modifications on this model help to represent the propulsive power of the origin, the attractive power of the destination, and the power of intervening opportunities. Hence the expanded model estimates interaction,  $T_{ij}$ , with a set of three vectors:

$$T_{ij} = f(V_i, W_j, S_{ij})$$

Where

$T_{ij}$  = interaction between two regions,  $i$  and  $j$   
 $V_i$  = vector of origin attributes  
 $W_j$  = vector of destination attributes  
 $S_{ij}$  = vector of separation attributes

Unlike the Markov chain model, which may sometimes precede or concurrently be applied with the proposed framework, the gravity model can directly utilize the results of this framework. The applicable variables in this case are the amenity and spatial factors. The amenity factors represent either the propulsive forces (vector of origin attributes) or the attractive forces (vector of destination attributes), while the spatial factors represent the intervening opportunities (vector of separation attributes). Thus this

framework assists in terms of efficient and objective process of selecting the relevant variables for the model.

The main problem with this combination, however, is that a major factor (mobility factor) will not be accounted for, which is normal for gravity models. This shortcoming is, however, addressed by the proposed framework, which helps to identify a set of variables that are similarly crucial to the migration process but are not accounted for by the gravity model. Thus, whereas there may be compelling reasons (propulsive and attractive forces) for a migrant to choose one point (destination) over the other (origin or other alternatives), in the face of minimal intervening opportunities (destination), migration is not guaranteed. In this case, the identification of certain individual characteristics is vital for a better explanation of the migration process. This framework not only helps to identify such a shortcoming but also cautions any interpretation of the gravity model beyond amenity and spatial factors.

#### Regression Analysis

The regression model attempts to explain the relationship between a dependent variable, such as migration, and independent variables, such as income. A typical model is of the following form:

$$M_{ij} = f(X_1, X_2, \dots, X_n, e)$$

Where

- $M_{ij}$  = the number of migrants from i to j
- $X_1$  = the value of the first independent variable
- $X_2$  = the value of the second independent variable
- $X_n$  = the value of the nth independent variable
- $e$  = the error term

In view of the multitude of potential variables, it is crucial that a few representative variables are used. This may save time by avoiding redundancy. Under certain conditions (i.e., with a small sample) it also helps in terms of degrees of freedom. Another potential problem would be multicollinearity. Consequently, there is need for an efficient yet systematic way of selecting appropriate variables. Such a system is the heuristic framework being proposed here. By identifying various variable associations, it becomes possible to identify and include all facets of variable configurations. It also becomes possible to explain why some variables are dropped from the model and, where there is multicollinearity, it makes it possible to explain such outcomes.

It will therefore be evident in this study that this heuristic framework is a valuable supplement to a number of existing migration models. The framework provides

objectivity in both variable selection and interpretation of results from models being applied.

### Meta-analytic Procedure

In Chapter II the fundamentals of scientific research towards theory were developed. It was evident that social sciences have generally been constrained in terms of enhancing and developing objectivity. According to Sullivan's editorial (cited by Wolf, 1986), "single experiments or studies in social or behavioral sciences rarely provide definitive answers to research questions" (p. 5). Hunter and Schmidt (1990, p. 13) have argued that the two steps of accumulating knowledge are through accumulation of results across studies to establish facts and formation of theories to organize facts into a coherent and useful form. However, due to the previously limited number of similar studies in social sciences, few facts could be established (Hunter & Schmidt, p. 13). It has been shown in this framework that now it is not only possible to obtain objectivity but also that, by applying a meta-analytic procedure on this framework's products, it is possible to develop a strong theory in social sciences.

Meta-analysis is a quantitative method for research analysis using statistical procedures and collections of empirical findings from individual studies for the purpose of integrating, synthesizing, and making sense of them



(Wolf, 1986, p. 5). The first journal article on meta-analysis was published in 1976 by Gene V. Glass (cited by Hunter & Schmidt, 1990, p. 16). Glass is similarly credited for coining the term "meta-analysis." In their 1981 edition Glass, McGaw, and Smith account for weaknesses in previous methods of reviewing social sciences literature (Glass, McGaw, & Smith, 1981, p. 13). The underlying weakness that they have underscored in this instance is lack of objectivity.

A meta-analytic research compiles findings from various studies on a specific question from which, through statistical configurations, the basis for an objective theory is established with regard to the study question. Usually the preceding studies on which meta-analysis has to be applied originate from findings of other models, such as regression analysis.

It is therefore emphasized that, by utilizing the framework proposed here, consistent studies utilizing the regression model, for example, will make it possible to apply meta-analysis as a means of testing the reliability of separate studies and thus developing a theory.

## RESEARCH DESIGN

### Explaining the Framework

The heuristic framework proposed in this study is explained in detail in Chapter IV. The various components

to note in this section include a conceptual analysis, variable identification, factor analysis, and meta-analysis. The conceptual analysis involved in this framework has already been covered in this chapter. Follow-up chapters will concentrate on the later phases of this framework. Thus the second phase in designing the heuristic framework would be to list all the variables identified in previous studies, as covered in Chapter II. The purpose of doing this is to contrast the early studies with the recent ones in terms of growing proliferation and refinement of migration studies. It will also reflect the problem of choosing variables.

The next step is to take a large sample of these previous studies so as to identify the types of variables that were used. The purpose is to rank variables by frequency. In this case, a frequency table will be designed in a matrix form consisting of 49 types of variables extracted from 72 separate studies. This frequency table will then serve as a guideline in the determination of which variable to choose as a proxy for other alternative variables. This includes the initial model specification as well as use of the factor analysis results in the specification of the follow-up regression model.

The third phase of the heuristic framework involves the application of a factor-analytic model that will use the 1980 county to country migration data in the state of

Oregon. The purpose here is to visualize the configuration of migration variables. Unlike the classification attempted in phase 1 as a rule of thumb, this method is more objective. Rather than being simplistic and intuitive, this analysis involves an iterative variable interaction. However, it is important to note that the success in the specification of this model and further analysis as well as its subsequent interpretation depends a great deal on the comprehensiveness of the hypothesis in phase 1. The less representative and less wholistic the hypothesis, the less the utility derived from factor analysis.

Once factor analysis creates variable classifications, further analysis such as regression analysis may be used only as far as the interpretation of factor analysis would allow. For example, if variables applied in regression analysis may be interpreted in factor analysis as mobility related, no interpretation of the regression results may go beyond analyzing mobility. The final product should therefore be seen as a partial analysis, consequently leading to a partial theory. If variables selected are representative of all the facets of migration process, then the analysis would be comprehensive.

The last phase of this heuristic framework requires a meta-analytic analysis. This process involves use of previous studies that have applied the above process. The

results of such analysis are expected to yield a strong theoretical foundation in migration studies.

In short, phase 1 involves conceptual analysis from past literature, and other scientific approaches, and mandates that an encompassing hypothesis be stated. In order to go to phase 2, it must be fairly satisfied that a simple and fair classification of all variables is prepared as a checklist for representativeness. Phase 2 involves the enumeration of several variables that affect the migration process. In this study these will be collected from some of the studies identified in this research. If such a list of variables is fairly representative of all the classifications hypothesized in phase 1, then the next step is to apply factor analysis to a sample of representative variables. Previous studies or hypotheses may be useful in making this sample. In this research, the frequency determined in phase 2 will influence the choice of variables.

Factor analysis will therefore objectively identify clusters of variables that are closely related to certain aspects of the migration process. The main thrust of this research, therefore, is that any selection of variables that does not cover all the aspects identified by a factor analytic procedure (given a wholistic approach in the first two phases above), should be considered to be partial, with interpretation limited to those aspects that the variables accrue from. A comprehensive analysis is only possible if

variables used are representative of all the aspects identified in factor analysis.

Phase 4 of this research involves a proposal for the collection of studies that have done a similar analysis to form data for a statistical meta-analytic procedure. This should provide a strong foundation for a partial or comprehensive theory in migration studies (depending on whether the analysis was representative of all aspects of factor analysis).

#### CONCLUDING REMARKS

As identified in Chapter I, the need for a comprehensive theory in migration studies is vital. Chapter II attempted to present certain trends towards theory but equally revealed a certain potential for diversion towards partial theories in migration studies. In this chapter, attempts were made to present methodologies that may be combined to provide a perspective that may not only lead towards a comprehensive theory in migration but may also be used to analyze other studies that represent a partial theory. It is this line of analysis that is presented in this study as a "heuristic framework," through which the development of a consistent theory in migration studies may be established. This heuristic framework is discussed in the next chapter, including the application of a factor analytic model.

## CHAPTER IV

### THE HEURISTIC FRAMEWORK

The Random House Dictionary (1987) defines the word heuristic in the following way:

A means of furthering investigation, encouraging a person to learn, discover, understand or solve problems . . . by experimenting, evaluating possible answers or solutions, . . . teaching method, . . . method of argument. (p. 898)

In this study, this concept is used to identify governing guidelines or a teaching tool. A heuristic framework, therefore, will refer to an analytical structure, i.e., a guided or organized process of analysis.

In this chapter, four main areas of the heuristic framework will be explored. These include a layout of the heuristic framework itself, analysis of variable specification, application of a factor analytic model, and an examination of prospects for further development.

First, the framework's layout will attempt to give an overview of various components that make up the proposed heuristic framework and their inherent interrelationships. Secondly, the analysis of variable specification will involve the enumeration, coding procedure, and comparison of

variable specifications across various previous studies in the field.

Thirdly, a factor analytic procedure will be applied to provide the framework with a more objective classification of factors inherent in the migration process. The final section that covers prospects for further developments will explain the utility of this framework in terms of applying a statistical meta-analytic procedure toward the final development of theory in migration.

#### COMPONENTS OF THE FRAMEWORK

Figure 9 is a flow chart of the heuristic framework. As already indicated, this consists of four critical components. These four components include the identification of the determinants in the migration process which is subjective but based on the survey of existing literature. The other components to be elaborated on include variable enumeration, factor analysis, and meta-analysis. The other components include decision nodes and subsequent outcomes.

The four alternative outcome scenarios may be paired first in terms of comprehensive versus partial theory developed from their respective analyses. Second is the academic exercise versus explanation of the migration process depending on whether real or generated data are applied. The decision node components provide for a systematic assessment

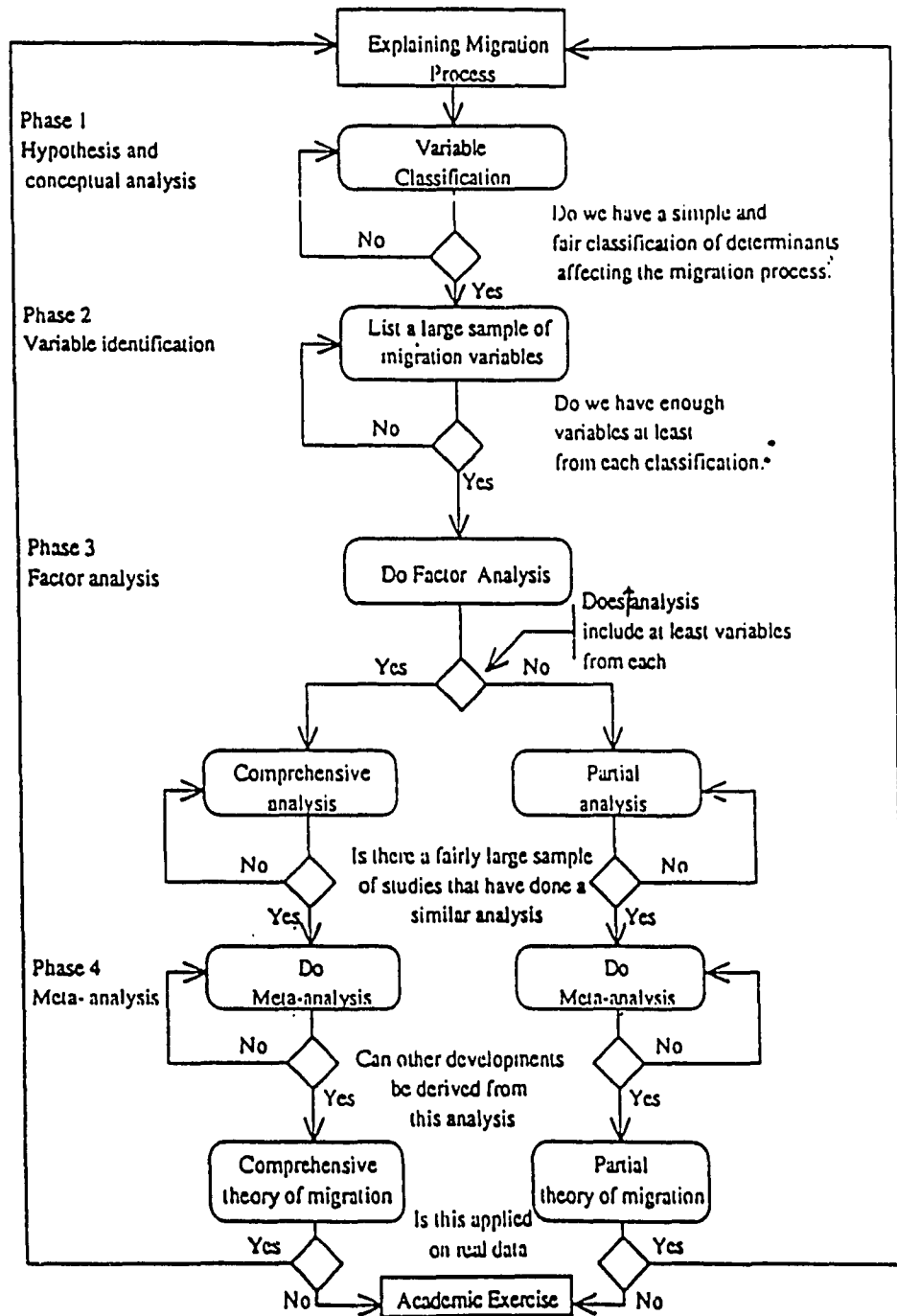


Figure 9. The heuristic framework.



of transitions between the framework's components (main and auxiliary). A schematic overview of the heuristic framework is shown in Figure 9.

#### A Schematic Overview

Figure 9 represents a schematic overview of the comprehensive framework proposed in this study. Starting at the top, the main objective here is the explanation of the migration process.

#### Explaining the Framework

In phase 1 a conceptual analysis from past literature and other scientific approaches mandates that an encompassing hypothesis be stated. In order to go to phase 2, it must be fairly satisfied that a simple and fair classification of all variables is prepared as a checklist for representativeness. This procedure was done in Chapter III, i.e., research hypothesis in terms of mobility, amenity, and spatial factors.

Phase 2 involves the enumeration of several variables that affect the migration process. In this study these variables will be enumerated in this chapter as obtained from some of the studies identified in this research. If such a list of variables is fairly representative of all the classifications hypothesized in phase 1, the next step is to apply factor analysis.

In phase 3 factor analysis is applied to objectively identify clusters of variables that are closely related to certain aspects of the migration process. Previous studies or hypotheses may be useful in the interpretation of subsequent factors. This procedure is similarly done in this chapter by utilizing county to county migration data in the state of Oregon. Also in this phase a preliminary meta-analytic procedure will be applied on appropriate models to determine the suitable model for further analysis. The choice of variables will be determined by the findings from frequencies of variables identified in phase 2. The main thrust of this phase, therefore, is that any specification of variables that does not cover all the aspects identified in factor analytic procedure (given a wholistic approach in the first two phases above), should be considered to be partial. Subsequent interpretations of such specifications should be limited to those aspects from which the variables accrue. A comprehensive analysis is only possible if variables specified are representative of all aspects identified in factor analysis.

