METROPOLITAN GROWTH AND THE INTRAMETROPOLITAN LOCATION OF HOUSING, EMPLOYMENT, AND POPULATION

PREPARED FOR

OFFICE OF THE ASSISTANT SECRETARY FOR
POLICY DEVELOPMENT AND RESEARCH
U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

PREPARED BY
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CHAPTER 1: INTRODUCTION AND EXECUTIVE SUMMARY

This study analyzes the impacts of changes in several broad national forces during the 1970s on the spatial distribution of economic activity and population in the United States by comparing the relative influence of different factors over three decades within a system of simultaneous equations. Compared to the 1960s, during the 1970s national labor supply grew rapidly, both relatively and absolutely, as young people and women entered the labor force. Economically, the 1970s were characterized by an early energy crisis, a deep recession during 1974-75, and inflation and severe international competition through much of the decade. Moreover, the industrial composition of employment changed sharply away from manufacturing and toward service activities. Increased housing demand, inflation, and high mortgage rates also made housing prices and housing supply conditions considerably different during the 1970s.

Factors such as the changed age structure of the population, changed labor force participation rates of women, changed industrial composition of employment, and the reversal of net nonmetropolitan to metropolitan migration during the 1970s relative to the 1950s and 1960s cause us to expect that some of the conventional understanding of the forces underlying metropolitan growth and intrametropolitan location may also have changed. If this understanding has changed, it could be very important to policy-makers and also to theorists, because it provides some clues about the influence of the macroeconomic climate on spatial redistribution. If the relative importance of various factors has not changed, conversely, the findings may support past theory.

Evidence from earlier work suggests that during the 1950s and 1960s metropolitan in- and out-migration were highly sensitive to metropolitan employment growth. In turn, employment growth was spurred by in-migration and

discouraged by out-migration. If these patterns also held during the 1970s in the presence of heavy interregional migration, they would suggest that migration was a major vehicle through which metropolitan employment change occurred. If this were true, however, the aging of the baby boom out of the most mobile age classes, by reducing the size of the population with the highest migration propensities, promises to lessen the importance of migration as a redistributive force during the late 1980s and the 1990s, when metropolitan growth experiences across broad regions of the country should be more similar than they were during the 1970s.

Earlier work concerning intrametropolitan location patterns is generally not definitive regarding the causal mechanisms underlying movement away from central cities and to suburban areas. Many competing hypotheses have been offered to explain the suburbanization phenomenon. For example, certain individuals argue that the labor force has moved from central cities to suburbs in response to the movement of employment, especially manufacturing employment. Others argue the opposite, that manufacturing employment has followed the labor force to the suburbs. Still others stress the importance of a high income elasticity of demand for high quality, low density housing in attracting households to the suburbs. Empirical evidence suggests that some truth is contained in each hypothesis, and in many others that have been offered to explain suburbanization, but the various hypotheses have almost never been treated in the context of a single, integrated model such as is done in this study. This approach allows an assessment of the relative importance of various factors on intrametropolitan location decisions.

Moreover, it is important for policy purposes to know not only whether suburban employment opportunities and/or suburban housing have been important

in attracting households from the central city, or in attracting metropolitan in-migrants to locate in the suburbs rather than in the central city, but it is also crucial to know which households respond to which incentives. Different types of employment opportunities (e.g., manufacturing versus retail) and different types of housing (e.g., owner occupied versus rental) may elicit different responses from different types of households (e.g., high income versus low income or white versus black), and these issues have to date not been extensively analyzed. They are the focus of major attention in this report.

The analytical phase of this study uses a sample of over 60 major metropolitan areas to examine the magnitudes of the causal linkages between employment growth and migration and generally to draw inferences concerning the forces underlying changing location patterns both between and within metropolitan areas during the 1970s. Because a simultaneous-equations model that accounts for the interactions between employment growth and migration is estimated separately for the decades of the 1950s, 1960s, and 1970s, the influence of employment growth and other factors on metropolitan migration can be compared over time. Furthermore, the study considers the interactions between migration and both income and unemployment growth. Intrametropolitan location patterns are also examined in the context of a simultaneous system in which employment opportunities and housing supply conditions influence location patterns and in turn such location patterns influence the spatial distribution of metropolitan employment and housing. The magnitudes of the influence of the many explanatory variables are also estimated for the 1950s, 1960s, and 1970s.

1.1 The Economic and Demographic Background

The sharp increase in labor supply that occurred during the 1970s had three primary causes. The first and most important was the maturing of the baby-boom cohort into the labor force. Second, female labor force participation rates, which increased during the 1960s, rose considerably more during the 1970s. Finally, legal immigration to the U.S. was appreciably higher during the 1970s than the 1960s, and due to economic conditions in Mexico and the Caribbean, illegal immigration was probably higher also.

The quadrupling of oil prices in 1973 was a severe shock to the economy at the very time it was undergoing continued dislocations and reallocations brought on by post-Vietnam adjustments. Moreover, the recession of 1974-75 was then the most severe of the post-World War II period, and the national unemployment rate soared from 5.0% to 9.2% in one year. Serious inflation accompanied high unemployment rates and contributed to sharply rising housing prices and mortgage interest rates. Furthermore, severe foreign competition, especially in steel and automobiles, had important implications for the economy.

The industrial composition of U.S. employment had been changing for some time, but the 1970s brought dramatic new elements to this change. The manufacturing sector was almost stagnant during the decade and the rate of growth of government employment fell sharply compared to the 1960s. On the other hand, due primarily to the energy crisis, the mining sector reversed a long-term downward trend and grew more rapidly than any other sector, which contributed to a resurgence of nonmetropolitan America.

Interstate and intracounty rates of mobility also declined somewhat during ~~and~~ 1970s, especially among young people. One of the most important

causes of decreased rates of movement was probably the continued fall in marriage rates of the young. Housing supply conditions, especially higher mortgage rates, may have contributed to decreased marriage rates, but other factors also seem important. A desire on the part of women, at least relative to their mothers, to decrease the number of children they bear and to postpone fertility has probably also caused the marriage rate to fall. These desires are likely to be tied to increased female labor force participation and labor force attachment.

Since approximately 1970, trends in the spatial distribution of population and of economic activity in the United States have changed dramatically. After many decades during which the West experienced the greatest volume of net in-migration, since about 1970 the South has had a volume of net in-migration twice that of the West. Previously the South had persistent net out-migration. Moreover, the rate of population growth in metropolitan areas slowed considerably, in part because the central-city population of many metropolitan areas declined and the suburban growth boom of prior years moderated appreciably. Partially as a cause and partially as a consequence of these changed circumstances, the historical trend of migration out of non-metropolian areas and into metropolitan areas reversed, and population in non-metropolitan America began growing more rapidly than that in metropolitan America. This trend began to reverse again late in the 1970s as areas previously categorized as nonmetropolitan began to assume a metropolitan character and were recategorized as such by the Bureau of the Census.

In 1970, the South and West held about 45% of the nation's nonagricultural employment, but during the 1970s these regions accounted for almost 73% of the nation's incremental employment of this type. Conversely, the North-

east and North Central regions held about 55% of national nonagricultural employment in 1970, but accounted for only 27% of incremental national employment. During the early 1980s, moreover, the Northeast and especially the North Central regions experienced sizeable absolute declines in their nonagricultural employment base. The manufacturing sectors of these regions were hit particularly hard by the recessionary conditions of the early 1980s. Since manufacturing is heavily concentrated in the metropolitan areas of the Northeast and North Central regions, these areas have been particularly touched by recessionary economic conditions.

The poor employment prospects in the Northeast and North Central regions gave the large and potentially mobile baby-boom generation that was maturing into labor-force ages strong incentives to migrate away from these regions, and thus also from metropolitan areas. Due to the relatively rapid rate of employment growth in the South and West, these regions proved attractive destinations for interregional migrants. As a consequence of heavy interregional migration, the South and West accounted for about 90% of the nation's incremental population during the 1970s and an even higher fraction during the early 1980s.

Interregional migration has been highly selective in terms of age and education. Since the propensity to migrate drops sharply with age, individuals in their late forties are only about one third as likely to move as individuals in their late twenties. Moreover, the age selectivity embodied in the migration streams changes the age structure of donor and recipient regions, such that the Northeast and North Central regions now have somewhat older age structures of their populations. The West has a particularly young age structure, which contributes to a higher rate of natural increase there than in the other regions.

In terms of educational composition, interregional migration streams tend to strongly favor the South and especially the West at the expense of the Northeast and North Central regions. During the late 1970s the Northeast, for example, gained only 53 college graduates for every 100 college graduates who migrated out of this region, whereas the West gained 179 college graduates for every 100 who left. Probably due largely to return migration, the South gained 231 migrants with no more than an elementary school education for every 100 who moved out. The West gained only 77 such individuals for every 100 who moved away. The educational composition of migration flows to the West thus seems especially conducive to future growth and economic development there.

The trends affecting the distribution of economic activity and population between regions and between metropolitan and nonmetropolitan areas in the United States have been described by many analysts. The conclusions of this research for the period from 1960 to 1975 have emphasized both a regional shift and a turnaround in long-standing relationships between metropolitan and nonmetropolitan areas. Due to the relatively high levels of metropolitanization of the Northeastern and North Central U.S., the regional shift and the turnaround are not easily separated.

The conclusions of previous researchers concerning the turnaround have depended heavily on data from the 1970-1975 period, during which time economic distress in 1974 and 1975 accentuated the problems of large metropolitan areas in the Northeastern and North Central U.S. At first, the serious recession of 1974-75 was thought to have caused the nonmetropolitan-to-metropolitan migration turnaround and to have contributed importantly to the acceleration of the shifts of employment and population out of the Northeast and North Central regions and into the South and West. Jusenius and Ledebur (1976, p. 34), for

example, speculate that policy decisions based on the assumption that the experience of 1970 through 1975 represents a new trend may be ill-considered and counter-productive in the long run.

Whereas the recession of 1974-75 may have contributed to changes in location patterns, the continued decentralization of the late 1970s suggests that it was not the primary causal force behind the shifts. It is important, therefore, that data from the period subsequent to the 1974-75 recession be considered if the dimensions of the economic/demographic redistribution that was occurring are to be evaluated.

Whereas certain of the causal forces behind the shift from metropolitan to nonmetropolitan areas will continue to operate, others will not. For example, the out-moded and relatively inefficient plant and equipment located in older urban centers may survive economically for long periods, but the baby-boom generation has almost matured out of those age classes that are most mobile. Although the phenomenon of decentralization may continue, perhaps at a slower pace, it may not be reflected in the data because many of the fastest growing nonmetropolitan areas are adjacent to metropolitan areas and eventually are included in the Census Bureau's definition of metropolitan space.

During the 1960s few of the nation's major metropolitan areas experienced absolute population decline, but during the 1970s such decline was common, particularly in the Northeast and North Central regions. New York alone lost more than 850,000 people, or 8.6% of its 1970 population. In addition to Philadelphia and Boston, a number of SMSAs in Michigan, Ohio, western New York, and Pennsylvania had absolute population loss. These same SMSAs also had serious losses of manufacturing jobs, as the steel and automobile industries struggled with foreign competition and antiquated technologies. Other

sources of employment, especially services, tended to offset the manufacturing decline, but overall employment in these SMSAs either decreased or increased only slightly.

As previously discussed, U.S. population growth during the 1970s was concentrated in the South and West, which captured an historic high level of national incremental population during the decade. Nevertheless, the extremely high growth rates that characterized many southern and western SMSAs during the 1960s moderated during the 1970s. Phoenix and Houston are exceptions, although plunging oil prices during the mid-1980s were to throw Texas into a severe economic slump that severely affected Houston. Relatively high rates of employment growth also characterized the typical southern and western SMSA during the seventies. Most areas had rates as high as, or higher than, those that prevailed during the 1960s. Because they maintained their employment growth rate while experiencing a decreased rate of population growth, the employment-to-population ratio increased relatively in most southern and western areas.

Primarily due to employment growth differentials that were probably reinforced by interregional migration, net migration strongly favored southern and western SMSAs during the 1970s. Moreover, retirement migration, which tends to be concentrated on a relatively few metropolitan areas, contributed importantly to SMSAs such as Phoenix and Fort Lauderdale-Hollywood. Areas of net in-migration were generally favored by the age composition of migration (young adults), as well as by the education (highly educated) and income (high income) compositions of these streams. Empirical evidence clearly shows that young, well-educated, and relatively high-income persons have the highest propensities to migrate, which means that such individuals are drawn away from slow growing and to fast growing areas.

Partially as a consequence of migrant selectivity, southern and western SMSAs also enjoyed relatively high rates of growth of median income during the 1970s. In real terms median income grew in only 14 sample SMSAs, and 12 of these were in the South and West. In terms of growth rate, all western SMSAs improved their rank between the 1960s and 1970s. Northeastern SMSAs generally ranked quite low. Those metropolitan areas that had high concentrations of employment in the steel industry had relatively high rates of income growth, although their employment growth rates were low.

Most SMSAs had considerably lower rates of growth of their housing stock during the 1960s than the 1950s, but during the 1970s the comparative growth performance was mixed. Whereas the stock tended to grow more slowly in many SMSAs in the Northeast and North Central regions, many of those in the South and West had faster growth. Between the 1950s and the 1960s a shift occurred in the tenure composition of metropolitan housing, as the rate of growth of owner-occupied housing fell and that of renter-occupied housing rose. At least in the South and West both types of housing tended to increase more rapidly during the 1970s than the 1960s.

Central city decay in major metropolitan areas of the country is a well-known phenomenon. One prominent explanation for the plight of central cities is that both workers and jobs have been involved in self-reinforcing movement to the suburbs. By eroding the central city tax base and thus shifting the burden of local taxes to employers and to relatively high-income residents remaining behind, this movement is thought to have encouraged further flight from the central city.

During the 1970s suburban population grew more rapidly than central city population in every SMSA studied. Moreover, many central cities, especially

in the Northeast and North Central regions, continued to experience absolute population decline. Suburban employment also grew more rapidly than central city employment, and several cities in each region lost jobs. Manufacturing and retail employment were the main sources of central city job loss, but late in the decade even service employment fell in a number of northeastern and midwestern cities. For many years growth of service employment had offset declines from other sources and had thus contributed to the viability of the city as a place to reside and work. This change appears to be one worth monitoring during the 1980s.

During the 1965-70 period most SMSAs had population and labor force losses to their suburbs, but during the 1975-80 period every major SMSA studied had such losses. Those in the South and in the North Central regions experienced the highest rates of movement from central city to suburbs (when either the central city or the suburbs is the base). Whites, especially those with higher income, generally had somewhat higher rates of out-movement to the suburbs than their black counterparts. Net migration (from areas external to the SMSA) was typically positive for both the central cities and suburban areas of SMSAs in the South and West, and was typically negative for those of SMSAs in the Northeast and North Central regions. These conditions tend to hold across race and income groups.

Almost without exception, the suburban housing stock has grown more rapidly than the central city housing stock over the last three decades. During both the 1960s and 1970s the number of owner-occupied units in the central city declined in many SMSAs in the Northeast and North Central regions. Moreover, decline of the renter-occupied housing stock was common in these regions during the 1960s and became more common during the 1970s. In

most SMSAs in the South and West both the owner- and the renter-occupied stock increased in both the central city and the ring. These changes are largely a reflection of population and household location patterns.

1.2 Migration and Metropolitan Growth

Probably the strongest finding concerning migration and metropolitan growth is that employment growth and migration interact in a self-reinforcing and cumulative way. That is, employment growth causes in-migration, which causes more employment growth, which in turn causes more in-migration, and so on. Migration's greatest impacts are on nonmanufacturing employment (not including government), but its impacts are not insubstantial for manufacturing and government employment. Moreover, these cumulative forces may have been stronger during the 1970s than during either the 1950s or the 1960s.

Contrary to conventional wisdom, income growth differentials between SMSAs do not explain metropolitan migration during any period, but income levels provide a partial explanation. During the 1950s and 1960s SMSAs with higher incomes had less out-migration, but during the 1970s this relationship failed to hold. Moreover, during the 1960s high income SMSAs were attractive for migrants, but during the 1970s low income SMSAs were attractive, other things being equal. This change seems important and may reflect the tendency for migrants to move from high-income areas of the Northeast and North Central regions where employment growth was lagging to the lower income areas of the South and West where job opportunities were growing rapidly. However, even after employment growth is taken into account in the model, the predominant flows were still away from Northeast and North Central SMSAs and to SMSAs in the South and West.

Although higher unemployment rates never appear to explain higher metropolitan migration, the growth of unemployment does. A striking finding regarding the unemployment variables is the similarity of the influence of unemployment growth during the 1950s and the 1970s. Unemployment growth encouraged out-migration both to other SMSAs and to non-SMSA areas during each of these decades, but not during the 1960s. Moreover, such growth discouraged in-migration from nonmetropolitan areas during the 1950s and 1970s, but again not during the 1960s. One possible reason for the different effect of unemployment growth during the 1960s is that this decade was generally one of sustained growth. The period from 1963 to 1969 was, in fact, the longest period of sustained growth during the post-World War II years.

In the income and unemployment change equations, the role of migration appears to have changed in the 1970s. During earlier decades migration failed to influence the rate of metropolitan income growth, which suggests that the labor demand shifts associated with in- and out-migration tended to offset the labor supply shifts associated with such migration. During the 1970s, however, in-migration encouraged significantly more rapid rates of growth of metropolitan income, suggesting that the demand shift newly dominates the supply shift, with the result that stronger cumulative forces may now be present, reinforcing differences among SMSAs. This conclusion should be qualified, however, because the 1960s coefficient on the in-migration variable in the income-change equation is positive and not statistically significant, but is somewhat greater in value than the statistically significant coefficient found for the 1970s.

The coefficients on the migration variables in the 1970s unemployment-change equation are consistent with the corresponding coefficients in the

income-change equation in implying that the effects of migration during the 1970s may have been stronger in a cumulative sense than during earlier periods. During the 1960s unemployment increased due to in-migration and decreased due to out-migration, which is consistent with labor demand and supply shifts due to migration that essentially offset one another, with migrants being unemployed in about the same proportion as the on-going residents. During the 1970s, however, in-migration reduced unemployment and out-migration increased it, giving further evidence that migration-induced labor demand shifts now dominate migration-induced labor supply shifts.

The results associated with the migration variables in the employment equations are generally consistent with the conclusion noted above. For example, the coefficient on the in-migration variable in the nonmanufacturing employment change equation is over twice as great for the 1970s as for the 1960s, and the corresponding coefficient in the government employment change equation is statistically significant for the 1970s but not for the 1960s. These findings also suggest that the cumulative tendencies were stronger during the 1970s.

A number of alternative models were also estimated to focus on issues that were not directly addressed in the model just described. We were surprised not to find a stronger link from employment to gross migration for the 1970s. Thus, one alternative treats the linkage between net civilian labor force migration and employment change. In the context of a simpler system of equations that considers only net rather than gross migration, the rate of employment growth proves to be a significant determinant of net metropolitan migration. This model shows that during the 1960s job growth was filled to a significantly lesser extent by migrants than during the 1950s or

1970s. To the extent that migrants were strongly attracted to jobs during the 1970s, the differential employment performance of SMSAs in the South and West compared to those in the Northeast and North Central regions may have translated into considerable employment migration from the latter to the former.

Since differences in migrant educational composition can have important implications for metropolitan employment growth, another model distinguishes the educational composition of metropolitan migration streams. One of the most striking findings from this perspective is that migration of the most educated group (i.e., those with more than 4 years of high school) has become far more responsive to employment opportunities over time. However, the in-migration of these individuals, at least during the 1950s and 1960s, had considerably greater impacts on local employment growth than did their in-migration during the 1970s. Out-migration of the best educated does not appear to have seriously affected metropolitan employment growth during either the 1960s or the 1970s.

In general, location-specific amenities do not explain metropolitan migration, which is a finding contrary to those of certain other studies. These studies, however, have not considered the influence of incremental job opportunities on migration. To the extent that jobs have grown relatively rapidly in amenity-rich areas, the findings of earlier studies may be spurious. The present study clearly shows the importance of employment opportunities in explaining metropolitan migration patterns. Migrants are strongly attracted to areas with rapidly rising employment opportunities and in turn they spur further employment growth in these areas.

1.3 Intrametropolitan Location

Since the early years of this century, the central cities of major U.S. metropolitan regions have been declining relatively, but important changes have occurred over time in the general pattern of this relative decline. Prior to World War II both population and employment were growing in most central cities and suburban ring areas, but because the central city's share of metropolitan population and employment was falling, growth was occurring at a more rapid rate in the suburbs. After World War II, however, absolute population decline began to characterize certain central cities. As this pattern of absolute decline spread more broadly, at first employment continued to grow in most central cities, and commuting from the suburbs satisfied the labor supply requirements of central city firms. Later, employment also declined absolutely in many central city areas.

Central city decay in the major metropolitan areas of the country is now a widely recognized phenomenon. During the 1970s both suburban population and suburban employment grew more rapidly than their central city counterparts in every major metropolitan area of the U.S. (Greenwood, 1984). Moreover, especially in the Northeast and North Central regions, many central cities experienced absolute population and employment declines. Manufacturing and retail employment were the main sources of central city job losses, but late in the decade even service employment fell in a number of northeastern and midwestern cities. In earlier years, the growth of service and government employment had more than offset declines in manufacturing and retail employment, with the consequences that the central city employment base did not erode absolutely.

A number of explanations have been offered for the plight of central cities. Some argue that jobs, especially in manufacturing, have moved to the suburbs and that the labor force has followed. Still others have argued the opposite. In other words, the labor force first moved to the suburbs and jobs followed. Much emphasis has also been placed on the importance of a high income elasticity of demand for high-quality, low-density housing in the suburbs, as well as on suburban amenities, such neighborhoods, schools, and low crime rates. The model of intrametropolitan location specified in this study tests many of these hypotheses in the context of a single, integrated model. Moreover, the results reported here are not based on indirect evidence such as that obtained from urban density gradients and their changes over time. Rather, the results are based on direct observation of movers between the central city and the suburban ring areas of over 60 SMSAs.

On a general level, during the 1970s housing was more important and employment was less important in attracting labor force members from central cities to suburbs than was true of either the 1950s or the 1960s. More specifically, unlike the prior two decades when employment was a significant determinant of such movement, during the 1970s employment opportunities failed to provide a statistically significant explanation of suburbanization. Moreover, neighborhood amenities, as proxied by suburban income growth relative to central city income growth, changed from being very attractive for movers from central cities to suburbs during the 1950s and 1960s to discouraging movement during the 1970s.

The empirical work concerning intrametropolitan location indicates that the labor force followed jobs from central cities to suburban areas during the 1950s and 1960s, but not during the 1970s. However, when employment is dis-

aggregated by type, suburban retail employment was still mildly attractive during the 1970s. Jobs followed the labor force to the suburbs during each decade, and the quantitative influence of people on jobs was similar over time. During each period growth of the suburban labor force significantly increased the growth of suburban retail and suburban manufacturing employment, with the response of manufacturing employment to labor force growth increasing over time. During the 1960s and 1970s retail and manufacturing employment were major factors in attracting wholesale employment to the suburbs, and during all three decades retail employment was important in attracting service employment.

Over the post-World War II period the availability of suburban housing was increasingly important in attracting labor force members to the suburbs. Suburban housing growth was also encouraged by the location of people in the suburbs. Suburbs with high income growth were attractive during the 1950s and 1960s, but not during the 1970s, when suburban areas with lower income growth proved more attractive. To the extent that income growth is correlated with growth of housing values, or perhaps anticipated growth of housing values, this result may suggest that during the 1970s the young baby boom cohort that was then strongly entering the labor force and facing high mortgage rates was opting for less costly housing.

During the 1950s relatively heavy concentrations of nonwhites in the central city encouraged movement to the suburbs, but during the 1960s and 1970s this relationship failed to hold. During the 1950s SMSAs with relatively heavy concentrations of central city nonwhites did not experience differential employment shifts to the suburbs, but during the 1960s and 1970s they did especially, in the service and retail sectors.

During the 1970s both central city blacks and whites were attracted to suburban housing. The same is true of whites in earlier decades, but during the 1960s growth of suburban housing actually discouraged the movement of blacks from central cities to suburban ring areas, though not significantly so. During the 1960s and the 1970s suburban jobs attracted blacks, but not whites. Moreover, as we saw with aggregate movement patterns, during the 1970s both blacks and whites were less likely to move to suburban areas with rapidly rising incomes. Central city crime encouraged the movement of blacks from central cities to suburban ring areas during each period, but the influence was statistically significant only during the 1950s.

