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Urban dynamics and the role of public policy: An analysis of urban hardship and fiscal institutions

Kim, Yul, Ph.D.
The Ohio State University, 1992
URBAN DYNAMICS AND THE ROLE OF PUBLIC POLICY:
AN ANALYSIS OF URBAN HARDSHIP AND FISCAL INSTITUTIONS

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Doctor of Philosophy in the Graduate School of
The Ohio State University

By

Yul Kim, B.A., M.P.A., M.A.

* * * * *

The Ohio State University

1992

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To
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and
Eddie Bum-Keun
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FIELDS OF STUDY

Public Policy and Management
Public Administration
Urban Economics
Public Finance
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The Research Question

Since the 1960s, a new pattern of human settlements has become clear among U.S. central cities as a part of the process of intra- and inter-metropolitan redistribution of population. Many large central cities in the Northeast and Northcentral regions not only ceased to grow but have been declining. On the other hand, a number of cities in the South and West emerged into front-rank status and have been growing rapidly. According to the 1990 Census Bureau's report, most large cities losing population in the 1970s were also big losers in the 1980s. The growing cities in the 1970s, on the other hand, continued to experience population growth in the 1980s as well.

Such a differential in the development pattern of U.S. central cities was also observed by Nathan and Adams (1989). In their recent study on urban hardship, they found a strong trend of increasing hardship disparities both across and within major metropolitan areas. Across metropolitan areas, the differential in economic, social, and physical conditions between the worst and best off cities increased substantially during the 1970s. Within metropolitan areas, there was a sharp increase in the number of areas where the central city compares very unfavorably to its adjoining suburbs over the ten-year period.
The demographic statistics and urban hardship analysis raise important questions regarding the underlying dynamic of our urban structure and the role of government. Why are some cities growing while others are declining? What makes cities grow or decline? Is urban growth or decline in the recent past a temporary phenomenon or a long-term change in the urban structure? Do any internal counter-currents or mechanisms exist in our urban system so as to reverse the trend and narrow the existing disparity? What is the role of government in the process of urban change? To what extent is the recent trend of urban decline and growth attributed to contemporary urban policy? What government policies are needed for a desirable change in urban development patterns?

The answers to these fundamental questions are primarily contingent upon a theoretical perspective on our urban structure. Economists have traditionally viewed the recent urban development as a movement toward an equilibrium through a "self-adjusting" process (Borts and Stein, 1964; Mills, 1970; Mills and Price, 1984). Market forces work to make appropriate adjustments by capitalizing differences in urban conditions into land and/or housing values or wages. These spatial differentials in factors prices provide a signal to utility-maximizing individuals that encourages spatial movements. Spatial movements would act to adjust urban differentials, and consequently result in the efficient allocation of resources in society. Since this view claims that such a self-correcting force is inherent in our urban system, there is no need for government intervention.
Another perspective, however, argues that the automatic self-adjusting mechanism does not work as hypothesized. Rather, it regards the current trend of urban decline and growth as a movement toward a new inequality through a "self-reinforcing" process (Baumol, 1967; Bradbury et al., 1982; Bradford and Kelejian, 1973; Grubb, 1982; Oates et al., 1971). In this view, the process of urban change involves feedback relationships among location-specific attributes which continuously intensify an initial change over time. Since it is argued that there exist no self-equilibrating mechanisms in our urban system, exogenous efforts such as public policies are to be undertaken to stop a continuous worsening or expansion.

Despite the recognition of the dynamic forces in the urban process, urban and regional studies were mostly static in nature until recently. A few attempts have been made in the past decades to formulate dynamic models, but they have made no success of taking into consideration both intertemporal and spatial dynamics. Much work in economics on the process of urban structure has been largely restricted to the spatial and intertemporal relationships among population, employment, and income in a single urban area (Hall and Licari, 1971; Mills and Price, 1984; Steinnes, 1977). The urban models in the migration literature, on the other hand, have been content with spatial matters, focusing on finding personal and location-specific determinants of individuals' migration (Alperovich, 1981; Boehm and Ihlanfeldt, 1986; Rossi, 1980).

While a considerable number of empirical analyses have been made in the context of the Tiebout hypothesis, they also suffer from one or
more of a set of shortcomings. These include an exclusive focus on a single or very limited policy variable(s), partial data that do not cover all of the local governments in the relevant area, or very limited samples which are mostly a single metropolitan area. Though a small number of scholars have recently attempted to find different migration effects of various policies among population subgroups, most have relied on indirect measures of movement such as changes in population (Bradford and Kelejian, 1973; Carlino and Mills, 1987; Ellson, 1980; Palumbo and Hutton, 1987) or changes in population density gradients (Grubb, 1982; Mills and Price, 1984). In addition, little work has been done within the setting of a dynamic model which deals with both the intra- and inter-metropolitan processes of urban growth and decline.

In this study, a three-sector dynamic urban model is presented to not only explore the cause and process of urban growth and decline, but also identify their implications for public policy. In the dynamic model, population change, location-specific attributes, and migration are interrelated both in an intertemporal and spatial sense. A change in a city's population influences location-specific attributes--economic, social, and physical conditions--in the city. The change in the city's conditions in one period causes migration, which will result in a change in the city's population in the following period.

Public policies are included as another important determinant of migration in the dynamic process of population change. They influence the location decision of individuals, and consequently change the pattern of urban development. Since the public sector varies from city
to city, the question is to what extent would such a variation result in different patterns of urban development by changing the relative attractiveness of different cities. Federal government policies do not much vary across jurisdictions so this study covers the revenue and expenditure sides of state and local (municipal, county, school, and special) government activities.

With all private and public sector variables specified, a linear form of the model is estimated through regression techniques in order to empirically investigate the role of dynamic elements in the process of urban change. A separate estimation is conducted for each of three different avenues, whereby a metropolitan population is affected by migration. An net intra-metropolitan analysis is carried out for both city-to-suburb and suburb-to-city migration, while two inter-metropolitan analyses are made for in-migration streams to either the central city or the suburbs from outside the metropolitan area. Differentials between income groups in the dynamic effect of the private and public sector variables are also investigated for each of the three analyses.

Empirical estimations are based on three sets of data. The first set of data draws on the patterns of individuals' migration during 1975-1980 within and across 52 large U.S. metropolitan areas (SMSAs) from the 1980 Census of Population and Housing. The second set consists of data on economic, social, and physical conditions of localities within these metropolitan areas in 1970, which are related to individuals' location decisions during the interval. A large portion of these location-specific conditions are well represented by
the urban hardship indices developed in the Nathan and Adams study (1976). Their 1970 city/suburb hardship disparity index values are chosen for the net intra-metropolitan analysis, whereas their 1970 central city and suburban hardship indices are used for the analyses of the inter-metropolitan process of population change. The third set of data is for the revenues and expenditures of state and local governments in 52 large SMSAs, which are drawn from the Bureau of the Census' Survey of Government Finances in 1973-74.

Outline of the Study

The dissertation consists of eight chapters. This chapter has provided an introductory statement. It raised research problems and policy issues, and gave a brief summary of information which is of relevant to empirical analyses.

The remainder of this study is divided into seven chapters. Chapter 2 provides a review and critique of the literature on urban economics, urban geography, migration, and public finance. The chapter first reviews various theoretical models which were developed to explain the underlying dynamic of urban growth and decline. It then focuses on empirical evidence for the effects of various dynamic elements on population change.

Chapter 3 presents the conceptual framework of this study. A three-sector dynamic model of urban growth is constructed using dynamic theories and empirical findings from the literature reviewed in Chapter 2. Based on the model, the chapter illustrates how the interaction of endogenous dynamic elements in our urban structure results in
population change. In addition, it discusses four varieties of the dynamic path of a city's population which would result from the interaction among dynamic elements.

Chapter 4 takes a detailed look at the importance of public policy in urban dynamics. It first presents two perspectives of government intervention in our urban system, which have different views on the balance and interaction of forces in our urban structure. In the next section, the importance of the public sector is discussed within the context of the conceptual model developed in Chapter 3. Along with a comparative static analysis of the model, the potential influences of fiscal policies on population growth are hypothesized. Finally, several related issues (e.g., tax exporting, service spillovers, grants) are discussed for the appropriate specification of the public sector variables.

Chapter 5 gives a detailed description of data and methodology used for empirical estimations of the model. It presents variable specifications and methodological issues which are of relevance to empirical estimations.

Chapter 6 reports empirical results of econometric estimations obtained using 52 metropolitan area data. The results are also compared with those of other studies reviewed in Chapter 2.

Chapter 7 discuss some implications for public policy. On the basis of the empirical findings, several policy options are suggested for the growth of urban areas.

Chapter 8 presents the conclusion of this study. Along with a brief summary of the methodology and findings of the study, this
chapter discusses the significance of the study and provides possible suggestions for future research on urban dynamics.
CHAPTER II
REVIEW OF THE LITERATURE

Introduction

The study of urban growth and decline represents a truly interdisciplinary field of endeavor, involving economists, geographers, demographers, sociologists, urban and regional planners, and other policy researchers. Although each discipline projects a particular orientation, such that economists emphasize the relationship between economic activities and population while geographers and sociologists are concerned with the spatial matter of population, there seems to be a genuine convergence of the disciplinary foci. This chapter reflects this convergence in that the concepts and models have been culled from a variety of perspectives.

The discussion is divided into two broad parts—that are of relevance to the basic theories of urban dynamics, and that deal with the existing empirical evidence which shows the role of dynamic elements in the process of urban change. The purpose of the first section is to prepare the foundation of the conceptual framework in subsequent chapters by placing the present study in the context of the existing literature. This section reviews various types of dynamic urban models which have been developed in such diverse fields as urban economics, labor economics, regional science, geography, and sociology.
The second part of this chapter presents a review of numerous empirical studies on population change and/or migration. It deals with the empirical evidence from the literature which has examined the influence of a variety of private and public sector factors on urban growth and decline.

Dynamic Urban Models

This section deals with various dynamic urban models which explicitly discuss population change in either an intertemporal or a spatial sense. Recent developments in urban and regional dynamic models may fall into two broad categories. One group of models focuses on mostly intertemporal relationships among population, employment, and income in a single urban area, while the other is concerned with the spatial and locational aspects of these urban activities within and across urban areas. The first group—called "non-spatial dynamic models"—is the aggregative analysis of population change in a non-spatial sense, while the second group—called "spatial dynamic models"—mostly adopts a behavioral approach which analyzes the spatial aspect of households' locations within and across urban areas.

1. Non-Spatial Dynamic Models

A majority of non-spatial urban dynamic models are concerned with the production activity of a single city or urban area, paying little attention to the spatial of population change. Most of these models adopt spatially aggregated methods and data, as they attempt to analyze the cause and process of changes in such economic activities as
production, employment, and income rather than their spatial patterns in an urban area. On the basis of their assumption regarding the cause of urban change, non-spatial models can be subcategorized into three types: demand-oriented, supply-oriented, and demand-supply interactive models (Miyao, 1987).

DEMAND-ORIENTED MODELS. Demand-oriented models assume that urban growth and decline is primarily caused by a change in the demand for a city’s products and not by a change in the supply of factors in the city. Probably the most popular hypothesis of this sort in the literature is called export base theory or economic base theory (Friedman and Alonso, 1964). The export base theory posits that a city’s employment is determined solely by the level of export demand, and the total population of the city grows over time as the export demand for its output increases exogenously. According to this theory, a city’s population \( P \) is an increasing function of its total employment \( E \),

\[
P = a_1 + b_1 E, \quad b_1 > 0, \quad (2.1)
\]

and total employment consists of the amount of employment in the export sector \( E_1 \) and that in the non-export sector \( E_2 \),

\[
E = E_1 + E_2, \quad (2.2)
\]

where \( E_2 \) is a function of the city’s total population \( P \),

\[
E_2 = a_2 + b_2 P, \quad b_2 > 0. \quad (2.3)
\]

The system (2.1)-(2.3) yields
\[ P = \frac{a_1 + b_1 a_2 + b_1 E_1}{1 - b_2}, \]  
(2.4)

which states that the total population of the city is determined by the level of employment in the export sector, and the city grows as exports increase, i.e.

\[ \frac{dP}{dE_1} = \frac{b_1}{1 - b_1 b_2} > 0, \]  
(2.5)

provided that

\[ b_1 b_2 < 1. \]  
(2.6)

While the export base theory remained essentially a static model in the early development of the theory, some intertemporal dynamic export base models were later developed (Lowry, 1966; Steinnes, 1977). In most cases the dynamic export base model is written as follows:

\[ P_t = a_1 + b_1 E_{t-2}, \]  
(2.7)

\[ E_t = E_{1t} + E_{2t}, \]  
(2.8)

\[ E_{2t} = a_2 + b_2 P_{t-1}, \]  
(2.9)

which together lead to

\[ P_t = b_1 b_2 P_{t-3} = a_1 + b_1 a_2 + b_1 E_{1(t-2)}. \]  
(2.10)

As seen in equation (2.10), these demand-oriented studies regard employment change as the most important determinant of population change in a city. These so-called "people-follow-jobs" advocates argue that the greater the growth of employment, the greater would be net immigration.

In addition, there have been other types of demand-oriented dynamic models of regional/metropolitan growth and decline. These
models generally focus on the determination and change of income in a regional/metropolitan area. Hall and Licari (1971) construct a metropolitan income growth model in which the growth of output in the export sector is directly linked to the growth of income in a metropolitan area. Anderson (1970) builds a dynamic version of the Keynesian regional/metropolitan econometric model, in which not only exports but also other demand items such as exogenous investment and government spending are included as important growth elements.

Demand-oriented models, however, ignore the supply of factors of production by assuming in effect that the supply of production factors is completely inelastic (Miron, 1979). It may be clear, at least from the theoretical point of view, that these models which take account of the demand side only are inadequate as long-run dynamic models. The availability of production factors such as labor and capital flows in a city should be an important determinant of its capacity to grow in the long run.

**SUPPLY-ORIENTED MODELS.** Supply-oriented dynamic models of urban growth regard a change in production factors as the main cause of urban change. They assume that the availability of inputs in a city, but not the demand for its products, determines the level of the city’s output and income, and that the supply of inputs changes internally and/or through labor and capital movements (Borts and Stein, 1964; Mills, 1967; Mills and Price, 1984; Smith, 1975). The supply-oriented model can be simply expressed as follows (Smith, 1975):
\[ Y = K^{a-1}N, \quad 0 < a < 1, \quad (2.11) \]
\[ \dot{K} = sY + v(r - r_c)K - dK, \quad 0 < s < 1, \quad v > 0, \quad d > 0, \quad (2.12) \]
\[ \dot{N} = nN + m(w - w_c)N, \quad n > 0, \quad m > 0, \quad (2.13) \]

where \( Y \) is output, \( K \) is capital, \( N \) is labor, \( r \) is the rental price of capital, and \( w \) is the wage rate. The saving ratio \( s \), the depreciation ratio \( d \), the national growth rate \( n \), and the coefficients \( a \), \( v \), and \( m \) are all constants. The \( \dot{\cdot} \) indicates differentiation with respect to time, and the subscript \( c \) means the national value. The second terms on the right hand side of (2.12) and (2.13) represent capital and labor movements, respectively, which respond to factor (capital and labor) price differentials.

Supply-oriented models are largely based on the neoclassical view of economics, highlighting the role of factor movements in determining the growth of urban income and output. The movements of factors occur whenever spatial differentials in factor prices exist and the movements continue until those differentials disappear at an equilibrium. It is argued that these factor movements not only increase the total output, but also dampen regional disparities in economic conditions, and consequently result in the efficient allocation of resources in society.

Supply-oriented urban dynamic models have been criticized by many scholars who question the validity of their underlying assumptions and self-adjusting mechanism (Miyao, 1987). Since the neoclassical adjustment/growth theory assumes ideal economic situations such as full
employment, complete information, and perfect competition and mobility, its automatic self-adjusting mechanism hardly works in the real world as hypothesized. In addition, the effect of supply responses to the demand side seems as important as demand responses to the supply side in the process of urban growth and decline.

DEMAND-SUPPLY INTERACTIVE MODELS. Criticisms of both demand- and supply-oriented models have led to the synthesis of the two views on urban dynamics. Paelinck (1970) simply extended the export base model so as to consider the effect of a city's population on the level of employment in the city's basic industry. Many similar demand-supply interactive models have been developed to emphasize the importance of both demand and supply in urban growth (Carlino and Mills, 1987; Greenwood, 1981; Greenwood and Stock, 1990; Mills and Price, 1984, Steinnes, 1977). In the crudest form, most of these demand-supply interactive models are as follows:

\[
\begin{align*}
\hat{E} &= a\hat{P} + b\hat{S}, \quad a > 0, b > 0, \quad (2.14) \\
\hat{P} &= c\hat{E} + dT, \quad c > 0, d > 0. \quad (2.15)
\end{align*}
\]

where \( \hat{E} \) and \( \hat{P} \) are employment and population growth, \( \hat{S} \) and \( T \) are vectors of exogenous (e.g., policy, socioeconomic, environmental, or regional) variables that affect \( \hat{E} \) and \( \hat{P} \), respectively. The system of these two equations can be solved for \( \hat{E} \) and \( \hat{P} \) as

\[
\hat{E} = \frac{a d T + b S}{1 - a c} > 0, \quad (2.16)
\]
\[ P - \frac{bcS + dT}{1 - ac} > 0, \quad (2.17) \]

provided that
\[ ac < 1. \quad (2.18) \]

While most of these interactive models can be regarded as an extension of the traditional models of export base growth, there is another type of demand-supply interactive models based on the principle of "cumulative causation," first suggested by Myrdal (1957). This principle emphasizes the existence of increasing returns to scale or agglomeration economies in manufacturing industries, and is intended to explain the cumulative advantages of fast-growing regions over slow-growing or declining regions (Richardson, 1978). Various spatial models of this cumulative causation are discussed in the following section.

2. Spatial Dynamic Models

Spatial dynamic models explicitly deal with the spatial and locational aspects of urban activities within and across regional/urban areas. While some models emphasize the subjective nature of individuals' decision making (e.g., place utility models), many others interrelate various location-specific factors within a general framework provided by the theory of consumer behavior. These spatial models can fall into two broad categories: intra- and inter-urban models. Intra-urban spatial models are concerned with the effects of dynamic factors (e.g., distance from the CBD, land and housing prices, transport costs, and income) on the spatial pattern of
residential location within an urban/metropolitan area. Inter-urban models, on the other hand, deal with the movement of individuals or households across regional/metropolitan areas, focusing on the determinants and consequences of migration across urban areas.

INTRA-URBAN MODELS. Since the decline of large central cities in the U.S. has historically resulted from the movement of central city households to the suburbs, many scholars in recent decades have concentrated their intra-urban studies on the process of suburbanization in metropolitan areas. The theory of suburbanization addresses the specific question of why people choose the suburb over the central city rather than the general question of why people choose a certain spot in an urban area. As far as the growth of the central city versus its suburbs is concerned, the model of suburbanization is more capable than the general model of explaining dynamics underlying the central city-suburban movement of population in a metropolitan area. Broadly speaking, two theories of suburbanization have been proposed: the "Accessibility" and "Flight from Blight" models (Follain and Malpezzi, 1981; Zorn, 1985).

The Accessibility model argues that suburbanization and the consequent decline of central cities result from income growth and technological improvements. As income rises, so does the demand for better and larger housing. Since land is generally cheaper in the suburbs than in densely populated central cities, households choose to live in the suburbs when they enjoy income growth. Furthermore, as improvements in transportation and communication technologies reduce
the costs of transport and communications, the disutility of commuting declines, and consequently the demand for suburban living increases still more.

The theory of the accessibility is based on the general theory of land use patterns in an urban area, which has traditionally been an application of microeconomic theory. According to the standard location models of Alonso (1964), Mills (1967), and Muth (1969), a utility maximizing household choose a spatial location with associated transport costs and amounts of land and housing at that location. A household, located at distance $x$ from the Central Business District, maximizes its utility, which depends on a consumption good $q$ and the amount of residential land $z$,

$$U(x) = U(q, z),$$

subject to its budget constraint

$$q + r(x)z = y - c(x),$$

where the price of the consumption good is normalized as unity, $r(x)$ is the price of land at $x$, $y$ is household income, and $c(x)$ is transport costs to the center. $r(x)$ is assumed to decline with distance $x$, while $c(x)$ is an increasing function of distance $x$. From equations (2.19) and (2.20), the following location equilibrium condition is derived:

$$\frac{dr}{dx} z = - \left( \frac{dc}{dx} - \frac{U_x}{U_q} \right)$$

where $U_x$ and $U_q$ are marginal utilities of distance and the composite good, respectively. The right hand side of equation (2.21) is a change in transport costs plus the monetized value of the disutility of a
commute, which at the optimal location must equal the change in outlays for land on the left hand side of the equation.

Since the Accessibility model focuses on land/housing consumption and one-dimensional distance gradients in a monocentric urban area, it ignores the importance of various neighborhood and regional characteristics such as socioeconomic composition, population density, environmental quality, or public services (Bradford and Kelejian, 1973; Grubb; 1982; Oates et al., 1971). While the Accessibility model emphasizes the positive effect of "pull" factors in destination (i.e., the suburbs), the Flight from Blight model focuses on the negative effect of "push" factors in origin (i.e., the central city). People leave the central city not because they prefer suburban living but because the city itself becomes a less desirable place to live. As the central city becomes more deteriorated, housing and neighborhood quality declines, and middle-to-upper income households flow to the suburbs.

The Blight-Flight model implies different urban policies which are almost opposite to those suggested by the Accessibility model. If the goal of policy is to stop or reverse the flow of population from the central city to the suburbs, the Accessibility model suggests that the best policy be heavy subsidization of land/housing in the city relative to its suburbs to offset suburban advantages due to their cheaper land. The Blight-Flight model, however, argues that only improvements in the city's conditions would result in the return of the wealthy. The Accessibility model rejects this as basically irrelevant, asserting
that rehabilitating the central city is relevant only to the extent it results in cheaper land/housing in the city relative to the suburbs.

A number of studies on intra-metropolitan dynamics have recently attempted to reconcile the Accessibility and Blight-Flight theories by showing the empirical evidence for a unified view of intra-metropolitan dynamics (Follain and Malpezzi, 1981; Zorn, 1985). They suggest that neither theory is sufficient by itself; both the Accessibility and Blight-Flight models are to be used in explaining the dynamic process of metropolitan growth or decline. Although this synthesis is based on the theory of microeconomics, it includes a variety of place characteristics such as economic, social, environmental, regional, and public policy factors as well as distance from the Central Business District.