Phase 4 of this research involves a proposal for the collection of studies that have done a similar analysis (i.e., benefiting from factors identified). These studies would constitute data for a statistically oriented meta-analytic procedure. This should provide a strong foundation for a partial or comprehensive theory in migration studies,

depending on whether the analysis was representative of all aspects of factor analysis.

#### OPERATION OF THE FRAMEWORK

The basic objective of this framework is to enhance the development of theory in migration studies. For purposes of application, this is conceptualized as the explanation of the migration process. As explained in the methodology section, the four phases are identified on the flow chart. Given both the main and auxiliary components, the first step is to determine whether the hypothesized determinants are simple enough but fairly representative of the migration process. If this is satisfied, an enumeration of individual variables affecting migration will follow up with emphasis on fair representation between determinants. Satisfaction of this condition lends to the application of factor analysis.

The subsequent step here is the determination of which migration variables are used in the specification of a migration model. The rule of thumb is that if variables from certain factors generated through factor analysis are not included in the specification, then the analysis is partial and so is the subsequent theory. If the specified variables are representative of all the factors, then a comprehensive analysis is achieved along with the subsequent

theory. This step may be useful when designing a new study or evaluating a previous study.

If there is a fairly large sample of studies that have accommodated such specifications, then a statistical meta-analytic procedure may be applied. Should this procedure produce any consistent findings, the conclusion from the framework would be that there is a strong basis for theory. The subsequent theory is anticipated to fairly explain the migration process (if real data were used) or to fairly provide a satisfactory academic exercise (if data are randomly generated).

#### VARIABLE SPECIFICATION ANALYSIS

##### Enumeration of Research Variables

In this section a sample of research variables so far identified in the present survey of literature is to be enumerated. Even a casual reading of the literature reveals that several variables influence the migration process. A tabular procedure will therefore be used to quantify this phenomenon. A composite list of variables from previous works and reviewed in this research is therefore presented in Table V to reflect the inherent potential for varied specifications. It should be noted that Table V only attempts to identify a partial list from a range of potential variables that one is likely to identify from other

TABLE V  
COMPOSITE LIST OF POTENTIAL VARIABLES  
AFFECTING MIGRATION

---

Adjacent state	Family size
Age	Gender
Assets	Government expenditures
Climate	- welfare expenditures
- cool days	Housing
- heat days	- age of house
- humidity	- housing starts
- seasons	Income
- sunshine	- growth
- temperature	- mean
- mean	- median
- January	- per capita
- July	- wage rate
- 32	Industrial similarity
- 90	Investment resources
- wind speed	Marital status
Cost of living	Migration rate
- house cost	- return migration
- rent	- immigration
Crime level	- outmigration
- violence	- migrant stock
Cultural ties	- migration history
- friends	Natural resources
- relatives	Occupational status
Distance	Pollution level
Education level	Population
- enrollment	- population density
- percent literate	- urbanization
- percent completed:	Physical assets owned
- high school	Physicians per X patients
- 2 years college	Poverty level
- 4 years college	Race
- graduate school	- black
- X number school years	- nonwhite
Employment	- white
- unemployment rate	Regional dummy variables
- labor force	Taxes

---

NOTE: These variables were collected from the literature cited in this research. Some were part of research models. Others had been cited as examples.

related studies that attempt to explain the migration process. The problem, therefore, is that of choice.

Thus, given a research problem such as finding the determinants of migration between  $i$  and  $j$ , and given a long list of potential variables as shown in Table V, the problem now is discovering which variables are more representative. How can consistency between separate studies be maintained? These are problems of proliferations in specifications, as have already been made evident in Chapter II. They are the problems to which this framework attempts to respond. They are real problems, especially in attempting to formulate a consistent procedure towards the development of theory.

The above variables were encountered at least once in the literature surveyed by this study. In spite of the comprehensive coverage attempted by this study, several other variables, most of them in different versions of the same, may be encountered in the literature. The more versions of such variables, the greater is the potential for confusion. The next step will therefore attempt to sort and minimize such versions to 49 variables identified by this study from 72 separate studies. The selection first involved representation of all three categories. Then from each category those variables that had been used at least in one model were selected. In some cases, proxies were used, such as mean temperature to represent different levels of temperature.

### Enumeration of Variable Specifications

In this section 49 different variables are identified from those enumerated in Table V. All of these variables were used in previous research, some more frequently than others. To compile a frequency matrix, a composite list of these variables was coded (see Table VI). Similarly, 72 separate studies were sampled for determining the frequency of individual variable utilization. The authors identified in this literature review are enumerated and alphabetically coded (see Table VII).

From Tables VI and VII, a tabular representation of the frequency for each variable's specification by the authors is derived by a frequency distribution table. Even though the listing in Table VI is more condensed than in Table V, the variables are still too many and may require further sorting. One way of doing so is to determine how frequently they are used. On the one hand, this prevents the researcher from falling into strong subjectivity. On the other hand, it is a hint (given two or more proxies for a variable) as to which proxy of a variable is readily available or tends to be more appealing.

Frequency Distribution. With reference to Tables VI and VII, a frequency table may be designed to show which variables were frequently used. Thus, by listing the codes for variables on the vertical axis and the codes for authors

TABLE VI  
CODING OF SAMPLED VARIABLES

1. Climate	26. Physicians
2. Cool days	27. Poverty level
3. Heat days	28. Tax
4. Humidity	29. Adjacent state
5. Seasons	30. Distance
6. Sunshine	31. Culture
7. Temperature mean	32. Friends
8. Wind	33. Population size
9. Crime	34. Urban/density
10. Violence	35. Age
11. Cost of living	36. Education
12. Rent	37. Family size
13. Employment	38. Gender
14. Unemployment	39. Housing
15. Labor force	40. Migration rate
16. Government expenditure	41. Return migration
17. Welfare	42. Outmigration
18. House age	43. Migrant stock
19. New house	44. Migration history
20. Per capita income	45. Occupational status
21. Median income	46. Nonwhite
22. Income growth	47. Race
23. Wages	48. Industrial
24. Natural resources	49. Regional factor
25. Pollution	

NOTE: Numbers here match with the vertical axis in Table VIII (pp. 121-122) and Table X (pp. 125-126).



TABLE VII  
SAMPLED STUDIES CODED BY AUTHOR

---

1. Arora & Brown (1971)	37. Greenwood (1978)
2. Alperovich et al. (1977)	38. Greenwood et al. (1972)
3. Barber & Milne (1988)	39. Haurin & Haurin (1988)
4. Beals, Levy, & Moses (1967)	40. Henderson (1982)
5. Boots & Kanaroglou (1988)	41. Herzog (1983)
6. Boventer (1969)	42. Hoenack, Peris, & Weiler (1984)
7. Bowles (1970)	43. Jun & Chang (1986)
8. Cebula & Vedder (1973)	44. Kau & Simmans (1976)
9. Cushing (1986)	45. Kau (1979)
10. Cushing (1987)	46. Kleiner (1984)
11. Cushing (1989)	47. Levy & Wadycki (1974)
12. DaVanzo (1983)	48. Mazek (1966)
13. Dorkoosh (1982)	49. McHugh (1988)
14. Dunlevy & Gemery (1977)	50. Miller (1973)
15. Farber (1983)	51. Molho (1984)
16. Fields (1971)	52. Morrison et al. (1975)
17. Foot & Milne (1984)	53. Navrath & Doyle (1977)
18. Fournier (1989)	54. Nelson (1959)
19. Fox, Herzog, & Schlottman (1989)	55. Nelson & Wyzan (1989)
20. Gallaway (1967)	56. Olivey (1970)
21. Gallaway et al. (1968)	57. Pack (1973)
22. Gallaway (1969)	58. Persky & Kain (1970)
23. Glantz (1973)	59. Rabianski (1971)
24. Gordon (1988)	60. Renas & Kumar (1982)
25. Goss & Chang (1983)	61. Renshaw (1970)
26. Grant et al. (1976)	62. Rogers (1967)
27. Graves (1979)	63. Sahota (1968)
28. Graves (1983)	64. Sandell (1977)
29. Greenwood (1969)	65. Schachter & Althaus (1989)
30. Greenwood (1970)	66. Schultz (1971)
31. Greenwood et al. (1971)	67. Shefer (1987)
32. Greenwood & Sweetland (1972)	68. Sommers & Suits (1973)
33. Greenwood (1973)	69. Trott (1971)
34. Greenwood (1973)	70. Wadycki (1974a)
35. Greenwood (1975)	71. Wadycki (1974b)
36. Greenwood (1976)	

---

NOTE: Numbers here match with the horizontal axis in Table VIII (pp. 121-122) and Table X (pp. 125-126).

on the horizontal axis, a cross check is indicated for every time a variable is used. A tally of these checks is shown in the right-hand column. This shows the frequency of each individual variable, as shown in Table VIII on the following two pages.

Analysis of the Frequency Table. As can be seen in Table VIII, out of the 49 variables from the 72 studies, only 15 variables were used more than 10 times. The most frequently used variables include distance (40 times, or a 56% chance of being applied), unemployment (33 times, or 46%), per capita income (29 times, or 40%), etc. Table IX shows the first 15 most frequently used variables in this sample in their order of frequency.

There are three implications of this analysis. First, the above variables may be used frequently because of their effective reliability in explaining migration behavior. Secondly, they may be used frequently because some researchers utilize the same variables for the purpose of reviewing previous research. And thirdly, these variables may be used frequently simply because they are easily available. This framework therefore attempts to enhance the first option, reliability, and to suppress the later option, easily available. It also advocates and suggests a systematic analytical procedure. Given such a predetermined structure, as identified in the methodology section, a researcher is forced to select variables that are more

TABLE VIII

UNSORTED VARIABLE FREOUENCIES

STUDIES (1 through 37)

VARIABLES (1-49)

TABLE VIII  
UNSORTED VARIABLE FREQUENCIES  
(continued)

[illegible]

TABLE IX  
MOST FREQUENTLY USED VARIABLES

Variable	Frequency
Distance	40
Unemployment	33
Per capita income	29
Population size	26
Education	22
Employment	22
Wages	17
Age	15
Labor force	14
Median income	13
Mean temperature	13
Regional dummy variable	13
Welfare	11
Migrant stock	10
Urbanization	10

representative of the migrational phenomena or else justify why certain expected variables have been excluded.

Based on the classification elaborated on in the methodology section, especially with reference to Lee's approach, migration variables may therefore be classified into three broad categories. First are the mobility variables, such as education and age, which attempt to identify a probably migrant based on the potential migrant's characteristics. Second are the amenity variables, such as income and unemployment, which attempt to identify the attractive and propulsive forces at destination and origin, respectively. Third are the spatial variables, such as distance

and migrant stock, which attempt to explain frictional deterrents to a migrational process. Whereas it will be attempted to rationalize that such a classification constitutes a more distinctive grouping of migrational variables, some overlaps and the potential for subcategories may not be ruled out. The primary essence of such a classification is therefore to attempt to force researchers to recognize such groupings so as to design more representative variable specifications for their studies.

A classification of the 49 variables into three categories, i.e. mobility, amenity, and spatial, based on the 72 research studies, is shown in Table X. Eight of these studies utilized variables exclusively associated with the amenity factors; 18 studies were associated with both the amenity and spatial factors; 31 studies utilized a combination of variables spanning over all three factor categories --spatial, amenity, and mobility; 14 studies were associated with both the amenity and mobility factors; and 2 studies utilized a combination of variables exclusively associated with both the spatial and mobility factors.

Whereas the majority of the studies in our sample (31, or about 43%) utilized all three variable categories, it is evident that 55% of the studies focused on a limited spread. In this case, it is the intention of this framework that interpretation of such studies be limited to only the context within which those variables appear without any

TABLE X

SORTED VARIABLES FREQUENCIES

[illegible]

TABLE X  
SORTED VARIABLES FREQUENCIES  
(continued)

[illegible]



implication for any other contexts not represented. In other words, these studies may not be relied upon to explain the migration process in its entirety. As such, it will be hypothesized that the more representative the distribution of variables, the more comprehensive would be the theory derived.

The main objective of this framework is to provide such a common basis from which independent regional migration studies may constitute a similar content and therefore be amenable for comparison between regions, between studies, and over time. These three groups of variables are advanced as a fair representation of the migration process since they measure the effect of spatial conditions, amenity effects, and potential mobility.

#### FACTOR ANALYTIC APPLICATION

In this section, three steps will be undertaken in the application of factor analysis, i.e., specification of the model, manipulation of the data, and explanation of the results. All variables in the model are considered independent. Eventually a subset of them will be used to explain migration, the implied dependent variable. As the purpose here is to identify redundancies among independent variables, this implied dependent variable is not included in the factor model. The data manipulation process will consist of factor extraction and rotation. The extraction

techniques are used for the purpose of deriving the initial statistics and very from principal component analysis to factor analysis. The rotation technique is used to enhance the interpretation process. Explanation of results would involve subjective analysis based on the factor scores derived.

### Variable Input

In the review of literature along with the previous analysis in this chapter, it is evident that certain variables are more in the analysis of migration than others. The selection of variables was made based on three criteria. First, variables with high frequencies, such as those in Table IX, should be included in the specification. However, and second, some variables such as per capita income, median income, and wage rate are so correlated that only median income was used as a proxy for others of similar characteristics. Inclusion of all three would overload the model and may stifle the emergence of lower eigenvalue factors.

Third, since intrastate moves in Oregon were at issue here, and climate distinctions are much more varied than county aggregates or averages could portray, variables such as this were excluded. The 25 variables enumerated below were thus deemed the distillation of the 49 established earlier that was both feasible and representative. The implication here is that, by identifying the most

frequently used variables and using proxies where there was correlation as well as restructuring the variables to provide for representativeness in all aspects of migration, it will be possible to reduce the number of variables without losing the substance of the study. Thus, factor analysis involves:

Factor Variables, = CRIMES to YNGAGE

Where

CRIMES = recorded crime rate per 100,000

CSTHSE = median monthly cost of a house

CSTRNT = median gross rent

DISTAV = average straight line distance from origin county seat to destination county seat in miles

EDUCTN = percent with 16 years or more of education

ESTABS = per capita establishments (total of manufacturing, wholesale, retail, and service industries)

FARMNG = percent of farms with more than 500 acres

GENDER = number of males per 100 females

HSEGRW = percent change of housing stock between 1970 and 1980

INCMDN = median income

INCPVT = percent of persons with income below poverty level

MARIED = percent of married couples

MOVERS = percent of recent immigrants to the county in previous 5 years (i.e., migrant stock)

NWHITE = percent of population that is nonwhite

OLDAGE = percent of population aged 65 years and over  
 PHYSCN = rate of active physicians per 1,000  
 POPULN = population in the county  
 SINGLE = percent of population living in a single household  
 SSCRTY = average monthly supplemental security income  
 TAXPRT = per capita property tax  
 UNEMPL = percent of civilian labor force unemployed  
 URBANN = percent of population in urban setting  
 WHITTE = percent of population that is white  
 WLFARE = per capita transfer payments  
 YNGAGE = percent of population aged between 5 and 17 years

Data Sources and Substitutions. The application for this study relied on the 1980 cross section data. There were three main sources of data. The 1980 county to county migration data were obtained from Area to Area Migration and County Income Data for 1980 (IRS, 1990), which is compiled by the IRS Statistics of Income Division. The other major source of data for other variables identified above was the City and County Data Book (U.S. Bureau of Census, 1983). Further related data for use as well as crosschecking were obtained from the 1980 Census of Population (U.S. Bureau of Census (1980)).