During the 1970s central city job opportunities attracted whites to relocate from suburban ring areas to central cities, but a similar pattern is not evident for blacks. Both blacks and whites were drawn to central cities that maintained relatively high rates of income growth during the 1970s, which presumably suggests that the quality of central city life was important for each group.

The major force influencing the location of metropolitan in-migrants during the 1970s was housing. The availability of suburban housing caused both black and white in-migrants to select suburban residences. Suburban employment opportunities, which were important for each group during the 1960s, were important for neither during the 1970s.

Theory and past empirical research suggest that low- and high-income households will differ in their location response to employment opportunities and housing. Moreover, low-income households are expected to have different impacts on employment and housing markets than high-income households. Consequently, much of the research on this project involved the analysis of

location decisions of low- versus high-income households, as well as the effects of these decisions for central cities and their suburban ring areas. Low income refers to those individuals in families that fall in the bottom quintile of each SMSAs income distribution, whereas high income refers to those in the highest quintile. Alternative analyses were performed for the bottom two and the top two quintiles, but the results do not differ greatly from those that relate to the bottom and top quintiles.

During the 1950s and 1970s the construction of new owner-occupied housing was discouraged by the presence of low-income households in the central city, but encouraged by the location of high-income households there. During the 1960s and 1970s high-income households also encouraged construction of new city rental housing, but their quantitative influence was considerably less on rental than on owner housing. The location of low-income households in the city significantly encouraged the construction of rental housing in the 1950s and 1970s. The location of high-income households in the suburbs encouraged the construction of new owner-occupied housing in the suburbs during each period, but the quantitative influence was greatest during the 1970s. Low-income households never encouraged construction of suburban owner housing. However, low-income households encouraged the construction of new suburban rental housing during each period. High-income households significantly influenced the construction of new suburban rental housing only during the 1960s and 1970s.

In addition to influencing the distribution of housing across metropolitan space, the location decisions of high versus low-income households also influenced the distribution of employment. Suburban low-income households encouraged growth of suburban employment during the 1950s and especially

during the 1970s. On the other hand, high-income households spurred aggregate suburban employment during each period. The patterns of influence are similar for the central city, where high-income households encouraged employment growth during each period. Low-income households also spurred central city job growth during the 1970s, which reversed the pattern of prior decades when they had no significant influence on central city employment.

Patterns of movement from central cities to suburban areas changed somewhat during the 1970s relative to earlier periods. For example, during the 1960s new rental housing in the suburbs was of some importance in attracting low-income households from the central city, but during the 1970s it was the key attraction. Moreover, unlike the 1950s when new suburban owner housing was important for low-income movers from the central city, during the 1970s new owner housing actually discouraged the movement of such individuals to the suburbs. Although during the 1950s and 1960s suburban jobs were critical in the decisions of low-income households to move out of the central city, during the 1970s jobs did not attract these households. The influence of new owner housing in the suburbs on high-income out-movement was less in the 1970s than in the 1950s and 1960s. Finally, whereas suburban jobs were not attractive for high-income persons during the 1950s, they were of considerable importance during the 1960s and 1970s. In short, during the 1970s jobs became more important and housing less important in attracting high-income households to the suburbs, whereas the pattern was opposite for low-income households for whom the role of suburban jobs dropped while the importance of suburban rental housing grew.

Among low-income households, relocation from suburban areas to central cities of the same SMSA was caused in large part by the availability of rental

housing, at least during the 1960s and 1970s. Central city jobs had a moderate influence on movement into the city, but during the 1970s city income growth was critical. Moreover, high central city crime rates significantly discouraged the selection of a central city residence by those with low incomes. Two factors particularly stand out as encouraging high-income individuals to move from the suburbs to the city and their influence is consistent across time -- new rental housing in the city and jobs in the city. During the 1970s the quality of central city life as proxied by income growth was also important.

Whereas metropolitan in-migrants are influenced to locate in the central city by many of the same forces that cause on-going residents of the metropolitan area to relocate from suburbs to city, they are also influenced differently by certain factors. For each period new rental housing in the city was critical for each class of low-income individuals, but during the 1970s such housing was the single key factor for the low-income metropolitan in-migrants, which is consistent with the finding reported above for low-income intrametropolitan movers. In earlier periods new owner housing was also of some importance. Whereas new central city owner housing was significant in attracting high-income in-migrants to the city during each period, it was crucial for intrametropolitan relocators only during the 1950s. Although central city jobs were attractive in the relocation decisions of on-going high-income residents of the metropolitan area, high-income metropolitan in-migrants were influenced by central city jobs only during the 1960s.

Low-income metropolitan in-migrants who located in the suburbs were strongly attracted during each period by the availability of new rental hous-

ing, whereas high-income in-migrants were attracted by new owner housing. During the 1950s and 1960s, but not during the 1970s, low-income in-migrants were also attracted to the suburbs by new owner housing. Similarly, during the first two periods, but not during the 1970s, high-income in-migrants settled in the suburbs due to the availability of new rental housing there. Only during the 1960s did suburban jobs attract in-migrants, and then only high-income individuals.

These results may suggest that stratification is becoming stricter over time so that low-income households can only afford rental housing, whereas formerly they were also somewhat attracted by owner housing. If this conclusion is true, one possible cause of the change is the high inflation rates that prevailed during the 1970s, which helped cause low rates of real income growth and high nominal mortgage rates.

In sum, both housing and employment opportunities appear to attract households regardless of income, but housing is more consistently important. Rental housing exerts its primary but not exclusive influence on low-income households, whereas owner housing exerts its main influence on high-income households. Central city owner housing and central city jobs strongly attract high-income households to locate in the central city. This in-movement of high-income persons to the central city had three important consequences: (1) It encouraged the construction of more owner housing the the city, which tended in turn to draw more high-income in-movers, thereby contributing to a process of cumulative causation. (2) It encouraged the growth of each type of employment in the central city, which in turn was beneficial to low-income residents of the city. Every high-income in-mover to the city caused about three more jobs to be created there, which also tended to sustain cumulative

momentum by attracting more high-income residents to the city. (3) It caused significantly higher rates of central city income growth, which combined with the additional employment and more high-income housing, must have had a positive impact on the fiscal position of the city by increasing the tax base. These findings underscore the importance of central city economic development programs because they suggest that the new jobs will not be exclusively filled by commuters, but rather that some fraction of them will be accommodated by individuals who choose to both work and live in the city. The findings also underscore the importance of balanced housing progams that at the very least do not directly or indirectly discourage the construction of high-quality housing in the city.

CHAPTER 2: METROPOLITAN GROWTH AND MIGRATION

Migration research has historically been and continues to be strongly oriented toward the causes of migration. While the importance of examining the causes of migration is not questioned, the effects of migration on sending and receiving regions are also important. This section of the report studies the causes and the consequences of metropolitan migration in the context of various simultaneous equations models. Surely a "complete" model of migration would be extremely complex. Migration has important influences on demographic and social factors, as well as on more purely economic variables, and the many variables in turn interact with one another. This report is limited to a consideration of the impact that migration from and to Standard Metropolitan Statistical Areas has had on variables generally regarded by economists to be significant determinants of the direction and magnitude of migration--namely, employment, unemployment, and income.

The chapter begins by discussing model specification. The simultaneous-equations model of metropolitan growth and migration previously estimated by Greenwood (1975) for the 1950s and 1960s is first described. This model is then estimated for the 1970s and the results for this period are compared with those for the earlier two decades. Because employment growth does not at first appear in this model to influence migration during the 1970s, although it was a main factor in explaining migration during the 1950s and 1960s, a series of simpler models is estimated, including one that specifically emphasizes the employment-migration interaction. Indeed, employment growth proves to be a significant determinant of migration during each of the three decades. Migrant characteristics have not previously been introduced into a

model of metropolitan growth and migration, even though such characteristics should play an important role in explaining migration's impacts on area growth. Therefore, the final section of this chapter describes a simple model that includes migrant characteristics as endogenous variables to examine the importance of the educational composition of migration streams for metropolitan growth.

2.1 Specification of the Basic Model

A number of studies that have attempted to estimate the magnitudes in which various factors have influenced interstate or interregional migration in the United States or elsewhere employ a single-equation, multiple regression model to estimate the coefficients of those variables deemed important in explaining the migratory movements that have occurred. (See Greenwood (1975b) for a detailed discussion of this work.) A common shortcoming of these studies is that the estimated coefficients possess a simultaneous-equations bias, since the migration that has occurred has itself influenced the independent variables of the models. Bias is particularly likely in those studies that have employed as a dependent variable some measure of cumulative lifetime migration in combination with independent variables defined for the end of the period over which migration is measured. Improved model specification is one consequence of employing a simultaneous-equations model of migration such as that presented here. Another important advantage of this approach is that the model can be estimated for three decades, and consequently the influence of various factors can be assessed over time.

The first model estimated in the study consists of 14 equations (nine structural and five identities) in 14 jointly dependent (endogenous) variables. The endogenous variables include the rate of CLF out-migration (ROM),

the rate of CLF in-migration (RIM), the rate of income growth (RGINC), the rate of employment growth (RGEMP), the rate of unemployment growth (RGUNEMP), the rate of natural increase of the CLF (RNAT), and the rate of total CLF growth (RGCLF). Out-migration is disaggregated to out-migration to other SMSAs (ROMTS) and out-migration to nonmetropolitan areas (ROMTN). In-migration is disaggregated to in-migration from other SMSAs (RIMFS) and in-migration from nonmetropolitan areas (RIMFN). Finally, employment growth is disaggregated into component changes in manufacturing employment (RGMANU), government employment (RGGEMP), and other nonmanufacturing employment (RGNMANU). All changes relating to CLF variables are expressed relative to the beginning-of-period CLF level so as to allow formation of the identities that that close the model. The prefix R refers to "rate of" and G refers to "growth of." Thus, RG refers to "rate of growth of." Detailed definitions of all variables are provided in the appendix that is included at the end of the chapter. Specifically, the model is of the following form:

$$\text{ROMTS} = f_1(\text{RIMFS}, \text{RGINC}, \text{RGEMP}, \text{RGUNEMP}, \text{INC}, \text{UNR}, \text{CLF}, \text{EDU}, \text{AGE}, \text{D1}, \text{D2}, \text{D3}, \text{D4}, e_1) \; ; \tag{2.1}$$

$$\text{ROMTN} = f_2(\text{RIMFN}, \ldots, e_2) \; ; \tag{2.2}$$

$$\text{RIMFS} = f_3(\text{ROMTS}, \text{RGINC}, \text{RGEMP}, \text{RGUNEMP}, \text{INC}, \text{UNR}, \text{CLF}, \text{D1}, \text{D2}, \text{D3}, \text{D4}, e_3) \; ; \tag{2.3}$$

$$\text{RIMFN} = f_4(\text{ROMTN}, \ldots, e_4) \; ; \tag{2.4}$$

$$\text{RGINC} = f_5(\text{ROM}, \text{RIM}, \text{RNAT}, \text{RGUNEMP}, \text{INC}, \text{RGEDU}, \%\text{NW}, \text{RGARMFC}, \text{D1}, \text{D2}, \text{D3}, \text{D4}, e_5) \; ; \tag{2.5}$$

$$\text{RGMANU} = f_6(\text{ROM}, \text{RIM}, \text{RNAT}, \text{MANU}, \text{INC}, \text{RGEDU}, \text{RGARMFC}, \text{D1}, \text{D2}, \text{D3}, \text{D4}, e_6) \; ; \tag{2.6}$$

$$\text{RGGEMP} = f_7(\text{ROM}, \text{RIM}, \text{RNAT}, \text{RGINC}, \text{GEMP}, \text{RGEDU}, \text{RGARMFC}, \text{D1}, \text{D2}, \text{D3}, \text{D4}, e_7) \; ; \tag{2.7}$$

$$RGNMANU = f_8(ROM, RIM, RNAT, RGMANU, NMANU, INC, RGEDU, RGARMFC, D1, D2, D3, D4, e_8) ; \quad (2.8)$$

$$RGUNEMP = f_9(ROM, RIM, RNAT, RGINC, UNR, \%NW, RGARMFC, D1, D2, D3, D4, eg) ; \quad (2.9)$$

$$ROM = ROMTS + ROMTN ; \quad (2.10)$$

$$RIM = RIMFS + RIMFN ; \quad (2.11)$$

$$RGCLF = RGEMP + RGUNEMP ; \quad (2.12)$$

$$RGEMP = RGMANU + RGGEMP + RGNMANU ; \quad (2.13)$$

$$RNAT = RGCLF + ROM - RIM. \quad (2.14)$$

Note that two types of migration variables are employed in this study, one relating to out-migration and the other relating to in-migration. The use of two types of migration measures is in contrast to the use of a net-migration variable. The use of both gross out- and gross in-migration variables is preferable to the use of a variable relating to net-migration. Clearly, the impact that migration has on the sending and receiving localities depends critically on the characteristics of the movers themselves. For any given locality the characteristics of the out- and in-migrants, which will be discussed in more detail later in the study, are not likely to be identical. Moveover, the magnitude of the influence of certain factors on out-migration is likely to be different from the magnitude of the influence of these factors on in-migration, and certain factors that are relevant to explaining out-migration are not relevant to explaining in-migration. Later a model employing net migration is used to simplify the analysis of key variables in the system.

Although no specific migrant characteristics are introduced in this version of the model, the two gross-migration variables can account for differences in the determinants and consequences of out- and in-migration. The use of a net migration concept would involve a substantial loss of information and possesses no apparent advantages that cannot also be achieved by regarding the effect of net migration as the sum of the effects of gross out- and gross in-migration.

A few words are in order concerning the identities that close the system. Any change that occurs in the size of the CLF between points in time must be made up of component changes in employment (RGEMP) and unemployment (RGUNEMP). Hence RGCLF $_e$ RGEMP + RGUNEMP. The model contains an identity for the natural increase of the CLF. Perhaps some might question the use of RNAT as an endogenous variable, arguing instead that it is more reasonable to treat this variable as exogenous. However, as typically defined natural increase of the CLF of a given locality consists of the actual change in CLF plus CLF out-migration minus CLF in-migration. Thus, RNAT $_e$ RGCLF + ROM - RIM.[1] Since RNAT is defined in terms of endogenous variables, it must itself be treated as endogenous. We next turn to a more detailed discussion of the process of urban growth.

2.1.1 The Out- and In-Migration Equations

Since characteristics of nonmetropolitan areas tend to be decidedly different from those of metropolitan areas, the magnitude of the influence of various factors on migration from or to SMSAs is likely to differ from the magnitude of the influence of those factors on migration from or to non-SMSA areas. Moreover, since the characteristics of CLF members who leave SMSAs are somewhat different from those of CLF members who leave non-SMSA areas, the

impact on the destination of migration from the two types of origins is likely to be different. Ultimately, however, justification for disaggregating the migration data lies in the empirical results, which prove to be considerably different for the two types of localities.

Because the out- and in-migration concepts are somewhat, though not completely, symmetrical, the following presentation is facilitated by considering both the out- and in-migration equations in the same context. The model employed in this study attempts to explain gross out- and gross in-migration without the explicit introduction of an individual decision function. Rather, gross out- and gross in-migration are related to a number of aggregate proxy variables. We next turn to a discussion of these variables.

If migration tends to be away from relatively low-income areas and to relatively high-income areas, then the higher the beginning-of-period income level of an SMSA (INC), the smaller its expected out-migration and the larger its expected in-migration, ceteris paribus. Furthermore, because relatively rapid income growth (RGINC) may cause potential migrants to be optimistic about future income prospects, areas with rapidly rising incomes may prove desirable (destinations) for migrants. Since the relevant income measure for the potential migrant to consider is the present discounted value of his stream of expected future returns, both the current income level and expected future levels enter into the potential migrant's present-value calculation. Given the current income level, the greater the expected future increase in income, for which the current actual increase may be a good proxy, the poorer is the current level as a proxy for the discounted value of the stream of expected future returns.

Migrants may, therefore, be expected to move not only to areas with

relatively high income levels, but also to areas with relatively rapidly growing income levels, because ceteris paribus (including income level), the greater the expected increase in future income, the greater will be the present discounted value of the stream of expected future returns. This argument suggests that areas experiencing relatively sizeable income growth are expected to experience relatively small out-migration and relatively large in-migration, ceteris paribus.

Several previous studies indicate that where in-migration tends to be great, so does out-migration. A number of explanations have been offered for the phenomenon. Miller (1967) suggests that areas that experience much in-migration also experience out-migration because such areas possess substantial segments of their populations that are "migration prone." Since migration is selective of that portion of the population that is highly mobile, those who have moved at least once are more likely to migrate than those who have not moved at all. Eldridge (1965) estimates that 17 percent of the 1955-1960 interstate migrants were return migrants, which suggests that a significant fraction of out-migrants is likely to be disenchanted in-migrants from an earlier period who return home. Since a causal relationship is being postulated between in- and out-migration, a further test of the hypothesis is rendered by the inclusion of the in-migration variables in the corresponding out-migration equations and the out-migration variables in the corresponding in-migration equations.

Localities with larger labor markets are likely to experience both absolutely more out- and in-migration. In the structural equations for migration, beginning-of-period CLF has been placed on the right side of the equations because no strong a priori reason suggests that the relationships

between size of the urban area and migration from or to the area should be unitary elastic, which is the implicit assumption made by excluding CLF as an independent variable. Hence, no specification is made of the direction of the relationships between CLF and the migration rates.

It is generally expected that out-migration will be lower and in-migration will be higher the greater the employment growth (RGEMP) that occurs in a region, ceteris paribus. The growth of employment is here considered to be a proxy for the expansion of job opportunities in an area and is expected to reflect growing labor demand. (That migration to (or from) a given region may itself encourage more (less) rapid employment growth in that region will be treated in the discussion of the employment-change equations.)

Areas that are experiencing relatively rapid increase in excess labor supply (i.e., unemployment) are likely to experience relatively heavy out-migration and relatively light in-migration. Moreover, areas having higher unemployment rates (UNR) are also expected to experience both larger out-migration and smaller in-migration. Localities in which the pool of unemployment is increasing rapidly or in which the unemployment rate is high offer the potential migrant rather poor prospects for quick reemployment because jobs either are already difficult to find or are becoming more difficult to find. Furthermore, to the extent that the migrant must spend more time searching for work where such conditions prevail, his opportunity costs of entering these labor markets will be greater. Additionally, since the opportunity costs of migration are lower for unemployed CLF members, out-migration is expected to increase with increased unemployment growth (RGUNEMP), and with increased rate of unemployment.

A number of personal characteristics are likely to influence the individ-

ual's decision to migrate, particularly age and education. The probability that a labor-force member will migrate is likely to decrease as his age increases, since older persons have shorter expected working lives over which to realize the advantages of migrating, so that their rate of return on migration is lower. Moreover, as Becker (1964) points out, individuals for whom migration is profitable find it more profitable to move immediately rather than delay their move because to postpone moving involves the loss during early years of returns that are discounted least. Job security and family ties are also likely to be more important for older persons than for younger ones, which will further discourage older persons from migrating. Out-migration is thus expected to be lower the higher the median age (AGE) of the SMSA, ceteris paribus.

Employment information and job opportunities are both expected to increase with increased education. Each factor should in turn tend to increase the likelihood that an individual will migrate. Moreover, education may also reduce the importance of tradition and family ties and increase an individual's awareness of other localities, with the consequence that the forces that hold him to his present locality are weakened. Thus, ceteris parabus, the higher the level of education (EDU) of the SMSA, the greater the expected out-migration.

Four regional dummy variables are included in each of the migration equations, as well as in the other equations of the model. The dummy variables are constructed in such a way as to reflect the significance of the differential (intercept) shift for any one region (West, South, Midwest, or Northeast) relative to each of the other regions. If $\alpha 1$, $\alpha 2$, $\alpha 3$ and $\alpha 4$ are taken to be the coefficients of D1, D2, D3 and D4, respectively, then the regional inter-

cepts are given as follows: West = $\alpha 1$; South = $\alpha 1 + \alpha 2$; Midwest = $\alpha 1 + \alpha 2 + \alpha 3$; and Northeast = $\alpha 1 + \alpha 2 + \alpha 3 + \alpha 4$. The t-value associated with $\alpha 2$ thus gives the significance of the differential shift for the South as compared to the West, while the t-value associated with $\alpha 2 + \alpha 3$ (i.e., $(\alpha 2 + \alpha 3)/(\text{var})^{1/2}$ (D2 + D3)) gives the significance of the differential shift for the Midwest as compared to the West. Similarly, the significance of the differential shift for all 54 pairs of possibilities (six pairs for each of nine equations) can be obtained.

In the migration equations significant differential shifts might result from a number of factors. Regional differences in climate, cost of living, or social milieu could give rise to regional differences in the average propensity to migrate. Other factors that operate with differential impacts on the various regions and are not accounted for by existing variables in the equations could also give rise to significant differential shifts for various pairs of regions.

2.1.2 The Income-Growth Equation

No strong a priori reason suggests that the signs associated with the out- and in-migration variables in the income-change equation should be positive, negative, or equal to zero. Migration from or to a given area influences labor demand as well as labor supply in that area. The movement of persons from one locality to another causes labor supply to increase in the recipient locality and to decrease in the sending locality. In itself such a movement may be expected to place downward pressure on wage rates and income levels in the destination and upward pressure in the origin, if labor-demand functions are not infinitely elastic. However, if either the prices of locally-produced goods and services or the marginal product of locally-supplied labor is sensi-

tive in a positive direction to in-migration and sensitive in a negative direction to out-migration, then the derived demand for labor will tend to increase in the recipient region and decline in the sending region.

While the price level of the locality's exportable commodities may not be particularly sensitive to migration, the price level of those goods and services that are both locally produced and consumed is likely to be somewhat sensitive. (This sensitivity may not be symmetrical between sending and receiving regions, since downward price rigidity may prevent price declines in sending localities.) Moreover, if in-migration induces increased investment and if out-migration induces decreased investment in a locality, then labor's marginal product may be expected to increase in the receiving region and decrease in the sending region. Those adjustments that tend to result in outward shifts of the labor-demand function in the recipient region and in inward shifts in the sending region place upward pressure on wage rates and income levels in the destination and downward pressure in the origin.

There appears to be no a priori reason to suppose that the labor demand shift associated with migration will dominate the labor supply shift, that the supply will dominate the demand shift, or that the shifts will not offset one another. The signs on the out- and in-migration variables are therefore regarded as an empirical matter, and no a priori specification of the direction of the relationship between the out- and in-migration variables and income change is made.

For the same reasons that a sign is not specificed on the migration varibles in the income-change equation, a sign is not specified on RNAT. While greater natural CLF increase results in greater increased labor supply, it results in greater labor demand as well. No strong reason suggests that

such supply shifts will dominate or be dominated by such demand shifts.

Excess labor supply conditions are, other things being equal, expected to place downward pressure on wage levels. Hence, the greater the growth of excess labor supply, the smaller the expected income growth. In the income-change equation the sign on the unemployment-change variable is thus expected to be negative.

It is generally thought that a high correlation exists between education and income levels, and a positive relationship is expected between changes in these variables. Particularly if the latter relationship were alarmingly high, a problem could arise in specifiying the direction of the relationship between RGEDU and RGINC. However, the simple correlation coefficients between neither pair of variables are particularly high. Moreover, the lags involved in the relationship between income change and education change are likely to be greater than those between education change and income change, since many of the education effects of income growth accrue to offspring. Hence, the relationship is specified as running from education change to income change. If increased education (RGEDU) results in increased labor productivity, the consequence of the increased education will be increased labor demand. Given labor supply curves that are not perfectly elastic in the relevant ranges, increased labor demand will result in increased income growth.

Another variable included in the income-change equation is percentage of population that is nonwhite (%NW). To the extent that discriminatory practices directed against nonwhites result in upward wage rigidities for them, it is to be expected that the greater the percentage of a locality's population that is nonwhite, the smaller will be the locality's income growth.

Systematic interregional differences in the quality of out- and in-

migrants, or of new CLF entrants (net of migration), could lead to significant differential intercept shifts for regions. Moreover, differential (physical) capital growth and/or differential impacts of technical progress for regions could also account for interregional differences in income growth. Unfortunately, appropriate information on the stock of physical capital does not exist, and it is thus not possible to ascertain the independent influence of increased capital stock on either income or employment growth.

2.1.3 The Employment-Change Equations

The expected impacts of CLF out- and in-migration on a locality's level of employment are clear. Since in-migration results in rightward shifts of both labor-supply and demand curves, and out-migration results in leftward shifts of these curves, in-migration is expected to increase the locality's level of employment, while out-migration is expected to reduce the level.