In the synthesized model, a household is assumed to maximize its utility by choosing a location which best satisfies its preference for a combination of various location-specific attributes and an income constraint (Boehm and Ihlanfeldt, 1986; Hanushek and Quigley, 1978; Phipps, 1989; Wienberg, 1979). The household utility maximization problem is defined as the following constrained maximization problem:

$$\text{Max } U = U(h_i, q), \quad (2.22)$$

subject to

$$Y = P_h h_i + P_q q + T \quad (2.23)$$

where

$$h_i = h(S_i, A_i, N_i, G_i) \quad (2.24)$$

and the variables are defined as follows:
h_i = bundle of housing services supplied at location i, as a
function of structural characteristics (S), accessibility
(A), neighborhood quality (N), and government services (G) at
location i,
Y = household income,
P_h = price of housing services,
q = composite good representing all other goods,
P_q = price of q
T = taxes paid at location i.

Using such a synthesized model of intra-metropolitan mobility, many
empirical studies have estimated the dynamic effect of changes in the
levels of variables upon a household's equilibrium location. They
identified not only the internal disequilibrating influences (e.g.,
household preferences), but also the external disequilibrating
influences (e.g., public policies) on the process of urban change.
Empirical findings on these influences are discussed in the second
section of this chapter.

INTER-URBAN MODELS. Inter-urban dynamic studies stem largely from
simple attempts to model population change between regions, states, or
metropolitan areas. Those attempts take two--macro and micro--analytic
forms. Macro (or aggregate) analyses are concerned with the
descriptive and demographic explanation of migration flows, while micro
approaches emphasize panel and longitudinal studies of individual
behavior. Among a variety of inter-urban models, gravity models (as a
macro approach) and human capital models (as a micro approach) are those which have been the most popular during the past three decades.

Studies of aggregate population flows began with simple gravity model explanation of origins and destinations and of interaction between them. The gravity model is an attempt to explain the aggregate flows of migration by analogy to concepts developed in physics (Olsson, 1965). The general form of the gravity model in the migration context is

\[ M_{ij} = k \frac{p_i^a \cdot p_j^b}{D_{ij}} \]  

(2.25)

where \( M_{ij} \) is gross migration flow per period of time from place \( i \) to place \( j \), \( P \) is some measure of regional/urban mass (in this case populations), \( D_{ij} \) is distance between \( i \) and \( j \), and \( a, b, k \) and \( r \) are parameters.

The gravity concept in equation (2.25) basically postulates that the interaction between two places is determined by two counteractive forces: an attracting force created by the population masses of the two places and a friction caused by the distance between them. Thus, migration between two places is proportional to their sizes and inversely proportional to the distance between them.

Although any economic variables do not appear explicitly in the pure form of the gravity model as given in equation (2.25), the model has provided grounding for a number of empirical studies which emphasize the importance of the current size of population in changing its future size. Thus, many empirical findings suggest that population
size should be included in migration equations to capture the scale of social and economic structures that could attract potential migrants (Feeney, 1979; Mueser, 1989).

Sjaastad (1962), recently Da Vanzo (1980) and Shaw (1986), on the other hand, have recognized migration as an investment in human capital. According to this approach, a utility-maximizer would choose the location which offers the greatest expected net gain (income). The theory can be expressed simply in the following form:

$$ PV = \frac{B_j - B_i}{r} - C_{ij} $$ (2.26)

where $PV$ = the net present value of a migration investment (expected income),

$B_j$ and $B_i$ = the benefits in places $j$ and $i$, respectively,

$r$ = the rate of discount applied to future real income in $i$

$C_{ij}$ = the costs of migrating from $i$ to $j$.

Since one would expect the number of migrants moving from $i$ to $j$ ($M_{ij}$) to be positively related to $PV$, then

$$ M_{ij} = f [ \frac{B_j - B_i}{r} - C_{ij} ] $$ (2.27)

This formula states that an individual responds to the present value of the net gain which is given as the difference between the expected utilities of $i$ and $j$ minus the costs incurred of moving from $i$ to $j$, summed over the expected length of the remaining lifetime adjusted by the discount rate. Viewed in this perspective, population
growth will occur in the area which offers the greatest present value of expected income for would-be migrants.

Many researchers have used this theory either explicitly or implicitly, on its own, or as part of a broader framework. Most attempts to empirically estimate coefficients have taken the form of logit or probit models in which the decision to move is dichotomous and is a function of variables which might measure human capital formation, including the earnings of the individual, assets, length of residence, occupation, and distance to alternatives (Clark, 1982).

Empirical Evidence for Dynamic Effects

The discussion on these theoretical models will serve as a reference point for developing our dynamic urban model in the subsequent chapters. Since the unit of analysis in this study is places rather than individual households, more attention will be paid to models that reflect the aggregate analysis of population change. Non-spatial demand-oriented models help understand the relationship between employment (or public policy) and population change. The spatial intra-urban models, the Accessibility and Blight-Flight models, recognize the importance of differentials in many other private and public sector characteristics between the central city and its suburbs. Inter-urban models, especially the gravity models, help understand how an area's population size plays a role of determining the future size of population by changing the attractiveness of the area.

Most dynamic models reviewed in the previous section recognize population change as an important, even fundamental, component of urban
dynamics, and relate a variety of location-specific attributes to population change. It is through individual movements that households adjust their levels of housing consumption, and the aggregation of these individual changes results in an aggregate change in an area's population. Thus, differential urban growth can be largely explained in terms of differences among areas in the level of migration, which is determined by differences in a variety of the private and public sectors. The following sections discuss empirical evidence for the importance of various dynamic factors in population change.

1. Private Sector Influences

A variety of private sector variables have been recognized as the important determinant of migration. They include the socioeconomic, physical, and geographical characteristics of origins and destinations, though a lack of consistency exists among studies with respect to the specific variables used and the statistical significance of the variables. The subsequent section discusses the location effect of the private sector variables which are common in the literature. Table 2.1 presents a summary of the migration effects of various private sector variables.

WAGES/INCOME. Economists have traditionally emphasized economic opportunity differentials as the prime determinant of migration, as seen in the supply-oriented and human capital models. An important corollary of the neoclassical theory is that migration itself plays an equilibrating role by narrowing down wage differentials until they
### Table 2.1 The Location Effects of the Private Sector

<table>
<thead>
<tr>
<th>Place Factors</th>
<th>Effects</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wages/Income</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+</td>
<td></td>
<td>Glantz (1974)</td>
</tr>
<tr>
<td>+</td>
<td></td>
<td>Graves and Linneman (1979)</td>
</tr>
<tr>
<td>+</td>
<td></td>
<td>Graves and Regulska (1982)</td>
</tr>
<tr>
<td>+</td>
<td></td>
<td>Greenwood (1981)</td>
</tr>
<tr>
<td>+</td>
<td></td>
<td>Mills and Price (1984)</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>Greenwood and Stock (1990)</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>Weinberg (1979)</td>
</tr>
<tr>
<td>- (low) + (high)</td>
<td></td>
<td>Duncan and Duncan (1975)</td>
</tr>
<tr>
<td>- (low) + (high)</td>
<td></td>
<td>Reschovsky (1979)</td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>People-Follow-Jobs</td>
<td></td>
<td>Blanco (1964), Lowry (1966), Steinnes (1977)</td>
</tr>
<tr>
<td>Jobs-Follow-People</td>
<td></td>
<td>Borts and Stein (1964), Mills (1967)</td>
</tr>
<tr>
<td><strong>Housing Services</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity</td>
<td>+</td>
<td>Alperovich (1983)</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>Bradford and Kelejian (1973)</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>Palumbo and Hutton (1987)</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>Weinberg (1975)</td>
</tr>
<tr>
<td>Quality</td>
<td>- (low) + (high)</td>
<td>Reschovsky (1979)</td>
</tr>
<tr>
<td>S+(low) W+(high)</td>
<td></td>
<td>Bible and Brown (1981)</td>
</tr>
<tr>
<td>Price</td>
<td>-</td>
<td>Herzog and Schlottmann (1986)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Naroff and Liro (1982)</td>
</tr>
</tbody>
</table>
### Amenities

<table>
<thead>
<tr>
<th>Neighborhood Quality</th>
<th>+</th>
<th>Boehm and Ihlanfeldt (1986), Shear (1983), Weinberg (1979)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>-</td>
<td>Izraeli (1977)</td>
</tr>
<tr>
<td></td>
<td>0 (low) + (high)</td>
<td>Bradford and Kelejian (1973)</td>
</tr>
<tr>
<td></td>
<td>0 (low) + (high)</td>
<td>Greenwood and Stock (1990)</td>
</tr>
<tr>
<td></td>
<td>0 (low) + (high)</td>
<td>Grubb (1982)</td>
</tr>
<tr>
<td>Crime</td>
<td>-</td>
<td>Droettboom et al. (1971)</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Greenberg and Boswell (1972)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Greenwood and Stock (1990)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Mills and Price (1984)</td>
</tr>
<tr>
<td>Minority</td>
<td>-</td>
<td>Carlino and Mills (1987)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Bradford and Kelejian (1973)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Greenwood and Stock (1990)</td>
</tr>
<tr>
<td>Other Place Characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-</td>
<td>Bradford and Kelejian (1973)</td>
</tr>
<tr>
<td>Scale (Size)</td>
<td>+</td>
<td>Naroff and Liro (1982)</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>Bradford and Kelejian (1973)</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>Palumbo and Hutton (1987)</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>Reschovsky (1979)</td>
</tr>
</tbody>
</table>

1. -: negative effect on the location choice of households
   +: positive effect on the location choice of households
   0: little or no effect on the location choice of households

2. low: lower-income households
   mid: middle-income households
   high: higher-income households

3. S: strong effect (i.e., more sensitive)
   W: weak effect (i.e., less sensitive)

For example, S-(low) indicates strong and negative effects on lower-income households.
disappear and there is no further incentive for migration.

The importance of wage/income differentials as a determinant of migration has been extensively tested in the empirical literature. Many empirical studies show that an increase in the level of wages or income stimulates in-migration (Carlino and Mills, 1987; Graves and Linneman, 1979; Graves and Regulska, 1982; Greenwood, 1981; Mills and Price, 1984). Grouping households by their income, Zorn (1985) claims that higher-income households are more sensitive than lower-income households to changes in the median income of the neighborhood.

On the other hand, some studies argue for migration-generating income. According to the regional development theory, for example, in-migration may induce greater employment growth, which then leads to greater income growth in destinations, while out-migration may induce lesser employment growth, resulting in lesser income growth in origins (Henderson, 1982; Myrdal, 1957). Several scholars, however, state that the migration-generating-income argument does not always hold, depending upon who the in- and out-migrants are (Greenwood and Stock, 1990; Weinberg, 1979).

Not only is change in income as an indicator of change in economic opportunities, but also it is often used as a proxy for an overall change in the level of neighborhood amenities. Reschovsky (1979) has found that the higher the average income level of a location, the greater the number of higher income in-migrants and the lower the number of lower income in-migrants. This result is consistent with the "like-me hypothesis" of sociologists, which asserts that people generally prefer to associate with people of their own socio-economic
class (Duncan and Duncan, 1957). Greenwood and Stock (1990), however, found no consistent patterns of the relationship between suburban income change and the location of (higher-income or lower-income) households in the suburbs. Several studies even disclosed the existence of a tradeoff between real income and amenities: a higher level of amenity is associated with lower manufacturing jobs and consequently lower earnings (Roback, 1982; Rosen, 1979).

EMPLOYMENT. Of the sources of spatial population change, migration is likely to have the most immediate implications for employment. At the extremes, three theoretical approaches have been developed to characterize the relationship between migration and employment: the "people-follow-jobs" hypothesis, the "jobs-follow-people" hypothesis, and the simultaneous interaction between the two.

Challenging the orthodox--income differentials--theory, a group of scholars hypothesize that in areas suffering from economic distress workers will tend to migrate to places where job opportunities exist. Export base theory as well as the majority of the "people-follow-jobs" advocates address that employment change is exogenous and the main determinant of population movement (Blanco, 1964; Lowry, 1966; Steinnes, 1977). In this view, Blanco (1964) argues that "prospective unemployment" is critical in determining (inter-state) migration; the greater the growth of employment, the smaller is prospective unemployment, and hence the greater is the net in-migration.

The opposite relationship between migration and employment has later been argued: the "jobs-follow-people" argument hypothesizing a
one-way causation running from migration to employment change (Borts and Stein, 1964; Mills, 1967; Mills and Price, 1984). Under a number of assumptions, Borts and Stein (1964) claim that any increase in labor supply resulting from migration leads to an increase in employment. The Mills and Price simultaneous-equations model (1984) also provides evidence that jobs predominantly follow residents to suburbs.

Many recent studies have attempted to reconcile the two opposing views of the causal relationship between migration and employment by specifying a simultaneous-equations model of net migration and employment change (Carlino and Mills, 1987; Greenwood, 1981; Greenwood and Stock, 1990; Mills and Price, 1984; Steinnes, 1977; Steinnes and Fisher, 1974). The basic idea behind the simultaneous-equations model is that migration is responsive to job opportunities. Areas in which the rate of employment growth (job opportunity growth) is great are those that will experience the high rate of in-migration and the low rate of out-migration. Furthermore, the migrants themselves influence both the supply of, and demand for, local labor. Employment grows rapidly in those areas that are attractive to migrants, and employment declines in those areas that are suffering labor force losses due to out-migration. In such a model of mutual causality, migration is viewed as not only a consequence of employment change but also a cause of employment change.

HOUSING SERVICES. Typically three housing market variables are taken into account so as to measure the level of housing services in housing-mobility models: the quantity, quality, and price of housing.
Although a variety of measures exist, many studies seem to agree that the number of houses (or units) is a proxy for the quantity of housing (Alperovich, 1983; Greenwood and Stock, 1990; Reschovsky, 1979; Siegel, 1975) and that the age of the housing structure is a proxy for the quality of housing (Alperovich, 1983; Bradford and Kelejian, 1973; Naroff and Liro, 1982; Siegel, 1975).

Assuming that the level of housing services increases with the greater quantity of housing and decreases with lower quality, Alperovich (1981), Bradford and Kelejian (1973), and Weinberg (1975) have found that housing services have a positive effect on in-migration. Weinberg (1975) measures the tightness of the housing market in terms of mortgage rates, which were found to be inversely related to household mobility. In the Palumbo and Hutton (1987) model, the relative tightness of the housing market was measured by the ratio of central city to outside central city housing occupancy rates, which indicates the potential for population decentralization: the greater the ratio, the greater the number of in-migrants to suburbs.

Classifying movers by income level and housing tenure, Reschovsky (1979) has found that the mobility decisions of renters and owners are significantly different across income groups. The median number of rooms per housing unit has a negative coefficient for all lower-income households, for middle-income homeowners, and for higher-income renters. The variable, however, shows a positive sign for middle income renters, who tend to be young families, not yet able to afford a house, but desirous of suburban living in good, low density neighborhoods. In Bible and Brown’s (1981) and Phipps and Carter’s
(1983) studies, households classified as lower socio-economic status from the combinations of their income, occupation, and educational level, have less concern for the quality of local schools but have greater concern for property values, neighborhood status, and age of the dwelling than households of higher socio-economic status have. Using the growth of housing stocks as a measure of housing services, Greenwood and Stock (1990) have found that, during the 1960s and 1970s, lower-income movers from the central city to the suburbs had been attracted by new suburban rental housing, but discouraged by new suburban owner housing, while higher-income households had mostly been attracted by both types of new housing.

Not only the availability and quality of dwellings', but also the price of housing affects the mobility of households. In the study of inter-metropolitan migration, Herzog and Schlottmann (1986) have found that high housing price triggers out-migration of households. That is, the higher relative price of central city to suburban housing, the worse the relative position of the central city, the more likely the suburbs are chosen as a place of residence. Naroff and Liro (1982), however, observed unexpected signs, identifying that a tight housing market may not be a factor which turns people towards the other areas as a place to locate.

A rationale for the positive relationship between housing price and mobility might not be so simple, because the relative price variable captures the dynamic of the housing market—the supply of and the demand for housing. Incorporation of price into a household’s choice is an almost insurmountable task, especially due to the
heterogeneity of the housing market and the housing bundle. Thus, some
evidence suggests that the two measures for the quantity and quality of
housing are important determinants of housing prices as well, so they
can be used as a proxy for housing price (Reschovsky, 1979).

AMENITIES. A variety of amenity variables have been used to
measure the socioeconomic and environmental characteristics of
locations. As discussed above, public services, income, and housing
services are viewed broadly to include a bundle of amenities
(Alperovich, 1983; Carlino and Mills, 1987; Greenwood and Stock, 1990;
Weinberg, 1979). Amenities are also represented by other factors such
as neighborhood quality, population density, crime rate, ethnic
composition, and the like.

It appears from the migration literature that a household's
perceptions regarding the quality of neighborhoods are important
determinants of the household's mobility. Though Weinberg (1979)
observed that neither positive or negative changes in neighborhood
quality would have an important influence on the household's decision
to move, most empirical results show that households move in response
to declines or increase in neighborhood quality (Boehm and Ihlanfeldt,
1986; Shear, 1983).

To the extent that crowding and congestion are important
disamenities, population density would act both to push out residents
and to repel potential in-movement to the area (Izraeli, 1977). Bradford
and Kelejian (1973), Greenwood and Stock (1990), and Grubb
(1982) have found that the higher population density in central cities
tends to significantly influence higher-income households to select a suburban residence.

In addition, some studies show that crime has a significant effect on the residential location decision of households. According to Greenberg and Boswell (1972), the perception of deterioration—especially as related to a fear of crime—is the most important motivation for mobility among households in the New York metropolitan area. Droettboom et al. (1971) note that crime is a more important consideration in the movement of lower-income households than higher-income households, while Grubb (1982) argues that sensitivity to crime increases by income. Greenwood and Stock (1990) and Mills and Price (1984), however, assert that higher central city crime has little influence on location in the suburbs.

Several studies introduce the ethnic composition—mostly a proportion of minority population—in an area as an important determinant of mobility. Carlino and Mills (1987) and Mills and Price (1984) support its positive impact on the flight of households, while Bradford and Kelejian (1973) and Greenwood and Stock (1990) claim that the relative concentration of nonwhite persons in the central city have little influence on the selection of a suburban residence.

OTHER PLACE CHARACTERISTICS. Some migration studies adopted a small number of regional variables (mostly dummies) to characterize the internal structure of economic activities, geographic attributes, or institutional and political systems in a metropolitan area. Not only the region where the central city is located, but also the age and
scale of the city have been used. Bradford and Kelejian (1973) have found that the age of the central city in a metropolitan area contributes to increased flight of the rich to the suburbs and/or increased concentration of the poor.

In addition, the scale of the central city in a metropolitan area has been often employed in the migration research. It is expressed in various terms such as the degree of concentration of the metropolitan population in a central city (Bradford and Kelejian, 1973), the degree of central city dominance in the economic activity of a metropolitan area—the central city concentration of metropolitan employment (Reschovsky, 1979), the percentage of central city housing units in a metropolitan area (Naroff and Liro, 1982), the geographic distance from the Central Business District of the central city to the metropolitan boundary (Naroff and Liro, 1982), or the percentage of city land area in a metropolitan land area (Palumbo and Hutton, 1987).

2. Public Sector Influences

Interest in the effect of public policies on urban change arose with the pioneer study of Tiebout (1956), who attempted to solve efficiency problems associated with the provision of public goods. While the development of Tiebout's original hypothesis involves the relationship between population movement and various public policy variables, one group of studies has concentrated on the capitalization of taxes and spending in property values rather than on migration per se (Edel and Sclar, 1974; Hamilton, 1976; Heinberg and Oates, 1970; Meadows, 1976; Oates, 1969; Reinhard, 1981; Zorn, 1985). By estimating
the capitalization of location-specific characteristics into housing values, these studies have identified fiscal characteristics as a significant factor in an average household's residential choice decision. With complete capitalization, the fiscal surplus is exactly offset by differences in property values, implying that the two areas are equally attractive and that there is no incentive to migrate to the area with the fiscal surplus. However, most empirical findings suggest that capitalization is not complete, in which case one does expect to observe the movement of households (Edel and Sclar, 1974; Oates, 1969; Reinhart, 1981; Zorn, 1985).

A large number of other studies on the Tiebout hypothesis have been concerned with examining the direct impact of fiscal considerations on population movements. The migration effect of a variety of fiscal variables are summarized by Table 2.2. While a few studies present an insignificant effect of the property tax on the location decision of individuals (Fisher and Fisher, 1975; Steinnes and Fisher, 1974), most empirical results show that individuals are at least somewhat sensitive to living cost differentials resulting from differences in property tax levels between jurisdictions.

Some studies note that the migration sensitivity to changes in property taxes also varies significantly across income groups (Cebula, 1981; Zorn, 1985). Cebula (1981) argues that property tax levels have a much greater impact on higher-income households than on lower-income persons because by and large a relatively large portion of higher-income persons as compared with their counterparts are property owners. Zorn's (1985) analysis of San Francisco, however, shows that higher-
Table 2.2 The Location Effects of the Public Sector

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<th>Place Factors</th>
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<td><strong>Taxes</strong></td>
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<tr>
<td>Overall</td>
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<td>Property Tax</td>
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<td>W-(high)</td>
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<td><strong>Expenditures</strong></td>
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<tr>
<td>Overall</td>
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<td>Oates et al. (1971)</td>
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<td></td>
<td>S+(low)</td>
<td>Grubb (1982), Zorn (1985)</td>
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<td></td>
<td>W+(high)</td>
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<tr>
<td>Welfare</td>
<td>+</td>
<td>Brehm and Saving (1964)</td>
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<tr>
<td></td>
<td>+ (low)</td>
<td>Aronson and Schwartz (1973)</td>
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<td></td>
<td>- (high)</td>
<td>Cebula (1981)</td>
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<td></td>
<td>+ (low)</td>
<td>Cebula et al. (1973)</td>
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<td></td>
<td>- (high)</td>
<td>Sommers and Suits (1973)</td>
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<tr>
<td>+ (mid)</td>
<td>0 (high)</td>
<td>Ellson (1980)</td>
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1. -: negative effect on the location choice of households
2. +: positive effect on the location choice of households
3. 0: little or no effect on the location choice of households

low: lower-income households
mid: middle-income households
high: higher-income households

1. S: strong effect (i.e., more sensitive)
2. W: weak effect (i.e., less sensitive)

For example, S-(low) indicates the strong and negative effect on lower-income households.
income households are less sensitive than their counterparts to changes in the property tax rate.