Unfortunately, some of the variables were missing data, i.e., the data on HSEGRW for Wheeler County, the data on

PHYSCN for Gilliam and Sherman Counties, and the data URBANN for Gilliam, Grant, Jefferson, Wallowa, and Wheeler Counties. In this particular case, the "meansub" command was used to replace missing values with the mean value.

### Data Manipulation

Table XI shows the mean and standard deviations of the variables after the substitutions.

Extraction (Principal Component Technique). The principal component technique was used for variable extraction. Table XII shows the configuration of factors with their respective eigen values, their percentages and their cumulative values. In general, factors with eigen values greater than 1 may be retained since they tend to give consistent results with the researcher's expectations (Kim, 1978, p. 43). In this case, seven factors are identified with eigen values greater than 1 (i.e., ranging from 1.1 to 7.3). The first factor accounts for 29% of the variables, followed by 17% through 4% for the seventh factor. The cumulative effect for the seven factors is 84%.

The implication of this principal component extraction is that all of the variables applied in this model may reasonably be clustered in seven groups, with about 84% of the cumulative variance explained.

The scree test is a test advocated by Cattell (cited by Kim & Mueller, 1978, p. 44). It is a graphic representation

TABLE XI  
MEAN AND STANDARD DEVIATIONS BY MEANSUB COMMAND

Variable	Mean	Std. Dev.	Cases
CRIMES	4828.94	1876.62	36
CSTHSE	329.06	43.64	36
CSTRNT	230.61	28.37	36
DISTAV	176.67	32.78	36
EDUCTN	14.53	5.31	36
ESTABS	20.14	3.03	36
FARMNG	21.30	22.78	36
GENDER	99.50	3.09	36
HSEGRW	46.84	28.26	36
INCMNDN	18401.03	2313.53	36
INCPVT	11.11	3.05	36
MARIED	34.03	1.64	36
MOVERS	15.37	5.10	36
NWHITE	4.34	4.02	36
OLDAGE	12.33	2.45	36
PHYSCN	108.95	70.44	36
POPULN	73142.19	11087.37	36
SINGLE	8.02	1.33	36
SSCRTY	151.97	27.05	36
TAXPRT	382.05	108.93	36
UNEMPL	9.56	3.05	36
URBANN	39.87	34.68	36
WHITE	95.81	4.01	36
WLFARE	1557.30	233.17	36
YNGAGE	20.73	1.77	36

TABLE XII  
PRINCIPAL COMPONENT EXTRACTION

Variable	Communality	Factor	Eigen Value	% of Var.	Cum. %
CRIMES	1.00000	1	7.27	29.1	29.1
CSTHSE	1.00000	2	4.40	17.6	46.7
CSTRNT	1.00000	3	2.67	10.7	57.4
DISTAV	1.00000	4	2.51	10.1	67.4
EDUCTN	1.00000	5	1.80	7.2	74.7
ESTABS	1.00000	6	1.26	5.1	79.7
FARMNG	1.00000	7	1.10	4.4	84.2

of the spread of eigen values and requires that factoring be stopped at a point where eigen values begin to level off and form a straight line. The graph in Figure 10 starts at the eigen value of 7.269, drops steeply until the seventh factor when the eigen value is 1.108, and levels off thereafter.

The scree test is a visual confirmation of what was observed in the initial statistic above. Therefore, this test is used here for two purposes. On one hand, it is a good illustrative tool. The visual image is easier to grasp compared to the tabular form. On the other hand, the scree test was used for tautological reasons, i.e., to show different alternative ways of presenting the results.

Table XIII shows the factor loading matrix. Visually a pattern seems to be easily identifiable. In essence, the principal component's extraction here has produced a factor matrix with identifiable distribution of variables that may

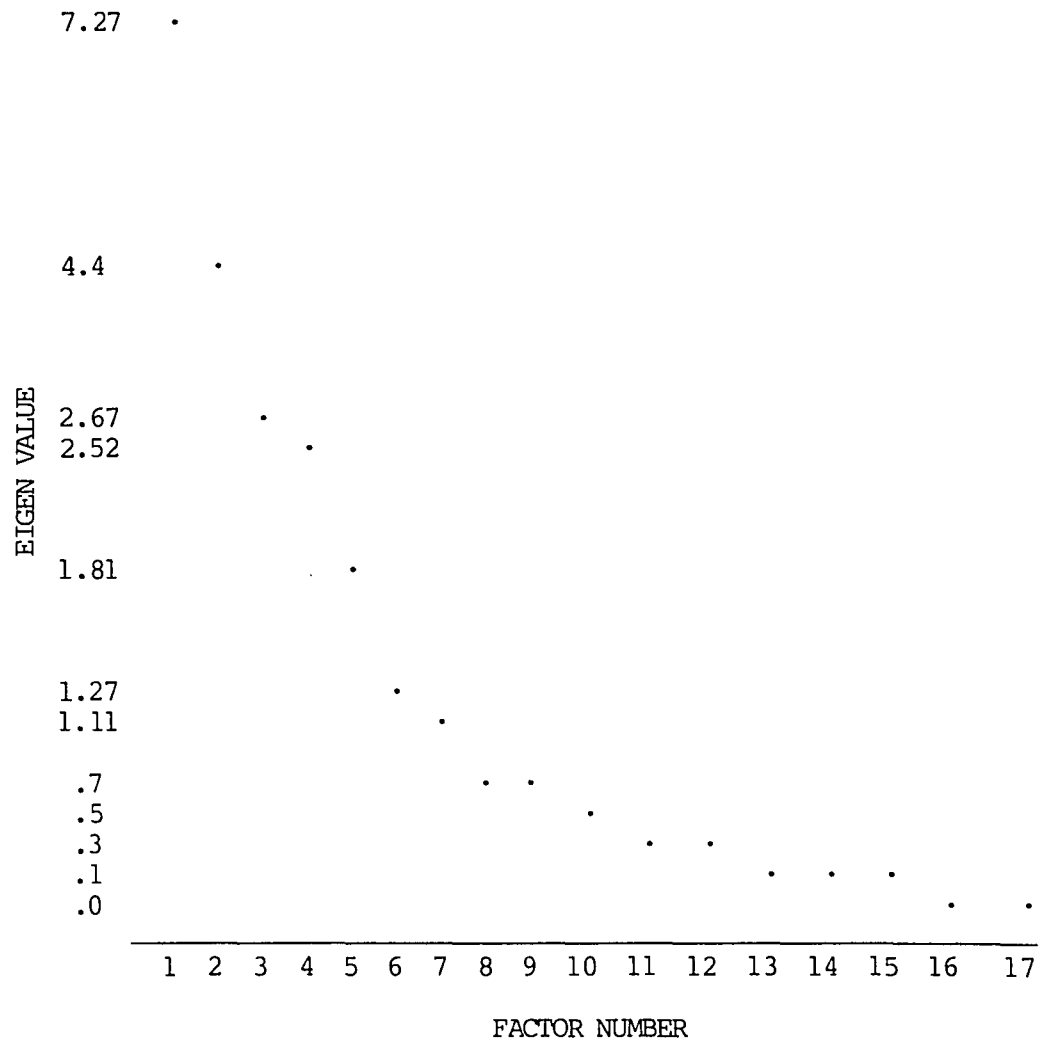


Figure 10. The scree test.



TABLE XIII  
PRINCIPAL COMPONENT FACTORS

Variable	Fct. 1	Fct. 2	Fct. 3	Fct. 4	Fct. 5	Fct. 6	Fct. 7
CRIMES	.87690	--	--	--	--	--	--
POPULN	.83747	--	--	--	--	--	--
GENDER	-.76438	--	--	--	--	--	--
PHYSCN	.73677	.32666	--	--	--	--	--
FARMNG	-.69809	--	--	--	--	.43158	--
CSTRNT	.58535	.35485	--	--	-.30283	--	.41224
WLFARE	--	-.82838	--	.40246	--	--	--
EDUCTN	--	.81714	--	.45536	--	--	--
OLDAGE	--	-.81556	--	.41348	--	--	--
INCMNDN	.39750	.75535	--	--	--	--	--
CSTHSE	.57422	.67461	--	--	--	--	.35908
MARIED	-.51545	-.62273	.43202	--	--	--	--
URBANN	.39040	.52542	--	--	--	-.50653	--
NWHITE	--	--	-.97335	--	--	--	--
WHITE	--	--	.96936	--	--	--	--
YNGAGE	--	--	--	-.90505	--	--	--
SINGLE	.37536	--	--	.77236	--	--	--
INCPVT	--	--	-.33421	--	.78000	--	--
DISTAV	--	--	--	--	.67923	-.31953	--
SSCRTY	--	--	--	--	.63008	--	.31564
ESTABS	--	-.32180	--	.50109	.55129	--	--
TAXPRT	--	--	--	--	--	.91125	--
UNEMPL	--	-.38057	--	--	--	-.68475	--
HSEGRW	--	--	--	--	--	--	.88149
MOVERS	-.46494	--	--	--	-.50011	--	.56683

be associated to each factor. The interpretation of these distributions is left for the section entitled Explanations of the Results.

Table XIV shows the final statistics from the principal component analysis. It is actually similar to the initial statistics analysis (Table XII), except that it only includes values pertaining to the first seven factors as identified by the rule of thumb (i.e., that only factors with eigen values greater than 1 are used).

Rotation (Varimax Technique). The initial factoring step usually determines the minimum number of factors that can adequately account for observed correlations and in the process determine the communalities of each variable. The rotation step attempts to find simpler and more easily interpretable factors while keeping the number of factors and communalities of each variable fixed. The varimax

TABLE XIV  
FINAL STATISTICS

Variable	Communality	Factor	Eigen Value	% of Var.	Cum. %
CRIMES	.89875	1	7.27	29.1	29.1
CSTHSE	.92978	2	4.40	17.6	46.7
CSTRNT	.82460	3	2.67	10.7	57.4
DISTAV	.74908	4	2.52	10.1	67.4
EDUCTN	.92769	5	1.81	7.2	74.7
ESTABS	.73433	6	1.27	5.1	79.7
FARMNG	.79803	7	1.11	4.4	84.2

rotation technique attempts to accomplish this by maximizing variance of the squared loadings for each factor.

Table XV shows the results obtained from varimax rotation. Convergence in varimax occurred after 14 iterations. As may be observed visually, rotated factors are more defined in Table XV than for the initial factoring as seen

TABLE XV  
VARIMAX ROTATED FACTORS

Variable	Fct. 1	Fct. 2	Fct. 3	Fct. 4	Fct. 5	Fct. 6	Fct. 7
CSTHSE	.91817	--	--	--	--	--	--
MARIED	-.84501	--	--	--	--	--	--
PHYSCN	.77156	--	--	--	--	--	--
POPULN	.75881	--	--	--	--	--	--
CRIMES	.75220	--	--	--	--	--	--
INCMDN	.75210	--	--	--	--	--	--
FARMNG	-.72521	--	--	--	--	--	--
EDUCTN	.70636	--	--	--	--	--	--
CSTRNT	.66003	--	--	--	--	--	--
URBANN	.62885	--	--	--	--	--	--
GENDER	-.51514	-.50771	--	--	--	--	--
WLFARE	--	.82884	--	--	--	--	--
SINGLE	--	.79877	--	--	--	--	--
OLDAGE	-.52847	.70898	--	--	--	--	--
YNGAGE	--	-.67695	--	--	--	--	--
ESTABS	--	.61881	--	--	--	--	--
WHITE	--	--	.75667	--	--	--	--
NWHITE	--	--	-.75630	--	--	--	--
TAXPRT	--	--	--	-.68734	--	--	--
UNEMPL	--	--	--	.67346	--	--	--
INCPVT	--	--	-.57470	--	.61083	--	--
SSCRTY	--	--	--	--	.54349	--	--
DISTAV	--	--	--	--	--	--	--
HSEGRW	--	--	--	--	--	.63067	--
MOVERS	--	-.52354	.52543	--	--	--	-.56753

in Table XIII. Thus the factor loadings are much more identifiable to particular factors. For example, in factor 1, the high factor loadings pertain to the first 12 variables in the table, with the gender variable almost equally divided with the second factor. Following a diagonal downward slope to the right, this pattern of high factor loadings is repeated until the seventh factor (MOVERS) with three loadings but only one in factor 7 showing a significant value. Similarly, there is little scattering of factor loadings, therefore reinforcing more precise clusters than those in Table XIII which had not been rotated. The number of factors, however, has remained the same, i.e., seven.

This process involves some subjectivity in analyzing the configuration of individual factors. In most cases some variables are dominant within a given factor while others contribute little. It is incumbent upon the researcher, therefore, to identify the representation of each individual factor. In this research, this process will be determined in the next section, Explanation of the Results.

According to Kim (1978, p. 60), with the exception of psychometric literature, factor analysis seems to have been used more often for further studies. As has been previously indicated in this study, factor analysis is being used here only as one of the pieces in the heuristic framework. The results of factor analysis will be used in the specification of the regression model that will follow.

### Explanations of the Results

The two rotation options, i.e., principal component and varimax, extracted seven factors each. The results are shown in Table XVI.

By observation, factor 1 variables may be characterized as urban. This association is further strengthened by the fact that, except for gender, all the variables belong to the amenity variable structure. One explanation to this exception may be that, since the gender ratio within counties is almost the same, it will be closely correlated with the population variable, which is closely associated with urbanization and thus will have the same effect. Furthermore, possibilities for its classification as a mobility variable are usually based on literature that is overwhelmingly about developing countries where gender plays a major role in migration and thus short of a homogeneous variable.