The effects just mentioned may be regarded as relatively direct effects of migration on employment in the sending and receiving regions. Certain indirect effects of migration on employment levels may also be of importance and may reinforce the direct effects. Borts and Stein (1964) argue that migration to a region is likely to induce investment in that region, which will in turn further increase the demand for labor, and thus, given positive supply elasticities, the level of employment. The opposite consequences are likely to be felt in regions that are losing migrants. Thus, ceteris paribus, the greater the rate of out-migration, the smaller the expected rate of employment growth, and the greater the rate of in-migration, the greater the expected rate of employment growth.

Since the CLF can increase due to an excess of labor-force entrants over exits (net of migration), labor supply and, hence, employment may rise due to natural factors. The signs expected on the natural CLF increase variable

(RNAT) are thus positive.

Employment change has been disaggreated to three components: change in manufacturing, change in government, and change in other nonmanufacturing employment. The distinction between change in manufacturing and change in other nonmanufacturing employment has been made so that these classifications might serve as crude proxies for change in employment in export- and nonexport-oriented industries, respectively. The export-base theory of regional growth suggests that employment is in basically two types of industries, those that produce goods for export from the region and those that produce goods and services for local consumption. Employment in the "basic," or export-oriented industries, is taken to be a function of demand in the "rest-of-the-world," and is thus taken to be a function of factors exogenous to the given region. In turn, nonexport-oriented employment is taken to be a function of employment in the basic sector. Exogenous shifts in export demand are seen as causing changes in demand for labor in the export sector, and as these changes in labor demand are met by changes in labor supply, consequent changes in demand for labor in the nonexport sector occur. Hence, employment in the nonexport-oriented industries rises by some multiple of employment in the export-oriented industries. Although the sign on the RGMANU variable in the RGNMANU equation is expected to be positive, the view expressed herein is not that of the naive export-base theory of growth, since both manufacturing and nonmanufacturing employment changes are made functions of changes in local labor endowments.

A reasonable argument can be made that the local public sector is largely endogenous to migration. Greater rates of in-migration, for example, are likely to result in greater rates of growth of demand for local public

services of various types, such as education. To the extent that these new demands are met, higher in-migration rates result in greater rates of growth of local government employment. To a lesser extent, perhaps, state employment in the local area can be regarded as endogenous to migration. Federal employment growth can be regarded as largely exogenous to migration. However, prior to the 1970 Census no distinction was made in the Census between state and local government employment on one hand, and federal employment on the other, and, hence, total government employment is here treated as endogenous. For the sample employed in this study, an average of 71 percent of total government employment was state and local in 1970.

In any given industry, the higher the rate of return on capital, the greater the expected rate of capital accumulation. Ceteris paribus, the greater the rate of capital accumulation, the greater the rate of increase in labor demand and in employment. Appropriate state data do exist for manufacturing industries to allow the estimation of at least crude rates of return on fixed assets by SMSA for the 1950s and 1960s. Hence, the following measure of the rate of return (RRET) in manufacturing industries was formulated: RRET = (value added-payrolls)/(gross book value of depreciable and depletable assets). The expected sign on the rate of return variable is positive. Because of limited data availability, this variable is not incorporated into the model for the 1970s.

Borts and Stein (1964) assert that if capital is immobile among regions, while labor is mobile, employment in high-wage regions should grow more rapidly than in low-wage regions. Olvey (1970), on the other hand, argues that if high wages reflect a low return on investment, employment growth should tend to be higher the lower the wage. Borts (1960) argues similarly

when he considers a one-product, two-factor, two-region economy in which capital is abundant relative to labor in one of the regions, and labor relative to capital in the other. Wage rates are high in the former region relative to the latter, and the rate of return to capital is high in the latter relative to the former. As a consequence of such conditions, labor migrates to the high-wage region, where the rate of return on capital is low, and capital migrates to the low-wage region, where the rate of return on capital is high. Due to the inflow of capital in the low-wage region and the outflow in the high-wage region, the demand for labor grows more rapidly in the low-wage region and less rapidly in the high-wage region, which tends to promote further wage equalization. However, since the out- and in-migration variables should themselves pick up the effects of labor migration on employment growth, the beginning-of-period income-level variable, which serves as a proxy for the wage level, should reflect the effects of differential capital growth and have a negative sign in the RGMANU equation. This latter argument applies particularly well to labor intensive manufacturing industries in their search for cheap labor.

In each of the employment-change equations education growth and growth of armed forces personnel are expected to have postive signs. The beginning-of-period level of each employment category relative to CLF size has also been included as an independent variable in the respective employment growth equations. In the case of manufacturing industries, the existence of agglomeration economies could result in more rapid growth of manufacturing employment in areas in which manufacturing employment is relatively important. Such a phenomenon is likely to evidence itself over limited time periods, since eventually agglomeration economies are likely to be offset by diseconomies of scale.

In localities in which government employment is relatively important, such as in Washington, D.C., and in state capitals, government employment is likely to grow at disproportionately high rates during periods of relatively rapid expansion of government employment. However, as with manufacturing employment, it is unlikely that this phenomenon will hold indefinitely. Since no attempt is made here to distinguish which phase of growth the various sectors are in during the specific decade in question, no specification is made of the direction of the relationships between the beginning-of-period level variables and the various employment changes.

While product market conditions in a given SMSA are likely to have important consequences for the SMSA's nonexport-oriented industries, the consequences for export-oriented industries are likely to be much less strong, since only a relatively small fraction of the output of such industries will be purchased locally. The income-level variable is therefore included in the RGNMANU equation to account for the local demand effects of higher income.

In addition to those factors mentioned in connection with regional differences in income change, certain other factors might give rise to regional differences in employment change. Fuchs (1962) suggests that one such important factor during the 1955-60 period was the rapid expansion of the aircraft industry in temperate climates. He further suggests that unionization discouraged and the availability of space encourage the relocation of manufacturing indutries. These latter two factors are likely to vary systematically between regions. Each of these factors would lead us to anticipate a differential shift in manufacturing employment growth in favor of the West and the South relative to the Midwest and Northeast.

2.1.4 The Unemployment Change Equation

Both Borts and Stein (1964) and Muth (1971) take the labor-demand curve for a locality to be perfectly elastic. However, the existence of unemployment (in excess of frictional) is not consistent with perfectly elastic labor demand. That the SMSAs that serve as the data base had substantial unemployment over the 1950-80 period is evident. The average rates of unemployment for the four Census years, beginning with 1950, are, respectively, 4.8%, 4.6%, 4.0%, and 6.2%. Hence, unemployment-change is treated as an endogenous variable in this model. Moreover, the use of unemployment-change as an endogenous variable is consistent with the use of employment-change as endogenous, and the use of the former closes the system, since it must necessarily be true that RGCLF = RGEMP + RGUNEMP.

Previously it was argued that, since migration affects labor demand as well as labor supply in both the sending and receiving areas, no a priori reason suggests that the impact on income levels will be in one direction or the other. a similar argument holds with respect to the influence of migration on unemployment. If the leftward (rightward) demand shift associated with out- (in-) migration were to dominate the leftward (rightward) supply shift associated with out- (in-) migration, unemployment would tend to rise (fall), given the wage rate at its initial, higher than equilibrium level. There appears to be no more reason to suppose that this dominance will occur than to suppose that supply shift will dominate demand shift, thus causing out- (in-) migration to place downward (upward) pressure on unemployment levels.

A final possibility is that migration has no impact on unemployment. It should be recognized, however, that to the extent that the unemployed are over-represented in migration streams, and to the extent that unemployed out-

migrants from a locality tend to become unemployed in-migrants in some other locality, the supply shift associated with migration is likely to dominate the demand shift such that out-migration results in decreased unemployment while in-migration results in increased unemployment. Moreover, to the extent that the percentage of the work force that is frictionally unemployed does not vary across SMSAs, out-migration should reduce unemployment by reducing the size of the labor force, while in-migration increases unemployment by increasing the size of the CLF.

Natural increase of the CLF will tend to result in increased labor supply, but increased labor demand as well. (The reasoning here is similar to that employed in the discussion of migration's impact on income levels.) However, since unemployment rates among the young tend to be relatively high, natural increase (RNAT) is expected to result in increased unemployment.

2.2 Estimation of the Model

In 1970, 64 of 242 Standard Metropolitan Statistical Areas in the continental U.S. had a population in excess of 250,000. These SMSAs are the only ones for which detailed published census migration data exist for the respective periods. The sample SMSAs employed in this part of the study consist of 62 that are common to the sets on which comparable migration data are reported in the 1960 and 1970 censuses. Because in 1960 the Los Angeles-Long Beach SMSA included Orange County (or what was to become the Anaheim-Garden Grove-Santa Ana SMSA), only 61 observations are employed to estimate the model for the 1950s. Moreover, between 1970 and 1980 the Dallas and Fort Worth SMSAs were merged into a single Dallas-Fort Worth SMSA. Toledo was unfortunately omitted from a costly computer run that was aimed at extracting data from the 1980 Public Use Files. Hence, for the 1970s the sample of areas consists of only 59 SMSAs.

The structural model discussed above has been estimated in double logarithmic form by two-stage least squares (2SLS). The 2SLS estimates of the model for the 1950-60 period, for the 1960-70 period, and for the 1970-80 period are presented in Table 2.1. (Appendix Table 2.1A contains beta coefficients associated with estimates of the 1970-1980 model.) This table is set up to facilitate the comparison of a given coefficient across the three periods. Not counting those of the dummy variables, 70 coefficients were estimated in the structural equations for the 1950s and 1960s and 69 for the 1970s. As reported in Table 2.2, of these coefficients, 54 have signs that are not unexpected for the 1950-60 period (77%), 53 for the 1960-70 period (76%), and 47 of 69 for the 1970-80 period (68%). For 1950-60, 27 of the 54 coefficients are significant at better than the ten-percent level. For the 1960-70 period, 26 coefficients are statistically significant, and for the 1970-80 period 24 are significant. Two of the 16 coefficients that have unanticipated signs for 1950-60 and two of the 22 coefficients that have unanticipated signs for 1970-80 are also significant at better than ten percent, whereas none of those that have unanticipated signs for 1960-70 is significant. The R^2s associated with the ordinary least squares estimates of the structural equations are reasonably high, ranging from 0.94 (RIMFS equation) to 0.49 (RGINC equation) for the 1950-60 period, from 0.93 (RIMFS equation) to 0.38 (RGINC equation) for the 1960-70 period, and from 0.92 (RIMFS equation) to 0.28 (RGUNEMP equation) for the 1970-80 period. We next turn to a more detailed discussion of the results for each structural equation.

In the migration equations the income growth variable generally performs poorly in the sense that it is insignificant, though for each period it has the expected negative sign in the equations for the rate of out-migration to

TABLE 2.1
Metropolitan Growth Model: Two Stage Least Squares Estimates of
Double-Logarithmic Regression Coefficients, 1950-60, 1960-70, and 1970-80

Independent Variables	Equation for ROMTS			Equation for ROMTN			Equation for RIMFS		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
ROM									
RIM									
ROMTS							0.468**	0.276**	1.081**
ROMTN									
RIMFS	0.554**	1.490**	0.543						
RIMFN				0.643**	0.663**	0.890**			
RGINC	-0.889	-0.087	-1.687	1.286	-0.048	1.451	0.508	0.047	0.334
RGEMP	-1.853**	-3.059**	1.023	-2.600**	0.806	-0.765	3.280**	3.895**	0.711
RGMANU									
RGUNEMP	12.64**	10.04	12.068**	15.13**	-18.46	7.332**	-6.435**	-6.430	-9.022
RNAT									
INC	-0.595**	-0.041**	1.028	-0.360	-0.025	0.713	0.259	0.043**	-0.696
UNR	0.127	-0.114	0.310	0.371**	-0.236	-0.670	0.008	-0.025	-0.386**
CLF	0.004	0.091**	0.114	-0.106	-0.009	-0.154**	-0.010	-0.052	-0.127**
EDU	1.441**	-1.053	-1.114	1.951**	-0.840	2.042			
AGE	-2.184**	-2.004**	-0.668	-0.764	-0.778**	-0.455			
MANU									
GEMP									
NMANU									
%NW									
RRET									
RGEDU									
RGARMFC									
D1	8.740**	10.01**	-5.332	1.836	3.376**	-9.509	-4.146	-1.945**	7.315
D2	-0.146	-0.191	0.014	0.076	-0.603	0.040	0.091	-0.349	-0.125
D3	-0.015	0.153	0.184	-0.184	0.027	0.539	0.013	0.018	-0.203
D4	0.093	-0.046	0.197	0.153	0.041	-0.159	-0.006	0.037	-0.159
OLS R^2	0.89	0.85	0.69	0.83	0.73	0.84	0.94	0.93	0.92

**Coefficient is significantly different from zero at the 10% level ($t \geq 1.29$).

TABLE 2.1 (continued)
Metropolitan Growth Model: Two Stage Least Squares Estimates of
Double-Logarithmic Regression Coefficients, 1950-60, 1960-70, and 1970-80

Independent Variables	Equation for RIMFN			Equation for RGINC			Equation for RGMANU		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
ROM				-0.104	0.825	-0.389	0.035	-0.224**	-0.252**
RIM				0.042	0.699	0.255**	0.070**	0.142**	0.164**
ROMTS									
ROMTN	0.538**	0.938**	0.772**						
RIMFS									
RIMFN									
RGINC	0.957	0.180**	-1.668						
RGEMP	2.517**	0.477	1.147**						
RGMANU									
RGUNEMP	-10.92**	22.27	-7.244**	1.376	-20.14	1.769			
RNAT				0.326	-3.222	0.709**	-0.120	0.424**	0.293**
INC	-0.045	0.101**	-1.181**	-0.299**	-0.324**	-0.556	-0.018	-0.009**	0.079
UNR	-0.550**	0.178	0.007						
CLF	-0.080	-0.057	0.132**						
EDU									
AGE									
MANU							0.031	-0.011	0.045
GEMP									
NMANU									
%NW				0.029	0.332	0.026			
RRET							-0.011	-0.004	
RGEDU				-0.038	-1.226	0.181	0.189	0.037	-0.238
RGARMFC				-0.922	0.303	2.082	0.285	0.106	-0.030
D1	-2.087	-0.223	9.842**	2.457**	5.731**	0.884	0.623	-0.158	-0.866
D2	0.038	0.682	-0.528	-0.174**	0.054	-0.106	-0.084**	-0.004	-0.041
D3	0.049	-0.002	-0.068	0.123	0.144	0.094	0.007	-0.009	0.005
D4	-0.477**	-0.088	0.008	0.019	-0.120	-0.008	0.046**	-0.013	-0.004
OLS R^2	0.91	0.75	0.84	0.49	0.38	0.49	0.78	0.75	0.66

**Coefficient is significantly different from zero at the 10% level.

TABLE 2.1 (continued)
Metropolitan Growth Model: Two Stage Least Squares Estimates of
Double-Logarithmic Regression Coefficients, 1950-60, 1960-70, and 1970-80

Independent Variables	Equation for RGGEMP			Equation for RGNMANU			Equation for RGUNEMP		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
ROM	0.046	-0.748	0.006	-0.134	-0.179	-0.046**	-0.059**	-0.044**	0.125**
RIM	0.039**	0.283	0.048**	0.257**	0.195**	0.489**	0.051**	0.024**	-0.076**
ROMTS									
ROMTN									
RIMFS									
RIMFN									
RGINC	-0.356**	-0.024	0.065				-0.062	0.001	0.183
RGEMP									
RGMANU				0.092	0.165	-0.579			
RGUNEMP									
RNAT	-0.136	0.420	-0.061	-0.691	0.264	0.285	0.030	0.105**	-0.199**
INC				0.308	-0.003	-0.091			
UNR							0.015	-0.013**	0.005
CLF									
EDU									
AGE									
MANU									
GEMP	0.005	0.012	0.007						
NMANU				0.111	0.110**	-0.127			
%NW							-0.003	-0.002	-0.006
RRET									
RGEDU	0.346**	-1.537	0.008	0.361	0.064	-1.258			
RGARMFC	0.376**	1.329**	-0.321	1.948**	0.180**	-1.217	0.297**	0.000	-0.717
D1	0.402**	-0.922	0.050	-1.905	0.183	0.950	0.041	-0.069**	-0.005
D2	-0.058**	0.327**	0.028**	0.082	-0.041**	0.005	0.030**	-0.029**	0.041**
D3	0.004	0.046	-0.003	-0.129	0.034	0.041	-0.000	0.003	-0.025
D4	0.038**	0.112	0.007	0.069	0.012	-0.261	-0.009	-0.005	-0.007
OLS R^2	0.80	0.59	0.75	0.79	0.83	0.89	0.65	0.75	0.28

**Coefficient is significantly different from zero at the 10% level.

TABLE 2.2

Summary Results of Two Stage Least Squares Estimates of Metropolitan Growth Model, 1950-60, 1960-70, and 1970-80

	1950-60	1960-70	1970-80
Coefficients estimated excluding dummies and intercept terms	70	70	69
Sign not unexpected	54	53	47
Percentage for which sign not unexpected[a]	77%	76%	68%
Coefficients for which $t \geq 1.29$[b]	27	26	24
Coefficients for which $t \geq 1.29$ and sign is not unexpected	25	26	22
Percentage for which $t \geq 1.29$ and sign is not unexpected	36%	37%	32%

a. Refers to expected a prior or not specified.

b. Refers to $t \geq 1.29$ for a one-tail test and $t \geq 1.67$ for a two-tail test; the latter test is applied to coefficients for which a sign is not specified and to coefficients with unanticipated signs.

other metropolitan areas and the expected positive sign for the rate of in-migration from such areas. The only equation for which the income growth variable is significant is that for in-migration from nonmetropolitan areas during the 1960s. This finding is noteworthy because economists have long emphasized the importance of income on a theoretical level. Recently, however, as discussed in Greenwood (1985), certain individuals have suggested that migration occurs within an equilibrium system in which income or wage differentials are "compensated" in the sense that the values of various amenities are reflected in the differentials. In such a system migration does not respond to income or wage differentials, but rather to changes in demand for location-specific amenities. Such changed demands may, for example, result from changing real income. Thus, the findings reported here do not provide strong support for this alternative theoretical perspective.

The income level variable performs slightly better, which provides modest support for the "disequilibrium" thesis that suggests that migration is responsive to real utility differentials that are reflected by real income differentials. During the 1950s and 1960s higher income significantly discouraged out-migration to other SMSAs, but during the 1970s income had no significant influence on such out-migration. During the 1960s higher income SMSAs were attractive both for migrants from other metropolitan areas and from nonmetropolitan areas. This relationship changed during the 1970s, however. Moreover, other things being equal, in-migrants from nonmetropolitan areas were apparently attracted to lower income SMSAs during the 1970s.

The most striking finding regarding the unemployment variables is the similarity of the influence of unemployment growth during the 1950s and the 1970s. Unemployment growth encouraged out-migration both to other SMSAs and

to non-SMSA areas during each of these decades, but not during the 1960s. Moreover, such growth discouraged in-migration from nonmetropolitan areas during the 1950s and 1970s, but again not during the 1960s. One possible reason for the different behavior of unemployment growth during the 1960s is that this decade was generally one of sustained growth. The period from 1963 to 1969 was, in fact, the longest period of sustained growth during the post-World War II years.

The unemployment rate at the beginning of the decade is almost always insignificant in explaining metropolitan migration. Perhaps the most notable exception to this statement is that during the 1970s higher unemployment rates discouraged in-migration from other SMSAs. The failure of unemployment rates to appear with statistical significance in migration equations is a common finding. The probable cause is that the unemployed are the individuals most likely to respond to unemployment incentives, and they are only a small fraction of the labor force. Consequently, the effects of their behavior may not be apparent in a study that focuses on aggregate labor force migration.

One of the most surprising findings reported in Table 2.1 is that employment growth was not particularly important in explaining metropolitan migration during the 1970s. On the contrary, employment opportunities were one of the driving forces behind migration during both the 1950s and 1960s. During the 1970s employment growth attracted only in-migrants from nonmetropolitan areas. Because the failure of employment growth to provide a reasonable explanation for metropolitan migration during the 1970s is contrary to expectations and to past findings (see, for example, Greenwood and Hunt (1984)), a number of alternative models to be described below were estimated.

During the 1950s and 1960s neither in- nor out-migration significantly influenced the rate of growth of metropolitan income, which presumably

indicates that the labor demand effects of migration balanced the labor supply effects of migration. During the 1970s, however, this situation changed. Higher rates of in-migration encouraged higher rates of income growth, which suggests that the demand shifts associated with in-migration newly dominate the supply shifts. A consistent finding is evident in the unemployment growth equation, where out-migration is observed to increase unemployment during the 1970s while in-migration reduces unemployment growth. Just the opposite effects were observed during the 1950s and 1960s. The coefficients on the migration variables in the income and unemployment equations appear to indicate stronger cumulative effects in areas of substantial in-migration than was true in early periods.

These stronger cumulative effects are also observed in the employment equations, especially that for other nonmanufacturing employment. For each decade in-migration encouraged a significant increase in nonmanufacturing employment, which is easily the most important component of employment studied here, but the coefficient for the 1970s is fully twice as high as that for either of the prior two decades. Moreover, the negative and significant coefficient on the out-migration variable is also about twice as high as in previous periods. In-migration influenced manufacturing employment in the same direction as nonmanufacturing employment, but the absolute values of the coefficients increase only slightly for the 1970s relative to the 1960s (to 0.164 from 0.142). Out-migration does not appear to have significantly affected government employment during any period, but in-migration had a significant positive effect during the 1950s and 1970s.

2.2.1 Alternative Model Specifications

To further investigate the surprising finding that employment growth had little effect on metropolitan migration during the 1970s, we estimated three

TABLE 2.3

Metropolitan Growth Model with Two Migration Equations and Excluding Regional Dummies: Two Stage Least Squares Estimates of Double-Logarithmic Regression Coefficients for 1970-80

Independent Variables	Equation for ROM 1970-80	RIM 1970-80	RGINC 1970-80	RGMANU 1970-80	RGGEMP 1970-80	GRNMANU 1970-80	GRUNEMP 1970-80
ROM		1.41**	-0.29	-0.17**	-0.06	-0.71**	0.11
RIM	0.53**		0.19	0.15**	0.07**	0.60**	-0.07**
ROMTS							
ROMTN							
RIMFS							
RIMFN							
RGINC	-1.59	1.52			-0.04		0.237
RGEMP	0.52	0.35					
RGMANU						-0.33	
RGUNEMP	9.11**	-12.22**	1.09				
RNAT			0.68**	0.23	0.03	0.09	-0.23
INC	1.04	-1.24	0.07	0.12**		-0.05	-0.01
UNR	0.03	-0.02					
CLF	0.02	-0.02					
EDU	-0.59	0.02					
AGE	-0.74**	0.85					
MANU				0.04**			
GEMP					0.01		
NMANU						-0.33	
%NW			0.01				0.00
RRET							
RGEDU			0.19	-0.15	0.05	-1.73**	
RGARMF			1.88	0.27	-0.04	-2.96	-0.83
D1	-5.48	8.39	-0.18	-1.22**	0.10	0.45	-0.12
D2							
D3							
D4							
OLS R^2	0.814	0.930	0.392	0.624	0.707	0.884	0.179

**Coefficient is significantly different from zero at the 10% level.

alternative specifications of the model described above. The first alternative involved dropped all regional dummy variables to determine whether systematic growth differentials between regions may have caused the dummy variables to pick up the effects of employment growth. This proved to be the case for when the dummy variables were removed from the 1970-80 equations, the t-values on RGEMP in both in-migration equations increased considerably (to 2.211 in the RIMFS equation and to 2.767 in the RIMFN equation). Moreover, the rate of growth of unemployment is negative and significant at better than 5 percent in each equation.

The second and third alternatives involved collapsing the migration variables into two equations, one for out-migration and one for in-migration. In this form, the model does not distinguish metropolitan from nonmetropolitan flows. This form of the model was estimated for the 1970s only both with and without the regional dummy variables. Once again the absolute t-values on the endogenous variables tend to increase when the regional dummies are removed, but except for income growth, the variables are generally significant in any case. Table 2.3 reports the coefficients and t-ratios associated with the version of the model that includes only two migration equations and no regional dummies. (Appendix Table 2.2A contains the version of the model that includes equations for the rates of out- and in-migration and the regional dummy variables.)

These results generally support the notion that job growth was attractive to migrants. However, areas with much in-migration also tended to experience much out-migration, and therefore higher job growth does not appear to discourage out-movement. The probable reason for this finding is that in-migrants possess all of those attributes that make persons more likely to

migrate, and many in-migrants subsequently become out-migrants. Much evidence of this phenomenon is available in the migration literature.