Much controversy surrounds the effect of local taxes on households when overall tax revenues are used as a tax measure (Carlino and Mills, 1987; Mills and Price, 1984; Oates et al., 1971; Reschovsky, 1979). Oates et al. (1971) observed a greater increase in the median family income in the cities with lower taxes per capita over the 1950's than in those with higher taxes. According to Reschovsky (1979), however, the total effective tax rate has a significant impact on the residential choices of lower-income homeowners and renters and middle-income renters, whereas its coefficients are insignificant for both middle-income homeowners and rich renters and homeowners.

In contrast with much of the public finance literature, however, Carlino and Mills (1987) note that total local taxes per capita have little impact on the location of households at all. Mills and Price (1984), furthermore, come up with unexpected, positive signs of tax variable coefficients. Relatively high central city tax rates are shown to be significantly related to large density gradients—less suburbanization. The authors conjecture that to some extent high taxes provide high-quality or large-quantity local government services, and the result is to attract residents.

As a proxy for the level of output and quality of public services, government expenditures have also received extensive investigation. The studies on the impact of expenditures on population movement can be divided into two: studies on special services such as welfare and education, and those on more general categories of expenditures. While
some studies present very significant effects of most public services on the growth or decline of urban areas, others show only limited or no significant effects. One important reason for such inconsistent findings is that each unit of analysis (e.g., the city) in these studies is unique in its revenue and expenditure assignment system, which makes it difficult to produce cross-sectional uniformities.

Since public welfare is not a "local" public good in most of the U.S. metropolitan areas, it has been largely discussed in the literature on regional/metropolitan growth and decline rather than in the literature on the intra-metropolitan process of urban growth and decline. Traditionally, the literature on inter-regional migration has viewed income differentials as a major determinant of location decisions. At least for welfare recipients, welfare benefits are an extension of or form of income; hence, if there exist significant geographical welfare differentials, would-be (or actual) welfare recipients are likely to respond to such differentials, ceteris paribus. Some empirical studies agree that the high level of welfare benefits acts as an attraction to poor migrants (Cebula, 1981; DeJong and Donnelly, 1973; Glantz, 1974; Pack, 1973), while others have found that the level of welfare payments plays no role in determining migration flows (Cebula, Kohn and Gallaway, 1973; Sommers and Suits, 1973).

However, there is some evidence that the high level of welfare benefits in effect represents an economic disincentive to the "better-off" (Aronson and Schwartz, 1973; Cebula, 1981). Because welfare benefits represent a redistribution of income through a tax-transfer
process from the economically better-off to the economically worse-off, higher-income households may view the area with high welfare benefits as the area with great income redistribution from themselves to others. Thus, the higher the level of welfare benefits in an area, the less likely it is to be attractive to the economically better-off, ceteris paribus.

Per capita school spending has widely been used as an output measure of local public schools in many migration studies. Most of the Tiebout analyses show a significant degree of capitalization of public education, implying the importance of good schools in residential choice decisions. According to Grubb (1982), the relatively high level of city school spending has a significant effect on the suburbanization of households, though none of the other public expenditures by and large are shown to be significant.

Reschovsky (1979) presents some significant differentials in the importance of public school spending across households of different socio-economic groups. For higher-income homeowners and middle-income renters, the school expenditure variable has a significant positive coefficient. This result supports the widely held view that higher-income households and middle-income families with children have a strong preference for high quality education. However, the coefficients of the school variable are significantly negative for higher-income renters and middle-income owners. It is likely that higher-income renters are primarily middle-aged and elderly without school-aged children. For the negative impact on middle- and lower-income homeowners, Reschovsky conjectures that the existence of zoning
and building code regulations results in the over-capitalization of high quality schools, raising housing prices so as to discourage middle- and lower-income movers.

The other public services often studied in the literature include police, fire, sewerage, sanitation, park and recreation, libraries, highways, public housing, and other utilities and public works. Using the aggregated data on the total local spending applicable to each location, Cebula (1981), Liu (1977), and Oates et al. (1971) observed a significant positive influence on the movement of individuals: the higher the per capita level of overall spending on these services in an area, the more attractive the area is to would-be migrants. Oates et al. (1971) suggest, furthermore, that a rise in public spending is a more powerful policy per dollar in terms of inducing higher-income households to locate in the area than is a reduction in local taxes.

As in the welfare and education cases, there is also some evidence for the complicated effect of those general municipal expenditures. To the extent that the level of local spending implies a high level of tax burdens and that higher-income persons view their share of the tax burden as relatively greater than that of lower-income persons, the high level of local government spending may be expected to be a more potent attracting force for lower-income movers than higher-income movers. The empirical results of Grubb (1982), Reschovsky (1979), and Zorn (1985) agree with this expectation. Reschovsky (1979) argues, in explaining the negative effect on higher-income households, that lower-income households rely more on the public sector to obtain public
services than do higher-income families, who may prefer many of these services to be provided through the private sector.

A small number of other scholars uses a composite index of the public sector, incorporating both taxes and expenditures into a single indicator. Aronson and Schwartz (1973) recognize the "imputed fiscal transfer (IFT)" of an individual as the key determinant of migration, which is defined as the difference between the per capita expenditures of the community and the taxes the individual pays. Comparing the actual shifts in population distribution among towns in the Harrisburg area to changes predicted by the IFT model, Aronson and Schwartz (1973) conclude that the individual's assessment of the magnitude of the IFT in various communities determines significantly the direction of migration.

Based on Gillespie's (1965) estimates of the incidence of state and local government expenditures and taxes by income group, Bradford and Kelejian (1973) construct different measures of the net fiscal surplus--per family expenditures minus family tax payments--for the middle- and lower-income groups. While Aronson and Schwartz (1973) rely on estimated data on the property taxes and local expenditures, Bradford and Kelejian (1973) use the actual data on the total amounts of a city's general expenditures, its own revenues, and grants-in-aid. Bradford and Kelejian (1973) have found that city-suburb fiscal surplus differentials do affect how population decentralizes but have no effects on firms. Using a similar model with 1970 and 1980 data, Summers and Luce (1987) show small, marginally significant tax and spending effects for both households and firms.
Ellson (1980), in a study of the central city versus suburban location for fifty metropolitan centers, employed a slightly different index of fiscal surplus, which measured the ratio of per capita government expenditures to per capita local taxes in the central city to that in the suburbs. In his total sample, the fiscal variations appear to have a significant effect on residential location, concluding that middle-income households are quite sensitive to fiscal influences. When the sample is disaggregated into declining and growing central cities, however, the concept of fiscally induced location is viable only in a limited sense. For the middle-income group, fiscal variations are no longer statistically significant in metropolitan areas with declining cities, where they are marginally significant in the sample with growing central cities. For the upper-income group, on the other hand, the fiscal variables are insignificant in all cases.

Summary and Concluding Comments

The purpose of this chapter has been to review the literature and issues which are of relevance to the present study. Attention has been paid to various models which shed light on the complex phenomenon of urban growth and decline. In addition, voluminous empirical evidence has been provided for the relative importance of a variety of private and public sector variables in the dynamic process of population change.

Focusing on relationships among urban activities in a single urban area, non-spatial dynamic studies have recognized the importance of various private sector variables in the process of urban growth and
45

decline. Demand-oriented models are concerned with the effect of employment on population change, while supply-oriented analyses specialize in the effect of population on the growth of employment and income. Demand-supply interactive models, on the other hand, emphasize the interactive relationship between population change and various economic activities in an urban area.

Spatial dynamic studies, however, explicitly deal with the spatial and locational pattern of urban activities within and across urban areas. A variety of push and pull factors are incorporated both in the intra- and inter-urban models of population change. For the intra-urban (re)distribution of population, the deterioration of the central city and the advantages of suburban living are emphasized in the models of suburbanization. Inter-urban models, on the other hand, attempted to identify the macro- or micro-level of determinants of migration between urban areas.

The discussion on these theoretical models and empirical findings will serve as a reference point for developing our dynamic urban model in the subsequent chapters. It provides an insight into the ways in which various types of private and public sector factors are treated in urban models, as well as the importance of these factors in the process of urban dynamics. Since the unit of analysis in this study is places rather than individual households, more attention will be paid to such models that reflect the aggregate analysis of population change as non-spatial demand-oriented, intra-urban, and inter-urban gravity models. It is from demand-oriented models that the relationship between employment (or public policy) and population change is derived. The
spatial intra-urban models of suburbanization—the accessibility and blight-flight models—recognize the importance of differentials in many other private and public sector characteristics between the central city and its suburbs. Inter-urban models, especially the gravity models, help us understand how an area's population size plays a role of determining the future size of population by changing the attractiveness of the area.

However, there seem to be several directions in which urban dynamic studies can be extended. First, most of the existing studies deal with either a single urban area (in non-spatial models) or two areas—origin and destination (in spatial models). Since a single or two urban area(s) are only part of a larger system and get along with the rest of the urban system, these dynamic analyses of a single or two area(s) should be taken cautiously and be regarded as a first step toward a more general treatment of the area(s) which interact with the rest of the system (Miyao, 1987).

With respect to dynamic elements in urban models, many studies have found fairly consistently that the private sector affects strongly the decision of at least some of the actors in the dynamic process. Although not unanimous, empirical evidence also supports the view that state and local government tax and expenditure policies can have systematic effects on urban growth and decline by influencing locational choices of individuals.

However, there is little agreement among the studies regarding the relative importance of factors (especially, the public sector) in the dynamic process. Nor is there strong evidence regarding how the effect
differs across income groups. Much of the ambiguity in these empirical results is due to the inconsistency of model specification and operationalization among the studies. Despite a wide variety of theoretical models, little progress has been made to develop a general form of dynamic models. In order to improve confidence in the validity of empirical results, there should be some sort of the generally accepted way of modelling fiscal influences and incorporating them in the functional form of dynamic urban models.
CHAPTER III
CONCEPTUAL FRAMEWORK

Introduction

The previous chapter discussed the major considerations associated with developing a dynamic urban model and identifying the influences of various factors on urban dynamics. The discussion provides an insight into the ways in which various types of private and public sector factors are treated in dynamic urban models, as well as the importance of these factors in the process of population change. Non-spatial models help us understand the dynamic relationship between population change and urban activities in an area. Spatial models, on the other hand, show how area differentials in many private and public sector characteristics play a role of changing migration between urban areas.

Based on the theoretical and empirical findings, this chapter develops a general model of urban growth and decline. The model takes explicit account of both time and space. A precise explanation of the model is followed by discussions of the spatial and intertemporal process of urban growth and decline. Several implications are drawn from the dynamic model so as to help understand the dynamic process of urban growth and the effect of government policies in the dynamic context. The role of government in urban dynamics will be addressed in the next chapter, along with the basic issue of government intervention in our urban structure.
A Dynamic Model of Urban Growth and Decline

In this section a three-sector urban model is developed to explain the dynamic process of urban decline and growth. The main concern here is with intertemporal and spatial relationships among population, location-specific attributes which include the private and public sectors, migration, and urban growth/decline. In the model, a change in a city's population affects the private sector--economic, social, and physical conditions--in the city. Along with an exogenous change in public policies, changes in the socio-economic structures of both the city and the rest of urban areas in the system influences migration, which results in a change in the city's future population.

The model is concerned with three areas, which are the central city, its suburban area, and the area beyond the metropolitan area (SMSA). An area's decline (or growth) is defined descriptively as a loss (or gain) in its population. Since many scholars (e.g., Bradbury et al., 1982; Long, 1988) observed that population changes in U.S. central cities had been historically attributed to migration, no natural increases (births minus deaths) are assumed here so as to focus on the role of migration as the most significant component of urban change. The model consists of 9 equations. The first set of 4 equations, two of which are identities, relates to population and population change in the central city, its suburban area, and the area outside the SMSA. The second 2 equations are for migration in the central city and in its suburban area. Moreover, a set of 3 equations is constructed for each respective location-specific attributes of the
private sectors in the central city, its suburban area, and the area outside the SMSA.

Since there are only three areas and no natural increases are assumed, the combined population of the three areas in period \( t \) becomes constant and population change in an area is equal to net in-migration into the area. Thus,

\[
\begin{align*}
\dot{P}_t &= P^c_t + P^s_t + P^o_t \\
\dot{P}^c &= M^c \\
\dot{P}^s &= M^s \\
\dot{P}^o &= M^o = -(M^c + M^s)
\end{align*}
\]  

(3.1) \hspace{1cm} (3.2c) \hspace{1cm} (3.2s) \hspace{1cm} (3.2o)

where \( P_t \), \( \dot{P} \), and \( M \) represent population in period \( t \), population change, and net migration in an area, and the superscripts \( c \), \( s \), and \( o \) indicate a central city, its suburban area, and the area outside the SMSA, respectively.

It appears from the migration literature, which was reviewed in the previous chapter, that an individual's propensity to migrate depends on various location-specific factors in the private and public sectors. Thus, an individual in an area optimizes location by selecting some combination of private and public goods in and outside the area, i.e.,

\[
M^c = M^c(x^c, g^c, x^s, g^s, x^o, g^o)
\]

\[
\left(\frac{\partial M^c}{\partial x^c} > 0, \frac{\partial M^c}{\partial x^s} < 0, \frac{\partial M^c}{\partial x^o} < 0\right)
\]  

(3.3c)
\[ M^S - M^S(x^C, g^C, x^S, g^S, x^O, g^O) \]

\[ (\frac{\partial M^S}{\partial x^C} < 0, \frac{\partial M^S}{\partial x^S} > 0, \frac{\partial M^S}{\partial x^O} < 0) \]  

(3.3s)

where \( x \) represents a vector of private sector variables and \( g \) is a vector of public sector variables. The equations postulate that an increase in a city's private sector levels stimulates in-migration into the city, while an increase in the private sectors of the other areas discourages in-migration into the city. The private sector factors include a variety of economic, social, and physical conditions such as economic opportunities, income, housing services, and neighborhood amenities, whereas the public sector represents various fiscal activities of state and local governments. The concept of the public sector used in the model does not imply Samuelson's (1954) definition of public goods; rather, it encompasses governmental actions which are location-specific.

Although the migration equations posit that individuals are sensitive to changes in the private and public sectors, capitalization often complicates our expectations for the migration sensitivity of the private and public sectors. As Hamilton (1976) has pointed out, the migration effects are closely related to the degree of capitalization in labor, land, and/or housing markets. To the extent that changes in the private and public sectors translate into price changes (capitalization into land and/or housing values or wages), migration would be prevented.
The sensitivity may also change as capitalization effects change over time. If some location-specific attributes (e.g., employment, geographic amenities, and public services) are in scare supply, then a certain area possessing them will enjoy a competitive advantage over the other areas. This advantage can be capitalized, as land and/or housing values in the area are bid up by those seeking entry. However, over time such a capitalized advantage will be bid away if the other areas are able to possess the attributes that are in short supply. In this sense, one could identify the possible different effects of the private and public sectors in the short run vs. long run.

Many urban and regional studies also specify population as an important determinant of private sector differentials. For example, the positive relationship between population and employment is theoretically justified by demand-oriented dynamic models (Greenwood, 1981; Greenwood and Stock, 1990; Lowry, 1967; Steinnes, 1977). In addition, some studies argue that location-specific amenities tend to be negatively related to population (Boehm and Ihlanfeldt, 1986; Diamond and Tolley, 1982; Izraeli, 1977). Thus, the private sector is simply expressed as a function of population:

\[ x^c = x^c(p^c_t) \]  
(3.4c)

\[ x^s = x^s(p^s_t) \]  
(3.4s)

\[ x^o = x^o(p^o_t) \]  
(3.4o)
The Dynamic Process of Population Change

Why are some cities growing while others are declining? What internal forces in our urban structure make cities grow or decline? How do various private sector factors work in the process of urban growth and decline? Is the endogenous process of urban dynamics either a self-adjusting or self-reinforcing phenomenon? Although a detailed discussion of two theoretical views on the urban system is reserved until Chapter 5, this section provides an illustration of urban dynamics in the context of the model so as to answer those questions.

In order to simplify the analysis, we choose as the determinant of migration only two private sector variables—employment (E) and neighborhood amenities (A). These two variables are those which many studies on urban economics and migration have identified as the most important elements in the dynamic process (Boehm and Ihlanfeldt, 1986; Carlino and Mills, 1987; Greenwood and Stock, 1990). It is also consistent with the literature that migration into an area depends on the high levels of employment and amenity in the area, while increases in the employment and amenity levels of the other areas reduce net in-migration into the area. Thus, the migration equation (3.3c) for the central city can have the following form:

$$M_C = M_C(E^c, A^c, g^c, E^s, A^s, E^o, A^o, g^o)$$

(3.3c-1)

where E and A indicate the levels of employment and neighborhood amenities, respectively.
If some interactions are assumed between the private sector variables, the employment equation (3.4c) is of the following form:

\[ E^c = E^c(P^c_t, A^c) \quad \left( \frac{\partial E^c}{\partial P^c_t} > 0, \frac{\partial E^c}{\partial A^c} < 0 \right). \]  

(3.4c-1)

This equation posits that the central city's employment opportunity level depends on its population size and location-specific amenities; a large population is associated with a high level of employment and a lower level of amenities. The positive relationship between population and employment is theoretically justified on the basis of agglomeration economies and other demand-side stimulative effects of population on employment (Borts and Stein, 1964; Mills, 1970; Mills and Price, 1984). Though the effect of amenities on employment often becomes uncertain, some empirical work supports the existence of a tradeoff between the two: a higher level of amenities is associated with fewer manufacturing jobs and consequently lower earnings (Roback, 1982; Henderson, 1982).

Amenities include a variety of location-specific traits such as population density, housing services, and other physical characteristics in the central city. They are largely expressed as a function of population and other private sector variables (here, employment) in the city:

\[ A^c = A^c(P^c_t, E^c) \quad \left( \frac{\partial A^c}{\partial P^c_t} < 0, \frac{\partial A^c}{\partial E^c} < 0 \right). \]  

(3.4c-2)

The amenity equation postulates that amenities diminish with increased population size and employment. For example, a larger population tends to increase congestion, travel distances, travel time, pollution, and
crime. The negative relationship between amenities and employment is supported by Roback's (1982) and Henderson's (1982) work.

From these new equations for the central city and appropriate substitutions, the first-order differential equation of the city's population is derived in the following general form:

\[
P^C = M^C[x^C(P^C), g^C, x^S(P^S), g^S, x^O(P^O), g^O] - M^C[E^C[P^C, A^C(P^C)], A^C[P^C, E^C(P^C)], g^C, E^S, A^S, g^S, E^o, A^o, g^o] (3.5)
\]

where all the private and public sectors in the other areas are fixed. The partial equilibrium condition for this dynamic model is that \( \dot{P}^C = 0 \), which implies \( \dot{P}^S + \dot{P}^O = 0 \). That is, given the values of \( g^C, E^S, A^S, g^S, E^O, A^O, g^O \), the equilibrium level of population, \( P^C \), can be determined by setting equation (3.5) equal to zero. For the population to be in dynamically stable equilibrium, we must have

\[
\frac{\partial P^C}{\partial p^C} = \frac{\partial M^C}{\partial x^C} \frac{\partial x^C}{\partial p^C} = \frac{\partial M^C}{\partial E^C} \frac{\partial E^C}{\partial p^C} + \frac{\partial M^C}{\partial A^C} \frac{\partial A^C}{\partial p^C} + \frac{\partial M^C}{\partial E^C} \frac{\partial A^C}{\partial p^C} + \frac{\partial M^C}{\partial A^C} \frac{\partial E^C}{\partial p^C} < 0 \quad (3.6)
\]

where the feedback effect of employment on employment itself through amenities and that of amenities on amenities themselves through employment are assumed to be insignificant (i.e., \( \frac{\partial E}{\partial A} \frac{\partial E}{\partial A} = 0 \) and \( \frac{\partial A}{\partial E} \frac{\partial A}{\partial E} = 0 \)).
The first term on the right hand side of equation (3.6) represents the direct effect of population on migration through employment, where a change in population affects economic opportunities in equation (3.4c-1), which in turn affects migration through (3.3c-1). The second term is the indirect effect of population on migration through the interaction of employment and amenity levels. A change in population influences amenities through (3.4c-2), which in turn affects employment through (3.4c-1), and then migration through (3.3c-1).

The third term represents the amenity effect of population change, where a change in population directly influences the amenity level in equation (3.4c-2), which in turn affects migration through equation (3.3c-1). The fourth term is the indirect effect of population on migration through the interaction of employment and amenity levels. A change in population affects the employment level through (3.4c-1), which determines the amenity level through (3.4c-2) and migration through (3.3c-1). The transmission mechanism of equation (3.6) is presented in Figure 3.1.

With the help of Figure 3.1, the dynamics of the model can be described as follows. If a city is in its decline phase (i.e., $\hat{P} < 0$), $P_t$ decreases (arrow 1 in Figure 3.1). A loss in $P_t$ will decrease the employment level (arrow 2), which in turn will discourage directly in-migration into the city (arrow 3) and, on the other hand, encourage indirectly in-migration by increasing the amenity level (arrows 6 and 5). At the same time, a loss in population $P_t$ will increase the amenity level (arrow 4), which will induce in-migration into the area.
Figure 3.1 The Dynamic Process of Population Change
directly (arrow 5) and, on the other hand, discourage in-migration indirectly by decreasing the employment level (arrows 7 and 3).

A similar argument would apply when a city is in the growth phase (i.e., \( \hat{P} > 0 \)). Being in the growth phase implies that \( P_t \) increases (arrow 1). A rise in \( P_t \) will increase the employment level (arrow 2), which in turn will encourage in-migration into the city directly (arrow 3) but, discourage it indirectly through amenities (arrows 6 and 5). At the same time, a rise in population \( P_t \) will decrease the amenity level \( A \) (arrow 4) and discourage in-migration into the area directly (arrow 5) and encourage it indirectly through employment (arrows 7 and 3).