The second factor exhibits low mobility characteristics, i.e., variables that constrain or enhance the ability to migrate. The WLFARE variable was hypothesized as an amenity variable, but was found in this analysis to be associated with the mobility variables. An explanation of this phenomenon may be that welfare recipients tend to be tied down to one place rather than risking to continually migrate (especially given their low income). Similarly, the income variable may be considered a mobility variable in view of the fact that low-income groups tend to be less

TABLE XVI  
EXTRACTION RESULTS

Factor	Principal Component	Varimax	Frequency
Urban Amenity	CRIMES (.8)	CRIMES( .9)	2
	CSTHSE (.9)	--	--
	CSTRNT (.7)	CSTRNT (.6)	4
	EDUCTN (.7)	--	--
	FARMNG(-.7)	FARMNG(-.7)	1
	GENDER(-.5)	GENDER(-.8)	3
	INCMDN (.8)	--	--
	MARIED(-.8)	--	--
	PHYSCN (.7)	PHYSCN (.7)	1
	POPULN (.7)	POPULN (.8)	1
	URBANN (.6)	--	--
Low Mobility	--	CSTHSE (.7)	1
	--	EDUCTN (.8)	22
	ESTABS (.6)	--	--
	--	INCMDN (.8)	13
	--	MARIED(-.6)	1
	OLDAGE (.7)	OLDAGE(-.8)	15
	SINGLE (.7)	--	--
	--	URBANN (.5)	10
	WLFARE (.8)	WLFARE(-.8)	11
Individual Mobility	YNGAGE(-.7)	--	--
	NWHITE(-.8)	NWHITE(-.9)	5
Negative Amenity	WHITE (.8)	WHITE (.9)	5
	TAXPRT(-.7)	TAXPRT (.9)	6
Low Spatial Amenity	UNEMPL (.6)	UNEMPL(-.7)	33
	DISTAV (.4)	DISTAV (.7)	40
Amenity	--	ESTABS (.6)	2
	INCPVT (.6)	INCPVT (.8)	2
	SSCRTY (.5)	SSCRTY (.6)	11
	HSEGRW (.6)	--	--
Mobility	--	HSEGRW (.9)	1
	MOVERS(-.6)	MOVERS (.6)	10
	--	SINGLE (.8)	1
	--	YNGAGE(-.9)	15

mobile, while high-income groups tend to be more mobile. Since median income was used rather than expected income differential, the amenity element was watered down by the mobility elements.

The third factor is defined by mobility variables, specifically in terms of the "migrants' characteristics," that is, nonwhite, white. Similarly, the fourth factor is defined by amenity variables. Both variables exhibit what may be termed as negative amenity elements, i.e., both property tax and unemployment may be considered propelling factors or deterrents to immigration.

The fifth factor also constitutes similar variables across both of the two approaches. However, the distance variable, which was hypothesized as a spatial variable, appears along with amenity variables, i.e., INCPVT and SSCRTY. Since both variables may be characterized by low amenity (i.e., poverty level income and social security), one may argue that the effect of distance has similar effects in that distance attempts to discount the value of expected amenity at destinations. Hence this group of variables may be characterized as constituting a "low amenity with spatial effects" factor.

The sixth factor constitutes variables HSEGRW, MOVERS, SINGLE, and YNGAGE, which may be termed as mobility/amenity variables. The latter variables are in fact characterized by high mobility or high potential for mobility such as

previous migrants, the young, singles, and the percentage of housing growth.

It is significant that out of the 25 representative variables, factor analysis attempted to extract seven factors under each of the two criteria, i.e., principal component and varimax. The overall implication is that the choice of migration variables must be systematic so as to avoid redundancy and multicollinearity, while at the same time being representative of the phenomena under research. Otherwise a researcher is forced to restrict particular interpretations only to specific situations. Similarly significant is the fact that a standard criterion for selecting variables is possible to ensure both representativeness while minimizing the number of variables used, i.e., variables within one factor are closely correlated and therefore there is no need to include all of them in a given specification.

#### CONCLUSIONS AND PROSPECTS FOR FUTURE DEVELOPMENTS

The framework in this study has established a reasonable procedure for evaluating potential variables for migration studies. It is also of interest that in spite of the high visibility that climatic factors have in migration literature, some qualifications need to be identified. In the first place, climate plays a less important role at a



local level, such as the county level. Secondly, it is possible that some migrants, such as retirees who move to warm climates such as Florida, may have been influenced by their earlier trips as tourists rather than solely the climate. In essence it becomes more of a recreation pull than a climatic pull factor. Hence further research in terms of recreation-based migration as opposed to climatic effects may be necessary in this case.

This framework has also set a challenge toward the development of a more generalized migration theory. It is anticipated that by utilizing the findings from this framework it will make it easier to choose variables to be applied in models such as regression analysis. It is further anticipated that this study, by utilizing other previous studies as part of the data, provides the need for a meta-analytic approach as a final test for the establishment of a standard migration theory.

## CHAPTER V

### A META-ANALYTIC EVALUATION

Chapter III covered alternative models. Chapter IV focused on the heuristic framework, with emphasis on the factor analytic model. In this chapter a preliminary meta-analytic evaluation of previous models is made. Previous studies will be classified in tabular format according to modeling approaches used. This classification will establish a criterion by which the choice for an applicational model will be made. The analysis will rely on a comparison between previous studies covered in this study, along with Mueller's previous classifications in terms of variable specifications and model applications.

### VARIABLE SPECIFICATION

In terms of variable specification this study has identified three classifications, i.e., mobility, amenity, and spatial. Mueller's study, on the other hand, has classified variable specifications by immigration, outmigration, place to place, and mobility. Similarly, a combination of the above classifications is possible.

Mobility, Amenity, and Spatial  
Classification

A classification of 49 variables based on 72 research studies from Table X is reproduced below in Table XVII. From this table it is evident that the majority of studies (31, or 43%) utilized variables related to all three classifications. However, this means that 55% of the studies used variables limited to one or two of the classifications. For example, eight of these studies utilized variables exclusively associated with the amenity category. Thirteen studies were associated with both the amenity and mobility categories, while 18 studies were associated with both the amenity and spatial categories. However, only two studies utilized a combination of variables exclusively associated with both spatial and mobility categories.

TABLE XVII  
FREQUENCY BASED ON 72 STUDIES

Rank	Variable Category	Frequency	%
1	Amenity variables	70	97
2	Mobility variables	48	67
3	Spatial variables	44	61
4	Amenity/mobility/spatial studies	31	43
5	Amenity/spatial studies	18	25
6	Amenity/mobility studies	13	18
7	Amenity studies	8	11
8	Mobility/spatial studies	2	3
9	Mobility studies	0	0
10	Spatial studies	0	0

Significant about this analysis is the fact that, in spite of the comprehensive nature of some studies (43% in this case), most of them (55% in this case) are partial, i.e., they focus on one or a few aspects of migration. Secondly, the amenity category appears to be represented in almost every study. And thirdly, unlike other associated that have been applied in combination, only amenity variables have been applied exclusively in a model, i.e., eight studies.

This table indicates the frequency of each variable's application. It also indicates the frequency of each classification or combinations by individual studies. For example, there is a 97% probability of finding an amenity variable in migration models based on the 72 studies surveyed in this study. Similarly, the chances are 67% and 61% of finding a mobility and spatial variable, respectively.

Besides variable classifications, a similar pattern is observed when individual studies are classified according to the associated or combination of associated they applied in their models. For example, there is a 43% chance of finding a comprehensive model, i.e., studies which use a combination of mobility, amenity, and spatial variables. The remaining 57% are partial models. Thus 25% use only the amenity and spatial variables, 18% constitute an amenity/mobility model, 11% constitute an amenity model, 3% a mobility/spatial model, and none use just a mobility or a spatial model.

### Mueller's Classification

Mueller's classification included immigration models, outmigration models, place to place models, and mobility models. This classification is further subdivided into submodels, as listed in Table XVIII.

A tabular overview of these models is represented in Appendices A through C. Five classifications of variable

TABLE XVIII

#### MUELLER'S SUBDIVISION OF MIGRATION MODELS

##### 1. Immigration Models

- Job Vacancy Models
- Structural Models
- Simultaneous-equations Models
- Alternative-opportunities Models

##### 2. Outmigration Models

- Propensity Models
- Simultaneous-equations Models

##### 3. Place to Place Models

- Allocation Models
  - Friends and Relatives Approach
  - Alternative Opportunities Approach
  - The Disaggregate Approach
- Origin/destination Models
  - Human Capital Approach
  - Behavioral Models

##### 4. Mobility Models

- Behavioral Mobility Models
- Mobility and Employment Status
- Mobility and Employment Status of Wives

specification include economic opportunity, amenities, fiscal, spatial structure, and propensity to migrate. By observation (also see Table XIX), it is evident that the economic opportunity variables are dominant in the immigration approach. Thus all nine studies applied variables using economic opportunity, and eight of them applied amenity variables. However, only two studies used spatial structure variables, while three studies used propensity to migrate variables.

From the outmigration approach, again, all eight studies utilized economic opportunity variables. Both the amenity and propensity to migrate variables were used six times, while the spatial structure variables were used three times. None of the fiscal variables were applied to outmigration models.

The place to place models indicate a similar pattern in economic opportunity variables, i.e., this category was represented in all 12 studies. Similarly, spatial structure variables were represented in all 12 studies. The amenity variables are represented in four studies, while both the fiscal and propensity to migrate variables are each represented in two of the studies. Table XIX shows their frequency.

In this table, each study has used economic variables, while spatial variables are used only 69% of the time. The least used variables are the fiscal variables, which appear

TABLE XIX  
FREQUENCY FROM MUELLER'S CLASSIFICATION

Rank	Variable Category	Frequency	%
1	Economic variables	29	100
2	Spatial variables	20	69
3	Amenity variables	18	62
4	Propensity variables	11	38
5	Fiscal variables	4	14
6	Economic/spatial studies	6	21
7	Economic/amenity/spatial/propensity studies	5	17
8	Economic/studies	4	14
9	Economic/amenity/spatial studies	4	14
10	Economic/amenity/fiscal/spatial studies	4	14
11	Economic/amenity studies	3	10
12	Economic/amenity/propensity studies	3	10
13	Economic/fiscal/spatial studies	2	7
14	Economic/propensity studies	1	3
15	Economic/spatial/propensity studies	1	3
16	Amenity studies	0	0
17	Fiscal studies	0	0
18	Spatial studies	0	0
19	Propensity studies	0	0
20	Economic/fiscal studies	0	0
21	All other combinations	0	0

only four times, or 14%. It is also evident that from this perspective there is no comprehensive model, i.e., none of the studies has utilized all five classifications. The closest to comprehensiveness is item 10, i.e., a combination of economic, amenity, fiscal, and spatial, which appears in four studies, or 14%. Similarly, four studies applied exclusively economic variables (see item 8). This analysis again underscores the tendency of migration studies to focus on partial rather than comprehensive models.

#### Combined Classification

This classification applies the mobility, amenity, and spatial classifications to Mueller's classification. In this case, amenity variables are identified to constitute Mueller's economic opportunity, amenities, and fiscal variables. Thus a positive economic opportunity is considered to be an attractive amenity, while a negative one is considered to be repulsive. Similarly, fiscal policies may constitute attractive or repulsive regional amenities. Spatial structure is represented by the spatial factor, while propensity to migrate is represented by the mobility factor. Table XX represents Mueller's classification with a combination of economic opportunity and fiscal factors into the amenity factor, along with spatial and mobility factors.

Table XXI, a comparison of Table XX with Table XVII, shows a strong similarity in terms of partial and



TABLE XX  
COMBINED CLASSIFICATION FREQUENCY

Rank	Variable Category	Frequency	%
1	Amenity variables	29	100
2	Spatial variables	20	69
3	Mobility variables	11	38
4	Amenity/spatial studies	18	62
5	Amenity studies	10	34
6	Amenity/mobility studies	8	28
7	Amenity/mobility/spatial studies	7	24
8	Mobility studies	0	0
9	Spatial studies	0	0
10	Mobility/spatial studies	0	0

TABLE XXI  
COMBINED CLASSIFICATION RANK COMPARISON

Variable Category	Table XX			Table XVII		
	Freq.	%	Rank	Rank	Freq.	%
<u>Variables</u>						
Amenity	29	100	1	1	70	97
Spatial	20	69	2	3	44	61
Mobility	11	38	3	2	48	67
<u>Studies</u>						
Amenity/spatial	18	62	4	5	18	25
Amenity	10	34	5	7	8	11
Amenity/mobility	8	28	6	6	13	18
Amenity/mobility/spatial	7	24	7	4	31	43
Mobility	0	0	9	9	0	0
Spatial	0	0	9	9	0	0
Mobility/spatial	0	0	9	8	2	3

comprehensive studies between Mueller's sample and the sample in this study. This comparison is shown in Table XXI. However, from Table XX it is evident that both analyses arrive at almost the same conclusions. In both analyses, the amenity variables are dominant relative to spatial and mobility variables. Similarly, in both analyses the ranking for items 2, 3, 4, 8, and 9, with the exception of items 5 and 7, have a difference of only  $\pm 1$ , while items 6 and 10 are ranked the same. Only item 7 is off by 3, while item 5 is off by only 2. Therefore, the frequency of variable use and the frequency of similar partial and comprehensive studies in migration studies are shown to follow a similar pattern.

#### MODEL SPECIFICATION

In terms of model specification, this study has identified five alternative models. These include factor analysis models, Markov chain models, gravity models, regression models, and meta-analytic models. In this section an analysis is made of 58 of the studies covered in this research along with Mueller's 29 studies. Table XXII shows frequencies of model specifications. Mueller's portion of this table was obtained from Table XIX. Appendix E shows how the frequency for this study's portion was obtained. A summary of these frequencies is shown in Table XXII.

TABLE XXII  
COMPARISON OF MODEL SPECIFICATION

Specified Model	This Study		Mueller's Study	
	Frequency	%	Frequency	%
Regression	47	81	29	100
Gravity Analysis	3	5	0	0
Factor Analysis	2	3	0	0
Markov Chain	1	2	0	0
Meta-analysis	0	0	0	0
Other Analysis	9	16	0	0
TOTALS	62 <sup>a</sup>	100	29	100

<sup>a</sup>Some of the 58 studies used more than one model.

From Table XXII it is clear that the regression model has been the most dominant tool in the analysis of migration studies. Based on these findings, the regression model will be recommended in the next section as a logical extension of the heuristic framework proposed here.

#### MODEL SELECTION

Among the potential beneficiaries of this framework are models such as the Markov chain model, the gravity model, and the regression models, as previously explained in

Chapter II. A brief review of their possible association with this framework is explained below.

### Markov Chain Model

The Markov chain model in migration studies has been usually used for predictive purposes. By preparing a table representing a certain category of migrants, a transition probability matrix may be developed for use in prediction.

The type of question that might be addressed by such a model is, to what extent will individuals born in one region redistribute themselves across other regions? This model is therefore a significant tool for demographers to analyze the changing patterns of population distribution. However, a further step is the explanation of the motives that underlie these migrational flows. Given the multitude of potential competing alternative variables, the framework proposed in this study would be a handy tool to rely on for determining the underlying variables. Such underlying variables may be used as corresponding weights for particular locations of particular migrant cohorts in order to strengthen the model's predictive power.

As already noted, the shortcoming of this combination is that the proposed framework may sometimes be applied either after or concurrently with the application of the Markov chain model. Hence, in such cases the framework's utility may not be as high towards a comprehensive theory.

### The Gravity Model

The evolution of the gravity model was accounted for in Chapters I and II. Unlike the Markov chain model, which may sometimes precede or concurrently be applied with the proposed framework, the gravity model can directly utilize the results of this framework. The applicable variables in this case are the amenity and spatial factors. This framework assists in terms of efficient and objective process of selecting the relevant variables for the model.

The main problem with this combination, however, is that a major factor (mobility factor) will not be accounted for, which is normal for gravity models. This shortcoming is addressed, however, by the proposed framework by helping to identify a set of variables that are similarly crucial to the migration process but are not accounted for by the gravity model. Thus, whereas there may be compelling reasons (propulsive and attractive forces) for a migrant to choose one point (destination) over the other (origin or other alternatives), in the face of minimal intervening opportunities, migration is not guaranteed. In this case, the identification of certain individual characteristics is vital for a better explanation of the migration process. This framework not only identifies such a shortcoming but also cautions any interpretation of the gravity model beyond amenity and spatial factors.