The model described in the next section involves the analysis of net metropolitan migration in the context of a considerably simpler model that emphasizes the employment-migration interaction, as well as the importance of selected location-specific amenity variables.

2.2.2 Migration, Employment, and Amenities

In an effort to further ascertain the influence of employment opportunities on migration, we greatly simplified the model described above. We expressed the net migration rate of employed persons (RNETMIG) as a function of the employment growth rate (RGEMP). Because both RNETMIG and RGEMP, as defined for the purposes of this section, are normalized by beginning of period EMP, this specification allows the coefficient on RGEMP (call it α) to be interpreted as the migrant-attractive power of an incremental job. The value of α must lie between zero and 1. If $\alpha = 0$, indigenous residents fill all incremental jobs. If α = one, migrants fill all incremental jobs, and if $0 < \alpha < 1$, some combination of migrants and indigenous residents fill incremental employment opportunities.

In the context of this specification, the coefficient on RNETMIG in the equation for RGEMP (call this coefficient β) indicates the direct impact that another migrant has on area employment. The value of β can be less than, equal to, or greater than one, depending upon whether another employed migrant substitutes for indigenous labor, results in an increase in employment equal to his own contribution to it, or causes an increase in employment over and above his own contribution.

The model is closed by the inclusion of an equation for the rate of change of the local labor force participation rate (RGLFPR), since incremental

employment opportunities can be filled from among the indigenous residents as well as by migrants. The RGLFPR equation includes as arguments rate of change of employment (RGEMP), rate of change of income (RGINC), unemployment rate (UNR), median education at the beginning-of-decade (EDU), percent nonwhite population at the beginning of the decade (%NW), and labor force participation rate at the beginning of the decade (LFPR).

Identification of the various equations of models such as this can present a problem because of the limited number of exogenous variables that are introduced. Prior research (e.g., Graves, 1979) suggests that location-specific amenities are important determinants of net migration. Both to test the amenities hypothesis and to help identify the RGEMP and RGLFPR equations, a number of amenity variables were introduced in the RNETMIG equation. Amenities that should positively influence net migration are percentage of land area in national forests or grasslands (PCTNF), average number of clear days per year (CLEAR), and a dummy variable (COAST) reflecting the presence (=1) or absence (=0) of a seacoast. Those expected to negatively influence net migration are degree days (DD or the sum of the daily deviations of the high temperature from 65° F), average humidity (HUM), and wind speed (WIND).

The specific form of the model is:

$$\text{RNETMIG} = f_1 (\text{RGEMP, EMP, INC, EDU, AGE, UNR, DD, HUM, WIND, CLEAR, COAST, PCTNF}) \quad (2.15)$$

$$\text{RGEMP} = f_2 (\text{RNETMIG, EMP, RGEDU, RGINC, RGARMFC, MANU, D}) \quad (2.16)$$

$$\text{RGLFPR} = f_3 (\text{RGEMP, RINC, LFPR, EDU, UNR, \%NW}) \quad (2.17)$$

The entire set of nine equations (three equations for each of three decades) was estimated as a system by three stage least squares. This technique both improves the efficiency of the estimates and allows a direct test

for structural change of the coefficients for the three time periods. In general, the results (see Table 2.4) become more robust over time. (Corresponding beta coefficients for each decade are reported in the Appendix Table 2.3A.) This observation can be seen in the net-migration equations. The only significant variable in the 1950s equation is RGEMP. The 1960s also show a significant contribution from RGEMP, as well as from EDU, HUM, and WIND. Significant variables for the 1970s are RGEMP, UNR, PCTNF, and CLEAR. Of the variables considered, net-migration appears to make the largest contribution to employment growth. The only other significant variable in the 1950s employment growth equation is D, which differentiates the South and West census regions from the Northeast and North Central regions. For each decade employment size has a negative effect on the rate of employment growth (though only that for the 1960s is statistically significant), suggesting that for large urban areas agglomeration economies may be exhausted.

The labor force participation rate change equations reflect the expected results. The sign on the unemployment rate variable is ambiguous because higher unemployment may on the one hand attract additional workers into the labor force and on the other may discourage unemployed workers from continuing to seek employment. These effects are commonly called the additional worker and the discouraged worker effects. During the 1950s, the added worker effect seems to have dominated, whereas the discouraged worker effect was dominant during the 1960s. Perhaps surprisingly, income growth significantly affects labor force participation growth only for the period 1970-80.

In the context of this simple system of equations the rate of employment growth proves to be a significant determinant of metropolitan migration. During the 1960s job growth was accommodated to a significantly lesser extent

TABLE 2.4
Net Metropolitan Migration and Metropolitan Growth:
Three Stage Least Squares Estimates

Dependent Variables	Equation for RNETMIG			Equation for RGEMP			Equation for RGLFPR		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
RGEMP	1.02**	0.31**	0.89**				-0.12**	0.57E-1	0.57E-1**
NET				0.88**	0.83**	0.75**			
EMP	0.47E-8	-0.11E-7	-0.69E-8	-0.20E-7	-0.10E-6**	-0.28E-7			
INC	0.44E-4	0.13E-4	-0.59E-5						
AGE	0.11E-1	0.76E-2	0.16E-1						
EDU	-0.95E-2	0.48E-1**	-0.75E-1						
UNR	1.01	0.73E-1	-1.84**				3.36**	-0.49	-0.69
RGED				-0.28	-0.44	-1.09	0.63**	-0.93E-1	-0.70E-1
RGINC				0.17	0.16	0.88E-1	-0.17	-0.87E-1	0.27**
RGARMFC				0.50E-2	0.79E-1**	0.64E-2			
MANU				-0.56E-1	0.18	-0.19			
LFPR							-1.05**	-0.51**	-1.29
%NW							-0.43E-3	-0.33E-2**	-0.98E-3
D				-0.11**	-0.13	-0.41E-1			
DD	0.13E-4	-0.35E-4	-0.44E-5						
HUM	-0.21E-2	-0.49E-2**	-0.16E-2						
WIND	0.96E-4	-0.86E-4**	0.83E-3						
PCTNF	-0.16	0.38E-1	0.72**						
COAST	-0.19E-1	0.15E-1	-0.22E-1						
CLEAR	-0.45E-3	-0.96E-3	0.58E-3**						
INTERCEPT	-0.52	-0.28	0.45	0.15	0.24	0.29**	1.59	1.43**	1.58**

**Coefficient is significantly different from zero at the 10% level.

by migrants than during the 1950s or 1970s. To the extent that migrants were attracted to jobs during the 1970s, the differential employment performance of SMSAs in the South and West compared to those in the Northeast and North Central regions may have translated into considerable employment migration to the former and from the latter.

Estimating the entire system of equations at once allows us to not only realize efficiency gains, but also to test various coefficients for structural change between time periods. These tests are performed for RGEMP and PCTNF in the net-migration equations, RNETMIG in the employment growth equations, and UNR in the change in labor force participation equation. The effect of RGEMP on net-migration decreased significantly ($F = 110.32$) between the first two periods, and increased significantly ($F = 57.26$) between the 1960s and 1970s. No structural difference is detected when comparing the 1950s to the 1970s at the five-percent level of significance ($F = 2.36$).

A significant structural change is apparent for the effect of PCTNF on net-migration between the 1960s and 1970s ($F = 8.55$), and the 1950s when compared to the 1970s ($F = 9.11$). The fact that areas with a higher percentage of land in national forests and grasslands were differentially attractive during the 1970s probably reflects the westward shift in population. It also suggests that even after accounting for employment growth, the recreational aspects of such areas were attractive to migrants, which seems generally consistent with the renewed growth of nonmetropolitan regions during the 1970s. When regressed on employment growth, RNETMIG shows no sign of structural change in the coefficient between time periods, ranging between 0.88 for the 1950s and 0.75 for the 1970s.

The forces behind the additional worker and discouraged worker hypotheses

are reflected in the effect of UNR on the change in labor force participation rate. This coefficient, which is positive for the 1950s and negative for the 1960s shows significant structural change between these two periods ($F = 6.46$). Structural change is also evident ($F = 6.53$), as this coefficient increased significantly between the 1960s and 1970s.

2.3 Metropolitan Growth and Migration with a Consideration of the Effects of Migrant Characteristics

Several studies have reported results that are qualitatively similar to those reported above in that regional or metropolitan growth and migration interact in a pattern that suggests strong mutual and cumulative causation. (See Greenwood (1975b) for a discussion of these studies.) Each of these studies has involved the simultaneous relationship between migrant numbers and various measures of growth, such as employment and income. None of the studies has, however, considered the impacts of migration of persons with different characteristics. For example, the in-migration of highly educated individuals ought to have a positive impact on the productivity of the local labor force. Such individuals not only embody differentially high amounts of human capital to supplement the human capital of on-going residents, but they may also include entrepreneurs and innovators who will subsequently affect the demand for local labor. Moreover, higher-income individuals should have greater impacts on local product and service markets, which will cause differential impacts on the derived demand for local labor. Many other examples of the potential differential effects of migrants with different characteristics could be offered.

In this section of the report we consider two alternative models that incorporate not only migrant numbers, but also migrant characteristics. The

simplest model focuses on the educational composition of in- and out-migration streams and shows that educational composition is as important as migrant numbers in explaining migration's impacts. The second model concerns the racial composition of migration in that it includes specific information on black and nonblack (or white and nonwhite) migration flows.

2.3.1 A Simple Model of Migration by Education Class

Within any given age class, migration propensities rise sharply with education. For example, the probability of a 25 to 29 year old person with 8 or less years of education in 1980 of making an interstate move between 1975 and 1980 was 0.105, whereas that for a person of the same age with 4 years of college was 0.246. Those with 5 or more years of college education had a probability of 0.321. Probabilities such as these strongly suggest that the magnitudes of the influences of certain factors on interstate or interregional migration may differ appreciably across different education classes of migrants. Generally, we would expect information to increase with education. Moreover, more educated individual should be better able to decipher complex information regarding alternative destinations, and the market for their skills may be more national in scope. Thus, more educated individuals ought to respond more strongly to economic stimuli when contemplating a move. Four "economic" variables are included in the model--employment change, income change, income level, and unemployment rate. The employment change variable is treated as endogenous and an equation is introduced for it.

Increased education also entails the expectation of higher life-time earnings. Graves and others have suggested that the demand for location specific amenities may be income elastic. If this is the case, those with different education levels respond differently to location-specific amenities. Consequently, in the model described below, a number of location-

specific amenity variables have been introduced. These variables are identical to those discussed above in section 2.2.2.

The exploratory model pertaining to migration by education class contains 9 equations in 9 unknowns. Three education classes of in-migrants and of out-migrants are identified. Persons 25 years old and over are distinguished as having less than 4 years of high school (ED1), 4 years of high school (ED2), and more than 4 years of high school (ED3). As shown below, a relative decline has occurred over time in the first group and a relative increase has occurred in the third group. The group with exactly 4 years of high school has also declined in relative importance since 1950, but not by as much as the group with less than 4 years of high school.

Population 25 Years Old and Over, by Education Class

Year	Percent less than 4 yrs. H.S.	Percent 4 yrs. H.S.	Percent more than 4 yrs. H.S.
1950	61	24	15
1960	58	13	29
1970	43	17	40
1980	38	18	44

The figures listed above are not national average values, but rather refer specifically to the set of SMSAs that underlie the estimation reported below.

As mentioned above, the model estimated in this section contains 9 equations in 9 endogenous variables. Three education classes of in-migrants, three education classes of out-migants, and employment change are the endogenous variables of the model. In this form of the model, employment change is measured in absolute terms, as is each migration variable. The specific form of the model is as follows:

$$IMED1 = f(\Delta\hat{EMP}, \Delta INC, UNR, CLF, EDU, LFPR, DD, HUM, WIND, PCTNF, COAST, CLEAR, e_1) \quad (2.18)$$

$$IMED2 = f(\Delta\hat{EMP}, \Delta INC, UNR, CLF, EDU, LFPR, DD, HUM, WIND, PCTNF, COAST, CLEAR) \quad (2.19)$$

$$IMED3 = f(\Delta\hat{EMP}, \Delta INC, UNR, CLF, EDU, LFPR, DD, HUM, WIND, PCTNF, COAST, CLEAR) \quad (2.20)$$

$$OMED1 = f(\Delta\hat{EMP}, \Delta INC, AGE, CLF, DD, HUM, WIND, PCTNF, COAST, CLEAR) \quad (2.21)$$

$$OMED2 = f(\Delta\hat{EMP}, \Delta INC, AGE, CLF, DD, HUM, WIND, PCTNF, COAST, CLEAR) \quad (2.22)$$

$$OMED3 = f(\Delta\hat{EMP}, \Delta INC, AGE, CLF, DD, HUM, WIND, PCTNF, COAST, CLEAR) \quad (2.23)$$

$$\Delta\hat{EMP} = f(\hat{OMED12}, \hat{IMED12}, \hat{OMED3}, \hat{IMED3}, INC, EMP, D3, MANU, \Delta ARMFC) \quad (2.24)$$

$$IMED12 = IMED1 + IMED2 \quad (2.25)$$

$$OMED12 = OMED12 + OMED2 \quad (2.26)$$

Three stage least squares estimates of this model are presented in Table 2.5. (Appendix Table 2.4A reports beta coefficients that correspond to the model reported in Table 2.5.) In each in-migration equation except that for the lowest education class for the 1970s, the coefficients on the employment-change variable have the expected positive sign and are highly significant. Moreover, during the 1960s and 1970s more educated migrants were somewhat more responsive to changing job opportunities.

The income growth variable has a negative sign and a reasonably high t-ratio for the two highest education classes for the 1970s, which suggests that in recent years educated persons have been moving to areas with relatively little income growth. In each out-migration equation the coefficient on ΔINC is negative, and for the 1950s and 1960s each coefficient is statistially significant.

TABLE 2.5
Migration by Education Class:
Three State Least Squares Estimates for 1950-60, 1960-70, and 1970-80

Independent Variables	Equation for IMED1 1950-60	IMED1 1960-70	IMED1 1970-80	IMED2 1950-60	IMED2 1960-70	IMED2 1970-80
ΔEMP	0.19*	0.28*	-0.46	0.12*	0.37*	1.43*
ΔINC	-2.99	-10.54	- 1.10	0.46	-8.33	-2.25*
UNR	0.52E5	0.43E6*	0.38	-0.24E5	0.56E6	0.12E-2
EDU	0.64E4*	0.86E4*	0.14	0.38E4*	0.78E4	-0.62E-1*
PED1	1.60*	-0.19	77.00*			
PED2				3.00	0.63	-5.50
PED3						
LFPR	0.62E4	-0.52E5	0.55E-1	0.42E4	-0.85E5*	-0.47E-1
AGE						
OMED12						
IMED12						
OMED3						
IMED3						
INC	-9.47	4.89	-0.03	-4.03	10.49	-0.11
EMP						
D						
MANU						
ΔARMFC						
DD	-5.93*	-11.42**	-0.09	-3.09**	-6.75	0.08
HUM	0.16E3	-0.20E3	-0.20	0.15E3	-5.76	- 0.61E-1
WIND	-0.20E3	-31.67	-0.58E-1	-0.12E3	-23.86	- 0.89E-2
PCTNF	-0.17E5	-0.26E5	-0.10	0.48E4	0.15E5	-0.62E-1
COAST	-0.52E4	0.70E4	1.30	-0.17E4	0.11E5	-2.03**
CLEAR	-57.98	-0.18E3	-0.79	6.80	-31.82	0.16
INTERCEPTE5	0.14	0.34	0.94	-0.11	-0.52	2.02
OLS R^2	0.861	0.537	0.879	0.899	0.607	0.914

*(**)Coefficient is significantly different from zero at 5% (10%).

TABLE 2.5 (continued)
Migration by Education Class:
Three State Least Squares Estimates for 1950-60, 1960-70, and 1970-80

Independent Variables	Equation for IMED3			Equation for OMED1		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
ΔEMP	0.11*	0.69*	5.92*	0.02*	0.52*	1.16*
ΔINC	0.86	-14.21	-6.37**	-3.55*	-39.48*	-1.25
UNR	-0.15E6**	0.11E7	0.73	0.50E4	0.11E7*	-0.35
EDU	0.36E4*	0.90E4*	-0.21			
PED1				18.16*	-0.34E-2	0.42
PED2						
PED3 E-1	0.85*	-0.25	0.33			
LFPR	0.75E4	-0.11E6	-1.79*			
AGE				-0.16E3	-86.48	-0.25E-2
OM						
IM						
OMED3						
IMED3						
INC	1.66	22.66	-0.40	3.87*	22.78**	-0.25
EMP						
D						
MANU						
ΔARMFC						
DD	-2.53**	3.79	- 0.37	-2.39*	3.79	0.03
HUM	0.13E3	0.72E3	0.76	-27.27	0.72E3	-0.14
WIND	-47.81	28.49	0.14	-53.07	28.49	-0.21
PCTNF	0.44E4	-0.79E5	-0.60	-0.67E4	-0.76E5	-0.29
COAST	-0.42E3	0.14E5	-9.41*	-0.25E4*	0.14E5	-1.77
CLEAR	14.93	3.19	- 0.60	-13.32	3.19E3	- 0.24
INTERCEPT	-0.27	-1.10	6.40	0.17	-0.11	2.90*
OLS R^2	.930	.677	0.956	.909	.170	0.880

*(**)Coefficient is significantly different from zero at the 5% (10%).

TABLE 2.5 (continued)
Migration by Education Class:
Three State Least Squares Estimates for 1950-60, 1960-70, and 1970-80

Independent Variables	Equation for OMED2			Equation for OMED3		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
ΔEMP	0.56E-1*	0.57*	0.73	0.47E-1*	0.72*	0.82
ΔINC	-9.20*	-45.11*	-1.60	-6.83**	-44.99*	-1.28
UNR	-0.56	0.11E7*	-0.62E-1	-0.17E6*	-0.14E7	-0.25E-1
EDU						
PED1						
PED2	0.64E-1*	-0.27E-1	0.47E-1*			
PED3				0.13*	-0.32E-1	0.14*
LFPR						
AGE	-0.19E3	-0.47E3	-0.14E-1	62.04	-56.14	-0.34E-1
OMED12						
IMED12						
OMED3						
IMED3						
INC	9.39*	27.07*	0.10	7.19*	32.00*	-0.15
EMP						
D						
MANU						
ΔARMFC						
DD	-1.02	7.77	0.14E-1	0.37	14.73	0.35E-2
HUM	0.25E3**	0.98E3	-0.12	0.14E3	0.12E4	-0.17
WIND	-82.53	0.25E3	-0.12	51.15	0.49E3	-0.15
PCTNF	0.11E4	-0.54	0.23E-1	0.89E4	-0.62E5	-0.69E-1
COAST	-0.12E4	0.25E5	-1.27	0.11E4	0.34E5	-1.04
CLEAR	33.91	0.12E3	0.10	32.99	0.26E3	0.65E-1
INTERCEPTE4	0.18	-15.95	23.72*	-0.82	-29.43**	21.32*
OLS R^2	0.909	0.170	0.910	0.920	0.212	0.887

*(**)Coefficient is significantly different from zero at the 5% (10%).

TABLE 2.5 (continued)
Migration by Education Class:
Three State Least Squares Estimates

Independent Variables	Equation for ΔEMP		
	1950-60	1960-70	1970-80
ΔEMP			
ΔINC			
UNR			
EDU			
PED1			
PED2			
PED3			
LFPR			
AGE			
OME12	1.19	1.49	-1.59*
IME12	-0.88	-2.08*	1.84*
OMED3	-6.19*	-2.28	1.03
IMED3	8.89*	5.37*	-0.06
INC	-40.75*	-80.17*	-0.08
EMP	-0.98E-1*	-0.59*	-0.86*
D	0.10E5	-0.61	0.12
MANU	-0.00	1.32*	-0.22
ΔARMFC	0.78	-1.56	0.92**
DD			
HUM			
WIND			
PCTNF			
COAST			
CLEAR			
INTERCEPTE5	1.19	5.20*	0.73
OLS R^2	0.963	0.608	0.908

*(**)Coefficient is significantly different from zero at the 5% (10%).

Although a number of exceptions are apparent, the amenity variables are generally lacking in significance. This observation holds as well for the group with the most education as for the two groups with less education. These findings are in sharp contrast to those of Graves, who shows that many of the same location-specific amenities are significant in explaining net population migration during the 1960s. The present study emphasizes the importance of job opportunities in migration decisions. Graves failed to include a measure of employment change in his migration regressions, and if jobs were growing most rapidly in amenity rich areas, his results may have in part been spurious.

The employment-change equations are of some interest. Out-migration of the two groups with the least education failed to deter area employment growth during the 1950s and 1960s, but had a significant negative effect during the 1970s. Out-migration of the group with the most education significantly deterred employment growth during the 1950s, but not during the 1960s and 1970s. During the 1960s in-migration of individuals with 4 or less years of high school actually discouraged employment growth, whereas in-migration of those with more than 4 years of high school had a strong positive impact on area employment growth, which was also true during the 1950s. During the 1970s in-migration of those with 4 or less years of high school had a significant positive effect on area employment, but in-migration of the group with the most education had no effect. During the 1950s and 1960s SMSAs with relatively low income levels had a tendency to experience more rapid rates of employment growth, but during the 1970s this tendency was not evident.

The results associated with this exploratory work on migration of the educated are suggestive, but not totally satisfying. Important differences

are evident in the impacts of the most educated relative to those with less education. This finding seems potentially important. Perhaps these differences would be more marked if a different grouping of education classes had been used, such as those with 4 or more years of college relative to those with less than 4 years of college. However, the pattern of impacts changes sharply from period to period, which could be a reflection of the changing composition of the education classes used here. The results would be more satisfying if the patterns of change over time were more regular. More work along these lines seems to be called for.

2.3.2 Racial Aspects of Metropolitan Growth

An earlier paper (Greenwood, 1976) showed that during the 1950s the determinants and consequences of white migration differed considerably from those of nonwhite migration. Although both whites and nonwhites were attracted to metropolitan areas with rapidly expanding employment, whites were more strongly drawn to such areas. Nonwhites were attracted to high income areas, whereas whites showed no statistically significant tendency to move to high income places. White out-migration from high-income metropolitan areas was, however, lower. One of the most remarkable findings concerning the determinants of migration was that higher origin unemployment rates encouraged white out-migration, but discouraged nonwhite out-migration, presumably because unemployed nonwhite persons were unable to finance out-movement, or did not have the required skills for quick reemployment elsewhere.

During the 1950s white out-migration discouraged growth of white income in the places of out-migration, whereas white in-migration encouraged growth of white income in receiving areas. Nonwhite migration failed to affect nonwhite income growth in a statistically significant fashion. For each group,

out-migration discouraged employment growth and in-migration encouraged employment growth. Moreover, the magnitudes of migration's impact on each class of employment were similar. Finally, nonwhite in-migration and natural civilian labor force increase both positively affected nonwhite unemployment. Although the same was also true of whites, the magnitudes of the influences were considerably greater for nonwhites.

In this section a closely comparable, but not identical model of race-specific migration and race-specific income, employment, and unemployment change is reported for the 1970s. The model for the 1970s differs in three ways from that for the 1950s. First, for the 1950s the distinction is between white and nonwhite, but for the 1970s it is between black and nonblack. Second, the natural increase variable could not be defined for the 1070s because the measure used yielded negative values, which could not be incorporated in the double-log estimation of the model. Moreover, the change in local government expenditures variable was not computed for the 1970s. This variable, however, was never significant for the 1950s and thus its absence from the model is probably not important. Third, the 1950s estimation is based on 100 SMSAs that had a 1960 population in excess of 250,000, whereas the 1970s estimation is based on a 62 SMSAs that had a 1970 population in excess of 500,000.