Such a dynamic process of population change confirms that both self-reinforcing and self-adjusting forces exist in our urban structure. Self-reinforcing forces are indicated by the arrows of positive effects in Figure 3.1 (i.e., the positive terms on the right side of equation 3.6): arrows 2-3 (the 1st term in equation 3.6) and arrows 4-7-3 (the 2nd term in equation 3.6). Self-adjusting forces, on the other hand, are represented by the arrows of negative effects in Figure 3.1 (i.e., the negative terms on the right side of equation 3.6): arrows 4-5 (the 3rd term in equation 3.6) and arrows 2-6-5 (the 4th term in equation 3.6). These two dynamic forces in the process of population change are illustrated in Table 3.1.
Table 3.1 Relationships among Dynamic Elements and Types of Dynamic Forces in the Process of Population Change

<table>
<thead>
<tr>
<th>Terms on the Right Hand Side of eq. (3.6)</th>
<th>Relationships among Dynamic Elements</th>
<th>Types of Dynamic Forces</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st term Population (+)</td>
<td>Employment (+) Migration</td>
<td>Self-Reinforcing</td>
</tr>
<tr>
<td>2nd term Population (-) Amenities (-)</td>
<td>Employment (+) Migration</td>
<td>Self-Reinforcing</td>
</tr>
<tr>
<td>3rd term Population (-)</td>
<td>Amenities (+) Migration</td>
<td>Self-Adjusting</td>
</tr>
<tr>
<td>4th term Population (+) Employment (-)</td>
<td>Amenities (+) Migration</td>
<td>Self-Adjusting</td>
</tr>
</tbody>
</table>
The Dynamic Path of Population Change

The pattern of a city's dynamic change in population is ultimately dependent upon how strong each of the two--self-adjusting and self-reinforcing--forces is and to what extent each offsets the other. The interaction of these two forces is reflected by the city's population function, of which slope (i.e., the value of $\frac{d\hat{P}}{dP}$ in equation 3.6) shows the pattern of population change. If all the basic equations in the model are assumed to represent the relationships among the variables in period $t$, a city's population in the next ($t+1$) period is simply obtained in the following general form:

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

$$= F(P_t, g)$$ from the migration equation (3.3c). (3.7)

If the public sector is assumed to be exogenously determined, the first-order difference equation of the population function generates several basic types of time path, which depend on the slope of population function $F(P_t)$. Table 3.2 summarizes the types of time path of the city's population by the range of possible values of $dF(P_t)/dP_t$. The equilibrium population becomes dynamically stable if the absolute value of $dF(P_t)/dP_t$ is less than 1 (i.e., $\frac{d\hat{P}}{dP}$ is negative), while it is dynamically unstable if the value is greater than 1 (i.e., $\frac{d\hat{P}}{dP}$ is positive). The stability condition states that in the neighborhood of
the equilibrium population, a decrease in population (or an increase if a city is in the growth phase) increases (or decreases) the rate of population growth (i.e., net in-migration). This occurs when the sum of the self-adjusting effects offsets the sum of the self-reinforcing effects. The population, on the other hand, is dynamically unstable if the self-reinforcing forces dominate the self-adjusting forces. Table 3.2 contains as many as six different possible cases of $dF(P_t)/dP_t$ specification, four of which are discussed with a graphical presentation.

Type (i) and (ii) are characterized by positive slopes, with one slope being less than unity and the other one greater than unity. The remaining two--type (iii) and (iv), on the other hand, are negatively sloped; one slope is between -1 and 0, the other one is less than -1. The algebraic sign of the slope determines whether there will be oscillation: while the positive slope generates the nonoscillatory time paths as in type (i) and (ii), the negative slope lead to the oscillatory time paths as in type (iii) and (iv).

The absolute value of the slope governs the question of convergence or stability. Since the slope of the phase line in type (i) and (iii) is less than 1 in its absolute value, the dynamic process results in a stable equilibrium population either through a nonoscillatory or oscillatory movement. When the phase line is greater than 1 in its absolute value, as in type (ii) and (iv), a divergent, unstable time path emerges.
<table>
<thead>
<tr>
<th>Type</th>
<th>Slope of $F(P_t)$</th>
<th>Nature of Time Path $P_t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE (ii)</td>
<td>$1 &lt; \frac{dF(P_t)}{dP_t}$</td>
<td>Non-oscillates, diverges from $P_e$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\frac{dF(P_t)}{dP_t} = 1$</td>
</tr>
<tr>
<td>TYPE (i)</td>
<td>$0 \leq \frac{dF(P_t)}{dP_t} &lt; 1$</td>
<td>Non-oscillates, converges to $P_e$</td>
</tr>
<tr>
<td>TYPE (iii)</td>
<td>$-1 &lt; \frac{dF(P_t)}{dP_t} &lt; 0$</td>
<td>Oscillates, converges to $P_e$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\frac{dF(P_t)}{dP_t} = -1$</td>
</tr>
<tr>
<td>TYPE (iv)</td>
<td>$\frac{dF(P_t)}{dP_t} &lt; -1$</td>
<td>Oscillates, diverges from $P_e$</td>
</tr>
</tbody>
</table>
Figure 3.2 Type (i)

Figure 3.3 Type (ii)
Figure 3.4 Type (iii)

Figure 3.5 Type (iv)
TYPE (i): DAMPED WITHOUT OSCILLATION. This occurs whenever the slope of the $F(P_t)$ is positive and less than that of a 45 degree line, i.e., when
\[ 0 \leq \frac{dF(P_t)}{dP_t} < 1. \]
This means that the phase line cuts the 45 degree line from above and the time path of $P_t$ will be as in Figure 3.2.

For this phase line, the iterative process leads from an initial population ($P_0$) to the equilibrium value ($P_e$) in a steady path, without oscillation. From wherever $P_0$ is located, $P_t$ will move in the same direction toward the equilibrium point $Q$ and equilibrium value $P_e$. That is, $P_t$ will rise up to $P_e$ steadily through time if $P_t$ rises from any one period to the next (when $P_e > P_0$). On the other hand, $P_t$ keeps on falling until it reaches at $Q$ if it falls.

TYPE (ii): EXPLOSIVE WITHOUT OSCILLATION. This will occur whenever the slope of $F(P_t)$ is greater than that of a 45 degree line, i.e., when
\[ 1 > \frac{dF(P_t)}{dP_t}. \]
Here $F(P_t)$ has a positive slope and cuts the 45 degree line from below. Given this phase line, whose slope exceeds unity, a divergent time path emerges. From an initial value $P_0$ greater than $P_e$, the arrowheads lead steadily away from the equilibrium to higher and higher $P_t$ values. An
initial value lower than $P_e$ gives rise to a similar steady divergent movement in the opposite direction. In this phase line, therefore, the time path of $P_t$ will be unstable as shown in Figure 3.3 by arrows which move further and further away from the equilibrium point $Q$ and equilibrium value $P_t$.

**TYPE (iii): DAMPED OSCILLATION.** Here the slope of the phase line is negative but greater than -1, i.e.,

$$-1 < \frac{dF(P_t)}{dP_t} < 0.$$ 

When the phase line is negatively inclined, there appears the phenomenon of overshooting the equilibrium mark. Since the slope of the phase line in this case is less than 1 in its absolute value, the time path of $P_t$ is shown by the cobweb-like construction line abcde... in Figure 3.4 and "dances around" equilibrium point $P_e$, getting ever closer to $P_e$.

**TYPE (iv): EXPLOSIVE OSCILLATION.** This occurs when the slope of the phase line is greater than 1 in its absolute value, i.e.,

$$\frac{dF(P_t)}{dP_t} < -1.$$ 

Since the slope is negative, the cobweb is also spun around the phase line and the 45 degree line. Unlike type (iii), however, this phase line results in a divergent time path since its slope exceed 1 numerically. The resulting diagram is shown in Figure 3.5.
Summary and Concluding Comments

This chapter has presented the basic analytical framework for the study. A three-sector dynamic model of urban growth was developed on the basis of dynamic theories and empirical findings from the literatures reviewed in the previous chapter. The model contains population equations, migration equations, and private sector equations of each of three areas—the central city, the suburban area, and the area outside the SMSA. In the context of the model, migration is seen as an important means through which population changes. Migration occurs when there exist differences in a variety of the private and public sectors among the three areas.

Within the context of the three-sector dynamic model, the chapter analyzed the dynamic process of a city's population change. Using the two most important private sector variables—employment and amenities, the second section offered an illustration of how the interaction of endogenous dynamic elements in our urban structure results in changes in a city's population. Moreover, this chapter discussed four varieties of the dynamic path of a city's population which would result from the interaction of dynamic elements.

The three-sector dynamic model has provided several advantages over other dynamic models reviewed in the previous chapter. The model is more comprehensive than others both spatially and temporally. It covers not one or two particular areas, but also a third-party area which could have an influence on the growth pattern of the first two. The model leads us to identify the long-run dynamic path of population as well as the interaction of dynamic elements in the process of an
area's growth and decline. More importantly, it provides a useful conceptual framework with which to analyze the role of the public sector in our urban system. A comparative-static analysis of the model in the next chapter will show the effects of the public sector on the distribution of population among regions.
CHAPTER IV
POTENTIAL POLICY INFLUENCES ON URBAN DYNAMICS

Introduction

Chapter 2 provided an overview of the literature on modeling urban dynamics and investigating the effects of various factors on urban growth and decline. Of particular interest was the potential influence that the public sector could have on urban dynamics. Differentials in urban growth within and across metropolitan areas might be attributed to great variations in the revenue structure and service responsibility among state and local governments.

The purpose of this chapter is to take a detailed look at the importance of the public sector in urban dynamics. The first section presents two perspectives of government intervention in our urban system, which have different views on the balance and interaction of forces in our urban structure. In the next section, the importance of the public sector in urban dynamics is discussed within the context of the conceptual framework developed in the previous chapter. A comparative static analysis of our model leads us to hypothesize potential influences of fiscal policies on migration. Finally, several related issues (e.g., tax exporting, service spillovers, and grants-in-aid) are discussed for the appropriate specification of the public sector variables. The last two sections intend to provide useful insights into the plausibility of the relationship between population
change and fiscal influences prior to the actual empirical investigations in the subsequent chapters.

Urban Dynamics and the Role of Government

The role of government in urban dynamics is primarily contingent upon a theoretical perspective on our urban system, which concerns the balance and interaction of internal forces that either restore or destroy equilibrium. There are two views: first, the endogenous process in our urban system is self-adjusting and second, it is rather self-reinforcing. The distinction is important in designing appropriate policy responses as well as observing the long-term process of urban growth which is a movement toward either an equilibrium or a new inequality.

1. Self-Adjusting or Self-Reinforcing?

Economists traditionally view that self-adjusting elements or forces are inherent and dominant in our market economy. They suggest that a system of self-interest guided by the "invisible hand" results in the best possible--the most efficient--outcome for society as a whole; the perfectly functioning economic system maximizing individual benefits and operating efficiently with no welfare losses eventually leads to a market equilibrium. An exogenous shock or initial change is followed by the reaction of rational households and firms, which capitalizes the change into land and/or housing prices or wages.

Such a self-adjusting mechanism is assumed in several dynamic urban models reviewed in Chapter 2. In the context of supply-oriented
or human capital theory, spatial differentials in capitalized factor prices (e.g., real wage rates) provide signals to utility-maximizing workers that encourage spatial mobility. The movement of population, seen as an equilibrating reaction to a non-optimal location, continues until those differentials disappear at another equilibrium. This movement not only increases the well-being of the migrants themselves, but also results in improved resource allocation in society. In this view, population movement during the transition between these two equilibria is a consequence of and a reaction to socioeconomic disparities among localities as well as an indispensable cause of urban growth and decline.

Another example of self-adjustment can be found in attempts to solve efficiency problems in public finance. Samuelson (1954) pointed out that the unwillingness of consumers to reveal their preferences for public goods, or to adjust quantities consumed in accordance with their preferences, would likely preclude efficient provision of public goods. Tiebout (1956), however, argued that a market-like efficiency, at least for local public goods, could be approximated by consumers locating themselves spatially in accordance with their preferences for different combinations of the goods. In his study, each community is seen as a supplier of a particular "fiscal bundle," which is characterized by the overall level of taxes, transfers, and public expenditures, as well as by their composition. Since different individuals have different preferences about the fiscal bundle, each individual will move "to that community where local government best satisfies his sets of preferences." By "voting with their feet," therefore, consumers can
maximize their welfare, local public services can be provided efficiently, and the whole society can maximize its economic welfare with a Pareto-optimal allocation of resources.

An alternative perspective of dynamism is one of "circular and cumulative causalities," which indicates that the process of change involves obvious feedback relationships that reinforce one another over time (Myrdal, 1957). Many supply-demand interactive and Blight-Flight models support the argument that regional/urban dynamics are a rather cumulative and self-reinforcing phenomenon, though continuous growth (or decline) after an initial positive (or negative) change may or may not lead to a new equilibrium (Baumol, 1963; Bradbury et al., 1982; Bradford and Kelejian, 1973; Grubb, 1982; Oates et al., 1971).

According to Myrdal (1957), the selectivity of migration is the major cause of "circular and cumulative causation" in the inter-regional/inter-urban dynamic process. Migration is selective of the younger, better-edu cated, and more highly productive workers. Such workers will be attracted away from those areas where labor demand is growing least rapidly and to those where labor demand is growing most rapidly. The selective character of migration will result in additional increased demand in receiving areas and decreased demand in sending areas. Further disparities in inter-regional/inter-urban wage and growth will thus result, which cause still more migration.

In the Baumol (1963) model, per capita income levels in the city, the quality of the urban public sector, the exodus of high-income families to suburbs, and urban blight are all interacting variables in the process of "cumulative deterioration." Initially, some high-income
households, attracted by better neighborhoods, move out of the city. The average income level in the city falls slightly, its tax base is diluted, the quality of public services declines, and a hint of blight can be detected. The initial equilibrium therefore is upset. Other high-income residents are stimulated to leave the city, further lowering the income level, diluting the tax base, and increasing blight. This "debilitating cycle" (Break, 1980) continues until "a chronic nadir of lethargy" (Baumol, 1963) is reached at the much lower level of the city's income.

A body of empirical work provides evidence for the argument that the dynamic of urban growth and decline is a self-reinforcing process. In their recent study on urban hardship, Nathan and Adams (1989) observed a strong trend of increasing hardship disparities both across and within major metropolitan areas. The differential in social and economic conditions between the worst and best off central cities increased substantially during the 1970s. Within metropolitan areas, there was a sharp increase in the number of areas where the central city compares very unfavorably to its adjoining suburban areas. Bradford and Kelejian (1973) and Grubb (1982) also affirm a "self-feeding phenomenon" in which the initial flight of central city residents aggravates the cities' fiscal problems, causing additional out-migration. Moreover, many other social and demographic studies show that the degree of residential segregation by race, occupation, education, or income has become greater and thus the social distance or disparity among regions and groups has been widening (Gober and Behr, 1982; Kirschbaum, 1972; Massey and Denton, 1989; Morgan, 1980).
2. Laissez-Faire or Government Intervention?

The two views on urban dynamics imply entirely different aspects regarding the role of government in our urban system. In the neoclassical view of economics, urban decline and disparity may not be a problem. They are only part of a natural adjustment to an equilibrium. Regional/urban disparities in the private and public sectors are at least partly reflected in labor, land, and/or housing markets. Such a capitalization response would change real values of disparity factors so as to make them indifferent among regions. This transition to a new equilibrium may be a slow, long-term process, and many of urban problems are only manifestations of the transition process. After such a painful transition process cities would emerge smaller but possibly viable and prosperous, with a more balance of different income groups in their resident population.

Since these neoclassical economists argue that self-adjusting forces are inherent and sufficient to minimize maladjustments in our market system, they are in favor of allowing these market forces to play a role of allocating resources across regional and urban areas. Any public policy to interfere with the self-equilibrating process would be undesirable and unnecessary. An appropriate policy response may be one of minimizing the problems caused in the adjustment process, which is part of classical economic remedies to market failures. For instance, to the extent that social costs associated with population change in the transition process (e.g., congestion, pollution) are not internalized by individuals, private migration decisions can result in
socially non-optimal consequences which justify public policy interventions (e.g., tax-subsidy policies).

The self-reinforcing perspective, however, suggests an entirely opposite response to regional/urban decline and disparities. It argues that there exist no self-equilibrating mechanisms internal to our urban structure and thus, some cities become less viable and others become more viable over time; the endogenous process of population change results in a continuous worsening (or expansion) after an initial negative (or positive) change. Hence, the perspective suggests that exogenous efforts (i.e., government interventions) should be undertaken to stop such an endogenously continuous growth or decline. In addition, even if any self-equilibrating mechanism is assumed to exist in our urban system, this perspective claims that the mechanism does not work to restore an initial level of population and it may result in an undesirable equilibrium; self-equilibrating is not necessarily either self-correcting or desirable. Figure 4.1 illustrates this non-self-correcting process of population change and the role of government in the process.

Assume first that the function $F(P_t)$ represents equation (3.7) in which a central city's population in period $t+1$, $P_{t+1}$, is a function of its population in $t$, $P_t$. The equilibrium of the city's population is determined by the function, $F(P_t)$: $P_t$ equals $P_{t+1}$ when population is at the equilibrium level, $P_e$. If, for example, in period $t=0$, $P_0$ were above $P_e$, we find that during this period outmigration of higher-income
Figure 4.1 The Role of Public Policy
units would occur, and consequently population would fall to $P_{t-1}$ in period $t-1$. But this would induce further deterioration, and additional outmigration would take place in period 2, with population falling to $P_2$. Assuming that the slope of $F(P_t)$ lies between zero and unity (that is, Type i in Table 3.2), this process will converge over time to $P_e$.

Since, given the function $F(P_t)$, any population levels either above or below $P_e$ are not be stable and there is movement toward $P_e$, any alteration in the value of $P_t$ will not change the outcome of the dynamic process. Therefore, a change in shift factors (e.g., the public sector) is necessary so as to prevent $P_t$ from going any lower than its current value $P_o$. Public policy would move the population function upward from from $F(P_t)$ to $F'(P_t)$, where $F'(P_t)$ represents a higher relative preference for central city residency than does $F(P_t)$. The shift will result in a new equilibrium population level for the central city, $P'_e$, which is higher than $P_e$.

Potential Policy Influences on Urban Dynamics

The previous section discussed two distinct views on the role of public policy in urban growth. The neoclassical view of economics argues that there is no role for policy intervention. An alternative perspective suggests that government intervention is necessary to prevent an initial change from being intensified over time. In this
view, public policy will result in a new equilibrium population level by shifting the population function.

If public policy ultimately changes the equilibrium level of population, how does this happen? To what extent does public policy affect the process of population change? In the conceptual model developed in the previous chapter, the public sector is assumed to change an area's population by influencing the residential location choice of individuals. Comparative static analyses of the model are here presented to see the effect of the public sector on urban growth and decline. After disaggregation of policy variables, the possible relationships between population growth and fiscal policy influences are hypothesized.

1. Comparative Statics

THE INTRA-METROPOLITAN ANALYSIS. To investigate the influence of public policies on the process of population movement between the central city and its suburban area, we exclude the variables regarding the area outside the SMSA. From the basic equations in the model, the first-order differential equation of population change is derived in the following general functional form:

$$\dot{P}^{c} = h^{c}(x^{c} (p^{c}), g^{c}, x^{s} (p^{s}), g^{s}, x^{o}, g^{o})$$

(4.1)

where \(x^{o}\) and \(g^{o}\) are fixed values of \(x^{o}\) and \(g^{o}\). In addition, the assumption that the combined population of these two areas in the SMSA is constant provides the following identity:
\[ p^c_t + p^s_t = \dot{p}_t - p^o_t = c, \quad (4.2) \]

thus, \( dP^s_t = dP^c_t. \)

Given the policy factor \( g, \) the stability condition of the equilibrium population is

\[
D = \frac{\partial M^c}{\partial x^c} \frac{\partial x^c}{\partial P^c_t} - \frac{\partial M^c}{\partial x^s} \frac{\partial x^s}{\partial P^s_t} < 0 \quad (4.3)
\]

where \( D = \frac{\dot{P}^c}{dP^c_t} \) and \( \frac{\partial M^c}{\partial x^s} < 0. \) This stability condition incorporates the feedback effect in both the central city and its suburban area. It represents the migration effect of populations in the two areas through changes in their private sectors. The two terms on the right side are opposite in their signs.

To see the effect of changes in policy factors, the system is assumed to be dynamically stable, which is depicted in Figure 3.2. In equilibrium, \( \dot{p}^c \) must equal zero (i.e., \( M^c = M^s = 0 \)). Hence, one gets a set of the following equations:

\[
M^c(x^c, g^c, x^s, g^s) = 0 \quad (4.4)
\]

\[
x^c - x^c(P^c_t) = 0 \quad (4.5)
\]

\[
x^s - x^s(P^s_t) = 0. \quad (4.6)
\]

By differentiating (4.4)-(4.6) totally, one obtains the effects of changes in the public sectors of the two areas on the city's equilibrium population:
and \( \frac{\partial P^c}{\partial g} = - \frac{1}{D} \left( \frac{\partial M^c}{\partial g} \right) \) (4.7)

and \( \frac{\partial P^s}{\partial g} = - \frac{1}{D} \left( \frac{\partial M^s}{\partial g} \right) \) (4.8)

where \( D = \frac{dP^c}{dt} = \left( \frac{\partial M^c}{\partial x^c} \frac{\partial x^c}{\partial P^c} - \frac{\partial M^s}{\partial x^s} \frac{\partial x^s}{\partial P^s} \right) \) and no relationships are assumed between the public sectors in the two areas (i.e., \( \frac{\partial g^c}{\partial g} = 0 \) and \( \frac{\partial g^s}{\partial g} = 0 \)).

From equation (4.3), \( D \) must be negative if the model is dynamically stable. Thus,

\[ \frac{\partial P^c}{\partial g} \triangleq 0 \text{ as } \frac{\partial M^c}{\partial g} \triangleq 0 \] (4.9)

and \[ \frac{\partial P^s}{\partial g} \triangleq 0 \text{ as } \frac{\partial M^s}{\partial g} \triangleq 0. \] (4.10)

These equations identify the importance of the migration effects of public policies in changing the pattern of urban development. A change in public policies will change equilibrium population in the same direction as it changes the migration level.

THE INTER-METROPOLITAN ANALYSIS. For the potential influence of public policies in the process of population movement between the central city and the area outside the SMSA, all the variables for the suburban area are assumed constant. For the analysis of population movement between the suburb and the area outside the SMSA, the variables for the central city are assumed constant. Here, only the
former analysis is described since both are basically the same, except for the unit of analysis (central city vs. suburban area).