### Regression Model

The most commonly used model in spatial economic analysis of interregional migration is the regression model. This model attempts to explain the relationship between a dependent variable such as migration and an independent variable such as income.

In view of the multitude of potential variables, it is crucial that a few representative variables are used. This heuristic framework attempts to do so and may likewise save time by avoiding redundancy. Another potential problem would be multicollinearity. Similarly, there is need for an efficient yet systematic way of selecting appropriate variables. Such a system is the heuristic framework proposed here. By identifying various variable associations, it becomes possible to identify and include all facets of variable configurations. It also becomes possible to explain why some variables are dropped from the model, and where there is multicollinearity it makes it possible to explain such outcomes.

It has been evident here that this heuristic framework is a valuable supplement to a number of existing migration models. The framework provides objectivity both in variable selection and results interpretation of the models being applied.

## OVERALL ANALYSIS

This study has found the regression model to be the most widely used model in migration studies. It is also the most closely associated with this framework. Similarly, in comparing this study's classification with Mueller's classification of migration studies, a basic structure is evident. In the first place amenity variables appear to be dominant in most studies. Secondly, of all partial studies that utilize variables from a single classification, the amenity classification dominates. And thirdly, only a small fraction of these studies have used variables from all of the classifications. Three major conclusions may therefore be drawn from this analysis.

First is the fact that the majority of migration studies are partial in nature and may therefore only explain or help to develop partial theories. Secondly, the basic content of most migration studies is similar, i.e., they revolve around the classic "push/pull" principle as hypothesized in the early studies. This has been evidenced here by the dominance of the amenity factor. And thirdly, the regression model seems to be the most logical extension of this framework. This model is therefore applied in the next chapter.

## CHAPTER VI

### MULTIPLE REGRESSION ANALYSIS

In Chapter III alternative models were analyzed in terms of their usefulness for factor analytic results. In this chapter an attempt will be made to demonstrate the utility of this framework. Samples of alternative applications from factor analytic findings have already been discussed in Chapter V, and the regression analysis model was chosen for further application on the framework's findings. Whereas the factor analytic model is the main procedure for the proposed framework, a regression analysis is going to be utilized as one of the alternative models to benefit from the framework. The application will rely on the same data used in factor analysis. Thus a cross sectional analysis will be made for the 1980 period. The data are obtained from the Area to Area Migration and County Income Data for 1980 (IRS, 1990), the 1980 Census of Population (U.S. Bureau of Census, 1980), and the 1980 data from the City and County Data Book (U.S. Bureau of Census, 1983).



## MODEL SELECTION

Given the nature of variables, a simultaneous equation model is highly recommended. A number of notable scholarly studies (Greenwood, 1975a; Greenwood, 1976; Olivey, 1970; and others) have taken this approach and resulted in insights that an OLS might have missed. (For a detailed review of such studies see Mueller, 1982, pp. 15-19 and 34-39.) This model is usually used in situations where the independent and dependent variables may have causal effects on one another. Eight such independent variables were identified in this model.

The following are areas in which variables are anticipated to have a simultaneous effect with immigration variable AAA:

1. It is anticipated that migration will affect the cost of housing in the area (Harris & Todaro, 1970).
2. It is similarly anticipated that migration will affect the cost of rent in the area (Harris & Todaro, 1970).
3. Migration into an area is also anticipated to affect the location of establishments such as businesses, institutions, etc. (Olivey, 1970).
4. Migration is anticipated to affect growth in housing (Harris & Todaro, 1970).

5. With a given level of income below poverty level, migration is anticipated to affect changes in that level (Muth, 1971).
6. The proportion of recent migrants is anticipated to be affected by new migrants (Greenwood, 1975b).
7. Migration is anticipated to affect the population size (Boventer, 1969).
8. The level of unemployment in an area is expected to be influenced by migration (Muth, 1971).

Among the several types of simultaneous equations, the two-stage least squares method is among the most used. It transforms variables with simultaneous effects into instrumental variables before regressing them along with other variables. This approach does not necessarily result in better predictions, but acknowledges cross dependencies that may hide the true causal source when using other approaches.

Unfortunately, due to the degree of freedom limitation with a 36 Oregon county example and the technical difficulties that result with two-stage least squares, the Ordinary Least Squares (OLS) regression model will be used here. As was stated earlier, the focus of this research is the analytical framework. The technical mechanics of individual models is left to the experts in their respective fields of specialization.

Regression analysis is concerned with the study of the dependence of one variable, the dependent variable, on one or more other variables, the

explanatory variables, with a view to estimating and/or predicting the (population) mean or average value of the former in terms of the known or fixed (in repeated sampling) values of the latter. (Gujarati, 1988, p. 14)

The term regression was introduced by Francis Galton in his 1886 proceedings of the Royal Society entitled, "Family Likeness in Stature" (Gujarati, 1988, p. 13), in which he found that "the average height of children born of parents of a given height tended to move or regress toward the average height in the population as a whole."

Three conceptual relations are identified here to illustrate/define regression further. First is the statistical as opposed to deterministic relationships. Regression analysis is concerned with the statistical rather than the functional or deterministic dependence among variables, such as those of classical physics. The difference is that, in statistical relationships, we deal with random or stochastic variables, i.e., variables that have probability distributions (Gujarati, 1988, pp. 17-19). Second is regression as opposed to causation. Thus, although regression deals with the dependence of one variable on other variables, it does not necessarily imply causation. And third is regression as opposed to correlation. Whereas correlation analysis measures the strength or degree of linear association between two variables, regression analysis acknowledges an asymmetry in the way the dependent and explanatory variables are treated. Here, the dependent variable is assumed to be

statistical, random, or stochastic, i.e., having a probability distribution. The explanatory variables, on the other hand, are assumed to have fixed values, i.e., in repeated sampling (Gujarati, 1988, pp. 18-20).

#### MODEL SPECIFICATION

By utilizing the proposed framework, four regressions are run to expose the effects of both unsystematic choice of variables and the contributions of the framework. Because factor analysis identified seven factors, seven representative variables were selected from each of the determinant categories. The selection criteria were based on the combination of a frequency table established in the previous chapter along with the widely accepted interpretations of variables (see Table XXIII).

#### THE BASIC MODEL APPROACH

##### Variable Specification

The following specifications will represent variables as factor associated in terms of amenity variables, mobility variables, spatial variables, and joint factors.

The general form of the model can be stated as:

$$\text{INMIGRATION} = f(\text{Amenity, Mobility, Spatial, Joint})$$

with inmigration by destination county as the dependent variable and Amenity, Mobility, Spatial and Joint as independent variables as elaborated below.

TABLE XXIII  
EXTRACTION RESULTS

	Principal Component	Varimax	Frequency
Urban Amenity	CRIMES (.8)	CRIMES( .9)	2
	CSTHSE (.9)	--	--
	CSTRNT (.7)	CSTRNT (.6)	4
	EDUCTN (.7)	--	--
	FARMNG(-.7)	FARMNG(-.7)	1
	GENDER(-.5)	GENDER(-.8)	3
	INCMND (.8)	--	--
	MARIED(-.8)	--	--
	PHYSCN (.7)	PHYSCN (.7)	1
	POPULN (.7)	POPULN (.8)	1
	URBANN (.6)	--	--
Low Mobility	--	CSTHSE (.7)	1
	--	EDUCTN (.8)	22
	ESTABS (.6)	--	--
	--	INCMND (.8)	13
	--	MARIED(-.6)	1
	OLDAGE (.7)	OLDAGE(-.8)	15
	SINGLE (.7)	--	--
	--	URBANN (.5)	10
	WLFARE (.8)	WLFARE(-.8)	11
	YNGAGE(-.7)	--	--
Individual Mobility	NWHITE(-.8)	NWHITE(-.9)	5
	WHITTE (.8)	WHITTE (.9)	5
Negative Amenity	TAXPRT(-.7)	TAXPRT (.9)	6
	UNEMPL (.6)	UNEMPL(-.7)	33
Low Spatial Amenity	DISTAV (.4)	DISTAV (.7)	40
	--	ESTABS (.6)	2
	INCPVT (.6)	INCPVT (.8)	2
	SSCRTY (.5)	SSCRTY (.6)	11
Amenity	HSEGRW (.6)	--	--
	--	HSEGRW (.9)	1
Mobility	MOVERS(-.6)	MOVERS (.6)	10
	--	SINGLE (.8)	1
	--	YNGAGE(-.9)	15

Amenity Variables. From the urban amenity factor, CSTRNT and GENDER were selected because of their higher frequency. In the negative analysis factor, both TAXPRT and UNEMPL were selected since they also had a high frequency. In the low spatial amenity factor, DISTAV, SSCRTY, and ESTABS were similarly selected.

Mobility Variables. Most of the mobility variables with high frequencies ended up in the low mobility factor. Those selected included EDUCTN, INCMDN, URBANN, and WLFARE. The variable OLDAGE was not selected because its counterpart, YNGAGE, was to be applied. Even when it was tested in substitution of YNGAGE, the effect was not any different. On individual mobility factor, NWHITE was used. Testing with the variable WHITTE in substitution did not change the conclusions either. In the mobility factor, MOVERS and YNGAGE were selected because of their high frequency.

Spatial Variables. All the variables in the low spatial factor, i.e., DISTAV, ESTABS, INCPVT, and SSCRTY, were used since there was no other such factor. To bring variables in this category to seven, three more variables were selected based on the widely used criteria on such variables as having spatial effects. The variable MOVERS was selected because it has usually been used to imply a migrant stock. From literature analysis in Chapter II, the migrant stock variable has been used as a proxy for cultural

distance. Thus studies have shown black migrants as going where there are more blacks. The tendency has therefore been movement into large urban areas rather than small ones where there is less likelihood of a necessary critical mass and thus increasing the cultural distance.

Joint Factors. Representative variables were selected from each factor according to their respective frequency level. The variables selected therefore included CSTRNT, EDUCTN, WHITTE, UNEMPL, DISTAV, MOVERS, and YNGAGE.

#### Model Analysis

The individual application results are as follows.

Amenity Variables. When a sample of variables identified as amenity variables in the framework were exclusively used in the specification of a regression model, the seven variables explained 61% of the variation in the dependent variable (see Table XXIV). Its adjusted  $R^2$  is not very different, i.e., 53%, which is usually independent of the number of variables applied in the model.

The respective  $t$  statistics here show some weakness in variables DISTAV (-0.6), TAXPRT (-0.9), and SSCRTY (1.1). The strongest variables in the model are CSTRNT (4.2) and GENDER (-2.2). This is supported by the two-tailed statistic, which rules out the probability that the magnitude of the coefficient would be as large due to pure chance. The

TABLE XXIV  
AMENITY FACTOR SPECIFICATIONS

Variable	Coefficient	Std. Error	t-Stat.	2-Tailed Sig.
CSTRNT	106.95167	24.903987	4.2945601	0.000
GENDER	-226.28014	103.72992	-2.1814356	0.037
TAXPRT	-8.3097599	8.4750078	-0.9805017	0.335
UNEMPL	-351.04184	287.71503	-1.2201025	0.232
DISTAV	-14.993259	25.991394	-0.5768547	0.568
ESTABS	313.19340	240.54573	1.3020118	0.203
SSCRTY	27.614683	25.402151	1.0871002	0.286
<hr/>				
R-squared	0.606774	Mean of dependent var	3600.028	
Adjusted R-squared	0.525417	S.D. of dependent var	5347.399	
S.E. of regression	3683.823	Sum of squared resid	3.94E+08	
Durbin-Watson stat	2.095314	F-statistic	7.458156	
Log likelihood	-342.8112			

NOTE: Dependent variable is Immigration. Sample range is 1-36.  
Number of observations is 36.

two-tailed statistics for CSTRNT (0.0) and GENDER (0.03) are very low.

Mobility Variables. Similarly, when the mobility variables are exclusively used in the specification, only 55% of the variation is explained (see Table XXV). The adjusted  $R^2$  is 45%, which implies that the number of variable applied had an effect on the usual  $R^2$ .

The  $t$  statistic indicates weakness in the EDUCTN (0.2), WLFARE (-0.2), and MOVERS (-0.5) variables. The strongest variables in the model are URBANN (2.0) and YNGAGE (-1.6). Their associated two-tailed statistics are URBANN (0.05) and YNGAGE (0.1).



TABLE XXV  
MOBILITY FACTOR SPECIFICATION

Variable	Coefficient	Std. Error	t-Stat.	2-Tailed Sig.
EDUCTN	38.221391	205.25356	0.1862155	0.854
INCMNDN	0.6778994	0.4250181	1.5949893	0.122
URBANN	84.267497	40.794581	2.0656542	0.048
WLFARE	-0.4572664	2.2000749	-0.2078413	0.837
NWHITE	151.26074	182.51408	0.8287621	0.414
MOVERS	-90.780945	172.27827	-0.5269437	0.602
YNGAGE	-553.93805	341.20372	-1.6234818	0.115
<hr/>				
R-squared	0.552380	Mean of dependent var	3600.028	
Adjusted R-squared	0.459769	S.D. of dependent var	5347.399	
S.E. of regression	3930.360	Sum of squared resid	4.48E+08	
Durbin-Watson stat	2.419157	F-statistic	5.964516	
Log likelihood	-345.1433			

NOTE: Dependent variable is Immigration. Sample range is 1-36. Number of observations is 36.

Spatial Variables. An exclusive specification with the spatial variables alone explained only 61% of the variations (see Table XXVI). Similarly, as in the mobility variables, the adjusted  $R^2$  (53%) differs from the usual  $R^2$ .

Weakness is detected in variables MOVERS (-0.7), NWHITE (0.8), and INCPVT (-0.9). Strength is detected, however, in variables URBANN (5.3) and DISTAV (-2.6). Their two-tailed statistics are URBANN (0.0) and DISTAV (0.01).

Joint Factors. When individual variables are selected, one from each factor, 70% of the variation in the dependent variable is explained by the variables specified in the

TABLE XXVI  
SPATIAL FACTOR SPECIFICATION

Variable	Coefficient	Std. Error	t-Stat.	2-Tailed Sig.
DISTAV	-55.551791	21.282273	-2.6102376	0.014
ESTABS	359.397324	211.33456	1.7006083	0.100
INCPVT	-266.54440	270.03873	-0.9870599	0.332
SSCRTY	26.4982274	25.232070	1.0501805	0.302
MOVERS	-77.553021	109.79874	-0.7063197	0.486
NWHITE	136.97920	169.08780	0.8101070	0.424
URBANN	136.41934	25.478504	5.3542916	0.000
R-squared	0.611834	Mean of dependent var	3600.028	
Adjusted R-squared	0.531524	S.D. of dependent var	5347.399	
S.E. of regression	3660.430	Sum of squared resid	3.88E+08	
Durbin-Watson stat	2.368849	F-statistic	7.618397	
Log likelihood	-342.5781			

NOTE: Dependent variable is Immigration. Sample range is 1-36.  
Number of observations is 36.

model (Table XXVII). The adjusted  $R^2$  here is larger than in the previous combinations.