Of the structural equations, 7 apply to whites and 7 symmetrical equations apply to nonwhites. The endogenous variables for each racial group include the number of CLF out-migrants (WOM, BOM), the number of CLF in-migrants (WIM, BIM), income change (RGWINC, RGBINC), employment change (RGWEMP, RGBEMP), unemployment change (RGWUNEMP, RGBUNEMP), CLF change (RGWCLF, RGBCLF), and natural change of the CLF (RWNAT, RBNAT). The natural

increase variables are defined for the 1950s only. The model is of the following form:

$$RWOM = f_1(\widehat{RGWINC}, \widehat{RGWEMP}, \widehat{RGWUNEMP}, BCLF50, WCLF50, WINC50, WUNR50, WEDU50, WAGE60, D1, D2, D3, D4, e_1) \quad (2.27)$$

$$RWIM = f_2(\widehat{RGWINC}, \widehat{RGWEMP}, \widehat{RGWUNEMP}, BCLF50, WCLF50, WINC50, WUNR50, D1, D2, D3, D4, e_2) \quad (2.28)$$

$$RGWINC = f_3(\widehat{RWOM}, \widehat{RWIM}, \widehat{RWNAT}, \widehat{RGBEMP}, \widehat{RGBUNEMP}, RGWEDU, RGGOVT, D1, D2, D3, D4, e_3) \quad (2.29)$$

$$RGWEMP = f_4(\ldots\ldots, e_4) \quad (2.30)$$

$$RGWUNEMP = f_5(\ldots\ldots, e_5) \quad (2.31)$$

$$RBOM = f_6(\widehat{RGBINC}, \widehat{RGBEMP}, \widehat{RGBUNEMP}, WCLF50, BCLF50, BINC50, BUNR50, BEDU50, WAGE60, D1, D2, D3, D4, e_6) \quad (2.32)$$

$$RBIM = f_7(\widehat{RGBINC}, \widehat{RGBEMP}, \widehat{RGBUNEMP}, WCLF50, BCLF50, BINC50, BUNR50, D1, D2, D3, D4, e_7) \quad (2.33)$$

$$RGBINC = f_8(\widehat{RBOM}, \widehat{RBIM}, \widehat{RBNAT}, \widehat{RGWEMP}, \widehat{RGWUNEMP}, RGBEDU, RGGOVT, D1, D2, D3, D4, e_8) \quad (2.34)$$

$$RGBEMP = f_9(\ldots\ldots, e_9) \quad (2.35)$$

$$RGBUNEMP = f_{10}(\ldots\ldots, e_{10}) \quad (2.36)$$

$$RGWCLF \equiv RGWEMP + RGWUNEMP \quad (2.37)$$

$$RWNAT \equiv RGWCLF + RWOM - RWIM \quad (2.38)$$

$$RGBCLF \equiv RGBEMP + RGBUNEMP \quad (2.39)$$

$$RBNAT \equiv RGBCLF + RBOM - RBIM \quad (2.40)$$

The variables in each of the above identities have the beginnings of period CLF in the denominator.

The migration equations for each group contain as explanatory variables the size of the CLF of the other group. This specification follows Becker (1957) in that each group is presumed to have a "taste for discrimination" that, other things being equal, causes the groups to repel one another.

Certain other white-nonwhite interactions variables have been included in

the model, namely RGWEMP and RGWUNEMP in the equations for RGBINC, RGBEMP, and RGBUNEMP, and comparable nonwhite variables in the corresponding white equations. The inclusion of such interactions in the model is based upon the queue theory of the low-income labor market. The dictum that nonwhites are "last hired, first fired" suggests that demand changes are transmitted to the nonwhite (less preferred) group via a tightening or loosening of the market for the white (more preferred) group. Hence, RGBINC, RGBEMP, and RGBUNEMP are dependent upon changes in white employment and unemployment. One the other hand, RGWINC, RGWEMP, and RGWUNEMP are not expected to be functionally related to RGBEMP or RGBUNEMP, except insofar as the consumption effects of increased or decreased nonwhite employment are transmitted to the white group.

It is generally presumed that either commodity trade in the absence of factor mobility, factor mobility in the absence of commodity trade, or some combination of commodity trade and factor mobility will lead to convergence of regional factor prices of comparable inputs. If, in response to interregional wage differentials, labor migrates from low- to high-wage regions, then increased labor supply in the high-wage regions will place downward pressure on wage levels (if demand is not perfectly elastic) and upward pressure on employment levels (if demand is not perfectly inelastic). In the low-wage regions decreased labor supply will place upward pressure on wage levels and downward pressure on employment levels. Hence, the traditional view of the factor price adjustment mechanism suggests that out-migration will result in increased wage and decreased employment levels, while in-migration and natural CLF increase result in decreased wage and increased employment levels.

The greater the improvement in the education of the CLF (RGEDU), the greater the expected increase in labor productivity, and hence the greater the

anticipated increase in the derived demand for labor. To the extent that the employment of additional highly productive workers results in the displacement of less-productive workers, and to the extent that these less-productive workers are unable to locate new jobs in their present locality, a decrease in product demand occurs. Since decreased product demand tends to result in decreased product prices (or less rapid increase than would otherwise occur), the value of labor's marginal product tends to fall (or rise less rapidly). Hence, effects on the consumption side of the market may to some degree offset increased factor demand that results from increased labor productivity. However, if after a reasonable period of search displaced less-productive workers are unable to locate new jobs in their present locality, they would presumably migrate out. Thus, the out-migration variables should in part reflect the effects of such occurrences. Increased education should therefore lead to increased income growth, but to the extent that the appropriate migration adjustments are lagged, the changes in employment and unemployment are indeterminate.

Certain earlier studies dealing with the effects of migration have taken the labor-demand curve for a locality to be infinitely elastic. Thus, any shift in labor supply resulting from migration could cause only a change in employment, since the existence of unemployment (in excess of frictional) is not consistent with perfectly elastic labor demand. That substantial unemployment of both whites and nonwhites existed during both the 1950s and the 1970s is clear. It is reasonable that migration influenced unemployment levels in sending and receiving localities, as well as influencing employment levels. Hence, unemployment change is treated as an endogenous variable in this study. In addition to being consistent with the use of employment change

as endogenous, the use of unemployment change as an endogenous variable closes the system.

The existence of excess-labor supply conditions in a given locality is expected to give rise to out-migration of the unemployed workers, such that excess-labor supply tends to be eliminated. Given wage levels that tend to be downwardly rigid, in-migration to a locality, or natural increase of the CLF of the locality, is likely to result in increased unemployment levels.

As in the model described in section 2.1, four regional dummy variables are included in each of the migration equations, as well as in the other structural equations of the model. These dummy variables indicate the significance of the differential (intercept) shift for any one region (i.e., West, South, North Central, Northeast) relative to each of the other regions. Significant differential shifts might result from a number of factors that operate with differential impacts on the various regions and are not accounted for by existing variables in the equations. In the migration equations regional differences in climate, cost of living, or social milieu could give rise to regional differences in the average propensity to migrate. Systematic interregional differences in rates of growth of (physical) capital and in the impacts of technological progress could cause differential shifts in the income, employment, and unemployment change equations. A number of other factors that are not easily measured and that may vary systematically across regions could be reflected in the dummy variables.

Model Estimation

Tables 2.6 and 2.7 report two stage least squares estimates of the race-specific models for the 1950s and the 1970s. (Appendix Table 2.5A reports the beta coefficients for the 1970-1980 white model, and appendix Table 2.6A

Table 2.6
White Migration and White Metropolitan Change, 1950-60 and 1970-80:
Two Stage Least Squares Estimates

	RWOM		RWIM		RGWINC		RGWEMP		RGUNEMP	
	1950-60	1970-80	1950-60	1970-80	1950-60	1970-80	1950-60	1970-80	1950-60	1970-80
RWOM					-0.07*	0.01	-0.50*	-0.23*	-0.69*	0.12
RWIM					0.09*	-0.01	0.41*	0.30*	0.42*	-0.26
WNAT					0.01		0.03*		0.03*	
RGWINC	-0.46	-0.17	0.26	-1.44						
RGWEMP	-0.10	0.56	3.12*	2.27*						
RGWUNEMP	-.45	-0.91	-0.77*	-0.56*						
RGBEMP					-0.08	0.03	0.23	0.23*	-0.42	0.30
RGBUNEMP					-0.01	0.02	0.02	0.03	0.33*	0.57
BCLF	0.15*	0.16	-0.03	0.15*						
WCLF	0.70*	0.66*	0.89*	0.61*						
WINC	-0.77*	0.08	-0.12	-0.95						
WUNR	0.27*	-0.92	-0.50*	-0.67*						
WEDU	1.82*	-0.36								
WAGE	-0.87*	0.72								
RGWEDU					0.41*	0.13	-0.22	-0.32	-0.86	-0.13
RGGOVT					0.02		0.01		0.05	
D1	6.74*	2.20	-0.55	13.93*	0.15	0.64*	0.97*	-0.74*	3.04*	1.58
D2	-0.13	-0.68*	-0.09	-0.63*	-0.07*	0.04	0.02	0.08	-0.03	0.35*
D3	-0.02	0.24	-0.03	0.24	0.05*	-0.03	-0.14*	-0.07	0.10	-0.14
D4	-0.01	0.08	-0.35*	-0.08	0.02	-0.06*	-0.04	0.02	-0.12	-0.29*
OLS R^2	0.95	0.77	0.96	0.95	0.39	0.36	0.80	0.84	0.44	0.30

*Indicates that the coefficient is significant at the 10% level or better

Table 2.7
Nonwhite Migration and Nonwhite Metropolitan Change, 1950-60 and 1970-80:
Two Stage Least Squares Estimates

	RBOM		RBIM		RGBINC		RGBEMP		RGBUNEMP	
	1950-60	1970-80	1950-60	1970-80	1950-60	1970-80	1950-60	1970-80	1950-60	1970-80
RBOM					-0.27	0.86	-0.57*	-0.26*	-0.65*	-0.42*
RBIM					0.10	-0.02	0.39*	0.23*	0.53*	0.47*
BNAT					0.12*		0.10*		0.17*	
RGBINC	0.51	1.08	2.55*	-0.049						
RGBEMP	-0.08	-1.01	1.90*	2.08*						
RGBUNEMP	-0.04	0.00	0.02	-0.30						
RGBEMP					-0.40	0.28*	-0.25	0.76*	-1.87*	0.28
RGBUNEMP					-0.22*	-0.08	-0.03	0.15	1.38*	0.19*
WCLF	0.10*	0.11	0.00	-0.04						
BCLF	0.75*	0.77*	0.79*	0.82*						
BINC	0.08	-0.26	1.18*	-0.40						
BUNR	-0.22*	-0.02	-0.17	-0.39*						
BEDU	0.07	2.26								
BAGE	-1.62*	-3.53								
RGBEDU					1.49*	0.05	0.59	-0.77	1.84	1.40
RGGOVT					0.20		-0.02		0.02	
D1	4.09	9.19	-9.57*	6.52	0.60*	0.70*	1.06*	0.57	-0.29	-0.05
D2	-0.53*	-0.77	0.23	-0.44*	0.03	0.01	-0.14	-0.27*	-0.08	-0.22
D3	-0.19	-0.15	-0.48*	0.15	-0.24	-0.08	-0.17	0.08	-0.39	0.43*
D4	-0.02	0.21	-0.17	-0.22*	-0.03	-0.01	0.01	0.15*	-0.09	0.20
OLS R^2	0.96	0.78	0.96	0.94	0.36	0.50	0.75	0.76	0.46	0.26

*Indicates that the coefficient is significant at the 10% level or better

reports corresponding beta coefficients for he nonwhite model.) The results are generally similar for the two periods, but certain noteworthy differences are apparent. One of the sharpest differences is in the WOM equations, where the exogenous variables were uniformly strong in explaining white out-migration during the 1950s, but provide little explanatory power for the 1970s. White employment growth encouraged and white unemployment growth discouraged white in-migration during each period, but for the 1970s the absolute values of the coefficients are only about 75 percent of their 1950 values. During each period higher white unemployment rates also discouraged in-migration.

As is true of white out-migration, none of the endogenous variables is significant in the nonwhite out-migration equations. During each period nonwhite employment growth encouraged nonwhite in-migration, and the magnitude of the influence of employment opportunities was quite similar during the 1950s and the 1970s. The major change that occurred in nonwhite in-migration patterns is evident in the income growth and in the income level variables. During the 1950s nonwhites were attracted to metropolitan areas with high nonwhite income levels and with high rates of nonwhite income growth. No such tendency is evident for the 1970s, and moreover, the coefficients on both income variables are negative though not statistically significant. Both white and nonwhite in-migration was discouraged by high unemployment rates during the 1970s. In general, structural patterns of nonwhite in-migration now parallel those of white in-migration. The probable cause of this shift is that nonwhite migration is now directed at the South, whereas in earlier years it was directed at the North. The directional patterns of white and nonwhite flows are now more similar.

During each period out-migration discouraged employment growth and in-

migration encouraged it. Moreover, the magnitudes of the coefficients on the migration variables in the employment equations are quite similar for each group. Nonwhite out-migration reduced unemployment and nonwhite in-migration increased it during the 1950s, but during the 1970s white migration failed to significantly influence white unemployment. Finally, nonwhite migration failed to affect the patterns of nonwhite income growth during each period. The same observation characterizes white migration during the 1970s, but during the 1950s white out-migration discouraged white income growth whereas white in-migration spurred white income growth.

Some evidence in support of the queue theory of the low-income labor market is presented in Tables 2.6 and 2.7. For the 1950s nonwhite unemployment increases more than in proportion to white unemployment growth, and for the 1970s white unemployment growth also causes an increase in nonwhite unemployment, but the strength of the relationship is considerably lower than during the earlier period. Moreover, as expected, the coefficients on RGWEMP and RGWUNEMP are greater in absolute value in the equation for nonwhite unemployment growth than in the equation for nonwhite employment growth.

The impacts of nonwhite employment and unemployment on the white system are expected to be less strong than the impacts of the corresponding white variables on the nonwhite system. The empirical results tend to confirm this expectation. Nonwhite employment growth significantly affected white employment during the 1970s, whereas white employment growth significantly influenced nonwhite income and employment growth during the 1970s, and white unemployment growth had a significant negative influence on nonwhite income during the 1950s.

Although the models are not identical, it is informative to compare the results in Table 2.2A for migration of the total population with those reported in Tables 2.6 and 2.7 for migration of the white and black components of the population. For the decade of the 1970s, where the comparison makes the most sense, the importance of employment growth in attracting in-migrants is evident in both the aggregated and the disaggregated regressions. However, whereas the growth of unemployment discouraged total in-migration and white in-migration, it did not discourage black in-migration. Other findings reported for migration in general are very consistent with those reported for white and black migration.

APPENDIX TO CHAPTER 2

VARIABLE DEFINITIONS AND DATA SOURCES

Each of the following variables except the dummies is expressed as a logarithm.

Jointly Dependent Variables

ROMTS = out-migration (rate) to SMSAs; i.e., the number of individuals classified as CLF members in 1960 (1970) (1980) who resided in the SMSA in question on April 1, 1955 (1965) (1975), but in a different SMSA on April 1, 1960 (1970) (1980), divided by the 1950 (1960) (1970) CLF of the SMSA.

ROMTN = out-migration (rate) to nonmetropolitan areas; i.e., the number of individuals classified as CLF members in 1960 (1970) (1980) who resided in the SMSA in question on April 1, 1955 (1965) (1975), but in a nonmetropolitan area on April 1, 1960 (1970) (1980), divided by the 1950 (1960) (1970) CLF of the SMSA.

RIMFS = in-migration (rate) from SMSAs; i.e., the number of individuals classified as CLF members in 1960 (1970) (1980) who resided in the SMSA in question on April 1, 1960 (1970) (1980), but in a different SMSA on April 1, 1955 (1965) (1975), divided by the 1950 (1960) (1970) CLF of the SMSA.

RIMFN = in-migration (rate) from nonmetropolitan areas; i.e., the number of individuals classified as CLF members in 1960 (1970) (1980) who resided in the SMSA in question on April 1, 1960 (1970) (1980), but in a different nonmetropolitan area on April 1, 1955 (1965) (1975), divided by the 1950 (1960) (1970) CLF of the SMSA.

RGINC = rate of income growth; i.e., the percentage change (+1) between 1949 and 1959 (1959 and 1969) (1969 and 1979) in median income of persons residing in the SMSA on April 1, 1960 (1970) (1980), and April 1, 1950 (1960) (1970).

RGMANU = manufacturing-employment growth; i.e., the change in manufacturing employment in the SMSA between 1950 (1960) (1970) and 1960 (1970) (1980) divided by the 1950 (1960) (1970) CLF of the SMSA (+1).

RGGEMP = government employment growth; i.e., the change in government employment in the SMSA between 1950 (1960) (1970) and 1960 (1970) (1980) divided by the 1950 (1960) (1970) CLF of the SMSA (+1).

RGNMANU = other nonmanufacturing-employment growth; i.e., the change in employment exclusive of manufacturing and government in the SMSA between 1950 (1960) (1970) and 1960 (1970) (1980) divided by the 1950 (1960) (1970) CLF of the SMSA (+1).

RGUNEMP = unemployment growth; i.e., the change in unemployment in the SMSA between April 1, 1950 (1960) (1970), and April 1, 1960 (1970) (1980), divided by the 1950 (1960) (1970) CLF of the SMSA (+1).

Exogenous Variables

RGEDU = rate of education growth; i.e., the percentage change (+1) between 1950 and 1960 (1960 and 1970) (1970 and 1980) in median number of years of school completed by persons 25 years old and over.

RGARMFC = growth of armed forces personnel; i.e., change between 1950 (1960) (1970) and 1960 (1970) (1980) in the number of armed forces personnel in the SMSA divided by the 1950 (1960) (1970) CLF of the SMSA (+1).

INC = median 1949 (1959) (1969) income of persons residing in the SMSA in 1950 (1960) (1970).

UNR = rate of unemployment prevailing in the SMSA on April 1, 1950 (1960) (1970).

CLF = civilian labor force of the SMSA, 1950 (1960) (1970).

EDU = median number of years of school completed by persons 25 years old and over, 1950 (1960) (1970).

AGE = median age of the population of the SMSA, 1950 (1960) (1970).

MANU = ratio of manufacturing employment to CLF, 1950 (1960) (1970).

GEMP = ratio of government employment to CLF, 1950 (1960) (1970).

NMANU = ratio of other nonmanufacturing employment to CLF, 1950 (1960) (1970).

%NW = percentage of the SMSA's population that was nonwhite, 1950 (1960) (1970).

RRET = rate of return in manufacturing; i.e., value added by manufacturing industries in the SMSA net of manufacturing payrolls in the SMSA divided by an estimate of the gross book value of depreciable and depletable assets in the SMSA's manufacturing sector, 1957.

D1, D2, D3, D4 = regional dummy variables; see the table below for definitions.

DEFINITIONS OF DUMMY VARIABLES

Region	D1	D2	D3	D4
West	1	0	0	0
South	1	1	0	0
Midwest	1	1	1	0
Northeast	1	1	1	1

TABLE 2.1A
Metropolitan Growth Model, 1970-80: Beta Coefficients Associated With Two Stage Least Squares Estimates

Independent Variables	Equation for								
	ROMTS	ROMTN	RIMFS	RIMFN	RGINC	RGMANU	RGGEMP	RGNMANU	RGUNEMP
ROM					-2.13	-1.24**	0.57E-1	-0.98**	1.96**
RIM					2.68**	1.56**	0.87**	2.01**	-2.27**
ROMTS			0.60**						
ROMTN				0.57**					
RIMFS	0.97								
RIMFN		1.22**							
RGINC	-0.26	0.21	0.29E-1	-0.18	-0.11		0.11		0.52
RGEMP	0.53	-0.37	0.20	0.40**					
RGMANU								-0.25	
RGUNEMP	0.66**	0.37**	-0.28	-0.27**	0.62				
RNAT					1.36**	0.51**	-0.20	0.21	-1.08**
INC	0.31	0.20	-0.12	-0.24**		0.14		-0.68E-1	
UNR	0.23	-0.47E-1	-0.16**	0.37E-2					0.62E-1
CLF	0.22	-0.28**	-0.14**	0.18**					
EDU	-0.10	0.17							
AGE	-0.17	-0.11							
MANU						-0.33			
GEMP							0.65E-1		
NMANU								-0.11	
%NW					0.33				-0.22
RRET (N/A)									
RGEDU					0.73E-1	-0.86E-1	0.54E-2	-0.20	
RGARMFC					0.32	-0.42E-2	-0.86E-1	-0.74E-1	-0.32
D1									
D2	0.16E-1	0.40E-1	-0.76E-1	-0.39E-1	-0.73	-0.26	0.33**	0.14E-1	0.81**
D3	0.25	0.68E-1	-0.15	-0.62E-1	0.81	0.36E-1	0.41E-1	0.14	-0.61
D4	0.24	-0.18E-1	-0.11	0.65E-2	-0.63	-0.26E-1	0.91E-1	-0.78E-1	-0.16
OLS R^2									

**Coefficient is significantly different from zero at the 10% level.

TABLE 2.2A
Metropolitan Growth Model with Two Migration Equations
and Including Regional Dummies: Two Stage Least Squares Estimates
of Double-Logarithmic Regression Coefficients

Independent Variables	Equation for ROM 1970-80	RIM 1970-80	RGINC 1970-80	RGMANU 1970-80	RGGEMP 1970-80	GRNMANU 1970-80	GRUNEMP 1970-80
ROM		0.869**	-0.389	-0.252**	0.006	-0.460**	0.125
RIM	0.690**		0.255**	0.164**	0.048**	0.489**	-0.076
ROMTS							
ROMTN							
RIMFS							
RIMFN							
RGINC	-0.477	-0.843			-0.065		0.183
RGEMP	0.161	1.247**					
RGMANU						-0.579	
RGUNEMP	8.169**	-5.180**	1.769				
RNAT			0.709**	0.293**	-0.061	0.285	-0.199**
INC	0.687	-0.645	-0.056	0.079		-0.091	
UNR	0.183	-0.221**					0.005
CLF	0.031	-0.025					
EDU	0.099						
AGE	-0.685**						
MANU				-0.045**			
GEMP					0.007		
NMANU						-0.127	
%NW			0.026				-0.006
RRET							
RGEDU			0.181	-0.238	0.008	-1.258**	
RGARMF			2.082	-0.030	-0.321	-1.217	-0.717
D1	-4.541	6.219	0.884	-0.866	0.050	0.950	-0.005
D2	0.070	-0.149	-0.106	-0.041	0.028**	0.005	0.041**
D3	0.152	-0.150	0.094	0.005	-0.003	0.041	-0.025
D4	0.081	-0.041	-0.008	-0.004	0.007	-0.026	-0.007

**Coefficient is significantly different from zero at the 10% level.

TABLE 2.3A
Net Metropolian Migration and Metropolitan Growth:
Beta Coefficients

Dependent Variables	Equation for RNETMIG			Equation for RGEMP			Equation for RGLFPR		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
RGEMP	1.04**	0.58**	0.85**				-0.30**	0.13	0.12**
NET				0.86**	0.44**	0.79**			
EMP	0.65E-2	-0.53E-1	-0.16E-1	-0.27E-1	-0.26**	-0.70E-1			
INC	0.40E-1	0.62E-1	-0.22E-1						
AGE	0.47E-1	0.15	0.15						
EDU	-0.22E-1	0.26**	-0.97E-1						
UNR	0.35E-1	0.28E-1	-0.75E-1				0.28**	-0.23	-0.60E-1
RGED				-0.29E-1	-0.90E-1	-0.95E-1	0.17**	-0.44E-1	-0.12E-1
RGINC				0.30E-1	0.39E-1	0.36E-1	-0.74E-1	-0.49E-1	0.22**
RGARMFC				0.17E-1	0.30**	0.86E-2			
MANU				-0.18E-1	0.70E-1	-0.64E-1			
LFPR							-0.57**	-0.37**	-0.58
%NW							-0.22E-1	-0.23**	-0.55E-1
D				-0.12**	-0.22	-0.70E-1			
DD	0.40E-1	-0.32	0.20E-1						
HUM	-0.33E-1	-0.23**	-0.37E-1						
WIND	0.15E-2	-0.38E-2**	0.19E-1						
PCTNF	-0.28E-1	0.19E-1	0.18**						
COAST	-0.21E-1	0.50E-1	-0.37E-1						
CLEAR	-0.32E-1	-0.20	0.63E-1						
INTERCEPT									

**Coefficient is significantly different from zero at the 10% level.

TABLE 2.4A
Migration by Education Class:
Beta Coefficients Associated with Three Stage Least Squares Estimates

Independent Variables	Equation for IMED1			Equation for IMED2		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
DEMP	0.68*	0.92*	0.53*	0.64*	1.09*	0.52*
DINC	-0.08	-0.59E-1	-0.36*	-0.24E-1*	0.43E-1	-0.21*
UNR	-0.02	0.53	-0.18*	-0.30E-1	0.68	-0.19*
ED	0.15*	0.15**	0.13*	0.14	0.13	0.11*
PED1	0.31*	-0.21E-2	0.50*			
PED2				0.32*	-0.21E-1	0.42*
PED3						
LFPR	0.17E-1	-0.13	-0.04	0.19E-1	-0.19	-0.17*
AGE						
OM						
IM						
OMED3						
IMED3						
INC						
EMP						
D						
MANU						
ΔARMFC						
DD	-0.31*	-0.38**	-0.19**	-0.23*	-0.13	-0.18**
HUM	0.67E-2	-0.91E-2	0.14**	0.27E-1	0.63E-1	-0.01
WIND	-0.27E-1	0.12E-1	0.04	-0.27E-1	0.72E-2	-0.00
PCTNF	-0.22E-1	-0.57E-1	0.08	0.16E-1	0.25E-1	0.23*
COAST	0.93E-1	0.82E-1	0.01	-0.59E-1	0.15	0.00
CLEAR	-0.58E-1	-0.98E-1	0.02	0.21E-3	0.66E-1	0.11**

*(**) Coefficient is significantly different from zero at the 5% (10%).