The following first-order differential equation of population change is obtained in the general functional form:

\[ \hat{P}_c = N_c(x_c, g^c, x^o, g^o, \dot{x}^c, \dot{x}^o) \]  

(4.11)

where \( \dot{x}^c \) and \( \dot{x}^o \) are fixed values of \( x^c \) and \( g^c \). In addition, the assumption that the combined population of the central city and the area outside the SMSA is constant provides the following identity:

\[ P^c_t + P^o_t = p^c_t - p^o_t = C', \]  

(4.12)

thus, \( dP^o_t = -dP^c_t \).

Given the policy factor \( g \), the stability condition of the equilibrium population is

\[ H = \frac{\partial M^c}{\partial x^c} \frac{\partial x^o}{\partial p^c_t} - \frac{\partial M^c}{\partial x^o} \frac{\partial x^o}{\partial p^o_t} < 0 \]  

(4.13)

where \( H = \frac{\hat{P}_c}{dP^c_t} \) and \( \frac{\partial M^c}{\partial x^o} < 0 \). This stability condition incorporates the feedback effect in both the central city and the area outside the SMSA. It represents the effect of population movements between these two areas on migration through changes in the private sectors in both areas. The two terms on the right side are opposite in their signs.

To see the effect of changes in the policy factors, the system is assumed to be dynamically stable, which is illustrated in Figure 3.2.
In equilibrium, \( \dot{P}_c \) must equal zero (i.e., \( M^c - M^o = 0 \)). Hence, one gets a set of the following equations:

\[
M^c(x^c, g^c, x^o, g^o) = 0 \tag{4.14}
\]

\[
x^c - x^c(P^c) = 0 \tag{4.15}
\]

\[
x^o - x^o(P^o) = 0. \tag{4.16}
\]

By differentiating (4.14)-(4.16) totally, one obtains the effect of changes in the public sectors of the two areas on the city's equilibrium population:

\[
\frac{\partial P^c}{\partial g^c} = -\frac{1}{H} \left( \frac{\partial M^c}{\partial g^c} \right) \tag{4.17}
\]

and

\[
\frac{\partial P^o}{\partial g^o} = -\frac{1}{H} \left( \frac{\partial M^o}{\partial g^o} \right) \tag{4.18}
\]

where \( H = \frac{\partial P^c}{\partial t} = \left( \frac{\partial M^c}{\partial x^c} \frac{\partial x^c}{\partial P^c} - \frac{\partial M^c}{\partial x^o} \frac{\partial x^o}{\partial P^o} \right) \) and no relationships are assumed between the public sectors in these two areas (i.e., \( \frac{\partial g^o}{\partial g^c} = 0 \) and \( \frac{\partial g^c}{\partial g^o} = 0 \)).

From equation (4.13), \( H \) must be negative if the model is dynamically stable. Thus,

\[
\frac{\partial P^c}{\partial g^o} > 0 \text{ as } \frac{\partial M^c}{\partial g^c} < 0 \tag{4.19}
\]

and

\[
\frac{\partial P^o}{\partial g^o} > 0 \text{ as } \frac{\partial M^o}{\partial g^o} > 0. \tag{4.20}
\]

Along with equations (4.9) and (4.10), these equations (4.19) and (4.20) also show the importance of the migration effects of public
policies in changing the pattern of urban development; a change in public policies will change equilibrium population in the same direction as it changes migration.

2. Potential Fiscal Influences on Migration

Since Charles Tiebout's study, analyses of fiscal influences on population movement assume that individuals with different socioeconomic characteristics have different preferences about location-specific goods and services. The difference in individuals' preferences about public goods will result in different responses to different sets of fiscal policies. For the most useful and valid policy options, therefore, it is essential to disaggregate migration flows along socioeconomic characteristics of migrants and to identify differentials in the migration effect of the public sectors.

If individuals with different preferences for a vector of fiscal bundles are grouped into i income groups, some of the equations in the model are rewritten as follows:

\[ \hat{P}_c = \sum_i M_i \]

\[ = \sum_i M_i(x^c, g^c, x^s, g^s, x^o, g^o) \]  \hspace{1cm} (4.21)

\[ x^c = x^c(p_c^c) \]  \hspace{1cm} (3.4c)

\[ x^s = x^s(p_s^s) \]  \hspace{1cm} (3.4s)

\[ x^o = x^o(p_o^o) \]  \hspace{1cm} (3.4o)

where the i subscript refers to income group.
In the intra-metropolitan equilibrium, \( P^c \) must equal zero and we get:

\[
\sum_i M_i^c(x^c, g^c, x^s, g^s) = 0 \quad (4.22)
\]

\[
x^c - x^c(P^c) = 0 \quad (4.5)
\]

\[
x^s - x^s(P^s) = 0. \quad (4.6)
\]

We differentiate these three equations totally to obtain

\[
\frac{\partial P^c}{\partial g^c} = - \frac{1}{D} \sum_i \frac{\partial M_i^c}{\partial g^c} \quad (4.23)
\]

and

\[
\frac{\partial P^c}{\partial g^s} = - \frac{1}{D} \sum_i \frac{\partial M_i^c}{\partial g^s} \quad (4.24)
\]

where \( D = \sum_t \frac{dP_t^c}{dP_t^c} = \sum_i \left( \frac{\partial M_i^c}{\partial x^c} \frac{\partial x^c}{\partial P_t^c} - \frac{\partial M_i^c}{\partial x^s} \frac{\partial x^s}{\partial P_t^c} \right) \).

\( D \) must be negative if the model is dynamically stable. Thus,

\[
\frac{\partial P^c}{\partial g^c} \geq 0 \quad \text{as} \quad \sum_i \frac{\partial M_i^c}{\partial g^c} \geq 0 \quad (4.25)
\]

and

\[
\frac{\partial P^c}{\partial g^s} \geq 0 \quad \text{as} \quad \sum_i \frac{\partial M_i^c}{\partial g^s} \geq 0. \quad (4.26)
\]

In the inter-metropolitan equilibrium, \( P^c = 0 \) and thus,

\[
\sum_i M_i^c(x^c, g^c, x^o, g^o) = 0 \quad (4.27)
\]

\[
x^c - x^c(P^c) = 0 \quad (4.28)
\]

\[
x^o - x^o(P^o) = 0. \quad (4.29)
\]
Differentiating these equations totally gives

\[
\frac{\partial P^c}{\partial g^c} = -\frac{1}{H} \sum_i \frac{\partial M^c}{\partial g^c}
\]

(4.30)

and

\[
\frac{\partial P^o}{\partial g^o} = -\frac{1}{H} \sum_i \frac{\partial M^i}{\partial g^o}
\]

(4.31)

where

\[
H = \frac{dP^c}{dP^c_x} = \sum_i \left( \frac{\partial M^c}{\partial x^c} \frac{\partial x^c}{\partial P^c_t} - \frac{\partial M^c}{\partial x^o} \frac{\partial x^o}{\partial P^o_t} \right).
\]

H must be negative if the model is dynamically stable. Thus,

\[
\frac{\partial P^c}{\partial g^c} \leq 0 \quad \text{as} \quad \frac{\partial M^c}{\partial g^c} \leq 0
\]

(4.32)

and

\[
\frac{\partial P^o}{\partial g^o} \leq 0 \quad \text{as} \quad \frac{\partial M^i}{\partial g^o} \leq 0.
\]

(4.33)

Equations (4.25), (4.26), (4.32), and (4.33) simply state that the effect of the public sector on population change is the sum of the effects of different policies on the migration of different population subgroups. Disaggregating policy variables into three broad categories--taxes and public services, we will present a set of research hypotheses regarding the differences in the migration effect of various fiscal policies in each category.

TAXES. The tax structure in state and local governments is expected to affect the location decision of individuals by imposing different incidence or burden of taxes on individuals. Taxes may affect the received real income of individuals either directly by
reducing net nominal earnings, or indirectly by influencing the prices of goods and services. Thus, a city's taxes are generally expected to have a negative effect on in-migration into the city (i.e., \( \frac{\partial M_c}{\partial g_c} < 0 \) and thus, \( \frac{\partial P_c}{\partial g_c} < 0 \)), while taxes in the other areas would have a positive effect on in-migration into the city (i.e., \( \frac{\partial M_o}{\partial g_o} > 0 \) or \( \frac{\partial M_s}{\partial g_s} > 0 \) and thus, \( \frac{\partial P_s}{\partial g_s} > 0 \) or \( \frac{\partial P_o}{\partial g_o} > 0 \)).

Since the property tax is largely imposed on residential land and real estate, its level may have a significant effect on the location decision of individuals. The effect can be expected to be greater on middle-to-upper income persons than on lower-income individuals, because by and large a relatively large portion of middle- and higher-income persons as compared with lower-income persons are property owners. Thus, the higher level of the central city's property tax is likely to result in the larger proportion of lower-income persons in the future, ceteris paribus.

The effects of non-property taxes on residential locations are not straightforward. If the individual income tax is imposed on the basis of place of residence, it would affect the residential location decision of taxpayers. In addition, its progressive tax structure tends to make the area more unattractive to higher-income people than low-income persons. However, the taxes on sales of goods and services (e.g., sales taxes, license and permit taxes) would have little impact
on population change, since they are largely state and metropolitan-
wide taxes and only affect an individual's location of purchase of
taxed goods.

PUBLIC SERVICES. The level of output and quality of public
services may influence the migration decision of individuals by
changing the attractiveness of an area. Generally, the higher level of
a city's public services can be expected to induce in-migration into
the city and thus, contribute to its future growth (i.e., \( \frac{\partial M_c}{\partial g_c} > 0 \) and
thus, \( \frac{\partial p_c}{\partial g_c} > 0 \)), while that of the other regions would have a negative
effect on in-migration into the city (i.e., \( \frac{\partial M_s}{\partial g_s} < 0 \) or \( \frac{\partial M_o}{\partial g_o} < 0 \) and thus,
\( \frac{\partial p_s}{\partial g_s} < 0 \) or \( \frac{\partial p_o}{\partial g_o} < 0 \)).

General public services include police, fire, sewerage,
sanitation, park and recreation, libraries, highways, public housing,
and other utilities and public works. To the extent these services
influence the overall quality of life in an area, they may have a
significant positive effect on in-migration into the area.

In contrast to its role in providing general services, a city
either has or does not have responsibilities for education, public
welfare, health, and hospitals. While welfare-related services are not
"local" goods in most states, elementary and secondary education is a
much "local" good mostly provided by special school districts.
Many Tiebout studies (e.g., Edel and Sclar, 1974; Heinberg and Oates, 1970; Meadows, 1976; Oates, 1969) show a significant degree of capitalization of public education, implying the importance of good local schools in residential choice decisions. The capitalization of high quality schools would raise housing prices so as to discourage low-income movers. In addition, some differentials in the importance of and preference for education might exist across different income groups.

Issues in the Specification of Fiscal Variables

It was argued that the public sector could provide a structural change in the city's growth path by affecting the location decision of individuals. People would move from one region to another in response to differences in the public sectors to be found in the regions. However, there exist various public sector flows between regions as well as levels of government so it is important to identify the actual levels of taxes and services to which potential migrants respond. Although a detailed description of the public sector variables will be presented in the following chapter, this section discusses three important issues associated with specifying the location-specific public sector, which are tax exporting, service spillovers, and grants-in-aid.

1. Tax Exporting

Tax liability flows across jurisdictional boundaries. A jurisdiction is said to export its taxes when a part of their incidence
is borne by non-residents. This tax exporting occurs in a variety of ways: (1) directly through a tax on income earned in a jurisdiction by non-residents, a sales tax on purchases by non-residents, or an excise tax on hotel occupancy or some other expenditure highly correlated with non-residency; (2) indirectly through a property or business tax on commercial and industrial enterprises that is shifted to non-resident consumers, owners, or employees; and (3) through deductions of and credits for local tax payments against federal and state taxes (Neenan, 1981).

The degree of tax exporting differs across jurisdictions as well as types of taxes. The financial system of U.S. local governments not only vary across states, but also across types of governments within the state and, in some cases, among similar governments in a state. The diversity in the tax structure of local governments causes substantial variations in the ability of the governments to export part of their tax burden to non-residents. To the extent that the burden of taxes is shifted to non-resident taxpayers, the actual level of taxes ultimately borne by residents, which would affect the location decision of potential migrants, may decrease.

While many studies have recognized the importance of tax exporting, only a few have attempted to measure the exportability of state and/or local taxes. Unlike McLure's (1967) estimation of interstate tax exporting, Ladd and Yinger (1989) calculated export ratios for three taxes--property, general sales, and earnings--for major central cities. In their approach, a city's export ratios are assumed to depend on the proportion of each tax which is borne by
various types of taxpayers and the fraction of each type of taxpayers that lives outside the city.

According to the analysis of Ladd and Yinger (1989), property tax export ratios in general appear to be smaller relative to export ratios of either sales taxes or earnings taxes. Among the 12 cities that rely on property and earnings taxes, for example, the 9 cities relying more heavily on earnings than on property taxes export a higher proportion of their earnings tax burden than of their property tax burden. In contrast, the 3 cities that rely more heavily on property taxes than on earnings taxes have similar average export ratios for property and earnings taxes. Similarly, among cities with access to both property and sales taxes, the sales tax export ratio is higher relative to the property tax export ratio in the category relying more heavily on the sales tax.

Although the Ladd and Yinger approach is very comprehensive, it underestimates the ultimate tax incidence of city residents by ignoring tax importing from other jurisdictions. As the size of urban areas grows, more tax bases flow into the suburbs and the areas outside metropolitan areas, and consequently the greater volume of tax importing occurs. In addition, data limitations prevent us from including tax exporting aspects in our empirical estimations. The application of the Ladd and Yinger approach to the suburban areas in the large SMSAs requires a variety of data such as those on land use and property types, assessed values, assessment-sales ratios, residents' propensity to consume retail goods, and the location of residents' employment.
2. Service Spillovers

Another problem with the specification of fiscal variables concerns service spillovers. As defined in the conceptual model constructed in Chapter 3, public services in this study do not refer to Samuelsonian goods which exhibit two properties—nonrival consumption and nonexcludability. Rather, they encompass location-specific goods and services that are publicly provided. Thus, those goods and services tend to have a mixed public-private nature that can be characterized in one or other of the following ways: (1) there is a spatial dimension to their impact, (2) some rivalry enters into their consumption, and (3) consumers can be excluded from their benefits only with considerable costs (Neenan, 1981).

Although local public goods are exclusive in some sense and their main beneficiaries are the local citizens, benefits of a lesser amount may spread further away to other areas. Public goods, such as local transportation facilities (highways), education, or health services, create benefits which "spill out" into surrounding jurisdictions. At the same time, similar services in other regions provide benefits which "spill in" to this region. In other words, there are reciprocal externalities generated among various regions.

When concern is with externalities within a metropolitan area, such a reciprocal spillover seems to turn into a one-way relationship running from the central city to its suburbs. Suburban residents may receive uncompensated benefits from various services provided by the central city (e.g., highways, parks and recreation, and mass transit). The discussion of such an intra-metropolitan externality often raises
the question of "exploitation", which is caused by unequal reciprocities between the central city and its suburbs. Several "suburban-central city exploitation theses" have identified a net flow of uncompensated services from the central city to suburban citizens (Hawley, 1951; Kasarda, 1972; Greene, Neenan, and Scott, 1974). Despite the findings, interpretation has been problematic because of the inconsistent measurement of revenues, expenditures, and benefits among the studies (Neenan, 1981). Since the issue--who benefits whom--is more like an empirical one and it requires another in-depth analysis, the spillover issue cannot be taken into consideration in our empirical estimations.

3. Grants-in-Aid

Grants-in-aid, one type of government interventions, also need special attention since they could affect the location decision of individuals either directly or indirectly by changing the local public sector. There are several commonly suggested rationales for intergovernmental grants, which can fall into two broad categories--political and economic justifications (Break, 1980; Gramlich, 1977; Oates, 1972). Grants are used for the decentralization of political power in multi-level systems, which fits democratic reasons to keep power close to the people. The economic rationales are related to allocation (efficiency), distribution (equity), and stabilization objectives of government intervention in the market economy. Most grants can be either explicitly or implicitly justified on their
performance in addressing one or some combination of these three functions of government.

Economic theory suggests that effects of grants are largely dependent on the types or forms of grants (Break, 1980; Gramlich, 1970, 1977; Oates, 1972; Wilde, 1971). A matching grant would cause relative prices to change and thus, in general, could stimulate more local spending than a lump-sum grant. A lump sum grant, on the other hand, would not alter the relative price of goods and have the same effect on local spending as any other change in private income in the community. Empirically, however, the latter prediction has not been supported while the former has. Empirical analyses generally show that a lump-sum grant increases local spending more than an equal increase in community income does. This is sometimes referred to as the "flypaper effect," because the money transferred to the local government "sticks where it hits," that is, it is spent by the locality rather than being used to reduce local taxes (Courant et al., 1979).

Since this empirical finding is incompatible with economic predictions, efforts have been made to explain this anomaly, especially the flypaper effect in some appropriate fashion (Break, 1980; Courant et al., 1979; Gramlich, 1977; Niskanen, 1971; Oates, 1979). To the extent that these recently developed models offer an explanation for the flypaper effect, they may be taken to be superior to the traditional economic model. However, these alternative models seem to suggest that a lump-sum grant could have the same effect on local spending as an equal value matching grant (King, 1984). This prediction is inconsistent with Gramlich's (1977) review in which he
found that a lump-sum grant had less effect than an equal value matching grant. In this respect, these alternative models seem to be inferior to the traditional economic model, which makes the prediction consistent with the conclusion of Gramlich (1977).

The examples of the inconsistency among various models show the need for developing a more adequate model so that it can better explain empirical results. Each existing or prospective grant program is obviously unique, and the response of recipient governments to it depends on not only the size and type of the grant, but any other political or institutional, social, and bureaucratic factors as well as economic factors including underlying elasticities (Gramlich, 1977). In this regard, more institutionally oriented social scientists (Rawlins and Nathan, 1983; Adams et al., 1983) develop an interdisciplinary way of evaluating policies which considers not only political or institutional, economic, and social factors, but also the interactions among them. From this field network perspective, it could happen that different recipient governments produce completely different effects of the exactly same grant, since they are in different environments.

As the field network approach emphasizes the long-term effect of grants, a general equilibrium framework considers not only the initially direct effects of grants on local spending but also their various subsequently indirect effects (e.g., Inman's study in 1977 on school spending in the New York metropolitan area shows that the long-run effects of a change in grants might be 20-60% below the initial effects). An increase in grants may, initially, cause an increase in
local spending and a reduction in local tax rates. These responses would lead to changes in consumers' expenditure and saving, and also, perhaps, encourage governments to alter their tax rates and expenditures. Further, there may be changes in, for example, land values, household and business location choices, investment decisions, and so forth. Some of these induced changes could feed back to both grantor and grantee governments and cause new changes in their fiscal policy and behavior. Thus, grants-in-aid would change the pattern of urban development by affecting the location choice of households directly as well as indirectly through changes in the fiscal behavior of recipient governments.

Summary and Concluding Comments

This chapter focused on the importance of the public sector in the pattern of urban development. It presented the two theoretical views on the interaction of internal forces in our urban structure and their implications for public policy. From the neoclassical point of view, government intervention is undesirable and unnecessary since self-adjusting elements or forces are inherent in our market economy. An alternative perspective, however, argues that a variety of urban life elements play a role of reinforcing their initial change by working together to produce a new and even greater inequality. If a city is in this self-aggravating process, it would need government intervention, which could move the city's population function upward, resulting in a higher equilibrium population level for the city.
After disaggregation of the public sector, the potential influences of various fiscal policies on population growth were hypothesized. In general, property taxes are expected to have a significant and negative effect on the intra-metropolitan process of population growth. Because of their metropolitan-wide characteristics, most nonproperty taxes may have little influence on the intra-metropolitan movement of individuals. Rather they could affect their inter-metropolitan choice of residential locations. The level of output and quality of public services can be expected to have a positive effect on urban growth, since it could affect the location decision of individuals by changing the attractiveness of urban areas.

For a more valid empirical result, it is important to identify the ultimate level of the public sector in an area to which potential migrants respond. Attention has been paid to public sector flows both between areas as well as levels of governments. The issues relevant to tax exporting, service spillovers, and grants-in-aid were discussed for the appropriate specification of the public sector variables.

The discussions in this chapter have provided grounding for incorporation of public sector influences in the conceptual framework for this study. In the next chapter, the private and public sectors in the model are explicitly defined and constructed for empirical estimations.
CHAPTER V
DATA AND METHODOLOGY

Introduction

The three-region dynamic model developed in Chapter 3 posits that urban growth and decline is attributed to changes in the private and public sectors. The private sector would influence migration through the interaction of self-adjusting and self-reinforcing forces, determining an equilibrium population. The public sector, which was discussed in detail in Chapter 4, could provide a structural change in the central city's growth path by affecting migration and consequently, change the equilibrium level of population.

Since migration is an important means through which urban growth and decline occur, an investigation of the migration sensitivity of individuals to the public sector is essential to understand the role of public policies in urban dynamics. As seen in the partial equilibrium analyses of the model in Chapter 3, a separate analysis is made for each of three different avenues, whereby a metropolitan population is affected by migration. An intra-metropolitan analysis is concerned with both city-to-suburb and suburb-to-city migration, while two inter-metropolitan analyses are for in-migration streams from either the central city or the suburban area from outside the SMSA.
These empirical investigations require a detailed discussion of the data used, their sources, and the logic and methodology employed in constructing the variables in estimating equations. Since it is interjurisdictional migration flows which are being analyzed, it is important that all the variables chosen reflect as accurately as possible total differences in the private and public sectors for that level of geographical demarcation. The analyses of Chapters 2 and 4 provide the guidelines for proceeding with this task.

Data Description and Sources

1. The Sample

In examining the migration effect of fiscal policies within urban areas, Standard Metropolitan Statistical Areas (SMSAs) become obvious units of analysis. The data in this study consists of 52 of the largest SMSAs, all of which had populations over 500,000 in 1970 and were under the Nathan and Adams hardship analyses (1976; 1989). The central cities of the SMSAs in this study are those cities determined by the Bureau of the Census as of 1980. The term "suburban" includes all of the SMSA except the central cities, and is equivalent to the term "outside central cities," as defined by the Bureau of the Census. This study regards the adjacent SMSAs (e.g., Dallas and Fort Worth, Long Beach and Los Angeles) as one consolidated SMSA with more than one central cities, whereas Nathan and Adams considered them separate SMSAs, each of which have a single central city. In addition, incomplete migration data for the Norfolk and Omaha metropolitan areas force us to omit these two SMSAs from the study.
2. Migration Flows

Much past work has relied on indirect measures of movement such as changes in population (Bradford and Kelejian, 1973; Carlino and Mills, 1987; Ellson, 1980; Palumbo and Hutton, 1987) or changes in population density gradients (Grubb, 1982; Mills and Price, 1984). However, the theoretical model developed in Chapter 3--especially, equation (3.3)--results in a dependent variable which is the actual number of migrants. The data which relate to actual movers between regions enable us to understand the interregional relationship which cannot be identified from those indirect data.