When joint factors are applied, there are very few weak variables compared to twice as many of the strong variables. For example, the weakest variables as evidenced by the  $t$  statistic are DISTAV (-0.1) and UNEMPL (-0.3). However, almost all the rest have a  $t$  statistic greater than 2, i.e., CSTRNT (4.4), INCMDN (2.6), MOVERS (2.5), and YNGAGE (2.2). The respective two-tailed statistics similarly show low chances of a probable large coefficient magnitude due to pure chance, i.e., CSTRNT (0.0), INCMDN (0.01), MOVERS (0.02), and YNGAGE (0.04).

TABLE XXVII  
JOINT FACTOR SPECIFICATION

Variable	Coefficient	Std. Error	t-Stat.	2-Tailed Sig.
CSTRNT	108.08392	24.333498	4.4417750	0.000
INCMDN	0.7373623	0.2863516	2.5750240	0.015
WHITTE	-180.89859	100.67556	-1.7968471	0.083
UNEMPL	-59.052758	211.47618	-0.2792407	0.782
DISTAV	-2.2540701	21.075293	-0.1069532	0.916
MOVERS	-300.93516	121.42928	-2.4782750	0.019
YNGAGE	-578.29178	263.36849	-2.1957516	0.036
<hr/>				
R-squared	0.702052	Mean of dependent var	3600.028	
Adjusted R-squared	0.640407	S.D. of dependent var	5347.399	
S.E. of regression	3206.624	Sum of squared resid	2.98E+08	
Durbin-Watson stat	2.018757	F-statistic	11.38873	
Log likelihood	-337.8168			

NOTE: Dependent variable is Immigration. Sample range is 1-36.  
Number of observations is 36.

#### THE DISAGGREGATED APPROACH

Unlike the basic model, which used average distance and total migration to a specific county as discussed above, the disaggregated model differs in three major ways. First, instead of an average distance between respective counties, this approach uses individual county to county distance. Secondly, instead of using total migration to a specific county, each individual migration stream from a specific county to a specific county is used. And thirdly, because of the above individual components in the specification, the number of cases are multiplicative and therefore there is

improvement in degrees of freedom. The model is thus specified as follows:

$$\text{MIGRTN} = X_1, X_2, X_3 \text{ ----- } X_n$$

This variable configuration is outlined in Table XXVIII.

The MIGRTN (i.e., immigration) variables show the number of migrants from origin "i" into destination "j." The accounting continues for all 36 "i"s into "j"1 to "j"2 and so on until "j"36. Within an individual county, 0.01 is used instead of zero if no migration occurred to avoid computer elimination for missing values, while preserving insignificant numbers.

There were 861 cases where there was no immigration. Thus most migrations seem to have been channeled into certain counties but not others. The average, therefore, would be that, of the 35 possible origins into a county, immigrants would come from at least 12.1 counties but none from the other 23.9. Some counties, such as Wheeler, did not receive any migrants, while Multnomah County received at least 6,996 migrants from Clackamas County alone.

Because of the missing values resulting from lack of migration between two counties, it is anticipated that the impact of certain place specific variables may not be completely reflected in the results such as low correlation with migrant specific variables.

TABLE XXVIII  
DISAGGREGATED APPROACH SPECIFICATION

MIGRTN	CSTRNT	DISTAV	EDUCTN.....	YNGAGE
1,1	1	1,1	1 .....	1
1,2	1	1,2	1 .....	1
1,3	1	1,3	1 .....	1
:	:	:	:	:
:	:	:	:	:
1,36	1	1,36	1 .....	1
2,1	2	2,1	2 .....	2
2,2	2	2,2	2 .....	2
2,3	2	2,3	2 .....	2
:	:	:	:	:
:	:	:	:	:
2,36	2	2,36	2 .....	2
3,1	3	3,1	3 .....	3
3,2	3	3,2	3 .....	3
3,3	3	3,3	3 .....	3
:	:	:	:	:
:	:	:	:	:
3,36	3	3,36	3 .....	3
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:
36,1	36	36,1	36 .....	36
36,2	36	36,2	36 .....	36
36,3	36	36,3	36 .....	36
:	:	:	:	:
:	:	:	:	:
36,36	36	36,36	36 .....	36

The first independent variable, CSTRNT, reflects the conditions (in this case, disamenity conditions) at destination "j." Further interpretations link the DISTAV variable to MIGRTN variables, while the rest are linked to the CSTRNT variable.

The number of cases for each of the 16 variables used here is therefore 1,296. The variable MIGRTN is the dependent variable, while the rest are treated as independent variables. The same variable configurations from the previous section (basic regression) are used in this section.

#### Variable Specification

As was the case in the previous section, variable specification in this section was also based on factor analytic results. Seven factors were extracted. The procedure involved a selection of variables for regression analysis. Some individual factors were combined according to their respective interpretational associations. Out of this, four factors were therefore obtained for regression analysis. The results of these four are shown in Tables XXIX through XXXII.

These findings would further be compared with a regression using at least one variable from each of the factors. It is anticipated that the selection of variables by use of

TABLE XXIX  
REGRESSION ANALYSIS RESULTS FOR  
URBANIZATION FACTOR

Multiple R	.2116	Analysis of Variance			
R <sup>2</sup>	.04477	DF			
Adjusted R <sup>2</sup>	.04182	Regression		4	
Standard error	416.58707	Residual		1292	
<u>F</u> = 15.13956					
Variable	B	SE B	Beta	<u>t</u>	Sig <u>t</u>
-----					
URBANN	1.649	.578	.0992	2.888	.0039
INCMDN	.104	.256	.0241	.800	.4237
CSTRNT	1.811	.472	.1196	3.836	.0001
EDUCTN	2.119	2.712	.0269	.809	.4188
(Constant)	-534.218	140.482	--	-3.803	.0002

TABLE XXX  
REGRESSION ANALYSIS RESULTS FOR  
NEGATIVE MOBILITY FACTOR

Multiple R	.17759	Analysis of Variance			
R <sup>2</sup>	.03218	DF			
Adjusted R <sup>2</sup>	.02913	Regression 4			
Standard error	419.32361	Residual 1292			
<u>F</u> = 10.74020					
Variable	B	SE B	Beta	<u>t</u>	Sig <u>t</u>
-----					
YNGAGE	-14.670	6.153	-.0594	1.803	.0716
GENDER	-21.332	4.038	-.1326	-5.220	.0025
ESTABS	8.773	4.745	.0266	.795	.4266
WLFARE	-.247	.062	-.1335	-3.963	.0001
(Constant)	2808.557	437.150	--	6.424	.0000



TABLE XXXI  
REGRESSION ANALYSIS RESULTS FOR  
DISAMENITY MOBILITY FACTOR

Multiple R	.13518	Analysis of Variance			
R <sup>2</sup>	.01827	DF			
Adjusted R <sup>2</sup>	.01524	Regression		4	
Standard error	422.32575	Residual		1292	
<u>F</u> = 8.11252					
Variable	B	SE B	Beta	<u>t</u>	Sig <u>t</u>
-----					
UNEMPL	-22.883	4.868	-.1520	-4.696	.0021
INCPVT	-2.638	4.120	-.0186	-.640	.5221
NWHITE	-.690	3.248	-.0064	-.213	.8316
TAXPRT	-.438	.134	-.1100	-3.254	.0012
(Constant)	483.930	102.778	--	4.708	.0000

TABLE XXXII  
REGRESSION ANALYSIS RESULTS FOR  
SPATIAL MOBILITY FACTOR

Multiple R	.20710	Analysis of Variance			
R <sup>2</sup>	.04289	DF			
Adjusted R <sup>2</sup>	.03993	Regression 4			
Standard error	416.99724	Residual 1292			
F = 14.47468					
Variable	B	SE B	Beta	t	Sig t
WLFARE	-.867	.050	-.0866	-1.334	.1826
MOVERS	2.823	2.489	.0335	1.134	.2571
DISTAV	-.952	.138	-.1884	-6.859	.0000
SSCRTY	.798	.473	.0500	1.689	.0915
(Constant)	180.142	101.680	--	1.575	.1154

factor analysis will provide a better, more wholistic representation of the phenomena under study.

#### Analysis of the Results

Unlike the previous analysis, the gravity approach shows an extremely low R<sup>2</sup>. However, regardless of this finding, the pattern is still the same, i.e., selection of variables across all factors shows a higher R<sup>2</sup> than the others. Respective analyses are shown in the following Tables XXIX through XXXII.

Urbanization Factor. The urbanization factor consisted of EDUCTN, URBANN, CSTRNT, and INCMDN, as shown in Table XXIX. When these variables, identified as urbanization variables in the framework, are exclusively used in the specification of a regression model, the four variables have an  $R^2$  of 0.04. Its respective adjusted  $R^2$  (0.04) is not very different, which implies insignificant effect due to the number of variables applied. The  $t$  statistics have shown some weakness in variables INCMDN (0.8) and EDUCTN (0.8). The other two variables, URBANN (2.8) and CSTRNT, (3.8), show strength. Their two-tailed statistics are practically zero, 0.003 and 0.0001, respectively.

Negative Mobility Factor. Variables such as YNGAGE, ESTABS, WLFARE, and GENDER are anticipated to affect mobility negatively. When these variables are exclusively used in a specification, their  $R^2$  is 0.03, as shown in Table XXX. The adjusted  $R^2$  (0.029) is similarly not very different.

The  $t$  statistics in this analysis show some weakness in the variable ESTABS (0.7). The other variables show strength, i.e., YNGAGE (-1.8), GENDER (-5.2), and WLFARE (-3.9). Their two-tailed statistics are practically zero (i.e., 0.07, 0.0, 0.0, respectively), except for ESTABS, whose two-tailed statistic is 0.4.

Disamenity Mobility Factor. Because of few variables in the later factors, two were combined in order to be able to compare their  $R^2$  meaningfully. Therefore, the amenity

and mobility variables were combined, i.e., TAXPRT, UNEMPL, INCPVT, and NWHITE, as shown in Table XXXI. It should be noted that the resulting  $R^2$  (0.018) is not very different from the adjusted  $R^2$  (0.015).

The  $t$  statistics here indicate some weakness in variables INCPVT (-0.6) and NWHITE (-0.2). The UNEMPL (-4.6) and TAXPRT (-3.2), on the other hand, exhibited strength. The two-tailed statistic for both UNEMPL and TAXPRT is zero.

Spatial Mobility Factor. As above, this factor was also combined. The variables include SSCRTY, MOVERS, MIGRTN, and DISTAV. However, because MIGRTN is used as the dependent variable, a similar negative mobility variable (WLFARE) is used as a substitute. The results are shown in Table XXXII.

The  $R^2$  in the spatial mobility factor was 0.04. The  $t$  statistics are all strong, i.e., WLFARE (-1.3), MOVERS (1.1), DISTAV (-6.8) and SSCRTY (1.6). Similarly, their two-tailed statistics negate the probability of a large coefficient magnitude due to pure chance, i.e., WLFARE (0.2), MOVERS (0.3), DISTAV (0.0), and SSCRTY (0.1).

Joint Factors. As in the previous analysis, when individual variables are selected one from each factor,  $R^2$  is 0.066. Also, its respective adjusted  $R^2$  (0.063) is larger than any other combination and still is not meaningfully different from the  $R^2$ . In spite of the low figure,

this is larger than any of the above specifications. Table XXXIII shows the results of this combination.

Again as in the previous analysis, when joint factors are applied, there are very few weak variables and more strong variables. For example, there is only one such variable, as evidenced by the  $t$  statistic, i.e., NWHITE (0.6). All of the other three have large  $t$  statistics, i.e., URBANN (6.2), DISTAV (-7.0), and ESTABS (1.5). Their two-tailed statistics similarly negate the probability of a

TABLE XXXIII  
REGRESSION ANALYSIS RESULTS FOR  
JOINT FACTORS

Multiple R	.25848	Analysis of Variance			
R <sup>2</sup>	.06681	DF			
Adjusted R <sup>2</sup>	.06392	Regression		4	
Standard error	411.75366	Residual		1292	
<u>F</u> = 23.12471					
Variable	B	SE B	Beta	<u>t</u>	Sig <u>t</u>
-----					
URBANN	2.821	.448	.1897	6.289	.0000
DISTAV	-.996	.137	-.1914	-7.028	.0000
NWHITE	1.769	2.910	.0164	.608	.5433
ESTABS	6.073	3.886	.0428	1.563	.1183
(Constant)	-26.624	84.070	--	-.317	.7515

large coefficient magnitude due to pure chance, i.e., URBANN (0.0), DISTAV (0.0), NWHITE (0.5), and ESTABS (0.1).

#### SIGNIFICANCE OF THE RESULTS

Although some multicollinearity problems may still exist, factor analysis was shown to give a better means of selecting representative variables than purely structured modeling. In both basic and gravity approaches, it was found that factor analytic results provide a more balanced reduced model for application in a regression model. It is anticipated that this framework therefore provides greater opportunity for objectivity and thus a stronger case for a scientific specification of migration variables. Such a scientific specification enhances possibilities for the development of theory.

In general, migration studies obtained wide ranges of  $R^2$ . The magnitude is related to the case under study and the number of variables used. This study selected 28 different studies that attempted to compare findings from different specifications. About 234 specifications were identified and their  $R^2$  listed in tabular form (see Appendix D). These ranged from a high of 0.92 to a low of 0.01.

The  $R^2$  found in this study, i.e., ranging from a high of 0.70 to a low of 0.13, compares well with the above studies. For example, the aggregated model in this study

consistently showed a high  $R^2$  (0.70 to 0.55), compared to a disaggregated model whose  $R^2$ s were consistently low (0.26 to 0.13). However, this pattern is not unique to this study alone. In their study, Navrath and Doyle (1977) focused on three objectives, two of which are relevant for this study. One was to combine personal and area-specific attributes in one model (without a gravity aspect). The other was to explore the sensitivity of determinants at different levels of aggregation. Their results are shown in Appendix E and Appendix F. Using 11 variables with four case studies, the respective  $R^2$ s for the aggregate model were 0.57, 0.44, 0.43, and 0.48 (all but one with a lower  $R^2$  than this study), as shown in Appendix E. In comparing the same cases, the  $R^2$  for the disaggregated model was consistently lower than the aggregated model (the same as the findings of the present study), i.e., 0.26, 0.24, 0.22, and 0.26, respectively (see Appendix F).

Navrath and Doyle (1977, p. 1455) point out two reasons for such a discrepancy. First, the process of aggregation reduces the total amount of variation that remains in any variable unless all observations in each class are actually at the mean (see Kmenta [1971, pp. 322-336] for a technical explanation). Second, whereas the aggregate model uses average values, the disaggregate model references specific characteristics.

Comparing the  $R^2$ s of the present study with the 234 other cases identified in Appendix D, the findings of this study are judged to be reasonable. Similarly, the pattern established by this study between findings from an aggregated model and the disaggregated model concur with Navrath and Doyle's (1977) findings, as indicated in Appendices E and F. Hence this strengthens the credibility of these findings.

### CONCLUSIONS

This applicational analysis has enhanced the idea of a more structured approach to analysis of migration variables. By utilizing the proposed framework, it is suggestive in this chapter that the probability of selecting reliable variables is high.

It is equally important to note that this research was not about the specifics of the regression model; it was concerned with how to interpret the model with given variables, i.e., whether the model is partial or comprehensive. In both respects, however, this chapter has shown the utility that this heuristic framework may provide for a researcher and the user of migration research findings.