TABLE 2.4A (continued)
Migration by Education Class:
Beta Coefficients Associated with Three Stage Least Squares Estimates

Independent Variables	Equation for IMED3			OMED1		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
ΔEMP	0.53*	1.09*	0.42*	0.36	-0.13	0.60*
ΔINC	0.25E-1	0.13	0.06**	-0.65E-1	0.30*	0.02
UNR	-0.53E-1	0.76	-0.08*			
EDU	0.12*	0.96E-1	0.01			
PED1				0.87*	-0.12E-1	0.79*
PED2						
PED3	0.53*	-0.67E-1	0.67*			
LFPR	0.28E-1	-0.11	0.05			
AGE				-0.54E-1	-0.42E-1	-0.04
OM						
IM						
OMED3						
IMED3						
INC						
EMP						
D						
MANU						
ΔARMFC						
DD	-0.13*	0.15	-0.18*	-0.15	-0.14	0.13
HUM	0.29E			0.62E-2	0.28**	0.05
WIND	-0.13E-1	-0.30E-1	0.02	-0.22E-1	-0.14	-0.01
PCTNF	-0.42E-2	-0.17E-1	0.08*	-0.53E-1	-0.14	-0.11*
COAST	-0.32E-1	0.25*	0.01	-0.13*	0.14	-0.09**
CLEAR	0.67E-2	0.19**	-0.01	-0.61E-1	0.18	-0.05

*(**)Coefficient is significantly different from zero at the 5% (10%).

TABLE 2.4A (continued)
Migration by Education Class:
Beta Coefficients Associated with Three Stage Least Squares Estimates

Independent Variables	Equation for OMED2			OMED3		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
ΔEMP	0.36	-0.69	0.60*	0.25	-0.15	0.34*
ΔINC	-0.67E-1	0.28**	0.04	-0.35	0.38**	0.19*
UNR						
EDU						
PED1						
PED2	0.81*	-0.21E-1	0.75*			
PED3				0.86*	-0.37E-1	0.77*
LFPR						
AGE	-0.343-1	-0.56E-1	-0.02	0.71E-2	-0.31E-1	0.03
OM						
IM						
OMED3						
IMED3						
INC						
EMP						
D						
MANU						
ΔARMFC						
DD	0.22E-1	-0.26E-1	0.18*	0.93E-1**	0.19E-1	0.08
HUM	0.11*	0.31**	-0.01	0.54E-1	0.30*	-0.09
WIND	-0.21E-1	-0.11	-0.01	-0.50E-2	-0.11	0.05
PCTNF	-0.10E-1	-0.99E-1	-0.03	-0.15E-1	-0.95E-1	-0.01
COAST	0.18E-1	0.22	0.01*	0.88E-2	0.23	0.01
CLEAR	0.38E-1	0.26	0.09	0.33E-1	0.30	0.05

*(**)Coefficient is significantly different from zero at the 5% (10%)

TABLE 2.4A (continued)
Migration by Education Class:
Beta Coefficients Associated with Three Stage Least Squares Estimates

Independent Variables	Equation for ΔEMP 1950-60	1960-70	1970-80
ΔEMP			
ΔINC			
UNR			
EDU			
PED1			
PED2			
PED3			
LFPR			
AGE			
OM	0.17	2.29	1.65*
IM	-0.25	-1.59	-0.40
OMED3	-0.96**	-2.39	-0.99*
IMED3	1.55*	3.09*	1.66*
INC	-0.44E-1	-0.24	-0.16*
EMP	0.67*	-3.14	-2.18*
D	0.15E-1	-0.29E-1	0.01
MANU	-0.25	2.07*	0.89*
ΔARMFC	0.57E-1*	-0.26E-1	-0.01
DD			
HUM			
WIND			
PCTNF			
COAST			
CLEAR			

*(**)Coefficient is significantly different from zero at the 5% (10%)

Table 2.5A
White Migration and White Metropolitan Change, 1970-80:
Beta Coefficients Associated with Two Stage Least Squares Estimates

	Equation for				
	RWOM	RWIM	RGWINC	RGWEMP	RGWUNEMP
RWOM			0.20	-0.95**	0.27
RWIM			-0.11	1.16**	-0.53
RWNAT					
RGWINC	-0.11E-1	-0.11			
RGWEMP	0.13	0.60**			
RGWUNEMP	-0.41	-0.28**			
RGBEMP			0.14	0.33**	0.22
RGBUNEMP			0.77E-2	0.32E-1	0.36
BCLF	0.27	0.34**			
WCLF	0.58**	0.57**			
WINC	0.10E-1	-0.13			
WUNR	-0.46	-0.36**			
WEDU	-0.17				
WAGE	0.70E-1				
RGWEDU			0.67E-1	-0.44E-1	0.10E-1
RGGOVT					
D1					
D2	-0.34**	-0.34**	0.27	0.17	0.39**
D3					
D4	0.46E-1	-0.45E-1	-0.47**	0.38E-1	-0.27

**Coefficient is significantly different from zero at the 10% level.

Table 2.6A
Black Migration and Black Metropolitan Change, 1970-80:
Beta Coefficients Associated with Two Stage Least Squares Estimates

	Equation for				
	RBOM	RBIM	RGBINC	RGBEMP	RGBUNEMP
RBOM			0.80E-1	-1.01**	-1.95**
RBIM			-0.16	0.80**	1.89**
RBNAT					
RGBINC	0.12	-0.61E-1			
RGBEMP	-0.26	0.61**			
RGBUNEMP	0.38E-4	-0.76E-1			
RGWEMP			0.48**	0.54**	0.23
RGWUNEMP			0.25	0.20	0.30
WCLF	0.71E-1	-0.29E-1			
BCLF	0.95**	1.16**			
BINC	-0.37E-1	-0.66E-1			
BUNR	-0.47E-2	-0.13			
BEDU	0.19		0.27E-1		
BAGE	-0.20				
RGBEDU				-0.18	0.39
RGGOVT					
D1					
D2	-0.29	0.19**	0.35E-1	-0.40**	-0.38
D3	-0.70E-1	0.81E-1	-0.32	0.15	0.92**
D4	0.86E-1	-0.10**	-0.23E-2		0.37

**Coefficient is significantly different from zero at the 10% level.

3. INTRAMETROPOLITAN LOCATION WITHIN A SIMULTANEOUS-EQUATIONS CONTEXT

Central city decay in the major metropolitan areas of the country is a well-known phenomenon. One prominent explanation for the plight of central cities is that both workers and jobs have been involved in self-reinforcing movement to the suburbs. A number of studies dealing with the cumulative flight phenomenon, such as those of Kain (1968), Mills (1970), and Steinnes (1977), have focused specifically on the causal relationships between the movement of jobs and the movement of workers. Do jobs follow workers to the suburbs, or do workers follow jobs? Other studies, such as those of Muth (1969), place more emphasis on the role of housing services in determining the optimal location of an urban household's place of residence. These models and supporting empirical work suggest that a high income elasticity of demand for high quality, low density housing could also be responsible for the movement of many households to the suburbs. Rather than taking a suburban job, many workers may opt for a suburban residence and commute a longer distance to the same job.

The present study recognizes that households may change location not only in response to changes in workplace, but also in response to changes in housing supply conditions. Furthermore, it recognizes that household location decisions may in turn influence the distribution of employment and housing across metropolitan space. The study thus develops a simultaneous-equations model of metropolitan growth and intrametropolitan location that treats housing, employment, and labor force location within the same framework. This approach allows us to disentangle the relative importance of various factors on metropolitan growth and intrametropolitan location and to determine changes over time in the magnitudes of these factors.

3.1 The Model

The model developed in this chapter contains three blocks of equations--a housing block, a distribution block, and a location block. A fourth block for metropolitan-wide economic growth is implicit, but since the variables of this latter block are assumed to influence those of the other three blocks without in turn being influenced by the variables of these blocks, the relationships between the growth block and the remainder of the model are recursive. As such, the specification of the growth block does not influence the specification of the housing, distribution, and location blocks.

The model described in section 3.1 is hereafter called the "basic model." This model was previously estimated for the 1950s and 1960s, as reported in Greenwood (1980), and is updated to include estimates for the 1970s. Subsequent sections concern extensions and modifications of this model. For example, the model is extended to distinquish white and nonwhite intrametropolitan locators. Then it is modified to allow more straightforward interpretation of the coefficients. This modification also allows further disaggregation of many variables of the model. Variables of the location block are disaggregated by income, and the housing variables are disaggregated by tenure class and age. Several other important changes are made in the model for the 1970s, where the use of the 1980 Public Use Microdata Samples allows the separate analysis of male versus female headed households, different age classes of households, and households by the presence of children. In each case the variable is cross-classified by income.

Metropolitan-wide growth of the housing stock is determined in the housing block, and in the distribution block this growth is distributed to either the central city or the suburban ring. Metropolitan-wide growth of employ-

ment, civilian labor force (CLF), and income are also distributed to central city or suburbs in the distribution block. In the location block the suburban relative to central city location of CLF in-migrants is determined, along with CLF movements between central city and suburbs and between suburbs and central city. Because the model for the 1970s is based in part upon data drawn from the Public Use Files of the 1980 Census, an equation is also estimated for CLF out-migrants from the central city relative to the suburban ring. Data on SMSA out-migrants, identified as having previously resided in the central city versus the suburban ring, are not reported in the published census volumes, and thus this equation could not be estimated for the 1950s and 1960s. Variables of the location and distribution blocks are determined simultaneously, and location decisions in turn influence metropolitan-wide growth of the housing stock.

A number of linkages are assumed to exist between metropolitan growth and the remainder of the model. Growth of CLF residents over the entire metropolitan area is hypothesized to induce growth of the metropolitan housing stock, but growth of the housing stock is assumed not to directly influence growth of residents. A second linkage is between the growth block and the location block. In-migrants to the metropolitan area must locate in either the central city or the suburban ring. Finally, metropolitan-wide growth of the CLF, of employment, and of (median) income are implicitly assumed to be determined in the growth block and then to exogenously feed into the distribution block, where the growth is distributed within the metropolitan area. All growth rates defined in this section of the study are ratios of end-of-period to beginning-of-period values. In alternative specifications discussed in later sections, the growth variables are defined differently.

3.1.1 The Housing Block

Metropolitan areas experiencing greater rates of growth of labor force residents (RGR) should experience greater rates of growth of their housing stock (RGH); moreover, metropolitan areas with static population or labor force could also experience increasing housing stocks due to the demand of their residents for new and better housing. If, for example, new housing is constructed in the suburbs in response to the demand of central city residents, and old central city housing does not filter out of the housing stock as rapidly as new suburban housing is constructed, then metropolitan-area housing may grow in spite of no increase occurring in the number of households demanding housing. A number of factors might contribute to slowing the decline of the stock of old central city housing, such as quality improvements realized through the upgrading of existing structures. Net intrametropolitan relocation of CLF members from central city to suburbs (RNMOV) should thus have a positive sign in the housing-growth equation. Higher vacancy rates at the beginning of the period (V_{t-10}) are expected to result in lower rates of housing growth both because more vacant housing is available to new residents and to households relocating in the metropolitan area, and because in metropolitan areas characterized by high vacancy rates the supply response of builders is likely to be less vigorous.

In most studies that have examined the relationship between consumption of housing services and income, some value measure of housing consumption has been employed as the dependent variable.[1] In the present study, however, the dependent variable is the rate of growth of the number of housing units. The problem that is encountered when value relationships are not considered and

number of housing units or its change is utilized as the dependent variable is that in the housing equation the sign on the variable for the rate of growth of family median income (RGY) becomes ambiguous. Muth has demonstrated that since higher income households consume greater quantities of housing, population density is lower in higher income residential areas. Hence, within any given urban spatial area or subarea, higher family income may be associated with fewer dwelling units that are larger in size and/or occupy more land. Consequently, in the equation for growth of the metropolitan housing stock, no sign is specified on the income-growth variable. The housing block thus consists of a single equation of the following form:

$$RGH = f_1(RGR, RNMOV, RGY, V_{t-10}, e_1). \qquad (3.1)$$

Detailed definitions of the symbols used in this section are presented in the appendix.

3.1.2 The Distribution Block

The structural equations of the distribution block are intended to explain the rate of suburban growth relative to central city growth of a number of economic activities deemed relevant to explaining residential location decisions of CLF members. The distribution block contains three implicit identities, one for the rate of growth of the suburban housing stock relative to the rate of growth of the central city housing stock (RGHSC or RGHS/RGHC), one for the rate of growth of suburban employment relative to the rate of growth of central city employment (RGESC or RGES/RGEC), and one for the rate of growth of suburban CLF residents relative to the rate of growth of central city CLF residents (RGRSC or RGRS/RGRC).[2] Each of these identities is derived from a corresponding identity that expresses the end-of-period SMSA value as the sum of the component central city and suburban values (e.g., H80

= HC80 + HS80).[3] With the addition of a behavioral equation for the relative rates of suburban and central city income growth (RGYSC or RGYS/RGYC), the distribution block consists of of the following four structural equations:

Housing: $RGHSC = f_2(RGRSC, RGYSC, VSC_{t-10}, e_2)$, (3.2)

Employment: $RGESC = f_3(RGRSC, RGYSC, e_3)$, (3.3)

CLF Residents: $RGRSC = f_4(RNMOV, RIMSC, e_4)$, (3.4)

Income: $RGYSC = f_5(RGRSC, RGESC, YSC_{t-10}, e_5)$. (3.5)

In the equation for suburban relative to central city housing growth, RGRSC is clearly expected to have a positive sign, whereas the sign on RGYSC is ambiguous for reasons given in the earlier discussion of the anticipated relationship between growth of metropolitan income and growth of the metropolitan housing stock. The higher are beginning-of-period suburban vacancy rates relative to central city vacancy rates (VSC_{t-10}), the lower the expected rate of growth of suburban housing relative to central city housing.

RGRSC is expected to have a positive sign in the equation for RGESC because CLF growth should reflect both increased labor supply and increased product demand. The sign on RGYSC should also be positive, at least for the employment components that are related to nonexport demand, such as retail trade and services tend to be, because this variable also reflects product demand, given RGRSC.

In the equation for RGRSC, net intrametroplitan relocation of CLF members from central city to suburbs (RNMOV) and in-migration of CLF members to the suburbs relative to in-migration to the central city (RIMSC) should clearly have positive signs. Unfortunately, for the 1950s and 1960s, published out-migration data for the various metropolitan areas do not distinguish

whether the migrants were residents of the central city or the suburban ring, and hence out-migration cannot be incorporated into the model in any meaningful fashion, except in the growth block. Since data for the 1970s were drawn from the 1980 Public Use Microdata Samples, metropolitan out-migrants can be distinguished as originating in the central city versus the suburban ring, and an out-migration equation can be incorporated into the model. Thus, the model for the 1970s is not identical to that for the 1950s and 1960s.

Whether RGRSC takes a positive or a negative sign in the equation for RGYSC is dependent in part upon the differential characteristics of incremental CLF residents of the two areas. The sign on RGRSC is thus ultimately an empirical matter that cannot be specified without some reference to the data themselves. Greater rates of suburban relative to central city income growth have frequently been attributed in large part to differential rates of employment growth. A positive sign on RGESC would be consistent with this hypothesis.

3.1.3 The Location Block

In-migrants to a metropolitan area must locate in either the central city or the suburban ring. On-going residents who relocate have the same two choices. Various intraurban location models suggest that households optimize location by selecting some combination of housing and proximity to place of work. Other things being equal, the typical household not already at its optimal location would prefer to move closer to its place of work so as to minimize commuting time.

The foregoing discussion suggests changes of two types that influence the relocation decisions of indigenous households and the location decisions of in-migrant households--changes in job location and changes in housing market

supply conditions. Two other types of changes are also likely to influence relocation decisions of urban households, namely, changes in income or wealth and life-cycle factors, such as changes in household composition. In the present model change in employment (RGE) proxies change in job location. Changes in housing supply conditions are in part proxied by change in the housing stock (RGH). Because the income measure (RGY) employed in this study is specific to place of residence, it reflects in part differential changes in neighborhood quality, such as schools, and hence proxies this important component of housing quality. Neighborhood quality is also reflected by the crime rate (CRM), by the percentage of population nonwhite (NW), and by population density (PD), all defined at the beginning of the period. Incorporation of life-cycle changes into the model is precluded by the aggregate nature of the data employed in the study.

The equations of the location block are therefore as follows:

Movement from central city to suburbs:

$$RGMCS = f_6(RGHSC, RGESC, RGYSC, RC_{t-10}, CRMC_{t-10}, NWCS_{t-10}, PDC_{t-10}, e_6) \quad (3.6)$$

Movement from suburbs to central city:

$$RMSC = f_7(RGHCS, RGECS, RGYCS, RC_{t-10}, CRMC_{t-10}, NWCS_{t-10}, PDC_{t-10}, e_7) \quad (3.7)$$

In-migration to suburbs relative to central city:

$$RIMSC = f_8(RGHSC, RGESC, RGYSC, CRMC_{t-10}, NWCS_{t-10}, PDC_{t-10}, e_8). \quad (3.8)$$

Net intrametropolitan movement:

$$RNMOV = RMCS/RMSC \quad (3.9)$$

An alternative version of the model has been estimated for the 1970s. This alternative includes an equation for out-migration from suburbs relative to central city (ROMSC) that involves an identical set of independent variables to that in equation (3.8).

The signs on the variables for differential housing growth, for differential employment growth, and for differential income growth should be positive in the structural equations of the location block. While the signs on the former two variables are straightforward, that on the latter is not. To the extent that RGYSC (and RGYCS) proxies neighborhood characteristics, it should have a positive sign. However, Muth's model of residential location suggests that in response to an increase in income the household's optimal location will shift toward its place of employment if its income elasticity of demand for housing is less than its income elasticity of marginal transportation costs. Hence, an increase in income could cause a household to move in either direction, depending upon its relative income elasticities. The income effects of increases in central city (suburban) income relative to suburban (central city) income are therefore not of unequivocal sign.

Neighborhood crime is a disamenity that is likely to act as a repulsive force on location decisions.[4] Central city population is likely to proxy a number of factors, including pollution, congestion, and land prices. While these factors are interrelated, they are not all related in a positive direction. It cannot unequivocally be claimed that greater central city population density should encourage the selection of a suburban residence. Central city pollution, congestion, and land prices might well discourage many households from locating there. However, if the household locates in the suburbs and commutes to work in the central city, congestion in densely populated urban

areas would impose relatively heavy (commuting) time costs on the household. These costs could be sufficient, especially for some higher income households, to induce location in the central city. This argument is consistent with Muth's model of intraurban location.[5]

Percentage of population nonwhite is included to reflect the effects of racial discrimination on location patterns. Beginning-of-period central city CLF (RC_{t-10}) is included in the equation for movement from central city to suburbs so as to normalize the flow. The larger the CLF of the central city, the greater the expected movement to the suburbs. For the same reason, suburban CLF (RS_{t-10}) is included in the equation for movement from suburbs to central city.

3.2 The Sample Metropolitan Areas and The Data

In 1970, 64 of 242 Standard Metropolitan Statistical Areas in the continental United States had a population in excess of 500,000. In 1960, 100 of 211 SMSAs in the continental United States had a population in excess of 250,000. These SMSAs are the only ones for which detailed published census migration data exist for the respective periods. The census also reports comparable information on intrametropolitan relocations between the central city (suburban ring) and suburban ring (central city) of each of these SMSAs. Finally, SMSA in-migrants are distinguished as locating in either the central city or the suburbs. In each case the central city or cities of the SMSA correspond to the political boundaries of the cities indicated in the SMSA title, while the suburban ring consists of the remaining land area in the SMSA.

The sample SMSAs employed in this study consist of 62 that are common to the sets on which comparable migration and intrametropolitan relocation data are reported in the 1960 and 1970 censuses. Published data available in the

1960 and 1970 Censuses thus dictated the choice of SMSAs that underlie the empirical work reported in this study, in spite of the fact that the 1980 Public Use Files were used for much of the data for the 1970s. The sample SMSAs are indicated in Table 3.1, where they are also ranked according to 1970 population. The availability of more and better data for population census years makes it convenient to examine SMSA growth patterns over 10-year intervals. This study especially focuses on growth patterns for three time periods, namely, 1950 to 1960, 1960 to 1970, and 1970 to 1980.

Between 1960 and 1970 censuses the Los Angeles-Long Beach SMSA, as defined in 1960, was split into two components (Anaheim-Santa Ana-Garden Grove and Los Angeles-Long Beach), both of which are included in the data set for the 1960-1970 period. Hence, for the 1950-1960 period only 61 observations exist for migration data, though the geographic area covered by the divided SMSA is identical for the two periods. As defined in 1970, the Los Angeles-Long Beach SMSA is Los Angeles County, while the Anaheim-Santa Ana-Garden Grove SMSA is Orange County, California. Data other than that on migration can in some instance be adjusted back through time on a county basis, and therefore the SMSAs can sometimes be distinguished for years other than 1970.

Although data on the Jacksonville SMSA are available for each period, the Jacksonville observation was eliminated from the data set due to the fact that no suburban ring existed in 1970 after the city of Jacksonville merged with Duval County, Florida. Whereas a 1970 observation is available on the Greensboro-Winston-Salem High Point SMSA, none is available in 1960, and thus this SMSA was not included in the data set. Although an observation on Honolulu is available for each period, this SMSA has been eliminated from the data set because its location suggests an entirely different type of spatial

TABLE 3.1
Sample SMSAs Ranked by 1970 Population

Rank	SMSA	1970 Population
1	New York	11,571,899
2	Los Angeles-Long Beach	7,032,075
3	Chicago	6,978,947
4	Philadelphia	4,817,914
5	Detroit	4,199,931
6	San Francisco-Oakland	3,109,519
7	Washington, D.C.	2,861,123
8	Boston	2,753,700
9	Pittsburgh	2,401,245
10	St. Louis	2,363,017
11	Baltimore	2,070,670
12	Cleveland	2,064,194
13	Houston	1,985,031
14	Newark	1,856,556
15	Minneapolis-St. Paul	1,813,647
16	Dallas	1,555,950
17	Seattle-Everett	1,421,869
18	Anaheim-Santa Ana-Garden Grove	1,420,386
19	Milwaukee	1,403,688
20	Atlanta	1,390,164
21	Cincinnati	1,384,851
22	Paterson-Clifton-Passaic	1,358,794
23	San Diego	1,357,854
24	Buffalo	1,349,211
25	Miami	1,267,792
26	Kansas City	1,253,916
27	Denver	1,227,529
28	San Bernardino-Riverside-Ontario	1,143,146
29	Indianapolis	1,109,882
30	San Jose	1,064,714
31	New Orleans	1,045,809
32	Tampa-St. Petersburg	1,012,594
33	Portland	1,009,129
34	Phoenix	967,522
35	Columbus	916,228
36	Providence-Pawtucket-Warwick	910,781
37	Rochester	882,667
38	San Antonio	864,014
39	Dayton	850,266
40	Louisville	826,553

TABLE 3.1 (continued)
Sample SMSAs Ranked by 1970 Population

Rank	SMSA	1970 Population
41	Sacramento	800,592
42	Memphis	770,120
43	Fort Worth	762,086
44	Birmingham	739,274
45	Albany-Schenectady-Troy	721,910
46	Toledo	692,571
47	Norfolk-Portsmouth	680,600
48	Akron	679,239
49	Hartford	663,891
50	Oklahoma City	640,889
51	Syracuse	636,507
52	Gary-Hammond-East Chicago	633,367
53	Fort Lauderdale-Hollywood	620,100
54	Jersey City	609,266
55	Salt Lake City	557,635
56	Allentown-Bethlehem-Easton	543,551
57	Nashville-Davidson	541,108
58	Omaha	540,142
59	Grand Rapids	539,225
60	Youngstown-Warren	536,003
61	Springfield-Chicopee-Holyoke	529,922
62	Richmond	518,319

SOURCE: U.S. Bureau of the Census (1973), List B, p. XIV.

relationship with other areas than holds for the SMSAs within the continental United States. Moreover, between 1970 and 1980 the Dallas and Fort Worth SMSAs were merged into a single Dallas-Fort Worth SMSA. Toledo was unfortunately omitted from a costly computer run that was aimed at extracting data from the 1980 Public Use File. A second computer run would have been prohibitively expensive, and thus Toledo is not included in the data base for the 1970s. Consequently, the sample for the 1970s consists of 60 SMSAs.