The migration data are obtained from the Public Use Microdata Samples (PUMS: one-percent "B" Sample) of the 1980 Census of Population and Housing. Since only one half of the sample microdata identify 1975 residence, the effective sample size for this study becomes 0.5 percent. The data are processed to extract individuals aged 23 and over in 1980 (18 and over in 1975) who were not college students, the armed forces, and inmates of institutions in 1980. The rationale for the selection is that these individuals are deemed capable of making their decisions of residential locations. The data consist of 272,586 individuals, 108,375 of whom had a residence in the central cities and 164,211 in the suburbs in 1980. Of the entire sample, 41.5 percent established a new residence at the different house either in the same jurisdiction or another during 1975-80.

Migration can be specified in terms of either the ratio or actual number of movers. Some studies adopted the ratio of migrants to the total residents in a jurisdiction as a measure of migration flows
They calculated the ratio by dividing the actual number of movers during an interval by the number of residents at the beginning of the interval. Since the ratio is the value which is already divided by the total number of residents, it does not allow the total number of residents (i.e., population) to be included as a potential determinant of migration. This is contrary to the suggestion that population should be included to capture the scale of social and economic structures that affects the residential decision of individuals (Feeney, 1973; Greenwood and Stock, 1990; Mueser, 1989). In this sense, the number of movers seems to be a better measure of migration flows, which is necessarily compatible with the inclusion of population that normalizes the number of movers.

For the intra-metropolitan analysis, the number of net migrants between the central city and its suburb is used as the dependent variable. It is calculated by subtracting the number of city-to-suburb movers from the number of suburb-to-city movers. While many intra-urban studies neglected the suburb-to-city flow by focusing on the city-to-suburb flow (e.g., Bradford and Kelejian, 1973; Grubb, 1982), this study takes into consideration both flows by using the number of net intra-metropolitan migrants, which reflects the relative attractiveness of the central cities over the suburbs.

For the inter-metropolitan analyses, on the other hand, net migration estimates are not possible because the data on the out-migration of city (or suburban) residents to the area outside the SMSA are not available from the 1980 Census. Rather, the number of in-migrants from outside the SMSA into either the central city or the
suburb is used as the dependent variable. The number of in-migrants represents the volume of new blood into the central city (or the suburb) from the area outside the SMSA, reflecting the relative attractiveness among the central cities (or the suburbs).

To examine differentials in the migration effect of fiscal policies, the sampled individuals are divided by their income at destination in 1979. This study uses the sum of income from wages and salaries, nonfarm self-employment, farm self-employment, interest, dividends and rentals, and all other sources except social security and public assistance. Two income groups--middle-to-upper and lower income--are defined on the basis of the income distribution of the entire sample. The middle-to-upper income group represents the upper fifty percent of persons in the sample. The lower-income group is the bottom twenty-five percent of the entire sample, which corresponds roughly to the official definitions of poverty employed by the U.S. government. These income-group definitions are the same as those Bradford and Kelejian (1973) used in their study on suburbanization. The exclusion of the third quartile, which is between the twenty-fifth and fiftieth percentile levels, reduces our sample to 204,526, two-thirds of which are categorized as the middle-to-upper-income group and one-third is defined as the lower-income group.

3. Private Sector Variables

It was argued in the dynamic model that migration would be partly motivated by the private sector. Many previous empirical works reviewed in Chapter 2 have included a variety of social, economic, and
physical conditions, such as employment, wage, income, housing costs, housing services, population size, population density, crime rate, ethnic composition, and climate. In this study, however, these location characteristics are measured by indices developed for various dimensions of urban hardship conditions by Nathan and Adams (1976, 1989). Since migration usually involve a lagged response to these location-specific attributes, the 5-year lag in the 1970 hardship variables may be a reasonable approximation.

The composite indices in the Nathan and Adams analyses (1976, 1989) were based on six socioeconomic variables, which are unemployment, dependency, education, income, crowded housing, and poverty. Each of these variables was converted into a standard score, the individual scores were summed, and then an overall average standard score was determined. The resulting indices provide comparative hardship scores between the central cities and their suburbs as well as among these central cities. The city/suburb disparity index shows city stress compared to surrounding suburbs, while the intercity (or intersuburb) index shows the distress of one city (or suburb) compared to all other cities (or suburbs). For the intra-metropolitan analysis in this study, the 1970 central city/suburban hardship disparity values are chosen. In the inter-metropolitan analyses, on the other hand, the 1970 intercity and intersuburb hardship values are used.

In addition to the 1970 urban hardship values, a regional factor is incorporated into the inter-metropolitan equations. It appears from many empirical works on migration that climate is an important determinant of the interstate and inter-metropolitan movements of
individuals (Graves and Linneman, 1979; Graves and Regulska, 1982). The 1977 County and City Data Book provides the mean annual percent values of possible sunshine, which are used as a proxy for metropolitan area climate.

4. Public Sector Variables

The theoretical model posits that public policies would also influence the pattern of urban development by shifting a population function through its migration effects. Among many government policies, this study is concerned with state and local fiscal institutions, which are mainly of three types--taxes, expenditures, and grants. Government expenditures in this study are used as a proxy for the level of output and quality of public services.

The fiscal data in this study include taxes, expenditures, and intergovernmental grants of state and local governments in 52 large U.S. metropolitan areas. The data are drawn from the 1973-74 Annual Survey of Government, which was conducted by the Bureau of Census. With the recognition that migration is likely to respond with a lag to both the burdens and benefits of taxation, Bradford and Kelejian (1973) suggest that the 2- or 3-year lag in these fiscal variables is a reasonable approximation.

Since many governments are usually involved in both the central cities and their suburbs, the fiscal behavior of all the governments is aggregated for each area. If local governments overlie all or parts of the central cities and their suburbs, the fiscal output of the governments is allocated between these two areas. Such allocation is
done on the basis of population. More precisely, the revenues and expenditures in a central city are the sum of (1) those of the central city municipal government, (2) a pro rate share of those of school and special districts overlying the central city, and (3) a pro rate share of those of the central county governments. Our method of aggregation is essentially the same one used by Campbell and Sacks (1967).

The fiscal behavior of state governments is included only for the inter-metropolitan analyses. This is because inter-metropolitan migration seems to be a matter of inter-state differences, while the intra-metropolitan process of migration is more likely to depend on the internal differences of the metropolitan area. The consolidated--state and local--data in the inter-metropolitan analyses portray the overall levels of tax burdens and service benefits in the central city and the suburban area.

In this study, the three most important tax categories are selected in this study: property taxes, income taxes, and the other taxes imposed on sales of goods and services such as general sales taxes, selective sales taxes, licenses taxes, and so on. These taxes may influence the received real income of individuals either directly by reducing net nominal earnings, or indirectly by influencing the prices of goods and services. Since many local governments rely largely upon the property tax and are not allowed to impose income and sales taxes, only two broad categories are chosen for the intra-metropolitan analysis: property taxes and non-property taxes.

Public service expenditures are also grouped into two broad categories: general and special service expenditures. General service
expenditures are government spending for air transportation, libraries, parks and recreation, police, sewerage, sanitation other than sewerage, fire, highways, housing and urban development, parking, and water transportation. Although special services usually include health, hospitals and public welfare as well as education, this study selects education services (elementary and secondary schools) only. This is not only because a large number of local governments do not provide these welfare-related services, but also because data on service recipients are hardly available for many suburban areas.

Another revenue category used in this study is intergovernmental grants. Although grants may not have a direct impact on the location decision of individuals, they would affect migration indirectly by changing the fiscal behavior of recipient governments. The indirect effect of grants on migration must be partially reflected by the tax and expenditure variables. To the extent that the tax and expenditure variables used in this study do not cover all the fiscal characteristics in jurisdictions, the indirect effect of grants could be prevalent. Both state-to-local grants and interlocal government grants are used for empirical estimations in this study.

For comparability among jurisdiction, all the fiscal variables in this study are expressed in per capita terms. While most studies agree that the per capita measure is appropriate for both expenditure and grants variables, there is little agreement over the measure of the tax variables. Some studies (e.g., Carlino and Mills, 1987) used per capita taxes, but others adopted either nominal (Steinnes and Fisher, 1974) or average (e.g., Liu, 1977) tax rates. However, the wide
variety of tax bases and rates defined in the tax statutes of state and local governments preclude calculating the rates in a jurisdiction or aggregating them for either the central city or the suburban area. In practice, therefore, the per capita measure seems to be the most preferable.

Methodology

The central focus of the study is on the migration effects of various state and local fiscal policies. In order to investigate differentials in these effects between migration flows as well as income groups, three sets of regression equations are constructed: one for the intra-metropolitan movement and the others for the inter-metropolitan movements. Each set consists of two income group equations: one for the middle-to-upper income group and the other for the lower-income group.

More precisely, two income group equations are estimated for the "net" migration flow between the central city and its suburban area (these equations are here called the net intra-metropolitan equations). In the net intra-metropolitan migration equation for the middle-to-upper income group, the dependent variable is the numbers of net middle-to-upper income movers between the central city and its suburb, while the number of net lower-income movers between the central city and the suburb is used as the dependent variable in the net intra-metropolitan equation for the lower-income group. Another sets of two income group equations are established for inter-metropolitan analyses which deal with in-migration streams to the central city or its suburbs.
from outside the SMSA. In these four inter-metropolitan equations, the dependent variables are the number of in-migrants from outside the SMSA to either the central city or the suburbs.

1. The Intra-Metropolitan Analysis

The (net) intra-metropolitan analysis concerns the intra-metropolitan process of population change, which represents both city-to-suburb and suburb-to-city migration streams. It associates the number of net intra-metropolitan migrants with a variety of private and public sector conditions both in the central city and its suburb. The number of net migrants between the central city and its suburb is used as a measure of the relative attractiveness of the central city over its suburbs.

A linear form of the net intra-metropolitan estimating equation is directly derived from the migration equation (4.4). That is,

\[ M^c_t = a_0 + a_{1c} X^c + a_{1s} X^s + a_{2c} LPT^c + a_{2s} LPT^s + a_{3c} LNF^c + a_{3s} LNF^s + a_{4c} LGS^c + a_{4s} LGS^s + a_{5c} LEDU^c + a_{5s} LEDU^s + a_{6c} LIS^c + a_{6s} LIS^s + a_{7c} LLIG^c + a_{7s} LLIG^s + a_{8} POP^c \] (5.1)

where
$M_{i}^{c}$ = number of net intra-metropolitan migrants of the specified income group type $i$;

$X^{C}$ = a measure of the private sector in the central city;

$X^{S}$ = a measure of the private sector in the suburban area;

$LPT^{C}$ = local property taxes per capita in the central city;

$LPT^{S}$ = local property taxes per capita in the suburban area;

$LNPT^{C}$ = local nonproperty taxes per capita in the central city;

$LNPT^{S}$ = local nonproperty taxes per capita in the suburban area;

$LGS^{C}$ = local government spending per capita for general public services in the central city;

$LGS^{S}$ = local government spending per capita for general public services in the suburban area;

$LEDU^{C}$ = local government spending per capita for education in the central city;

$LEDU^{S}$ = local government spending per capita for education in the suburban area;

$LSIG^{C}$ = state grants per capita in the central city;

$LSIG^{S}$ = state grants per capita in the suburban area;

$LLIG^{C}$ = interlocal governmental grants per capita in the central city;

$LLIG^{S}$ = interlocal governmental grants per capita in the suburban area;
\( \text{POP}^C \) = total number of city residents in 1975.

The total number of the central city's population in 1975 (\( \text{POP}^C \)) is included on the right hand side of the equation. The logic of the inclusion of the population variable is quite clear in several respects. First, the inclusion normalizes the dependent variable—the number of net migrants within a metropolitan area. This normalization allows us to control differences among the central cities in the number of city residents (Greenwood and Stock, 1990). Secondly, it has been suggested that population should be included to capture the scale of social and economic structures that are not measured by the other independent variables (Feeney, 1973; Mueser, 1989). In a similar aspect, some empirical studies on the basis of the gravity model observed the importance of the current size of population in changing its future size (Olsson, 1967).

Because of certain multicollinearity problems, however, the equation (5.1) cannot be used as our basic estimating equation for the net intra-metropolitan analysis. Multicollinearity can arise for three reasons. First, certain components of the public sector may be correlated with the private sector. It is obvious that taxes (\( \text{LPT} \) and \( \text{LNPT} \)) depend on socioeconomic conditions—for example, income, economic opportunities, and housing services—in the area. Expenditures (\( \text{LGS} \) and \( \text{LEDU} \)) and the private sector may be correlated through wages and/or the cost of living. Moreover, grants-in-aid from higher governments
are largely formulated on the basis of socioeconomic conditions in the area.

Second, certain elements of the public sector tend to be correlated with each other. Taxes (LPT and LNPT) and expenditures (LGS and LEDU) may to some extent be correlated with each other because of the nature of fiscal decision making at all government levels. Although some observers like Pack (1973) deny the existence of the correlation between taxes and expenditures, the high level of public services may imply the high level of taxes. The fiscal structure of local governments depends upon not only political decisions at their own level, but also various regulations and policies at the federal and state levels.

Finally, multicollinearity occurs since public sectors may be correlated across the places of origin and destination—the central city and its suburbs. Though our theoretical model in Chapters 3 and 4 assumes no relationships among public sectors across regions \( \frac{\partial g_c}{\partial g^s} = 0 \) and \( \frac{\partial g^s}{\partial g_c} = 0 \), a variety of local cooperation and competition in taxing and delivering public services may affect the fiscal structure of local governments in the metropolitan area.

One straightforward way to reduce the multicollinearity problem is to construct new variables of central city-suburban differentials in the private and public sectors. Since the coefficients of the variables for the suburbs are expected to be opposite to those for the
central cities, the basic estimating equation can take the following form:

\[ M_C^* = b_0 + b_1(X_C^* - X_S^*) + b_2(LPT_C^* - LPT_S^*) + b_3(LNPT_C^* - LNPT_S^*) + b_4(LGS_C^* - LGS_S^*) + b_5(LEDU_C^* - LEDU_S^*) + b_6(LSIG_C^* - LSIG_S^*) + b_7(LLIG_C^* - LLIG_S^*) + b_8\text{POP}_C \]

where the cs superscript represents central city-suburban area differentials. For a measure of the central city-suburb differential in the private sector \((X_C^*)\), we use the city-suburb hardship disparity index developed by Nathan and Adams (1976). The fiscal differentials \((LPT_C^*, LNPT_C^*, LGS_C^*, LEDU_C^*, LSIG_C^*, \text{and LLIG}_C^*)\) are constructed by subtracting the suburban value of each respective variable from its central city value. These differentials portray the levels of the
private and public sectors in the central city relative to those in the suburbs.

It is convenient here to see the coefficient signs for the different variables in equation (5.2), which follow from the discussion in the previous chapter. We expect the coefficient for the private sector variable \( \beta_x \) to be negative, since the high value of the hardship disparity index indicates the relatively low condition of the city, which would result in the low level of net in-migration. In addition, the signs for the tax variables \( \beta_2 \) and \( \beta_3 \) are predicted to be negative, while those for expenditures and grants \( \beta_4, \beta_5, \beta_6, \) and \( \beta_7 \) are expected to be positive. This is simply because the relatively low level of taxes and the relatively high level of public services would make the city attractive to potential migrants.

2. The Inter-Metropolitan Analyses

The inter-metropolitan analyses concern the inter-metropolitan process of population change. Due to data limitations on out-migration, net migration estimates are not possible so our inter-metropolitan analyses focus on in-migration streams to central cities or the suburbs from outside the SMSAs. In addition, the unavailability of data on the origin of in-migrants forces us to establish estimating equations with only the data for destination cities and suburbs.

THE INMIGRATION-TO-CITY ANALYSIS. This analysis deals with an in-migration stream to the central city from outside the SMSA. A linear
form of the estimating equation is directly derived from equation (4.14) in the previous chapter. That is,

\[ IM^C_i = \beta_0 + \beta_1 X^C + \beta_2 SLPT^C + \beta_3 SLIT^C + \beta_4 SLNPIT^C + \beta_5 SLGS^C + \beta_6 SLEDU^C + \beta_7 LSIT^C + \beta_8 LLIG^C + \beta_9 CLIMATE + \beta_{10} POP^C \]  

(5.3)

where

- \( IM^C_i \) = the number of central city in-migrants of income group \( i \);
- \( X^C \) = a measure of the private sector in the central city (i.e., the central city hardship index value);
- \( SLPT^C \) = state and local property tax per capita in the central city;
- \( SLIT^C \) = state and local income tax per capita in the central city;
- \( SLNPIT^C \) = state and local non-property and non-income tax revenue per capita in the central city;
SLGS_C = state and local government spending per capita for
general public services in the central city;
SLEDU_C = state and local government spending per capita for
education in the central city;
LSIG_C = state grants per capita in the central city;
LLIG_C = interlocal governmental grants per capita in the central
city;
CLIMATE = mean annual percent of possible sunshine in the SMSA;
POP_C = total number of city residents in 1975.

We expect the coefficient of the private sector (r_1) to be
negative, since the high value of the city hardship index indicates the
low level of its socioeconomic condition, which would discourage in-
migration from outside the SMSA. The signs for the tax variables (r_2,
r_3 and r_4) are also predicted to be negative, while those for
expenditures and grants (r_5, r_6, r_7, and r_8) are expected to be
positive. This is simply because low tax rates and high services could
make the city attractive to potential in-migrants from outside the
SMSA.

THE INMIGRATION-TO-SUBURB ANALYSIS. This analysis concerns an in-
migration stream to the suburbs from outside the SMSAs. Unlike the
other analyses in this study, it needs some extra treatments since, in
general, the suburbs are tightly linked to their central cities. The suburbs may be highly dependent upon the central cities not only in the flow of private goods but also in the provision of public services; suburban growth seems to be largely attributed to the private and public sectors in the central cities. For instance, deterioration in the quality of central city's business and public services would reduce the suburbs' attractiveness as places to live.

The potential influences of the central city's conditions on suburban growth result in an estimating equation which includes some of the central city variables as well as the pure suburban variables. The central city hardship value ($X^c$) and three fiscal variables ($SLIT^c$, $SLNPIT^c$, $SLGS^c$) are selected as the central city variables which might influence immigration to the suburbs from outside the SMSA. Although the selection of the fiscal variables seems to be a little arbitrary, tax exporting and service spillovers between the central city and the suburb provide reasonable grounding for the selection of income taxes, non-property and non-income tax revenues, and general public services. The city's other fiscal variables, such as the property tax, education, and grants, are excluded since they are more likely to be location-specific. Thus, an estimating equation for the suburban analysis takes the following form:

$$I_{ts}^s = r_0$$

$$+ r_1 X^c + r_2 SLIT^c + r_3 SLNPIT^c + r_4 SLGS^c$$
\[ + r_5X^S + r_6SLPT^S + r_7SLIT^S + r_8SLNPIT^S + r_9SLGS^s + r_{10}SLEDU^S + r_{11}LSIG^s + r_{12}LLIG^S + r_{13}CLIMATE + r_{14}POP^S \]  \hspace{1cm} (5.4)

where

\( \text{IM}_i^s \) = the number of suburban in-migrants of income group \( i \);

\( X^C \) = a measure of the private sector in the central city
\hspace{1cm} (i.e., the central city hardship index value);

\( SLIT^C \) = state and local income tax per capita in the central city;

\( SLNPIT^C \) = state and local non-property and non-income tax revenue per capita in the central city;

\( SLGS^C \) = state and local government spending per capita for general public services in the central city;

\( X^S \) = a measure of the private sector in the suburban area
\hspace{1cm} (i.e., the suburban hardship index value);

\( SLPT^S \) = state and local property tax per capita in the suburban area;

\( SLIT^S \) = state and local income tax per capita in the suburban area;
SLNPIT$^S$ = state and local non-property and non-income tax revenue per capita in the suburban area;

SLGS$^S$ = state and local government spending per capita for general public services in the suburban area;

SLEDU$^S$ = state and local government spending per capita for education in the suburban area;

LSIG$^S$ = state grants per capita in the suburban area;

LLIG$^S$ = interlocal governmental grants per capita in the suburban area;

CLIMATE = mean annual percent of possible sunshine;

POP$^S$ = total number of suburban residents in 1975.

We expect the coefficients of the private sectors both in the central city and the suburban area ($r_1$ and $r_5$) to be negative, since the high values of the hardship indices indicate the low level of socioeconomic conditions, which would discourage in-migration into the suburban area. The signs for the tax variables ($r_2, r_3, r_6, r_7,$ and $r_8$) are also predicted to be negative, while those for expenditures and grants ($r_4, r_9, r_{10}, r_{11},$ and $r_{12}$) are expected to be positive. This is simply because low tax rates and high services both in the central city and the suburban area would make the suburb more attractive to potential in-migrants from outside the SMSA.
Summary

This chapter has presented a detailed description of variables, data sources, and estimating equations which will be used for empirical estimations in the next chapter. The sample consists of the central cities and the suburbs in 52 large SMSAs. Migration data for individuals aged 23 and over in 1980 (18 and over in 1975) were extracted from the Census files. These individuals were categorized into two income groups: the middle-to-upper income group represents the upper fifty percent and the lower-income group indicates the bottom twenty-five percent of the entire sample.

The Nathan and Adams hardship indices were chosen as a measure of the private sector that would influence urban development patterns by affecting the location decision of individuals. The 1970 central city-suburb hardship disparity index values were selected for the net intra-metropolitan analysis, while both the central city and suburban hardship indices were chosen for the inter-metropolitan analyses.

The fiscal data in this study include the taxes, expenditures, and intergovernmental grants of state and local governments in the central cities and the suburbs of the 52 large SMSAs for the fiscal year 1973-74. Since many governments are usually involved in both the central cities and the suburbs, the fiscal behavior of all the governments is aggregated for each area. Taxes were grouped into two--property and nonproperty taxes--for the net intra-metropolitan analysis, while three--property, income, and the other--tax categories were selected for the inter-metropolitan analyses. Public service expenditures, on the other hand, were grouped into two--general services and local
schools--for both intra- and inter-metropolitan analyses. For comparability among jurisdictions, all the fiscal variables were expressed in per capita term.