## CHAPTER VII

### SIGNIFICANCE OF THE FRAMEWORK AND CONCLUSIONS

The significance of this research is the development of a framework through which migration studies may be analyzed. This includes the recognition of major components that contribute towards the migration process as well as their inherent configurations. This framework also provides for an objective methodology through which a parsimonious application of migration variables is possible. Further contributions include this framework's attempt to address the problem of proliferations in the approaches of migration studies. This was done by emphasis on a wholistic perspective to ensure representativeness of variables among migration models.

In this chapter, therefore, a review of this study is done in terms of the problem, the framework, and the organization of the study. This is followed by the significant challenges that were encountered or should be anticipated from such a study. Finally, an elaboration of this study's overall contributions is made, followed by conclusions from the study.

## REVIEW OF THE STUDY

### The Problem

The main problem that was identified in this study involved the overwhelming multitude of potential variables for migration research without any established procedures for selecting variables. As a result there have been several studies on migration, most of which attempt to explain common migration questions but with varied variables and therefore differing conclusions. This has meant a strong potential for misinterpretation by policy makers and other researchers. It has also meant a tendency towards the development of partial theories of migration rather than a more generalized theory.

### The Framework

This study therefore identified a possible objective process through which migration variables may be selected. A heuristic framework was therefore developed as an operational tool. This framework was developed based on some background literature and the need for an objective analysis of interregional migration. The main thrust of this framework is its meta-analytic approach. First, it involves the identification of various possible variables that have previously been utilized by different researchers. Thus a sample of potential variables associated with migration studies was listed, out of which 49 different variables were

identified from 72 different studies. The second step was to examine the frequency of individual variables used. By using a tabular exposition, a number of variables were found to be utilized more often than others. Based on these findings and with the help of previous literature, a hypothetical conceptualization of the underlying structure of migration variables was developed. The rationale was to condense the variables into a less clustered configuration without losing their representativeness.

The main challenge, as has been evident in each of the previous chapters, was how to objectively select individual variables that would be more representative of the migration process. This framework attempted to provide such a process. Thus, by hypothesizing a wholistic configuration, this research was forced to identify a wide range of variables.

Therefore the third step utilized this representative structure for the selection of variables which were subjected to a factor analytic procedure to determine the nature of variable interrelationship in migration studies. This analytical procedure was therefore to identify a simpler yet comprehensive synthesis of all the probable variables associated with the migration process. By so doing, it was indicated that both the vision of the forest and the trees must be in perspective and that future interpretation of succeeding steps in the framework might be

enhanced by this approach. Three categories of variables were thus identified as determinants of migration, i.e., the mobility, spatial, and amenity variables.

In order to account for variable association and variability, the next step was to apply the factor-analytic model as the most efficiently objective way to pick out variables selectively. The last two steps of the framework dealt with further projections of the framework, i.e., the application of utility through a regression analysis model and also its suggestion for further subjection to a statistical meta-analytic procedure. A regression model was thus applied to variables selected based on the outcomes of the factor analytic procedure. The anticipation was that the process of this heuristic framework and consequent application models, such as regression analysis, would provide groundwork for diverse studies whose results may be further subjected to a meta-analytic approach for the final development of theory. It is anticipated that the utilization of such a procedure will reduce the level of subjectivity in the development of a more generalized theory of migration.

#### Organization

This study began with Ravenstein's 1885 laws of migration in response to Farr's 1876 remarks that migration appeared to have no definite laws. Subsequent problems in the development of migration theory were then identified.

Similarly, the objectives, research procedures, and the general considerations of this study were covered in Chapter I.

In Chapter II, a large sample of previous literature was reviewed. One portion of the chapter focused on the earlier literature, which emphasized migration principles, theoretical propositions as well as an attempt towards theoretical synthesis. The other portion focused on the recent studies that tended to exhibit various interdisciplinary approaches, but with a growing proliferation of approaches towards diverse partial models.

In Chapter III applicable methodologies were explored and pertinent issues were put into a wholistic context to unearth the need for a simplified and concomitant approach against further proliferations. Emphasis was placed on the possibilities for emulating reliable and useful problem conceptualizations from other disciplines so as to develop a more objective analysis of migration studies. In Chapter IV a heuristic framework was developed to address these challenges. The framework utilized hypothetical, tabular, and statistical analyses to establish a criterion for variable selection and a projection for further development towards a generalized theory of migration.

The relationship of alternative applicational models with the framework were further discussed in Chapters V and VI. Emphasis was especially placed on the regression

model's application and suggestions for further meta-analytic procedures as the final steps in the framework.

#### CHALLENGES EXPERIENCED IN THE STUDY

In the development of this framework a number of challenges encountered were identified. The first group of challenges involve the framework's developmental problems. For example, in some cases, certain literature material was not readily available, especially the early literature. Secondly, as in most social sciences, most of the variables are only proxies of actual situations. This represents problems of actual/exact measurements and therefore may mean some allowances for overlaps and some subjectivity in interpretations. The appropriate data were also very expensive. This also applied to necessary software. These created a financial limit in terms of alternative geographical locations to extend further applications of the framework,

The second group of challenges involves anticipated limitations in the framework. In the first place, this framework requires a long-term accumulation of research material that has previously utilized a similar approach before a statistical meta-analytic procedure is possible for the development of a final theory. Secondly, the framework only attempts to enhance objectivity, but under different environments certain variables may tend to exhibit stronger influences depending on prevalent conditions than under

different conditions. This is due to the different levels of variable covariations under different variable combinations. However, whatever the conditions, this framework was designed to preserve consistency and therefore accommodate such variabilities against consequential theoretical proliferations.

As is evident, therefore, the modeling heuristic has some caveats. Whether an aggregated or disaggregated model specification is used, a factor analysis of potential independent variables is an essential step. In some cases actual data for this factor analysis may be expensive and difficult to obtain. Variables representing all clusters may not be available; irreducible specification errors are implied. Also, factor analysis requires some qualitative interpretation to elaborate clusters, both in naming them and selecting those to appear in the reduced model. Hence there is not a single specification from a given structure. Similarly, qualitative analysis is critical in phase one of the framework. However, in both of these instances a wide coverage of literature provides reasonable insurance against subjective error.

#### CONTRIBUTIONS OF THE FRAMEWORK PROPOSED

The heuristic framework proposed here can therefore contribute to migration studies in three ways: (a) as an explanatory tool that allows elaboration of migration

studies as part of a behavior system; (b) as a utility for both interpretation and design of migration models (hence it functions as a general purpose algorithm that can be implemented in specific research contexts); and (c) as a map pointing to directions for future development of theory.

#### As an Explanatory Tool

This study identified three aspects that influence the migration process, i.e., Mobility, Amenity, and Spatial factors. This configuration allows one to identify the subparts without losing sight of the whole. This heuristic framework therefore provides a simple means of both synthesis and differentiation. For example, by hypothesizing that a migration process may be explained by the mobility, amenity, and spatial factors, it becomes possible to synthesize the migration process, thereby including each associated variable. Alternatively, one may differentiate amenity variables that affect migration in a framework assuming multicausality. For example, differentiation of the amenity factor into climatic variables in general or even to a tight focus on, say, temperature is also possible. The factor analytic model assists in this process of differentiating at least major structural components of the migration system.



Research Design/Interpre-  
tational Utility

Because of the identifiable differentiation through factor analysis, this framework on one hand provides a range of variables within each factor from which a researcher may choose. The main advantage therefore is its parsimony in that a researcher has identifiable alternative proxies in case data for a required variable are unavailable. This is due to the inherent correlations between such variables as exhibited by factor analysis. Similarly, because of regional and chronological differences, such a pool of variables allows a researcher to choose variables that apply to their unique issues of interest.

On the other hand, this framework guides both researchers and policy makers in their interpretation of previous studies. Thus a mobility oriented study may only be interpreted within that respect without reference to other aspects nor the whole migration process.

For applied researchers and policy makers, therefore, this framework helps to identify configurations of migration variables important to the specific problem they are studying. Thus, by acknowledging the subparts of the whole, policy makers will be able to identify the necessary subparts of strategies that will affect their goals. Similarly, by streamlining the structure of migration variables, policy makers will find it easier to interpret migration

research findings. Researchers, too, may be able to design or review previous studies from a more structured perspective.

#### Future Developments

The main line of thinking is that, given the structure of variables as suggested by the heuristic framework, the next step would be to utilize an existing model such as a regression analysis to produce statistical findings. Over time, however, as several researchers produce large quantities of migration studies (a necessary critical mass) that are consistent with one another in their approach (as enhanced by this framework), these studies may then be subjected to a statistical meta-analytic study that will sort out any remaining subjective biases. This will eventually enhance the development of a better theory in migration studies.

#### CONCLUSIONS

In view of the potential for future proliferations as well as the previous proliferations that have been developing over time in migration studies, it is vital that a wholistic perspective is developed in migration studies so as to enhance variable representativeness. It was important that a more objective procedure for handling this problem be

developed. More so, further steps towards a more generalized theory were essential.

The central problem identified in this study was the multitude of potential variables for migration research and lack of established procedures for selecting among them. This study found that several researchers on migration have attempted to answer common migration questions, but with differing variables and therefore divergent conclusions. There is thus a strong potential for misinterpretation by researchers and policy makers. Partial theories of migration have been developed rather than a unified one. Therefore, this study offered an objective process through which variables may be selected for purposes of migration model design or interpreting completed studies by researchers, policy makers, and others.

Meta-analysis was used to develop a heuristic framework as an operational tool for selection of migration modeling options. The variables identified for a meta-analytic procedure were further subjected to a factor analysis to identify the inherent variable constructs. Seven clusters (constructs) emerged. They included urban amenity, low mobility, and amenity. Each cluster was representative of a partial approach.

These clusters were then tested by regression analysis by sorting them out into amenity, spatial, and mobility related variables. Two techniques were used, i.e., an

aggregated and a disaggregated approach, both using the basic Ordinary Least Squares. Both approaches produced a similar pattern of results. Thus when mobility, spatial, and amenity variables were tested individually, their  $R^2$  was not as high as when variables were selected from each (in spite of having the same number of variables each).

These findings have several implications. Thus a rationalized unified model, where each significant cluster is represented by a variable, allows parsimonious prediction of migration. A factor analysis is the key technique in pinpointing the minimal set of useful variables. The significance of this heuristic approach also has further implications. First, identification of an analytical structure for the development of a unified theory in migration studies. This heuristic is useful as an applied forecasting device and an academic tool in policy areas. Secondly, it provides a framework that may be useful to other social sciences' development of their respective theories.

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## APPENDIX A

### SUMMARY OF IMMIGRATION MODELS

Researcher (year)	Year of analysis	Unit of analysis	Method of analysis	Dependent variable
<i>a. Job vacancy</i>				
Mázek (1966)	1955-1960	47 SMSAs	Multiple regression	Rate of immigration
Giantz (1973)	1955-1960 and 1965-1970	100 SMSAs and 63 SMSAs	Two-stage least squares	Immigration rate for: a. the poor (income ≤ \$4000 b. nonwhites (1955-1960) c. blacks (1965-1970)
<i>b. Structural</i>				
von Böventer (1969)	1959-1961 and 1961-1966	Cities	Multiple regression	Gross immigration
Pack (1973)	1955-1960	20 Central cities	Multiple regression	Immigration rate
<i>c. Simultaneous equations</i>				
Olvey (1970)	1955-1960	56 SMSAs	Three-stage least squares	Immigration rate a. Long distance b. Short distance
Greenwood (1973)	1950-1960	100 SMSAs	Three-stage least squares double log	Gross immigration
Greenwood (1975b)	1950-1960 and 1960-1970	63 SMSAs	Two-stage least squares double log	Gross immigration a. From metro areas b. From nonmetro areas
Greenwood (1976)	1950-1960	100 SMSAs	Two-stage least squares double log	Gross immigration a. Whites b. Nonwhites
<i>d. Alternative opportunities</i>				
Alperovich, Bergsman, and Ehemann (1977)	1965-1970	All SMSAs	Two-stage least squares	Immigration rate relative to the combined- attractiveness measure

Researcher (year)	Independent variables (categories)				
	Economic opportunity	Amenities	Fiscal	Spatial structure	Propensity to migrate
<i>a. Job vacancy</i>					
Milzok (1966)	Potential unemployment Regional unemployment				
Glantz (1973)	Median income Employment potential Industrial relocation Welfare	Population Percentage poor Percentage nonwhite			
<i>b. Structural</i>					
von Böventer (1969)	Growth in per capita income Employment structure	Climate and landscape Number of students Excess demand for rental housing Housing rents Population potential	Tax receipts Public spending on infrastructure	Hinterland effect of distance Agglomeration effect of distance Railroad accessibility Highway accessibility	
Pack (1973)	Median income Growth in income Unemployment rate Median education	Percentage housing a. Owner occupied b. Unsound Percentage nonwhite	Per capita taxes Educational spending General spending Welfare payment per recipient	Population	
<i>c. Simultaneous equations</i>					
Olvey (1970)	Growth in employment Hourly wage Per capita income Population	Climate			
Greenwood (1973)	Change in income Change in employment Change in unemployment Income Unemployment	Civilian labor force			Outmigration
Greenwood (1975b)	Change in income Change in employment Change in unemployment Income Unemployment	Civilian labor force		Regional dummies	Outmigration
Greenwood (1976)	Change in income Change in employment Change in unemployment Income Unemployment	Civilian labor force a. Own race b. Other race		Regional dummies	
<i>d. Alternative opportunities</i>					
Alperovich, Bergsman, and Ehemann (1977)	Unemployment rate Growth in employment Wage Alternative opportunities (weighted sums of the economic attributes of alternatives).	Climate City size a. Log (population) b. (log (population)) <sup>2</sup>		Combined attractiveness measure (the attractive force in gravity terms of all alternatives in the system).	Stock of nonmigrants Previous migrant rate Fraction of old age (65 or older)

## APPENDIX B

### SUMMARY OF OUTMIGRATION MODELS

Researcher (year)	Year of analysis	Unit of analysis	Method of analysis	Dependent variable
<i>a. Propensity</i>				
Miller (1973a)	1955-1960	48 States	Multiple regression	Outmigration rate
Trott (1971a)	1960-1963 and 1963-1966	173 OBEEAs	Multiple regression	Outmigration rate of White males. For: (a) Large OBEEAs (b) Small OBEEAs For: (a) Aged 25-34 (b) Aged 35-44 (c) Aged 45-54 (d) Aged 55-64 (Labor force participants)
Renshaw (1970)	1960-1961, 1961-1962, 1962-1963, 1963-1964, and 1964-1965	224 metro areas	Multiple regression	Outmigration rate (labor force partici- pants)
Morrison and Relles (1973)	1960-1961, 1961-1962, 1962-1963, 1963-1964, and 1964-1965	63 SMSAs	Multiple regression	Outmigration rate (labor force partici- pants)
<i>b. Simultaneous equations</i>				
Olvey (1970)	1955-1960	36 SMSAs	Three-stage least squares	Outmigration rate
Greenwood (1973)	1950-1960	100 SMSAs	Three-stage least squares double log	Gross outmigration
Greenwood (1975b)	1950-1960 and 1960-1970	63 SMSAs	Two-stage least squares double log	Gross outmigration: (a) To metro areas (b) To nonmetro areas
Greenwood (1976)	1950-1960	100 SMSAs	Two-stage least squares double log	Gross outmigration: (a) Whites (b) Nonwhites