Between 1950 and 1980 a number of SMSAs included in the sample experienced a change in their geographic scope as new counties were added to their definitions or, in some instances, counties were deleted. All data have been adjusted where possible to reflect SMSA definitions at the end of each respective decade. These adjustments consist of including the appropriate data for the added counties in the earlier SMSA totals. In the cases of the four New England SMSAs (Boston, Hartford, Providence-Pawtucket-Warwick, and Springfield-Chicopee-Holyoke) the adjustments were somewhat more difficult to make and were somewhat less exact since they had to be estimated. Population is the only reported characteristic of towns that were subsequently included in the various SMSA definitions. The adjustments consisted of calculating per capita suburban values of variables of interest, such as employed and unemployed residents, assuming that the added towns had per capita values equal to those calculated for the old suburban definition, and multiplying the earlier per capita values by the corresponding earlier population of the towns subsequently included in the SMSAs. The resulting values were then added to former SMSA totals. In no instance was an adjustment to a New England SMSA of either absolute or relative magnitude sufficient to appreciably affect metropolitan or even suburban values of the affected variables.

Different and less comprehensive data than those found in the Census of Population are available in the Censuses of Business and of Manufactures. Since these censuses are taken in different years than the Census of Population, they yield somewhat different and shorter time intervals. These two data sources have also been extensively utilized in this study, especially for the examination of changes in intrametropolitan employment location patterns. Data from the Censuses of Business and of Manufactures are discussed in more detail in Greenwood (1984).

Each SMSA has been divided into two components--its central city or cities and its suburban ring. Geographically, the central city or cities are defined by the political boundaries of the city or cities included in the SMSA title. The suburban ring is the remainder of the SMSA. Beginning-of-period central city and suburban values for employment and civilian labor force have been adjusted for intercensal annexation of outlying areas by the various central cities. These adjustments are also discussed in more detail in Greenwood (1984).

Data on CLF residents and on family median income, disaggregated by central city and suburbs, have been calculated from the 1950, 1960, 1970, and 1980 Censuses of Population. Data on actual central city and suburban employment, as distinct from data on the residence of employed persons, are interpolated from various Censuses of Manufactures and Censuses of Business. Four types of employment are distinguished in these latter two census sources--manufacturing, retail, wholesale, and selected services. Since the timing of the Censuses of Manufactures and Business differs from that of the Census of Population, linear interpolations were performed to obtain estimates of actual 1950 employment (from 1947 and 1954 data on manufacturing and from 1948 and

1954 data on retail, wholesale, and service), 1960 employment (from 1958 and 1963 data), 1970 employment (from 1967 and 1972 data), and 1980 employment (from 1977 and 1982 data).

The census does not provide data on earlier (prior census) levels of population or employment in areas subsequently annexed by central cities. The only information available on annexed areas is 1960 (1970) population and land area in places annexed since 1950 (1960). Hence, estimates of employment and labor force in the annexed areas at the time of the previous census must be based on population or on density estimates, which have led to a number of criticisms of various adjustment techniques. For example, Kain (1968), following Meyer, Kain, and Wohl (1965), based his adjusted estimates on the assumption that the percentage of employment annexed in each category was the same as the percentage of annexed population. He essentially attempted to hold central city boundaries constant at their earlier locations by adding his adjustments to the suburbs and subtracting them from the central cities. For one reason or another, various urban scholars, such as Cohen and Noll (1968) and Harrison (1974), have criticized Kain's adjustments. Steinnes (1977) goes to the extent of making no annexation adjustments whatsoever, which, given his sample of cities, is clearly inappropriate for analytical purposes.

In the present study annexation adjustments are based on the assumption that annexed areas are represented by average suburban per capita values of the relevant variables. The adjustments themselves are reported in Greenwood (1981 and 1984), where they are also discussed in some detail. The procedure used here attempts to hold central city boundaries constant at their end-of-period definition. In addition to having intuitive appeal, the end-of-period boundaries require fewer adjustments than would have been required if

beginning-of-period boundaries had been utilized. The migration and intrametropolitan relocation data are defined for the end of the respective periods, and adjustments to these data would have involved far greater problems than those otherwise encountered.

Computation of SMSA, central city, and suburban family median income is described in Greenwood (1984).

3.3 Estimation of the Basic Model

Excluding the growth block, the model described above consists of eight structural equations and one (explicit) identity in nine jointly dependent variables. The structural equations have been estimated in logarithmic form by three stage least squares, by two stage least squares, and by ordinary least squares. The results obtained using each estimation technique are very similar, and only the three stage least squares estimates are presented here. Table 3.2 contains the results for all three periods, with a layout that facilitates comparison of corresponding coefficients over time. For each period the coefficients generally have the expected signs and are significant.

The results associated with growth of the metropolitan housing stock are generally similar for the three periods. Between the 1960s and the 1970s the the coefficient on growth of residents declines by about 0.2, perhaps due to the slowing of the rate of growth of many metropolitan areas and the absolute decline of the CLF of others. The coefficient on the net intrametropolitan movement variable almost doubles in size for the 1970s relative to the 1960s, which suggests an increasing importance of intrametropolitan location in explaining increases in the metropolitan housing stock.

During the 1950s and 1960s relative growth in both suburban housing and suburban employment attracted CLF members from the central city, but housing

TABLE 3.2
Basic Intrametropolitan Location Model: Three Stage Least Squares
Estimates of Logarithmic Regression Coefficients, 1950-60, 1960-70, and 1970-80

Independent Variables	RGH			RMCS			RMSC			RIMSC		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
RGR	0.941*	0.894*	0.698*									
RNMOV (e)	0.003	0.013*	0.025*									
Y	-0.382*	-0.044	-0.078									
V (t-10)	-0.025*	-0.018**	-0.010									
RGHSC (e)				1.521*	2.859*	3.829*				1.378*	1.171*	1.727*
RGHCS (e)							0.521	1.369*	-0.996			
RGESC (e)				0.643*	0.729*	-0.203				-0.134	0.309**	0.278
RGECS (e)							0.054	-0.787*	0.044			
RGYSC (e)				4.484*	4.892*	-6.714*				0.333	-0.493	-1.830*
RGYCS (e)							0.366	7.363*	6.871**			
RGRSC (e)												
RIMSC (e)												
RC (t-10)				0.098**	0.205*	0.317*						
RS (t-10)							0.017	0.101**	0.289*			
CRMC (t-10)				-0.009	-0.067	-0.081	0.092	0.089	0.265**	0.120**	-0.011	-0.039
NWSC (t-10)							0.156*	0.074	-0.180*			
NWCS (t-10)				0.171*	-0.044	-0.008				0.022	-0.088**	-0.056**
PDC (t-10)				-0.378*	-0.390*	-0.380*	-0.279*	-0.365*	-0.329*	0.128*	0.053	-0.047
YSC (t-10)												
VSC (t-10)												
CON	0.233*	-0.045	0.054	-1.085	-3.022*	-2.903*	-0.111	0.008	-3.552*	-0.406	-0.201	0.712*
OLS R^2	0.972	0.955	0.799	0.734	0.628	0.649	0.325	0.370	0.269	0.664	0.363	0.438

*(**)Indicates $t \geq 1.67$ ($t \geq 1.29$).
(e)Indicates endogenous variable.

TABLE 3.2 (continued)
Basic Intrametropolitan Location Model: Three Stage Least Squares
Estimates of Logarithmic Regression Coefficients, 1950-60, 1960-70, and 1970-80

Independent Variables	ROMSC			RGHSC			RGESC			RGRSC			RGYSC		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
RGR RNMOV (e)										0.082**	0.143*	-0.299*			
Y V (t-10)															
RGHSC (e)			0.373												
RGHCS (e)															
RGESC (e)			-1.079*										0.019	0.034	0.111**
RGECS (e)															
RGYSC (e)			-1.544	1.186*	-1.407*	0.684*	0.302	0.281	1.636*						
RGYCS (e)															
RGRSC (e)				0.448*	0.492*	0.330*	0.385*	0.353*	0.440*				0.064*	-0.002	-0.079*
RIMSC (e)										0.818*	0.545*	1.352*			
RC (t-10)															
RS (t-10)															
CRMC (t-10)			0.074												
NWSC (t-10)															
NWCS (t-10)			0.111**												
PDC (t-10)			-0.114**												
YSC (t-10)													-0.180*	-0.124*	0.185*
VSC (t-10)				0.008	0.083**	-0.015									
CON			0.832	0.089	0.226*	0.102*	0.343*	0.264*	0.010	-0.333*	-0.027	-0.190*	0.079	0.072*	0.082*
OLS R^2			0.068	0.340	0.509	0.397	0.054	0.071	0.147	0.359	0.622	0.435	0.241	0.064	0.132

*(**)Indicates t > 1.67 (t > 1.29).
(e)Indicates endogenous variable.

was more important than employment. During the 1970s suburban housing remained important and its quantitative effect in attracting labor force members from the central city grew. However, whereas suburban employment attracted city-to-suburbs movers during the 1950s and 1960s, it had no significant impact during the 1970s. Prior to the 1970s higher growth of suburban income relative to that of the central city attracted CLF members to the suburbs, presumably because income growth proxies neighborhood amenities. During the 1970s, however, a surprising and important change occurred in this relationship. Where suburban income grew relatively more rapidly, significantly fewer central city residents relocated to the suburbs. This finding warrants further consideration in the context of a model in which the intrametropolitan relocators are distinguished by their characteristics, especially by their income.

As was the case during the 1960s, during the 1970s central city income growth attracted CLF members from the suburbs. Unlike the previous decade, in the 1970-80 equation for movement from suburbs to central city the sign on the employment variable is positive, although the coefficient is not statistically significant. Moreover, the sign on the housing variable is actually negative, but again the coefficient fails significance (when a two-tail test is applied). Thus, the quality of life in the central city, as presumably proxied by the rate of growth of central city compared to suburban income, was a primary factor in attracting households to the central city and away from the suburan ring.

Like intrametropolitan movers, in-migrants were strongly attracted to locate in the suburbs because of the availability of housing. Although this relationship holds for each period, the coefficient on the housing variable is

largest for the 1970s. Furthermore, higher relative rates of suburban income growth caused in-migrants to select central city locations, which is a finding consistent with that observed on RGYSC in the RMCS equation.

Unlike the two earlier periods, an equation for out-migration of CLF members from the suburbs relative to the central city can be estimated for the 1970s. The reason for this difference is that estimation of the models for the 1950s and 1960s is based on published data, whereas estimation for the 1970s is based in part on data drawn from the Public Use Files of the 1980 Census. This data source allows the identification of metropolitan out-migrants and indicates whether these individuals had resided in the central city or the suburban ring of the metropolitan area. The variables included in the out-migration equation do not yield a very good fit. The only variable of strong explanatory significance is suburban employment growth, which discouraged higher out-migration from the suburbs than the city.

One of the most surprising and important findings noted above is that employment no longer seems to be attracting CLF members out of the central city and into the suburbs, as indicated by the lack of signficance of the employment variable in the RMCS equation. One possible explanation for this finding is that the various types of employment exert offsetting influences on movement to the suburbs. To test this hypothesis, we replaced the employment variable in each equation (i.e., RGESC or RGECS) with its sector-specific employment components. The results for the 1970s are presented in Table 3.3.

Retail and manufacturing employment did attract central city residents to the suburbs, but their effects seem to have been offset by wholesale and service employment, each of which has a negative sign in the RMCS equation (though neither is statistically significant). Growth of central city manu-

facturing and wholesale employment encouraged relocation from the suburbs to central city, whereas retail employment growth discouraged the flow. Thus, it appears that retail employment growth is making the suburbs more attractive.

New in-migrants were encouraged to locate in the suburbs rather than the city due to growth of manufacturing jobs. Growth of suburban retail employment discouraged out-migration from the suburbs, but growth of suburban manufacturing and wholesale employment encouraged such out-migration.

During the 1970s growth of suburban income and suburban residents encouraged growth of the suburban housing stock. The same qualitative relationship held for the 1950s, whereas during the 1960s higher income growth had discouraged growth of the suburban housing stock. Income and residents also spurred the growth of suburban employment during the 1970s, whereas during the 1950s and 1960s residents but not income were an important determinant of the growth of employment in the suburbs. For the 1970s these results suggest strong mutual causation between the growth of housing and the growth of resident CLF members in the suburbs relative to the central city. However, whereas growth of the suburban labor force encouraged growth of suburban employment, growth of suburban employment was at best of marginal importance in explaining the location patterns of metropolitan residents. Thus, for the 1970s the evidence appears to support Mill's position that employment follows the labor force to the suburbs, and not the other way around. This finding will be considered in more detail at a later point in the study.

Central city crime rates do not appear to be of particular importance in explaining residential relocation decisions of metropolitan CLF members. The crime rate variable has the expected sign and is marginally significant only in the in-migrant location equation for the 1950-60 period. Crimes against

TABLE 3.3
Intrametropolitan Location Model Estimated With Sector-Specific Employment Growth: Results for the 1970s

Independent Variables	Equation for RMCS	RMSC	RIMSC	ROMSC
RGMSC	4.387*		-0.643	-3.618*
RGHCS		-7.129*		
RGYSC	-9.082*		-1.196	2.632
RGYCS		11.447		
RGMANUSC	-0.736**		0.792*	0.714
RGMANUCS		1.922**		
RGRETSC	1.804**		-0.372	-2.556*
RGRETCS		-2.477**		
RGSERSC	-0.798**		-0.169	-.117
RGSERCS		0.589		
RGWHLSC	-0.852		1.539**	2.751**
RGWHLCS		3.723**		
RC_{t-10}	0.500*			
RS_{t-10}		0.412		
$CRMC_{t-10}$	0.095	0.094	0.033	0.177
$NWCS_{t-10}$	-0.014		0.005	0.267*
$NWSC_{t-10}$		-0.033		
PDC_{t-10}	-0.358*	-0.115	-0.158**	-0.315**
CON	-5.195**	-6.049**	1.319**	1.857
OLS R^2	.700	.272	.482	.213

*(**) Indicates statistical significance at 5% (10%).

persons and crimes against property rates were also calculated and were separately substituted for the overall crime rate in the CLF location equations, but the empirical results were essentially unchanged.

The conclusion that central city crime rates are not an important determinant of intraurban location decisions must, however, be qualified. In a later part of this report we show that racial disaggregation of the variables of the location block yields different results. Whereas whites, who of course dominate in the aggregate measures used in the basic model, appear to be unaffected by central city crime, blacks are significantly affected by such crime regardless of their income level. If blacks tend to reside in particularly high crime areas of the city and thus tend disproportionately to be victims of crime, this finding is not surprising.

In-migrants locating in the suburbs played an important role in explaining the growth of suburban relative to central city CLF during the 1970s. Moreover, for reasons that are not clear, the RNMOV variable has a negative sign in the 1970-80 equation for RGRSC. At a later point in the report we will consider regressions that disaggregate the RNMOV variable into its component in- and out-movement variables.

Greater suburban employment growth encouraged greater suburban income growth during the 1970s, but not during the pervious two decades. The faster growth of CLF members in the suburbs retarded the growth in suburban median income. The reason for this latter finding is probably that the labor force entry of new CLF members due to the maturing of the baby-boom cohort resulted in relatively many young people with relatively low incomes contributing to suburban labor force growth. Unlike the 1950s and 1960s, higher income suburban areas experienced more rapid growth of median income during the 1970s.

During each period the growth of suburban residents encouraged the growth of suburban employment, but the strength of this linkage increased during the 1970s. Moreover, during the 1970-80 period, unlike the prior two periods, more rapid rates of suburban income growth encouraged more rapid rates of suburban employment growth.

3.3.1 Sector-Specific Employment Growth

As previously indicated, data on actual central city and suburban employment change for each metropolitan area were obtained by summing over four employment sources--manufacturing, retail, service, and wholesale. Since such aggregation conceals the behavior of the various employment components, which are of interest in themselves, and since sector-specific employment, especially in manufacturing, has been the subject of previous attention by others, the employment data were disaggregated and separate regressions were run on suburban relative to central city growth of each employment type. To close the system, an identity for the rate of total (suburban relative to central city) employment growth is introduced, where this rate is the sum of the weighted component rates of employment growth, with the weights being beginning-of-period employment shares.

Three stage least squares estimates of the sector-specific employment equations are presented in Table 3.4.[6] The disaggregation is revealing. When RGRSC and RGYSC alone are included in the relationships, the sign on RGRSC is positive in each equation for the 1950s and 1960s, but the coefficient is highly significant only in the equations for retail employment. For the 1970s not only is RGRSC positive and significant in the retail equation, but also in the manufacturing and in the wholesale equations. The coefficient on RGRSC is marginally significant in the 1950-60 equation for manufacturing employment

TABLE 3.4
Three-Stage Least Squares Estimates of Sector-Specific Employment Equations, 1950-60, 1960-70, and 1970-80

Independent Variables	Equations for Manufacturing			Retail			Services			Wholesale		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
RGRSC (e)	0.412*	0.199	0.678*	0.297*	0.280**	0.278*	0.110	0.235*	-0.120	0.203	0.099	0.239**
RGYSC (e)	-0.385	0.494	0.611	1.683**	-0.350	3.352*	0.615	0.114	2.138*	-0.667	1.417	1.751*
CON	0.366**	0.210	-0.001	0.412**	0.495**	-0.016	0.428**	0.399**	0.133	0.528**	0.656**	0.269*
OLS R^2	0.045	0.005	0.042	0.098	0.105	0.202	0.017	0.57	0.056	0.043	0.002	0.244
RGRSC (e)	0.315*	0.370*	0.684*	0.259**	0.371**	0.316*	0.040	0.307*	-0.050	0.162	0.207	0.307*
RGYSC (e)	-0.512	0.180	0.970	1.441	-0.272	3.303*	0.279	0.199	2.057*	0.474	0.985	1.673*
PDC (t-10)	0.101	0.152*	-0.051	0.013	0.072*	0.048**	0.042	0.058	0.068**	0.256**	0.105*	0.084*
CRMC (t-10)	0.123	0.020	-0.048	0.042	-0.034	-0.019	0.093	-0.034	-0.036	-0.029	0.037	-0.041
CON	0.094	-1.097	0.429	0.539	-0.329	-0.413**	0.554	-0.292	-0.417	-2.004	-0.125	-0.415**
OLS R^2	0.078	0.021	0.044	0.170	0.132	0.254	0.079	0.067	0.121	0.274	0.038	0.329
RGRSC (e)							-0.252**	-0.064	-0.544*	0.191	-0.326**	0.021
RGYSC (e)							-0.633	0.379	-1.264	1.134	1.201	0.138
PDC (t-10)							0.004	-0.015	0.030	0.232**	-0.026	0.074*
CRMC (t-10)							0.019	-0.005	-0.002	-0.010	0.064	-0.019
RGMANUSC (e)							0.312**	0.004	0.291	0.164	0.332**	0.226**
RGRETSC (e)							0.746**	0.992**	1.007*	-0.440**	1.168**	0.436*
CON							0.075	0.036	-0.144	-1.540	0.550	-0.345
OLS R^2							0.577	0.571	0.258	0.304	0.627	0.377

*(**) Indicates statistical significance at 5% (10%).

and in the 1960-70 equation for service employment. For the 1950s and 1960s the coefficient on RGYSC is highly significant only in the 1950-60 equation for retail employment, but for the 1970s it is significant for each type of employment.

Table 3.4 contains two alternative specifications of the sector-specific employment equations. In the first alternative beginning-of-period central city population density and crime rate are included. Urban location models, such as that developed by Muth, typically suggest a negatively sloped land-price gradient as distance from the city's center increases. These models also commonly predict more intensive utilization of land and consequently increasing population density closer to the city's core. Population density should therefore serve as a reasonable proxy for central city land prices. The greater are these prices, the stronger the expected tendency for land-intensive activities to opt for suburban locations, other things being equal. This tendency should be particularly evident for wholesale and especially for manufacturing activities. Of the employment sources defined in this study, service is likely to be least land intensive and hence least affected in its location decisions by land-price considerations.

The population density variable is positive in each equation except that for manufacturing during the 1970s and is significant in each wholesale equation, in the 1960-70 manufacturing equation, and in the 1970-80 service equation. It is also significant in the 1960-70 and 1970-80 retail employment equations. The results suggest, then, that higher central city land prices, and whatever other factors the population density variable may reflect, have encouraged more rapid rates of growth of suburban manufacturing and wholesale employment.

The location decisions of business firms as well as of households are frequently claimed to be a function of neighborhood crime rates. The results presented in Table 3.4 indicate that crime rates do not act as a significant determinant of business location decisions. Again the crimes against property and crimes against persons rates were separately substituted for the overall crime rate, and again the empirical results were essentially unchanged by these alterations.

In the final version of the employment equations, growth of suburban relative to central city manufacturing employment (RGMANUSC) and growth of suburban relative to central city retail employment (RGRETSC) are included in the equations for service and for wholesale employment. The hypothesis that underlies this formulation is that service employment, much of which includes business services, and wholesale employment are closely tied to other sources of employment growth. Since, other things being equal, closer proximity to demand sources is desirable, service and wholesale employment should grow more rapidly where manufacturing and retail employment are growing more rapidly.

The results presented in Table 3.4 indicate clearly that growth of suburban service and wholesale employment is a function of the growth of suburban manufacturing and especially suburban retail employment. The inclusion of RGMANUSC and RGRETSC in the service and wholesale employment equations also results in an appreciable increase in the OLS R^2s.

Moses and Williamson (1967) present empirical results that suggest that racial composition of the population may contribute importantly to the explanation of the location of urban manufacturing employment, with zones having higher percentages of nonwhite population being less desirable destinations for manufacturing firms. When $NWCS_{t-10}$ is included in the sector-specific

employment equations, the coefficient fails signficance in each 1950-60 equation, but is positive and highly significant in the 1960-70 and 1970-80 equations for service employment (coefficient = 0.126 and 0.080, respectively) and retail employment (coefficients = 0.060 and 0.059, respectively). Hence, for two of the four employment types a tendency is evident in recent years for suburban employment growth to be relatively greater where the central city contains relatively more nonwhite persons. Manufacturing employment growth does not appear to be sensitive to racial composition at the level of aggregation used in this study.

When the manufacturing and retail employment growth variables are included in the service employment equation for the 1950-60 period, the results suggest that greater rates of suburban CLF growth actually induced greater rates of central city service employment growth. The explanation could be that lags in the locational adjustment process resulted in growing suburban consumer demand for services being satisfied out of central city offices.

3.4 Racial Aspects of Intrametropolitan Location

The location block of the basic model was modified to incorporate black versus nonblack intrametropolitan movers, as well as the location of black versus nonblack metropolitan in- and out-migrants. (Nonblack is hereafter referred to as white.) The system was then reestimated for the 1950s, 1960s, and 1970s. A number of similarities, as well as a number of contrasts are evident between the two groups.

As reported in Table 3.5, during the 1970s both central city blacks and whites were attracted to suburban housing. The same is true of whites in earlier decades, but during the 1960s growth of suburban housing actually discouraged the movement of blacks from central cities to suburban ring areas,

though not significantly so. During the 1960s and the 1970s suburban jobs attracted blacks, but not whites. Moreover, as we saw with aggregate movement patterns, during the 1970s both blacks and whites were discouraged from moving to suburban areas with rapidly rising incomes. Central city crime encouraged the movement of blacks from central cities to suburban ring areas during each period, but the influence was statistically significant only during the 1950s.

During the 1970s central city job opportunities attracted whites to relocate from suburban ring areas to central cities, but a similar pattern is not evident for blacks. Both blacks and whites were drawn to central cities that maintained relatively high rates of income growth during the 1970s, which presumably suggests that the quality of central city life was important for each group.

The major force influencing the location of metropolitan in-migrants during the 1970s was housing. The availability of suburban housing caused both black and white in-migrants to select a suburban residence. Suburban employment opportunities, which were important for each group during the 1960s, were important for neither during the 1970s.