With all private and public sector variables specified, three linear-form estimating equations were derived from migration equations in the conceptual model. In the net intra-metropolitan equation, the number of net (suburb-to-city minus city-to-suburb) movers was used as the dependent variable, reflecting the relative attractiveness of the central city over the suburban area. To reduce potential multicollinearity problems, new variables representing central city-suburban differentials in the private and public sectors were constructed as the independent variables. For a measure of the central city-suburban differential in the private sector, the city-suburb hardship disparity index was used. All the fiscal differential variables were constructed by subtracting the suburban value of each variable from its central city value. These disparity variables reflect the relative levels of the city's conditions to its suburban area.

However, limitations on out-migration flows restricted our inter-metropolitan analyses to in-migration streams from outside the SMSA to the central city or the suburbs. Thus, the number of in-migrants from outside the SMSA either to the central city or the suburbs was used as a dependent variable in the inter-metropolitan equations. In addition, the unavailability of data on the origin of immigrants forced us to use only the data for destination cities and suburbs: state and local taxes and expenditures for central cities were used in immigration-to-city
equations. Due to the possible dependency of suburban growth on the central city's private and public sectors, immigration-to-suburb equations include the city's hardship condition and several fiscal variables as well as the pure suburban variables.
CHAPTER VI
EMPIRICAL FINDINGS

Introduction

The three-region dynamic model developed in the preceding chapters are empirically tested in this chapter. The intent is to identify private and public sector influences on population change in 52 large SMSAs. A separate analysis is conducted for each of three different avenues, whereby a metropolitan population is affected by migration. A net intra-metropolitan analysis is carried out for both city-to-suburb and suburb-to-city migration, while two inter-metropolitan analyses are made for in-migration streams to either the central city or the suburb from outside the SMSA.

Before presenting and analyzing estimation results, however, it is appropriate to give some consideration to a potential statistical problem that arises in our estimating equations. The next section reports estimation results that have been obtained using 52 metropolitan area data, comparing with those of other studies. The empirical results of the private sector (urban hardship) variables are followed by those of the public sector which is represented by various fiscal institution variables such as taxes, expenditures, and grants in state and local governments.
Econometric Considerations

Multicollinearity is a potential statistical problem where taxes, expenditures, and grants are likely to be correlated with one another. The reconstruction of the fiscal variables seems to have theoretically relieved the net intra-metropolitan estimating equation of multicollinearity. In the two inter-metropolitan equations, however, the possibility of multicollinearity still exists among some of the independent variables.

Several diagnostics were performed on all the three regressions. To detect multicollinearity, variance inflation factor (VIF) and condition numbers were used, along with the simple correlations among the variables. The VIF of a variable is interpreted as the ratio of the actual variance of its coefficient to what the variance of the coefficient would have been if the variable were to be uncorrelated with the remaining independent variables (Maddala, 1988). The condition number, on the other hand, measures the sensitivity of the regression estimates to small changes in the data (Maddala, 1988). It is suggested that multicollinearity may be a problem if the VIF value exceeds 5 or a condition number is higher than 30 (Kmenta, 1986).

The test result for the net intra-metropolitan equation show no evidence of multicollinearity, with all the VIF under 4.4 and the condition numbers under 9.6. For the immigration-to-city equation, all the VIF values are below 3.3, but one condition number exceeds the suggested limit. The test result for the immigration-to-suburb equation, on the other hand, shows that three VIF and condition number values exceed the suggest limits.
Despite the test results, the variance proportion and simple correlation coefficient values indicate that multicollinearity may not be a problem in this study. According to the variance proportion values for the immigration-to-city equation, the high condition number results from the possible correlation between SLNPIT (non-property-income taxes) and SLEDU (education spending). For the immigration-to-suburb equation, the variance proportion values show that the high VIF and condition numbers are due to the possible correlations between CLIMATE and SSIG (state grants) as well as between SLNPIT (non-property-income taxes) and SLIG (interlocal grants). Simple correlation analyses, however, provide little support for these three possible correlations, with all correlation coefficients under 0.13. In addition, none of the three possible correlations seems to be consistent with arguments in public finance.

Estimation Results

The regression results are presented in Tables 6.1, 6.2, and 6.3, each of which contains estimates for both middle-to-upper and lower income populations. Table 6.1 presents estimation results for the net intra-metropolitan analysis, where the dependent variable is the number of net (suburb-to-city minus city-to-suburb) movers and the independent variables are expressed in city-suburb difference terms. Estimation results for the inter-metropolitan analyses are shown in Tables 6.2 and 6.3. Table 6.2 presents the effects of the private and public sectors in the central city on immigration to the city from outside the SMSA, where Table 6.3 shows the effects of the private and public sectors
both in the central city and the suburb on immigration to the suburb from outside the SMSA. The dependent variables in immigration-to-city and immigration-to-suburb equations are the number of immigrants from outside the SMSA to the central city and the suburban area, respectively.

Estimation results show that F statistics for all these six regression equations are significant at the 0.01 level. Most estimated coefficients of independent variables have the anticipated signs, several of which are statistically significant at the 95% confidence level. The private sector, measured by urban hardship indices, is significant and negative in all cases for the middle-to-upper income group. The public sector variables, on the other hand, vary in their significance levels and their signs across migration flows as well as income groups. The population variables, which were expected to capture the scale of socioeconomic structures as well as to normalize the dependent variables, are significant in all cases. The regional variable--climate--in the inter-metropolitan equations are also strongly significant at the 95% confidence level.

1. Private Sector Results

The private sector variables used in this study are the three urban hardship index values measured by Nathan and Adams (1979): the central city-suburb hardship disparity index was used for the intra-metropolitan analysis; the intercity hardship index was chosen for the immigration-to-city analysis; and both the intercity and intersuburb hardship indices were used for the immigration-to-suburb analysis.
Table 6.1 Migration Effects of the Private and Public Sectors: Estimates for Intra-Metropolitan Movements, 1975-80

<table>
<thead>
<tr>
<th>Independent Variables:</th>
<th>Dependent Variable: Number of Net Migrants between the Central City and its Suburbs</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>hardship disparity</td>
<td></td>
<td>-0.350</td>
<td>-0.115</td>
</tr>
<tr>
<td>(X^{cs})</td>
<td></td>
<td>(-1.968) *</td>
<td>(-1.867)</td>
</tr>
<tr>
<td>property taxes</td>
<td></td>
<td>-0.483</td>
<td>-0.142</td>
</tr>
<tr>
<td>(LPT^{cs})</td>
<td></td>
<td>(-2.043) *</td>
<td>(-1.739)</td>
</tr>
<tr>
<td>non-property taxes</td>
<td></td>
<td>-0.167</td>
<td>-0.113</td>
</tr>
<tr>
<td>(LNPT^{cs})</td>
<td></td>
<td>(-0.549)</td>
<td>(-1.072)</td>
</tr>
<tr>
<td>general services</td>
<td></td>
<td>0.296</td>
<td>0.134</td>
</tr>
<tr>
<td>(LGS^{cs})</td>
<td></td>
<td>(1.665)</td>
<td>(2.179) *</td>
</tr>
<tr>
<td>education services</td>
<td></td>
<td>0.354</td>
<td>0.062</td>
</tr>
<tr>
<td>(LEDU^{cs})</td>
<td></td>
<td>(1.971) *</td>
<td>(1.001)</td>
</tr>
<tr>
<td>state grants</td>
<td></td>
<td>0.200</td>
<td>0.058</td>
</tr>
<tr>
<td>(LSIG^{cs})</td>
<td></td>
<td>(1.357)</td>
<td>(1.129)</td>
</tr>
<tr>
<td>inter-local grants</td>
<td></td>
<td>-0.108</td>
<td>-0.097</td>
</tr>
<tr>
<td>(LLIG^{cs})</td>
<td></td>
<td>(-0.117)</td>
<td>(-0.303)</td>
</tr>
<tr>
<td>population</td>
<td></td>
<td>-0.016</td>
<td>-0.006</td>
</tr>
<tr>
<td>(POP^{c})</td>
<td></td>
<td>(-4.696) *</td>
<td>(-4.750) *</td>
</tr>
<tr>
<td>F-value</td>
<td></td>
<td>3.484 *</td>
<td>4.381 *</td>
</tr>
</tbody>
</table>

Note:

1. The cs superscripts refer to the difference between the central city and its suburban area.
2. Figures in parentheses are t statistics.
3. * indicates significance at the 95% confidence level.
Table 6.2  Migration Effects of the Private and Public Sectors: Estimates for Inmigration-to-Central City, 1975-80

<table>
<thead>
<tr>
<th>Independent Variables:</th>
<th>Dependent Variable: Number of In-Migrants to the Central City from Outside the SMSA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Middle-to-Upper Income</td>
</tr>
<tr>
<td>city hardship</td>
<td>-2.266</td>
</tr>
<tr>
<td>((X^C))</td>
<td>(-3.065) *</td>
</tr>
<tr>
<td>property taxes</td>
<td>0.133</td>
</tr>
<tr>
<td>((SLPT^C))</td>
<td>(0.719)</td>
</tr>
<tr>
<td>income taxes</td>
<td>-0.369</td>
</tr>
<tr>
<td>((SLIT^C))</td>
<td>(-1.743)</td>
</tr>
<tr>
<td>non-property &amp; non-income taxes</td>
<td>-0.133</td>
</tr>
<tr>
<td>((SLNPIT^C))</td>
<td>(-0.563)</td>
</tr>
<tr>
<td>general services</td>
<td>-0.080</td>
</tr>
<tr>
<td>((SLGS^C))</td>
<td>(-0.536)</td>
</tr>
<tr>
<td>education services</td>
<td>0.117</td>
</tr>
<tr>
<td>((SLEDU^C))</td>
<td>(0.505)</td>
</tr>
<tr>
<td>state grants</td>
<td>-0.247</td>
</tr>
<tr>
<td>((LSIG^C))</td>
<td>(-1.138)</td>
</tr>
<tr>
<td>inter-local grants</td>
<td>0.340</td>
</tr>
<tr>
<td>((LLIG^C))</td>
<td>(0.572)</td>
</tr>
<tr>
<td>climate</td>
<td>4.790</td>
</tr>
<tr>
<td>((CLIMATE))</td>
<td>(2.926) *</td>
</tr>
<tr>
<td>population</td>
<td>0.035</td>
</tr>
<tr>
<td>((POP^C))</td>
<td>(9.833) *</td>
</tr>
<tr>
<td>F-value</td>
<td>20.570 *</td>
</tr>
</tbody>
</table>

Note: 1. The c superscripts refer to the value in the central city.
2. Figures in parentheses are t statistics.
3. * indicates significance at the 95% confidence level.
Table 6.3 Migration Effects of the Private and Public Sectors: Estimates for Immigration-to-Suburb, 1975-80

<table>
<thead>
<tr>
<th>Independent Variables:</th>
<th>Middle-to-Upper Income</th>
<th>Lower Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable: Number of In-Migrants to the Suburban Area from Outside the SMSA</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>central city variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>city hardship</td>
<td>-2.704</td>
<td>-0.899</td>
</tr>
<tr>
<td>((X_c))</td>
<td>(-2.829) *</td>
<td>(-1.903)</td>
</tr>
<tr>
<td>income taxes</td>
<td>-0.783</td>
<td>-0.210</td>
</tr>
<tr>
<td>((S\text{ILIT}^C))</td>
<td>(-1.987) *</td>
<td>(-1.077)</td>
</tr>
<tr>
<td>non-property &amp; non-income taxes</td>
<td>0.277</td>
<td>0.073</td>
</tr>
<tr>
<td>((S\text{LNPIT}^C))</td>
<td>(0.686)</td>
<td>(0.364)</td>
</tr>
</tbody>
</table>

| **suburban variables** | | |
| suburban hardship | -0.006 | 0.590 |
| \((X_s)\) | (-0.004) | (0.843) |
| property taxes | 0.128 | 0.021 |
| \((S\text{LPT}^S)\) | (0.498) | (0.161) |
| income taxes | 0.054 | 0.013 |
| \((S\text{LIT}^S)\) | (0.115) | (0.057) |
| non-property & non-income taxes | -0.259 | 0.063 |
| \((S\text{LNPIT}^S)\) | (-0.584) | (0.288) |
| general services | 0.283 | 0.274 |
| \((S\text{LGS}^S)\) | (1.153) | (2.254) * |
| education services | 0.191 | -0.076 |
| \((S\text{LEDU}^S)\) | (0.721) | (-0.582) |
(Table 6.3 continued)

<table>
<thead>
<tr>
<th></th>
<th>Value1</th>
<th>Value2</th>
</tr>
</thead>
<tbody>
<tr>
<td>state grants</td>
<td>-0.182</td>
<td>-0.096</td>
</tr>
<tr>
<td>(LSIG&lt;sup&gt;3&lt;/sup&gt;)</td>
<td>(-0.811)</td>
<td>(-0.866)</td>
</tr>
<tr>
<td>inter-local grants</td>
<td>1.553</td>
<td>0.329</td>
</tr>
<tr>
<td>(LLIG&lt;sup&gt;3&lt;/sup&gt;)</td>
<td>(1.104)</td>
<td>(0.474)</td>
</tr>
<tr>
<td>climate</td>
<td>5.563</td>
<td>3.226</td>
</tr>
</tbody>
</table>
| (CLIMATE)                | (2.534)| (2.973)| *
| population               | 0.041  | 0.019  |
| (POP<sup>S</sup>)        | (6.798)| (6.380)| *
| **F-value**              | **11.995** | **11.650** |

**Note:**

1. The c superscripts refer to the value in the central city.
2. The s superscripts refer to the value in the suburban area.
3. Figures in parentheses are t statistics.
4. * indicates significance at the 95% confidence level.
Empirical analyses provide sufficient evidence that in all cases, hardship conditions are of importance in influencing the residential location of middle-to-upper income persons both within and across the metropolitan areas. For the lower-income group, on the other hand, the coefficients of urban hardship indices are not significant at the 95% confidence level in all cases. This may be because lower-income persons mostly cannot afford to choose housing in better neighborhoods.

The net intra-metropolitan estimation shows that the city-suburb hardship disparity ($X^{CS}$) has a significant and negative effect on the net intra-metropolitan movement of middle-to-upper income persons. The negative and significant coefficient implies that the higher the level of hardship disparity between the central city and its suburbs, the less likely the central city is to have net middle-to-upper-income inmigrants from its suburbs.

In the inter-metropolitan analyses, the central city hardship variable ($X^C$) has a significant and negative effect on the immigration of middle-to-upper income persons to both the central city (-2.265) and the suburbs (-2.704), whereas the suburban hardship variable ($X^S$) is not significant even for inmigration to the suburbs. The negative coefficients of the central city hardship variables indicate that the central city's poor conditions (high values of the city hardship) appear to discourage immigration of middle-to-upper income persons to both the central city and the suburbs from outside the SMSA.

The statistically significant coefficients of the hardship variables imply that middle-to-upper income persons are quite sensitive
to the level of socioeconomic conditions. More importantly, their negative signs provide evidence for a self-reinforcing, cumulative causation, which has been argued by Baumol (1967), Bradford and Kelejian (1973), Grubb (1982), and Oates et al. (1971). The negative signs lead \( \frac{\partial M_c}{\partial x_c} \) on the right hand side of equation (3.6) positive, which indicates the higher level of the private sector (the lower value of the city hardship), the greater inmigration of middle-to-upper income persons. According to the Nathan and Adams analyses (1976; 1989), urban hardship conditions have a negative relationship with the proportion of middle-to-upper income persons in the area. This relationship leads \( \frac{\partial x_c}{\partial P_t} \) on the right hand side of equation (3.6) positive, which shows that the central city's private sector has a positive relationship with the proportion of middle-to-upper income population. Thus, we obtain \( \frac{dP_t}{dt} = \frac{\partial M_c}{\partial x_c} > 0 \). The positive value of \( \frac{dP_t}{dP_c} \) implies that the city's population is not in dynamically stable equilibrium.

Such a self-reinforcing process can occur in actual practice as follows. Initially, a few middle-to-upper income city residents distracted by the city's deterioration move to its suburbs. The out-migration then leaves fewer middle-to-upper income residents and relatively greater concentrations of lower-income residents (who are less sensitive to the hardship condition) in the central city. The
relative concentration of lower-income residents increases the city's hardship, which in turn will discourage potential middle-to-upper income movers to locate there (or will prompt the remaining middle-to-upper income residents to leave).

In addition, the significant and negative coefficient of the central city hardship variable in the immigration-to-suburb equation provides support for a "negative-sum" game which was recently observed by Nathan and Adams (1989). It indicates that the central city's poor conditions (high values of the city hardship) appear to discourage immigration of middle-to-upper income persons to the suburbs as well as the central city from outside the SMSA. That is, the central city hardship works to the disadvantage of both the central city and the suburbs; weakness in the central city will ultimately weaken its entire metropolitan region.

2. Public Sector Results

Tables 6.1, 6.2, and 6.3 also indicate that fiscal variations by and large have a substantial effect on urban growth and decline by changing the residential location decision of individuals, providing support for the Tiebout hypothesis. Nearly all estimated coefficients for the middle-to-upper income group have the anticipated signs, several of which are statistically significant. Although some results, especially for the lower-income group, are not quite so clear-cut, substantial differences can be observed across migration flows as well as income groups.
The property tax variable stays statistically significant only in the net intra-metropolitan equation for middle-to-upper income residents. The property tax variable in that equation, which was expressed in terms of the city-suburb difference ($LPT_{CS}$), has a negative effect on the net (city-to-suburb minus suburb-to-city) movers of middle-to-upper income persons, while it is insignificant at the 95% confidence level for the lower-income group. This result can be explained by the fact that by and large a relatively large portion of middle-to-upper income persons as compared with the lower-income group are property owners. The significant and negative $LPT_{CS}$ coefficients are consistent with many prior studies, implying that, ceteris paribus, fewer middle-to-upper income persons are moving into locations with higher property taxes (Cebula, 1980; Grubb, 1982; Zorn, 1985).

In addition, the significant $LPT_{CS}$ coefficient reflects that the central city-suburb property tax differences are undercapitalized into labor, land, or housing prices. Except for several studies that argue for full capitalization (Heinberg and Oates, 1970), our findings are compatible with a large number of empirical studies in a Tiebout world which present the incomplete capitalization of property tax differentials among communities (Edel and Sclar, 1974; Hamilton, 1976; Meadows, 1976; Oates, 1969). If elastic supply conditions are assumed to exist in housing markets, the number of owner-occupied housing units demanded at any specific location will be significantly reduced in response to high local property taxes. Thus, a high tax location will experience relatively small capitalization effects on housing, but a
relatively large (negative) effect on the number of movers to that location.

The nonproperty tax variables, however, have no significant effects on migration, with the exception of income taxes which have a significantly negative effect on the inmigration of middle-to-upper income persons from outside the SMSA. The insignificance of the nonproperty tax variable coefficients in the net intra-metropolitan equation can be explained by the fact that most non-property taxes are state or metropolitan-wide taxes. Although some income taxes are imposed by local governments, they are mostly based on work place rather than the place of residency.

The state and local income tax level in the central city (SLIT<sup>c</sup>) has a significant and negative effect on inmigration of middle-to-upper income persons to the suburbs from outside the SMSA (− .782). Since the central city, which is generally a employment center in a metropolitan area, imposes income taxes on the basis of the place of work, its income taxes will influence the inmigration of the middle-to-upper income group to the suburbs as well as the central city (the coefficient for inmigration-to-city movers barely misses the 95% significant level but is significant at a 90% level).

The difference in migration effects between property taxes and nonproperty taxes would provide an explanation for controversial findings of the previous studies. Using the overall tax revenue as a tax measure, some researchers have observed no significant impacts on migration and others have found a "positive" effect of taxes on
migration (Carlino and Mills, 1987; Mills and Price, 1984; Reschovsky, 1979). Such controversy might be due to the use of aggregate tax variables, which fails to comprehend the differences in migration effects among different taxes.

Unlike tax variables, government spending was expected to have a positive effect on population change, since it is used as a proxy for the output and quality of public services. In the results of our estimation, the city-suburb differential in local general service expenditures ($LGS_{CS}$) have a significant and positive influence on the net intra-metropolitan location decisions of lower-income individuals, though their coefficient for middle-to-upper income population is significant at a 90% confidence level but barely misses the 95% level. General service spending also stays significant and positive for the inmigration of lower-income persons to the suburbs from outside the SMSA.

The positive sign of the local general spending coefficients ($LGS_{CS}$) indicates that the higher the per capita level of spending on general services in an area, the more attractive the area is to would-be migrants. This positive relationship is justified by the fact that general service expenditures are on such basic, necessary services for living as highways, police, fire, sewerage, sanitation, water, parking, and corrections. Our result is in line with empirical findings of many researchers, including Cebula (1980), Grubb (1982), Liu (1977), Reschovsky (1979), and Zorn (1985).
Another interesting finding on the migration effect of general service expenditures is the differential between income groups. The coefficients of general service spending in the net intra-metropolitan and inmigration-to-suburb equations are significant for the lower-income group, but none of them is significant for the middle-to-upper income group at the 95% confidence level. This result suggests that the high level of general service spending is effective in attracting lower-income persons rather than middle-to-upper income persons. A possible explanation is that lower-income persons have no choice but to rely on the public sector to obtain basic services, while middle-to-upper income persons may prefer some of these general services to be provided through the private sector.

The next public service variable is school spending, a proxy for elementary and secondary public school quality. In the net intra-metropolitan migration equations, the coefficient of the city-suburb school spending disparity (LEDU<sub>CS</sub>) is significant at the 95% confidence level for the middle-to-upper income population (.354) but it is insignificant for the lower-income group. This result is fairly consistent with empirical findings of Grubb (1982) and Reschovsky (1979). The positive sign of LEDU<sub>CS</sub> for the middle-to-upper income group supports the view that middle-to-upper income households have a strong preference for high quality education. The insignificant coefficient for lower-income persons can be explained by the likelihood that they fear that future increases to finance high quality schools would result in higher rents which they cannot afford.
Finally, the coefficients of intergovernmental grants (LSIG and LLIG) are statistically insignificant at the 95% level in all cases. This result indicates that grants have little direct effects on the location decision of individuals, though they might exercise an indirect influence on migration through their tax-reduction and spending-stimulation effects.

Summary

This chapter has presented the empirical investigation of the private and public sector influences on population change. The investigation has been made for three migration flows, which are net intra-metropolitan, inmigration-to-city, and inmigration-to-suburb movements. The differentials in migration effects of the private and public sectors has been also examined between the two income groups.