Researcher (year)	Independent variables (categories)				
	Economic opportunity	Amenities	Fiscal	Spatial structure	Propensity to migrate
<i>a. Propensity</i> Miller (1973a)	Median income Employment growth rate	Mean January temperature		Log of population	Immigration rate Percentage of popula- tion with one or more years of college
Trou (1971a)	Base year conditions: Industrial concentration of employment Ratio of population to em- ployment Ratio of local job oppor- tunities to the average Previous growth in em- ployment Relative intensity of employment of a cohort Contemporaneous conditions: Dropout rate Excess labor demand Expected conditions (short term): Industrial relocation Expected wage relative to the actual Expected conditions (long term): Relative expected future wages of a cohort Relative expected five- year wages of a cohort				
Renshaw (1970)	Employment growth rate Employment growth rate (deviation from average) Employment size Average wage Percentage of "prime" workers	Mean January temperature Percentage of sun- shine			Median education
Morrison and Rellis (1975)	Employment growth rate				Previous immigration rate Previous out- migration rate Percentage of popula- tion aged 18 to 34 Percentage of popula- tion professionally employed
<i>b. Simultaneous equations</i>					
Olvey (1970)	Prospective unemployment Average wage	Mean January temperature			
Greenwood (1973)	Change in income Change in employment Change in unemployment income Unemployment	Civilian labor force			Median education Median age Immigration
Greenwood (1975b)	Change in income Change in employment Change in unemployment income Unemployment	Civilian labor force		Regional dummies	Median education Median age Immigration
Greenwood (1976)	Change in income Change in employment Change in unemployment income Unemployment	Civilian labor force a. Own race b. Other race		Regional dummies	Median education Median age



## APPENDIX C

### SUMMARY OF PLACE TO PLACE MODELS

Researcher (year)	Year of analysis	Unit of analysis	Method of analysis	Dependent variable
<i>a. Allocation</i>				
(1) <i>Friends and relatives</i> Greenwood (1969)	1955-1960	48 states	Multiple regression double log	Allocation rate
(2) <i>Alternative opportunities</i> Levy and Wadycki (1974)	1960-1961	20 states of Venezuela	Multiple regression double log	Allocation rate for males aged 15 to 54
Wadycki (1974b)	1955-1960	48 states	Multiple regression double log	Allocation rate
(3) <i>Disaggregative</i> Greenwood and Gurmely (1971)	1955-1960	48 states	Multiple regression double log	Gross allocation for each of the 48 states for whites and nonwhites
Wadycki (1974b)	1955-1960	48 states	Multiple regression double log	Allocation rate for a. Whites b. Nonwhites
<i>b. Origin-destination</i>				
(1) <i>Human capital</i> Rogers (1967)	1955-1960	19 SEAs (California)	Multiple regression double log	Migration streams for a. SMSA vs nonSMSA ori- gins and destinations b. Whites and nonwhites c. Males and fe- males d. Age groups (5-9, 20-24, 40-44, 75-79)

Researcher (year)	Independent variables (categories)				
	Economic opportunity	Amenities	Fiscal	Spatial structure	Propensity to migrate
<i>a. Allocation</i>					
(1) <i>Friends and relatives</i> Greenwood (1969)	Relative median income Unemployment (origin and destination)	Relative average temperature		Relative urbaniza- tion Distance Previous migrants	Education (origin and destination)
(2) <i>Alternative opportunities</i> Levy and Wadycli (1974)	Average wage Unemployment rate Population Alternative opportunities: Highest wage Lowest unemployment rate Largest population			Distance	
Wadycli (1974b)	Median income Unemployment rate Population Alternative opportunities: Highest median income Lowest unemployment rate Largest population			Distance	
(3) <i>Disaggregative</i> Greenwood and Gormely (1971)	Median income Population	Average tempera- ture		Distance	
Wadycli (1974b)	Median income Unemployment rate Population Alternative opportunities: Highest median income Lowest unemployment rate Largest population			Distance	
<i>b. Origin-destination</i>					
(1) <i>Human capital</i> Rogers (1967)	Unemployment rates (origin and destination) Per capita wages and salaries (origin and destination) Labor force size (origin and destination)			Distance	

Researcher (year)	Year of analysis	Unit of analysis	Method of analysis	Dependent variable
Gallaway, Gilbert, and Smith (1968)	1955-1960	48 states	Multiple regression	Migration rates for: a. All states  b. Each state
Rabianski (1971)	1955-1960	11 SMSAs	Multiple regression double log	Migration streams
Greenwood and Sweetland (1972)	1955-1960	50 SMSAs	Multiple regression double log	Migration rates for a. All SMSAs b. Each SMSA
Cebula, Kohn, and Vedder (1973)	1965-1970	48 states	Multiple regression double log	Black migration rate for each of 34 states
(2) <i>Behavioral</i> Arora and Brown (1971)	1955-1960	19 SMSAs	Multiple regression double log	Migration streams
Grant and Vanderkamp (1976)	1968-1969 and 1969-1970	10 Canadian provinces 44 Canadian regions	Multiple regression double log	The "odds" of mov- ing to a destination rather than staying in an origin for occupations (white- collar, blue-collar, other) by males (aged 14-19, 20-24, 25-54, 55-64, 65+ by females (married and other)

Researcher (year)	Independent variables (categories)				
	Economic opportunity	Amenities	Fiscal	Spatial structure	Propensity to migrate
Galloway, Gilben and Smith (1968)	Difference in per capita in- comes Difference in unemployment rates Difference in average wel- fare (general assistance) payments			Distance	
Rabianski (1971)	Relative average wages (real vs. nominal) Relative unemployment rates Employment size (origin and destination)			Distance	Fraction of origin la- bor force in low occupations
Greenwood and Sweetland (1972)	Median incomes (origin and destination) Population (origin and desti- nation)		Ratio of per capita gov- ernment ex- penditures	Distance South-non-South dummy	
Cebula, Kohn, and Vedder (1973)	Relative black per capita in- comes Relative per capita welfare (aid to dependent chil- dren) payments	Percentage of blacks		Distance	
(2) Behavioral Arora and Brown (1971)	Relative real incomes Percent of labor force em- ployed (destination) Origin population		Relative per capita gov- ernment ex- penditures	Distance	
Grant and Vanderkamp (1976)	Unemployment rates (origin and destination) Income measures: Expected income Average income Wage income Self-employed income Other (pension, rental, etc.) income	Percentage of French-speaking persons Destination popula- tion		Distance	

## APPENDIX D

### COMPARISON OF $R^2$ ACROSS STUDIES

Study	R1	R2	R3	R4	R5	R6	R7	R8	R8	Rt1	Vt1
1	.34	.62	.76	.78							
2	.41	.72	.39	.76	.53	.73	.35	.74			
3	.19	.21	.19	.18	.16	.11	.10	.27	.09		
4	.44	.66	.49	.60	.33						
5	.54	.55	.61	.73							
6	.32	.40	.45	.59	.51	.51	.49	.48	.44		
7	.04	.34	.25	.39							
8	.41	.72									
9	.42	.40	.30	.32	.12	.25	.09	.29	.15		
	.12	.18	.19	.19	.41	.32	.10	.23	.87		
	.11	.30	.05	.82	.50						
10	.48	.51	.52	.52							
11	.77	.79	.75	.77							
12	.67	.60	.04	.08	.53	.55	.17	.03	.52		
	.60	.18	.11	.46	.51	.15	.42	.77	.80		
	.19	.04	.66	.78	.13	.13	.85	.83	.08		
13	.08	.01	.08	.43	.45	.52	.54	.64	.69		
14	.77	.82	.77	.80							
15	.51	.53	.49	.45	.34	.28					
16	.57	.44	.43	.48							
17	.26	.24	.22	.26							
18	.74	.92	.70	.71	.92	.61					
19	.70	.43	.41	.57	.65	.50	.52	.69	.70		
20	.52	.51	.49	.57	.54	.54					
21	.01	.05	.01	.06	.05	.02	.05	.03	.05		
	.02	.05	.02								
22	.77	.80	.69	.78	.78	.75					
23	.48	.45	.49	.34	.34	.34	.34	.32	.34		
	.25	.34	.39	.39	.26	.33	.29	.24	.22		
	.39	.41	.36	.29	.22	.24	.28	.23	.21		
24	.62	.57	.44	.53	.20	.64	.63	.77	.54		
25	.75	.77	.79	.76	.78						
26	.62	.56	.79	.68	.70	.63					
27	.50	.65	.38	.71	.44	.85	.31	.52	.78		
	.42	.67	.73								
28	.66	.66	.55	.51	.57	.50					

## APPENDIX E

### AGGREGATED STUDIES MODEL



VARIABLE	WHITE MALES	WHITE FEMALES	BLACK MALES	BLACK FEMALES
COEFFICIENTS				
CONSTANT	-0.258 (-0.90)	-0.413 (-1.26)	-0.418 (-1.30)	-0.903 <sup>*</sup> (-2.08)
PERSONAL CHARACTERISTICS				
ZMAR	-0.379 (-3.54)	0.042 (0.68)	-0.050 (-1.07)	-0.096 <sup>*</sup> (-1.78)
ZJNG	-0.128 (-0.95)	0.001 (0.01)	-0.032 (-0.60)	-0.049 (-1.09)
ZMIL	0.044 (0.34)	---	0.011 (0.19)	---
AGE	0.011 (2.98)	-0.002 (-0.72)	0.003 (1.68)	0.003 (1.99)
EDUC	0.018 (2.42)	0.009 (0.81)	0.004 (0.84)	0.005 (1.28)
AREA CHARACTERISTICS				
ZJUN	-0.005 (-1.69)	-0.010 (-2.04)	-0.0002 (-0.03)	0.002 (0.25)
GRW	0.004 (7.01)	0.005 (6.24)	0.001 (0.92)	0.003 (1.97)
URB	0.053 (1.14)	0.102 (1.42)	0.244 (3.01)	0.354 (3.02)
TEMP	-0.0001 (-0.10)	0.001 (1.15)	-0.005 (-4.12)	-0.007 (-4.14)
AVED	0.009 (0.72)	0.025 (1.31)	0.048 (2.12)	0.087 (2.59)
PCY	-0.00001 (-0.82)	0.000006 (0.22)	-0.00004 (-1.14)	-0.0001 (-1.31)
MSK	-0.022 (-2.25)	-0.018 (-1.16)	-0.003 (-0.17)	0.012 (0.46)
POP	-0.049 (-1.23)	-0.095 (-1.52)	-0.077 (-1.12)	-0.124 (-1.27)
DIST	-0.000003 (-0.65)	0.000005 (0.61)	0.00002 (2.00)	0.00003 (2.75)
$\bar{R}^2$	0.57	0.44	0.43	0.48
N	82	82	74	68
d.f.	67	68	59	54
F	8.72	5.93	5.00	5.73

## APPENDIX F

### DISAGGREGATED STUDIES MODEL

VARIABLE	WHITE MALES	WHITE FEMALES	BLACK MALES	BLACK FEMALES
COEFFICIENTS				
CONSTANT	-2.048 (-2.56)	-3.225 (-1.90)	-3.104 (-2.24)	-5.766 (-2.41)
PERSONAL CHARACTERISTICS				
DMAR	0.096 (1.61)	-0.003 (-0.03)	-0.131 (-1.90)	0.035 (0.27)
UNSYA	0.499 (7.80)	0.278 (2.83)	0.196 (2.20)	0.484 (4.21)
DMSYA	0.918 (9.31)	---	0.965 (5.18)	---
PREVM	0.617 (14.12)	0.459 (5.19)	0.424 (6.24)	0.363 (3.32)
AGE	-0.022 (-11.46)	-0.024 (-7.20)	-0.028 (-9.07)	-0.037 (-7.11)
EDUC	0.065 (9.90)	0.054 (3.45)	0.045 (4.70)	0.019 (1.07)
AREA CHARACTERISTICS				
TUN	-0.039 (-2.68)	-0.017 (-0.54)	-0.032 (-1.19)	0.005 (0.10)
GRW	0.010 (3.81)	0.028 (4.96)	0.002 (0.31)	0.003 (0.35)
URB	0.486 (3.05)	-0.088 (-0.29)	0.293 (1.17)	0.164 (0.37)
TEMP	0.004 (1.44)	0.007 (1.09)	-0.015 (-2.85)	-0.021 (-2.24)
AVED	0.046 (0.79)	0.014 (0.10)	0.281 (2.79)	0.442 (2.62)
PCY	-0.0001 (-1.65)	0.0003 (1.71)	-0.0002 (-1.22)	-0.0001 (-0.03)
MSR	-0.092 (-1.90)	0.029 (0.39)	-0.046 (-0.79)	0.014 (0.13)
POP	-0.0000003 (-2.92)	-0.0000002 (-0.87)	-0.018 (-1.12)	0.003 (0.11)
R <sup>2</sup>	0.26	0.24	0.22	0.26
Pearson R <sup>2</sup>	0.17	0.14	0.14	0.17
N	8118	1816	3629	1417
d.f.	8102	1801	3613	1402
Chi-Squared	1045.6	225.9	400.1	211.5

## APPENDIX G

### COMPARISON OF MOST USED MODELS

Study	Other	Reg.	Grvt.	Mkv.	M-G.	Fct.
Farber (1983)		X				
Dorkoosh (1982)	Multinomial logit					
DaVanzo (1983)	Polytomous logit					
Dunlevy & Genery (1977)		X				
Fournier, Rasmussen, & Serow (1988)		X				
Fox, Herzog, & Schlottman (1989)		X				
Gallaway (1967)		X				
Gallaway (1969)		X				
Gordon (1988)			X			
Greenwood (1969)		X				
Greenwood (1976)		X				
Greenwood, Hunt, & McDowell (1986)		X				
Klaasen (1973)		X				
Jun & Chang (1986)		X				
Hoenack, Peris, & Weiler (1984)		X				
Herzog (1983)		X				
Haurin (1980)	Utility max- imization					
Haurin & Haurin (1988)		X				
Bowles (1970)		X				
Boots & Kanaroglou (1988)		X				
Barber & Milne (1988)		X	X			
Cushing (1986)		X				
Cushing (1989)		X				
Wadycki (1974)		X				
Kleiner (1984)		X				
Greenwood (1989)		X				
Fields (1971)		X				
Clayton (1982)					X	
Dierx (1988)		X				
Morgan & Robb (1981)		X				

Study	Other	Reg.	Grvt.	Mkv.	M-G.	Fct.
Molho (1984)		X				
McHugh (1987)	Indifference model					
McHugh (1988)		X				
Maxwell (1988)		X				
Liu (1975)		X				
Cebula (1983)		X				
Krieg (1990)		X				
Knapp & Graves (1989)	Equilibrium model					
Rogers & Belanger (1990)	Conditional probability					
Sahota (1968)		X				
Sandell (1977)		X				
Schachter & Althaus (1989)	Equilibrium model	X				
Schultz (1971)		X				
Schwartz (1973)	Cobb Douglas	X				
Shefer (1987)		X				
Sommers & Suits (1973)		X				
Renas & Kumar (1982)		X				
Puu (1989)	Hotelling model					
Persky & Kain (1970)		X				
Navrath & Doyle (1977)		X				
Nelson & Wyzan (1989)		X				
Nelson (1959)		X				