The empirical results show the importance of the urban hardship and several fiscal variables in the development pattern of the central city and the suburbs. The city-suburban hardship disparity has a significant and negative effect on the net intra-metropolitan location decision of middle-to-upper income individuals. While the suburban hardship variable has no significant effects on migration, the central city hardship values appear to have a significant influence on the inmigration of middle-to-upper income persons from outside the SMSA to both the central city and the suburbs.

The significantly negative coefficients of the hardship variables provide the empirical evidence for the self-reinforcing, cumulative causation process of urban dynamics. In addition, the importance of
the city hardship in both immigration-to-city and immigration-to-suburb movements provides support for a negative-sum game, which indicates the negative effect of the city's deterioration on the growth of its entire metropolitan area. The details of these dynamic phenomena and their policy implications will be discussed in the next chapter.
CHAPTER VII

IMPLICATIONS FOR PUBLIC POLICY

Introduction

In the theoretical model developed in Chapter 3, the private sector affects migration through the interaction of self-adjusting and self-reinforcing forces, resulting in the equilibrium level of population. The public sector, on the other hand, shifts the phase line by affecting migration, and consequently changes the equilibrium level. The disaggregation of the public sector postulated different influences of various fiscal policies on population change. The results presented in the previous section support the hypotheses that the private and public sectors play an important role in changing the pattern of urban development.

From the estimation results, two important dynamics underlying our urban system are identified: a self-reinforcing process of population change and a "negative-sum" relationship between the central city and the suburbs. The negative effects of the hardship values on the central city's growth confirm the cumulative deterioration process of urban change, while the negative effects of the central city's poor conditions on inmigration to the suburbs provide support for a negative-sum game which was recently observed by Nathan and Adams (1989).
In addition to the two dynamic phenomena in our urban system, this section discusses a variety of policy options for a desirable change in the pattern of urban development. The existence of self-reinforcing forces in the urban structure suggests that endogenous efforts (e.g., public policies) are needed to prevent urban decline from exacerbating itself in a chain of circular causation. The empirical result of a negative-sum phenomenon asserts the importance of the central city's condition in the growth and prosperity of the entire metropolitan area. Therefore, some policy intervention to break the cycle of cumulative causation is in the interest of the metropolitan area as a whole as well as the affecting cities. Our empirical results suggest that both self-help support and interlocal cooperation strategies are effective policy options that state and local governments can take. Although the results show that intergovernmental grants have no direct effects on urban growth, direct support through grants may influence urban development patterns by changing the levels of local taxes and services which affect the location choice of individuals.

A Self-Reinforcing System

It is obvious that many old central cities have suffered the loss of population, especially the decline of the middle-to-upper income population. In the context of our theoretical model, these declining cities would settle down to a new equilibrium with a much lower population size if the stability condition is satisfied. The new equilibrium will be achieved through the process of adjustment, whereby various self-adjusting and self-reinforcing factors interact with each
other. The adjustment process will continue until self-adjusting effects more than offset self-reinforcing effects.

Our empirical results, however, do not support this argument. Rather, they show that there exists a self-reinforcing, circularly cumulative phenomenon in our urban structure. The significant negative coefficients of the hardship variables indicate that the lower value of the city hardship (the higher level of the private sector), the greater immigration of middle-to-upper income persons. This leads $\frac{\partial M_c}{\partial x_c}$ on the right hand side of equation (3.6) positive. Since the central city's hardship condition has a negative relationship with the proportion of middle-to-upper income persons in the city, $\frac{\partial x_c}{\partial P_c}$ on the right hand side of equation (3.6) becomes positive. Therefore, we obtain the positive value of $\frac{\partial P_c}{\partial P_c} = \frac{\partial M_c}{\partial x_c} \frac{\partial x_c}{\partial P_c}$, which indicates that the city's population is not in dynamically stable equilibrium.

Such a self-reinforcing phenomenon can occur in actual practice as fellows. Initially, some middle-to-upper income city residents, attracted by better socioeconomic conditions, move out of the city. The out-migration then leaves fewer middle-to-upper income residents and relatively greater concentrations of lower-income residents (who are less sensitive to the hardship condition) in the central city. The relative concentration of lower-income residents increases the city's hardship, which in turn will discourage potential middle-to-upper
income movers to locate there (or prompt the remaining middle-to-upper income residents to leave).

The statistically significant and negative coefficients of the hardship values for the middle-to-upper income group reflect that the lower the central city's socioeconomic conditions, the smaller the numbers of both net immigrants from its suburbs and immigrants from the area outside the SMSA to the city. As the proportion of the middle-to-upper population in the central city decreases, the city will have the lower socioeconomic status, which negatively affects the city destination choice of middle-to-upper income movers. Such a self-aggravating process will continue until "a chronic nadir of lethargy" is reached (Baumol, 1963).

A Negative-Sum Game

In a recent update of their 1976 urban hardship study, Nathan and Adams (1989) uncovered an important insight into the long-term relationship between the central city and its suburbs in the metropolitan area. Their examination of long-term developments in hardship patterns revealed that city-suburban hardship disparity had worked to the disadvantage of the suburbs as well as to the disadvantage of the central city itself. Such an adverse effect of the intra-metropolitan disparity on both the central city and the suburbs can be called a "negative-sum" game.

Our estimation results provide support for a negative-sum game. The central city hardship values were found to be statistically significant for middle-to-upper income inmigrants to both the central
city and the suburbs from outside the SMSA. Interestingly, immigration to the suburbs from outside the SMSA is affected not by the suburban hardship but by the central city hardship values. Except for the regional factor--climate, the city hardship variable has the greatest influence on immigration from outside the SMSA to the suburbs.

The statistical significance of the city's hardship condition in both immigration-to-city and immigration-to-suburb equations implies an important role of the central city in the development, prosperity, and vitality of its whole metropolitan area. To the extent that the suburbs depend upon the central city for their growth, the central city may appear to be "exploited" by suburban jurisdictions. Although many central cities have been losing their role as a unique focal point for the agglomeration of manufacturing operation, our empirical results support the view that the central city still plays as a major service and employment center in the metropolitan complex. Deterioration in the quality of the central city's business services and medical, educational, and civic facilities will be directly reflected in the socioeconomic status of both city and suburban residents. Thus, weakness in the central city will ultimately weaken an entire metropolitan region.

Policy Options for Metropolitan Growth

If self-reinforcing and negative-sum phenomena are prevalent in our urban structure, what policy options can state and local governments take so as to achieve the growth and prosperity of both the central city and the suburbs? According to the conceptual model in
Chapters 3 and 4, it is clear that the self-reinforcing urban system cannot be self-equilibrating, implying that policy intervention is necessary to counteract cumulative causation. Public policy shifts the phase line by affecting migration, and consequently changes the equilibrium level of population which results from the interaction of the private sector variables. Our empirical results confirmed such a role of policy intervention, showing that in some sense, the fiscal behavior of state and local governments does change urban development patterns by affecting the location decision of individuals.

Some differentials in the growth effect of public policy were also found across income groups and disaggregated fiscal variables. Property taxes and education services are of importance to the net intra-metropolitan movement of the middle-to-upper income population. Here, our results show that the property tax difference has a greater effect than the differential in education services on the net intra-metropolitan movement of middle-to-upper income persons (the coefficient of the property tax is -.484, while that of education services is .354). The central city's income taxes were found to have a significant effect on the immigration of the middle-to-upper income group to the suburbs from outside the SMSA. General services are of great importance to lower-income movers in both net intra-metropolitan and immigration-to-suburb migration processes.

These differentials in the migration effects provide insights into influences of various policy alternatives on the growth of metropolitan areas. For the prosperity of the whole metropolitan area, it is important to adopt public policies that help attract middle-to-upper
income persons to the central city. Since states are the principal architects of local government finance, most policy options obviously require the action of states. These include self-help support enabling central cities to expand their revenue-raising capacity, policies governing burden sharing among localities in the provision of local services, and other options which local governments can take.

The first option is to provide self-help support for the central city. The significant and negative coefficient of property taxes in our findings suggests policy officials to diversify revenue bases by seeking other revenue sources that are less burdensome to city residents. Alternative revenue sources could be sales taxes, income taxes, commuter taxes, and non-resident use fees for city facilities.

Since sales taxes were found to have little influence on location decisions, they would be a substitute for the property tax. States can help the central city by removing restrictions from municipal use of sales taxes and/or increasing the amount of shared tax revenue from these sales that is returned to municipalities.

An income tax will be another substitute for the property tax. It would be more effective in reaching suburban residents if it applies to all income earned within the central city as well as upon income of residents wherever earned. Like commuter taxes, this essentially enables the central city to tax the income of suburban commuters.

The negative-sum relationship between the central city and its suburbs justifies regional/metropolitan tax-base sharing as well as commuter taxes. The purpose of a tax-base sharing strategy is to regionally equalize the benefits from property-tax-base increases and
to reduce fiscal disparity between the central city and its suburbs within a given metropolitan area. For example, under the plan adopted by Minnesota, "forty percent of the revenues generated from the growth in the property-tax base in the seven-county area of metropolitan Minneapolis-St. Paul is put in a pool and distributed to the affected localities based on indicators of 'need,' measured by population and per capita wealth" (Florestano, 1981). This strategy can be also a solution to tax competition among localities in the metropolitan area.

The second category of policy options concerns burden sharing among state and local governments in the provision of local services. It includes not only the transfer of costly service functions to other levels of governments, but also emphasizes collaborative efforts among localities in delivering public services and managing service agencies. Burden sharing can be performed with either other municipal, the county, special districts, regional councils of governments, or the state. To date, much emphasis has been upon those functions with a high "bricks and mortar" content such as water, sewers, bridges, tunnels, and airports (Oakland, 1979).

However, relatively little has been done with respect to education services. Our empirical findings showed that education services would have the most effective influence on the intra-metropolitan movement of middle-to-upper income individuals. Thus, reduction of the central-city-suburban disparity of school quality is important to retain middle-to-upper persons in the central city and/or attract them into the city. It can be performed through either the state assumption or
area-wide provision of education services, though some observers doubt the effectiveness of these strategies (Oakland, 1979).

Thirdly, our empirical results indicate that intergovernmental grants have little direct effects on the location decision of individuals. The results, however, do not necessarily deny the indirect effect of grants on population change through their tax-reduction and spending-stimulation effects. According to the estimation results, a reduction in local property taxes is a more powerful intra-metropolitan policy per standardized dollar in terms of inducing the middle-to-upper income population to locate in the cities than is a rise in any public service spending. If additional grant funds from the federal or state governments become available, the findings suggest that these funds could be better used to reduce local property taxes than to expand public spending. This suggestion implies that the flypaper effect of grants shouldn't be going on.

The argument for tax reduction rather than service expansion is opposite to the study of Oates et al. (1971), which measures the effect of the public sector on changes in a city's income. This contradiction is mainly due to the difference in the sample used: this study includes middle- and upper-income residents in the category of the middle-to-upper income group, whereas Oates et al. (1971) have chosen only upper-income families in central cities. As Reschovsky (1979) observed, the sensitivity of middle-income households to property taxes tends to be greater than that of upper-income families (e.g., an insignificant effects were found for the rich in the Reschovsky study). Thus, the
inclusion of middle-income persons in our study may have resulted in
the relative importance of property taxes to public services.

Our estimation results provide a suggestion for another dilemma
faced by policy officials in local governments. Many cities in an era
of federal cutbacks are attempting to balance their budgets by raising
taxes and cutting expenditures on public services. Such actions would
make a further downward shift of the phase lines in our theoretical
model since they play a negative role in attracting potential migrants.

In addition to reduced federal grants, a variety of restrictions
often force local governments to adopt balanced budgets. If cities
attempt to balance their budgets by reducing public services and
maintaining the same level of property taxes as before, our empirical
results wouldn't predict any unfavorable effects in terms of keeping
and attracting middle-to-upper income families in the cities.

Summary and Concluding Comments

This chapter has discussed the two important dynamic phenomena and
their implications for public policy. The statistically significant
and negative coefficients of the hardship variables provide the
empirical evidence for the self-reinforcing and cumulative process of
urban change. In addition, the importance of the city hardship in both
inmigration-to-city and inmigration-to-suburb movements provides
support for a metropolitan-wide negative-sum game, which indicates the
negative effect of the city's deterioration on the growth of its entire
metropolitan area.
The existence of a self-reinforcing phenomenon in our urban structure requires policy intervention so as to counteract cumulative causation. On the basis of the estimation results in the previous chapter, a variety of policy options were suggested for the growth of metropolitan areas. They include self-help strategies enabling local governments to expand their revenue-raising capacity, policies governing burden sharing among localities in the provision of local services, and several options which local governments can take for balancing their budgets.

The significant and negative coefficient of property taxes in our findings suggests policy officials to diversify revenue bases by seeking other revenue sources that are less burdensome to city residents. Alternative revenue sources could be sales taxes, income taxes, commuter taxes, and non-resident use fees for city facilities. In addition, tax-base sharing is also justified by the negative-sum relationship between the central city and its suburbs.

Burden sharing strategies include not only the transfer of costly service functions to other levels of governments, but also emphasize collaborative efforts among localities in delivering public services and managing service agencies. Although burden sharing has been performed for many functions, relatively little has been done with respect to education services. Since education services were found to have the most effective influence on the net intra-metropolitan movement of middle-to-upper income individuals, reduction of the central-city-suburban disparity of school quality through the state assumption or area-wide provision of education services would help the
central city retain middle-to-upper persons in the city and/or attract them into the city.

The finding that the property tax is more effective than public services suggests several options that local public officials can take. If additional grant funds from the federal or state governments become available, these funds could be better used to reduce local property taxes than to expand public spending; this suggestion implies that the flypaper effect of grants shouldn't be going on. In addition, an increase in public services financed through a rise in property taxes seems to have an unfavorable effect in terms of keeping and attracting middle-to-upper income households in the cities. Moreover, an attempt to balance budgets by reducing public services (without increasing property taxes) wouldn't hurt the future growth of the cities as much as one by maintaining the same level of public services financed by an increase in property taxes.
CHAPTER VIII
SUMMARY AND CONCLUSION

Introduction

The purpose of this concluding chapter is threefold: to briefly summarize the methodology and findings of the study and attempt to answer the original research questions that motivated this study; to discuss the significance of the study; and to provide possible suggestions for future research. The remaining three sections of the chapter address each of these issues in turn.

Overview of the Study

This study have attempted to achieve two basic goals. First, to put forth a theoretical model explaining the underlying dynamic of urban growth and decline, and then to report the empirical testing of the model. A three-sector dynamic model was developed to identify the dynamic process of population change and to investigate the role of various dynamic elements in the process. In the model, a variety of the private and public sectors were assumed to affect migration, which results in changes in the size and characteristics of population. The interaction of self-adjusting and self-reinforcing forces in our urban structure determines the pattern of urban development, resulting in urban growth or decline. The process of urban growth or decline has been shown to be a continuous change of our urban structure in the long
run rather than in the short run.

Three sets of data for 52 large U.S. metropolitan areas were used for empirical estimations. The migration data set, which was drawn from the 1980 Census, provided detailed information on individuals’ income and aggregate migration flows within and across metropolitan areas for the period of 1975-80. The hardship index values developed by Nathan and Adams (1976) were used as the private sector variable to give a picture of overall urban conditions. The fiscal data drawn from the 1974 Census’s Survey of Government Finances were used in constructing state and local policy variables, which were taxes, expenditures, and grants-in-aid.

Empirical estimations were conducted for three different migration streams, through which population change occurs. A net intra-metropolitan analysis was carried out for both city-to-suburb and suburb-to-city migration, while two inter-metropolitan analyses were made for in-migration streams to either the central city or the suburb from outside the SMSA. The differential in the effects of the dynamic elements between the middle-to-upper- and lower-income groups was also investigated for each of the three analyses.

In addition to the theoretical consideration, the estimation results (based on the ordinary least squares method) provide answers to the research questions which motivated this study. They have identified a self-reinforcing process, in which an initial change (decline or growth) continuously reinforces the process of urban change. A city’s undesirable condition--high urban hardship--discourages the influx of middle-to-upper income persons into the city.
As the proportion of middle-to-upper income residents decreases, the city will have a worsening socioeconomic condition, which in turn will discourage the inmigration of middle-to-upper persons.

Another interesting dynamic phenomenon found in the empirical estimations is a metropolitan-wide negative-sum game. The central city's hardship condition plays an important role in attracting potential migrants into not only the central city, but also the suburbs from outside the SMSA. This indicates that the growth of the central city is vital for the growth of its whole metropolitan region. Weakness in the central city will ultimately weaken not only the central city itself through a self-aggravating process, but also weaken its entire metropolitan area.

The existence of a self-reinforcing phenomenon in our urban structure implies that government intervention is necessary to counteract cumulative causation. The public sector estimation results provide an insight into a variety of policy options that state and local governments can take regarding the growth of the central cities and their suburbs. The significant and negative coefficient of property taxes in our findings suggests policy officials to diversify revenue bases by seeking other revenue sources that are less burdensome to city residents. Alternative revenue sources could be sales taxes, income taxes, commuter taxes, and non-resident use fees for city facilities.

The negative-sum relationship between the central city and the suburbs requires collaborative efforts among localities in delivering public services and managing service agencies. Since education
services were found to have the most effective influence on the net intra-metropolitan movement of middle-to-upper income individuals, reduction of the central-city-suburban disparity of school quality through the state assumption or area-wide provision of education services would help the central city retain middle-to-upper persons in the city and/or attract them into the city.

Although the empirical results show that intergovernmental grants have little direct effects on the location decision of individuals, they do not necessarily seem to deny the indirect effect of grants on population change through their tax-reduction and spending-stimulation effects. The finding that the property tax is more effective than public services suggests several options that local public officials can take. If additional grant funds from the federal or state governments become available, these funds could be better used to reduce local property taxes than to expand public spending. In addition, an increase in public services financed through a rise in property taxes seems to have an unfavorable effect in terms of keeping and attracting middle-to-upper income households in the cities.

Overall, the evidence suggests that state and local fiscal policies are having a distinct influence on the growth and decline of metropolitan areas. The estimation results in support of this should serve as useful inputs into many of the controversies and policy issues associated with taxation, service responsibilities, and grants-in-aid.
Significance of the Study

This study is important for several theoretical and practical reasons. Unlike much previous work, the study presented a general, grand theory of urban dynamics which explains the intertemporal and spatial process of population change. By putting the theory into practice, the study found the existence of self-reinforcing and negative-sum phenomena in our urban system and also provided support for the Tiebout hypothesis. To some extent this study is complementary to both urban dynamic studies and empirical tests of the Tiebout hypothesis. However, it differs from most urban dynamic and Tiebout analyses in several aspects.

First, the three-sector dynamic model provides a useful framework with which to analyze not only the interaction of dynamic forces in our urban system, but also the effect of public policy on urban growth and decline. Most dynamic models so far have focused on very limited dynamic elements in a single urban area and offered no explanation for the systematic interaction of internal forces in the urban structure. The model in this study, however, gives an insight into the dynamic process of population change, where self-adjusting and self-reinforcing forces interact with each other and consequently determine equilibrium population. Comparative-static analyses of the model also lead us to understand the importance of public policies in changing the equilibrium level of population.

Second, the approach employed in this study is to analyze the effects of the private and public sectors by looking at the migration sensitivity of individuals. The common approach used in most Tiebout
analyses is to observe the price capitalization effect of the local public sector (Edel and Solar, 1974; Hamilton, 1976; Heinberg and Oates, 1970; Meadows, 1976; Oates, 1969; Reinhard, 1981; Zorn, 1985). Studying capitalization does not enable us to identify the quantitative importance of dynamic factors on population change. In addition, there are some limitations on the general applicability of the empirical results of capitalization studies since these analyses mostly used data on a single urban (or metropolitan) area.

Third, this study distinguishes differential migration effects of public policies between income groups as well as migration flows. Some capitalization studies are unable to distinguish differential migration patterns of individuals of different socioeconomic groups. Their exclusive concentration on the city-to-suburb movement of population does not allow us to ascertain whether or not their results are valid for other migration streams, including the suburb-to-city movement. The disaggregation of migration flows with respect to both income groups and movement types improves the applicability of the Tiebout hypothesis.

Finally, the disaggregation of policy variables allows us to assess the relative importance of state and local fiscal institutions in population change. Our results of estimation conclude that property taxes and education services are powerful in attracting middle-to-upper income persons to the metropolitan area. The central city's income taxes play an important role in inducing new blood from outside the SMSA to flow into the suburbs. Though this conclusion might need full support from micro-level behavioral analyses on the residential
location of individuals, it provides an insight into various policy alternatives for a desired change in urban development patterns.

Suggestions for Future Research

The diverse body of the literature surveyed in this study gives an indication of the wide ranging field of the study. In fact, the topic is so vast and the potential for future research so varied that it is possible to give only a few of the many possibilities for subsequent investigation.

First, data limitations precluded an intertemporal estimation that accounts for the long-term dynamic effect of the private and public sectors. It seems that the dynamic model in this study works better with time-series data, which are not available at this moment. A pooled data set which includes the migration data for the period 1985-1990 would improve the quality of our analyses.

Another issue is with respect to the assumptions and methodology in this study. Assuming that no interactions exist between the private and public sectors, the study has been concerned with the direct effect of public policies on population change. In the real world, it is clear that the public sector influences migration indirectly by changing the private sector, which in turn affects the public sector. A more suitable methodology might be a structural model, which allow for not only the possibility of the causal link among explanatory variables themselves but also any kind of feedback effect or reciprocal causation between explanatory variables and dependent variables. The main task of the future study would be to capture the complicated and
sometimes, hardly predictable interactions among a variety of private and public sector variables as well as between these variables and migration flows.

The third issue is the usefulness of our research for predicting the consequences of public policies. Some people like Senator Moynihan argue that federal urban policies have "the" significant effect on urban growth and decline in the U.S. (Weinstein and Rees, 1982). If this is true, the exclusion of federal policies might generate a misleading result. More extensive study should include a variety of urban actions by the federal government.

Finally, it is important to recognize that this study has little real normative content. The dynamic model used in the study is concerned solely with the migration pattern of individuals among jurisdictions. While a specific policy option (based on our findings) may induce middle-to-upper income person to live in certain jurisdictions, such a policy is not necessarily in the national interest and may not desirable for social well-being. Hopefully, future progress is made with dynamic models to deal with broader normative issues.
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