3.4.1 Variants of the Race-Specific Model

Several variants of the basic race-specific intrametropolitan model were estimated. In the equations of the location-block, rather than including a single variable for the rate of employment growth, we introduced each of the four separate sources of employment. Moreover, because the simple correlation coefficients among the four employment variables are reasonably high, we also estimated the model four times, once with each employment source alone. The results are generally consistent, and consequently we report in Table 3.6 only

Table 3.5
Basic Intrametropolitan Location Model for Whites and Blacks:
Three Stage Least Squares Estimates of Logarithmic Regression Coefficients, 1950-60, 1960-70, and 1970-80

	RGH			RWMCS			RBMCS			RWMSC			RBMSC		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
RGR	0.944*	0.842*	0.873*												
RNMOV (e)	-0.003	-0.001	0.004												
Y	-0.406*	0.051	-0.050												
V (t-10)	-0.024*	0.007	-0.043*												
RGHSC (e)				1.901*	4.489*	3.063*	1.619*	-0.977	1.979*						
RGHCS (e)										0.849**	2.146*	-1.821*	-0.665	5.754*	-0.259
RGESC (e)				0.672*	-0.418	-0.816**	0.023	3.119*	1.078*						
RGECS (e)										-0.365	-0.624**	2.048*	0.371	-1.788*	0.760
RGYSC (e)				1.420	12.474*	-6.207*	-4.246**	-4.534	-4.492*						
RGYCS (e)										3.883*	8.340*	7.962*	0.096	10.660*	4.569*
RGRSC (e)															
RIMSC (e)															
RC (t-10)															
RS (t-10)															
WRC (t-10)				0.188*	0.093**	0.230*									
NWRC (t-10)							0.376*	0.204*	0.105*						
WRS (t-10)										0.034	-0.032	0.206*			
NWRS (t-10)													0.166	-0.002	0.115*
CRMC (t-10)				0.010	-0.159**	0.078	0.635*	0.123	0.095	-0.031	0.085	0.236**	-0.247**	0.040	0.257**
NWSC (t-10)										0.172*	0.046	-0.227*	0.166	0.231**	-0.199**
NWCS (t-10)				0.197*	-0.080	0.027	-0.537*	0.411*	-0.152*						
PDC (t-10)				-0.453*	-0.208**	-0.392*	-0.652*	-0.359**	-0.256*	-0.405*	-0.420*	-0.316*	-0.439*	-0.456*	-0.153
YSC (t-10)															
VSC (t-10)															
CON	0.258*	0.019	-0.111**	-1.297	-3.521*	-1.711*	0.783	-1.342	-2.316*	0.449	2.964*	-2.364*	-5.752*	3.681**	-3.549*
OLS R^2	0.982	0.932	0.951	0.701	0.638	0.655	0.685	0.300	0.685	0.307	0.463	0.339	0.492	0.120	0.090

*(**)Indicates t > 1.67 (t > 1.29).
(e)Indicates endogenous variable.

Table 3.5 (continued)
Basic Intrametropolitan Location Model for Whites and Blacks: Three Stage Least Squares Estimates of Logarithmic Regression Coefficients, 1950-60, 1960-70, and 1970-80

	RWIMSC			RBIMSC			RGHSC		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
RGR									
RNMOV (e)									
Y									
V (t-10)									
RGHSC (e)	1.690*	-0.623	1.401*	0.475	-1.099	2.218*			
RGHCS (e)									
RGESC (e)	-0.487*	1.393*	0.315	0.771*	1.893*	-0.247			
RGECS (e)									
RGYSC (e)	0.115	-2.029**	1.940*	-3.367*	-6.207**	-0.794	1.842*	-1.660*	-0.259
RGYCS (e)									
RGRSC (e)							0.604*	0.735*	0.465*
RIMSC (e)									
RC (t-10)									
RS (t-10)									
WRC (t-10)									
NWRC (t-10)									
WRS (t-10)									
NWRS (t-10)									
CRMC (t-10)	0.007	0.109**	0.014	0.326*	0.094	0.012			
NWSC (t-10)									
NWCS (t-10)	0.008	-0.054**	-0.025	-0.584*	-0.054	-0.046			
PDC (t-10)	0.227*	0.214*	-0.445	-0.287*	0.192	-0.072**			
YSC (t-10)									
VSC (t-10)							0.082*	0.069*	0.004
CON	-1.611*	-0.519	0.197	3.784*	-1.032	0.639**	-0.061	0.149*	0.195*
OLS R^2	0.587	0.519	0.433	0.762	0.170	0.411	0.434	0.744	0.409

*(**)Indicates t > 1.67 (t > 1.29).
(e)Indicates endogenous variable.

Table 3.5 (continued)
Basic Intrametropolitan Location Model for Whites and Blacks: Three Stage Least Squares Estimates of Logarithmic Regression Coefficients, 1950-60, 1960-70, and 1970-80

	RGESC			RGRSC			RGYSC		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
RGR									
RNMOV (e)				0.108*	0.116*	-0.226*			
Y									
V (t-10)									
RGHSC (e)									
RGHCS (e)									
RGESC (e)							-0.030	0.113*	-0.064
RGECS (e)									
RGYSC (e)	-0.659	0.985	0.776*						
RGYCS (e)									
RGRSC (e)	0.361**	0.879*	0.216*				0.126*	-0.082**	0.128*
RIMSC (e)				0.556*	0.301*	0.995*			
RC (t-10)									
RS (t-10)									
WRC (t-10)									
NWRC (t-10)									
WRS (t-10)									
NWRS (t-10)									
CRMC (t-10)									
NWSC (t-10)									
NWCS (t-10)									
PDC (t-10)									
YSC (t-10)							-0.164*	-0.140*	0.279*
VSC (t-10)									
CON	0.445*	-0.038	0.201*	-0.200*	0.161*	-0.056	0.076*	0.075*	0.067*
OLS R^2	0.055	0.127	0.272	0.266	0.564	0.399	0.196	0.067	0.195

*(**)Indicates t > 1.67 (t > 1.29).
(e)Indicates endogenous variable.

the most meaningful of the regressions, which are those that include all four variables.

During the 1970s, unlike the 1950s and 1960s, suburban growth of manufacturing employment attracted both white and black households to the suburbs. Suburban retail employment never attracted white households to the suburbs, but during the 1950s and 1970s it attracted black households. Black households were never drawn to suburban employment opportunities in services but whites were during the 1950s and 1960s, although not during the 1970s. We saw previously that during the 1970s employment opportunities in general failed to attract labor force members from central cities to suburban ring areas. Disaggregation of the movement equations by race and disaggregation of the employment variables by source reveals that indeed manufacturing employment attracted both whites and blacks to the suburbs, which is generally consistent with Kain's position that the labor force followed manufacturing jobs to the suburbs.

A second variant of the race-specific model includes separate variables for the rate of growth of owner versus renter housing. The availability of suburban owner housing attracted whites to the suburbs during the 1960s and 1970s (Table 3.7), but attracted blacks only during the 1970s. Renter housing, on the other hand, was attractive for blacks during the 1960s. Unlike the 1950s and 1960s, owner housing attracted both whites and blacks to relocate from suburban ring areas to central cities during the 1970s. Due to the availability of owner housing, metropolitan in-migrants of each type selected suburban residences during the 1970s.

Table 3.6

Location Equations of Basic Intrametropolitan Location Model by Race with Sector Specific Employment: Three Stage Least Squares Estimates of Logarithmic Regression Coefficients, 1950-60, 1960-70, and 1970-80

	RWMCS			RBMCS			RWMSC		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
RGHSC (e)	0.641	3.195*	2.020*	4.586**	7.459	2.251*			
RGHCS (e)							0.767	1.200	-2.324**
RGMANUSC(e)	0.274	0.231	2.229*	-3.540*	-6.440**	1.349*			
RGMANUCS(e)							-1.128*	-0.370	1.950**
RGRETSC (e)	0.147	-2.051	0.561	11.585*	-25.684*	0.889**			
RGRETCS (e)							3.305**	-3.416*	-1.225
RGSERSC (e)	1.363*	3.384**	-0.786	-12.010*	6.396	-0.183			
RGSERCS (e)							-3.426*	1.940	1.110
RGWHLSC(e)	-0.367	-1.142	-0.363	6.465*	21.953**	-0.887**			
REWHLCS(e)							1.106	1.124	1.304
RGYSC (e)	4.802*	8.987*	-7.904*	-15.640**	1.708	-4.931*			
RGYCS (e)							-0.897	5.153**	5.699*
WRC (t-10)	0.265*	0.152**	0.184						
NWRC (t-10)				-0.599**	-1.397**	0.147*			
WRS (t-10)							0.238	0.173**	0.214**
NWRS (t-10)									
CRMC (t-10)	0.032	-0.077	0.113	1.130*	-0.190	0.076	-0.029	0.084	0.153
NWSC (t-10)							0.014	-0.079	-0.232**
NWCS (t-10)	0.221*	-0.252**	0.053	-0.993*	-0.312	-0.143*			
PDC (t-10)	-0.445*	-0.124	-0.280*	-1.235**	2.200	-0.168*	-0.423**	-0.683*	-0.248**
CON	-2.496**	-3.484**	-2.314	14.714**	-13.128**	-3.368*	-1.729	1.992	-2.941**
OLS R^2									

*(**)Indicates t > 1.67 (t > 1.29).

(e)Indicates endogenous variable.

Table 3.6 (continued)

Location Equations of Basic Intrametropolitan Location Model by Race with Sector Specific Employment: Three Stage Least Squares Estimates of Logarithmic Regression Coefficients, 1950-60, 1960-70, and 1970-80

	RBMSC			RWIMSC			RBIMSC		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
RGHSC (e)				2.158*	0.381	1.670*	-0.053	0.036	2.317*
RGHCS (e)	-1.325	5.263*	0.948						
RGMANUSC(e)				-0.256**	0.024	0.026	0.357	-0.977	0.626**
RGMANUCS(e)	-0.239	-0.892	3.116*						
RGRETSC (e)				-0.046	1.363**	-0.621**	0.678	-1.922	-0.902**
RGRETCS (e)	1.794	-3.593**	-2.459**						
RGSERSC (e)				-0.733**	-0.874	0.245	0.243	3.569	-0.271
RGSERCS (e)	-0.716	3.067	-0.448						
RGWHLSC(e)				0.542**	0.372	0.290	-0.657**	0.614	0.525
REWHLCS(e)	-0.601	-0.131	2.905**						
RGYSC (e)				-1.133	0.865	2.076*	-2.238	-2.513	-0.712
RGYCS (e)	0.063	10.205**	2.945						
WRC (t-10)									
NWRC (t-10)									
WRS (t-10)									
NWRS (t-10)	0.271**	-0.045	0.129**						
CRMC (t-10)	-0.186	0.198	0.159	-0.001	0.103	0.027	0.341*	0.039	0.032
NWSC (t-10)	0.223	0.099	-0.137						
NWCS (t-10)				-0.007	-0.009	-0.027	-0.573*	-0.246	-0.022
PDC (t-10)	-0.548**	-0.632*	-0.075	0.094	0.195*	-0.065	-0.103	0.480**	-0.068
CON	-3.860	5.644**	-3.674*	-0.489	-1.068	0.399	2.246**	-4.123	0.500
OLS R^2									

*(**) Indicates t > 1.67 (t > 1.29).

(e) Indicates endogenous variable.

3.5 Income and Intrametropolitan Location

A great deal of public and governmental attention has been focused on suburbanization in the United States. One aspect of the discussion has been on the movement of higher income households to the suburbs, the consequence of which has been to leave central cities increasingly impoverished. Despite the long history of this discussion and the theoretical attempts to model the suburbanization of high income households (e.g., Oates et.al., 1971; Miyao, 1978; Kanemoto, 1980; and Brueckner, 1983), no empirical work has attempted to estimate the magnitudes of the influence of certain factors on high- and low-income intrametropolitan movement. Within the context of a somewhat more complex model than those described above, in this section we develop and estimate a model for income class-specific intrametropolitan location.

Although many public policy discussion focus on the flight of high income residents to the suburbs and/or their possible return to the central city, characteristics of movers other than income may help to explain high income out-movement, and these other characteristics are often of interest in their own right. In section 3.6, while controlling for income, we also consider age, presence of children, and sex of household head.

Black concentration in the central cities is in part a consequence of greater intrametropolitan mobility of whites. We are concerned with the forces that led to black concentration and those that may diminish it. Life cycle aspects are stressed by many scholars (e.g., Rossi, 1980; Quigley and Weinberg, 1977) who have attempted to explain intrametropolitan mobility. We try to capture the influence of life-cycle factors through age and presence of children. Finally, the increase in divorce rates has meant that a significant portion of households are now headed by women. Such households also represent

Table 3.7

Location Equations of Basic Intrametropolitan Location Model by Race with Tenure Class of Housing: Three Stage Least Squares Estimates of Logarithmic Regression Coefficients, 1950-60, 1960-70, and 1970-80

	RWMCS			RBMCS			RWMSC		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
RGOHSC (e)	-0.482	4.081*	4.904*	1.206**	0.770	3.098*			
RGOHCS (e)							-0.533	0.896	4.464*
RGRHSC (e)	1.070*	-0.086	-0.546	0.702	4.771*	-0.097			
RGRHCS (e)							0.683**	-0.005	-6.022*
RGESC (e)	1.084*	-0.017	-2.094*	0.030	-1.045	0.162			
RGECS (e)							-0.097	0.001	0.703
RGYSC (e)	6.937*	-0.041	-2.436**	-4.564**	9.284**	-1.642**			
RGYCS (e)							8.646*	2.182	9.767*
NRC (t-10)	0.242*	0.059	0.131*						
NWRC (t-10)				0.363*	0.249*	0.090*			
NRS (t-10)							-0.037	0.017	0.036
NWRS (t-10)									
CRMC (t-10)	0.041	-0.043	-0.139	0.622*	0.017	-0.045	-0.029	0.008	0.628*
NWSC (t-10)							0.202*	0.002	0.040
NWCS (t-10)	0.214*	-0.117**	0.166**	-0.499*	0.533*	-0.069			
PDC (t-10)	-0.319*	-0.219**	-0.221*	-0.577*	-0.389**	-0.154**	-0.476*	-0.411*	-0.494*
CON	-3.260*	-1.186	-2.283**	0.017	-3.165	-3.266*	2.297	1.187	1.568
OLS R^2									

*(**)Indicates t > 1.67 (t > 1.29).

(e)Indicates endogenous variable.

Table 3.7 (continued)

Location Equations of Basic Intrametropolitan Location Model by Race with Tenure Class of Housing: Three Stage Least Squares Estimates of Logarithmic Regression Coefficients, 1950-60, 1960-70, and 1970-80

	RBMSC			RWIMSC			RBIMSC		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
RGOHSC (e)				0.595**	0.177	1.807**	-0.463	-1.080	3.083*
RGOHCS (e)	-1.415**	3.078	7.414*						
RGRHSC (e)				0.548*	0.842**	-0.818	0.553**	1.622	0.106
RGRHCS (e)	0.002	0.330	-6.983*						
RGESC (e)				-0.203	0.462	0.353	0.814*	0.773	-1.100*
RGECS (e)	0.495	-0.728	-1.228						
RGYSC (e)				1.584	1.425	3.005*	-0.784	-0.056	1.805**
RGYCS (e)	3.260	-4.004	7.967*						
WRC (t-10)									
NWRC (t-10)									
WRS (t-10)									
NWRS (t-10)	0.318*	0.078	0.043						
CRMC (t-10)	-0.262**	-0.213	0.805*	0.044	0.087	-0.068	0.328*	0.049	-0.118
NWSC (t-10)	0.179	0.087	0.255**						
NWCS (t-10)				0.030	-0.022	0.038	-0.568*	-0.035	0.039
PDC (t-10)	-0.474*	-0.415**	-0.471*	0.275*	0.240*	0.013	-0.178**	0.178	0.019
CON	-5.252*	-0.381	0.339	-1.988*	-1.229**	-0.362	2.673**	-1.627	-0.350
OLS R^2									

*(**) Indicates t > 1.67 (t > 1.29).

(e) Indicates endogenous variable.

a significant portion of the population that lives in poverty. We have thus also analyzed the intrametropolitan location decisions of women.

The models reported here are an outgrowth of the simultaneous equation system of intrametropolitan population and employment mobility described above, in section 3.1, in the sense that the movement variables are disaggregated by income and other characteristics. The fundamental difference is that in the models described below, variables are estimated in absolute change form rather than as ratios of growth rates. Coefficients of variables in absolute change form have a more straightforward interpretation. For example, in ratio form the implicit assumption is that another percentage point increase in the rate of central city employment growth deters movement to the suburbs as much as another percentage point increase in the rate of suburban employment growth encourages such movement. By expressing the arguments of the location equations in ages such movement. By expressing the arguments of the location equations in terms of absolute changes in central cities and in suburban areas, we are able to distinguish the independent influences of employment and other variables in each type of area. This is what we mean when we say that in absolute change form the coefficients have a more straightforward interpretation.

Perhaps the most serious difficulty in expressing the model in terms of absolute changes is that many variables that embed scale (i.e., that tend to be larger in larger areas) are included on both sides of the equations. Hence, a high degree of multicollinearity may be present, and the independent influences of many variables could be obscured. This is the problem that initially caused us to estimate the model in ratio of rates form. However, we have now completed extensive work on the absolute form of the model, and after

conducting extensive sensitivity tests, we are convinced that this form of the model is acceptable and, indeed, preferable. Moreover, in the section that immediately follows, a model is presented that serves as a bridge between the ratio form of the model and the absolute change form. The results of the bridging model are somewhat less satisfactory than the results described above and considerably less satisfactory than those that are derived from the absolute-change version of the model. The bridging model described below contains several important instances in which a coefficient differs from what we expect a priori. Since several of these expectations are quite firm, the quintile ratio form of the model leaves us uncomfortable.

3.5.1 The Briding Equations: The Income Model in Ratio Form

To this point in the study, the intrametropolitan location model has been expressed in ratio form, which follows Greenwood's (1980) initial specification. This means that the housing, employment, and income variables are ratios of rates of growth of suburban to central city values. Because the symbols used above become unwieldy as variables are disaggreated further and further, Table 3.8 employs short descriptive statements in the "independent variables" column.

The model reported in Table.3.8 is a quintile model. When data are reported on the intrametropolitan movements of individuals or households grouped by income class, the groupings are based on nominal income classes. Whereas the nominal groupings may remain the same from census to census, the corresponding groupings based on real income change over time, and we have no convenient way to account for these latter changes. To control for this problem, we classified metropolitan residents and movers by income quintile.

TABLE 3.8.1

Quintile Ratio Model: Three Stage Least Squares Estimates of the Growth of Housing, Suburbs Relative to Central City

	Growth of Owner Housing S/CC			Growth of Rental Housing S/CC		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
Low Income Inmovement Rate, S/CC	0.30	0.25	0.37	0.76	0.35	0.61
	(3.05)	(3.82)	(2.27)	(4.68)	(4.06)	(3.01)
High Income Inmovement Rate, S/CC	-0.27	-0.24	-0.12	-0.68	-0.22	-0.55
	(2.80)	(2.24)	(0.92)	(4.66)	(1.81)	(3.52)
Growth Median Family Income, S/CC	2.52	0.88	1.21	2.60	-0.30	0.44
	(5.49)	(1.88)	(3.09)	(3.30)	(0.48)	(0.79)
Vacancy Rate, S/CC	-0.09	0.15	0.13	-0.05	0.10	-0.02
	(2.24)	(3.61)	(2.90)	(0.85)	(1.32)	(0.52)
Growth of Housing Type t-10 to t-20, S/CC	0.20	-0.32	-0.02	0.02	0.17	0.03
	(5.97)	(2.94)	(0.77)	(0.58)	(1.63)	(1.05)
Constant	0.16	0.28	0.14	0.34	0.25	0.30
	(2.02)	(4.61)	(1.98)	(2.47)	(3.84)	(2.95)
OLS R^2 adjusted	0.64	0.28	0.17	0.23	0.25	0.11

t-ratios in parentheses.

TABLE 3.8.2

Quintile Ratio Model: Three Stage Least Squares Estimates of the Employment Growth, Suburbs Relative to Central City

	1950-60	1960-70	1970-80
Low Income Inmovement Rate, S/CC	-0.17 (1.14)	0.42 (4.35)	0.84 (3.99)
High Income Inmovement Rate, S/CC	0.03 (0.17)	-0.35 (1.91)	-0.59 (3.08)
Growth Median Family Income, S/CC	1.31 (1.81)	0.80 (0.90)	2.32 (4.73)
Employment, t-10 S/CC	-0.15 (3.66)	-0.06 (1.64)	-0.03 (0.77)
Constant	0.26 (2.17)	0.40 (4.54)	0.20 (1.95)
OLS R^2 adjusted	0.24	0.19	0.15

t-ratios in parentheses.

TABLE 3.8.3

Quintile Ratio Model: Three Stage Least Squares Estimates of the Growth of Median Family Income, Suburbs Relative to Central City

	1950-60	1960-70	1970-80
Low Income Inmovement Rate, S/CC	0.06 (1.76)	-0.01 (0.33)	-0.35 (3.93)
High Income Inmovement Rate, S/CC	0.03 (1.08)	0.13 (4.93)	0.18 (2.44)
Employment Growth, S/CC	0.05 (1.38)	0.04 (1.07)	0.43 (4.18)
Median Family Income, t-10, S/CC	-0.25 (3.95)	-0.13 (2.95)	0.03 (0.36)
Constant	0.02 (0.65)	-0.02 (1.06)	-0.06 (1.23)
OLS R^2 adjusted	0.24	0.33	0.10

t-ratios in parentheses.

TABLE 3.8.4

Quintile Ratio Model: Three Stage Least Squares Estimates of the Movement Rate, Central City to Suburbs

	Low Income			High Income		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
Growth, Owner Housing S/CC	-0.34	-1.29	0.77	-0.60	1.69	3.19
	(0.87)	(1.81)	(0.84)	(1.27)	(1.97)	(2.84)
Growth, Rental Housing S/CC	1.75	2.25	0.14	1.35	-0.45	0.05
	(4.89)	(4.11)	(0.13)	(3.25)	(0.67)	(0.04)
Employment Growth S/CC	0.80	0.06	0.34	1.25	0.66	-1.49
	(2.84)	(0.13)	(0.42)	(3.59)	(1.13)	(1.57)
Median Family Income Growth, S/CC	1.02	4.05	-1.29	2.15	2.88	2.76
	(0.67)	(3.12)	(0.88)	(1.16)	(1.84)	(1.40)
Residents of Income Group in the CC, t	0.12	0.11	0.20	0.23	0.22	0.28
	(1.68)	(1.80)	(2.58)	(2.88)	(3.10)	(3.34)
Crime Rate per Capita CC, t	-0.13	0.18	-0.01	-0.14	-0.04	-0.59
	(1.33)	(1.67)	(0.04)	(1.19)	(0.33)	(2.24)
Percent Nonwhite CC/S, t-10	0.21	0.11	0.09	0.15	0.04	0.06
	(3.35)	(1.81)	(1.16)	(2.02)	(0.54)	(0.59)
Population Density CC, t-10	-0.03	-0.53	-0.23	-0.16	-0.50	-0.12
	(0.26)	(5.26)	(2.59)	(1.10)	(4.27)	(1.15)
Constant	-5.08	0.88	-3.64	-4.84	-1.52	-7.95
	(3.47)	(0.77)	(2.49)	(2.63)	(1.06)	(4.39)
OLS R^2 adjusted	0.43	0.43	0.29	0.43	0.49	0.45

t-ratios in parentheses.

TABLE 3.8.5

Quintile Ratio Model: Three Stage Least Squares Estimates of the Movement Rate, Suburbs to Central City

	Low Income			High Income		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
Growth, Owner Housing CC/S	-0.90	0.46	1.04	-0.23	-0.54	-3.55
	(1.33)	(0.40)	(0.84)	(0.43)	(0.70)	(1.93)
Growth, Rental Housing CC/S	2.31	0.97	-3.65	0.79	0.76	-4.58
	(3.48)	(1.16)	(-2.81)	(1.64)	(1.31)	(2.26)
Employment Growth CC/S	-0.43	0.08	2.89	-0.85	-0.87	6.15
	(0.95)	(0.11)	(2.79)	(2.23)	(1.71)	(3.63)
Median Family Income Growth, CC/S	4.89	4.12	-3.68	5.23	8.02	-7.26
	(1.98)	(2.03)	(1.86)	(2.79)	(6.18)	(2.16)
Residents of Income Group in S, t	-0.12	0.25	0.38	0.03	0.20	0.48
	(0.96)	(2.23)	(3.43)	(0.32)	(2.90)	(2.67)
Crime Rate per Capita CC, t-10	0.10	-0.04	-0.23	0.11	0.04	-0.47
	(0.65)	(0.27)	(0.81)	(0.86)	(0.40)	(1.07)
Percent Nonwhite CC/S, t-10	-0.23	0.06	0.19	-0.20	-0.05	0.25
	(2.04)	(0.61)	(1.76)	(2.41)	(0.79)	(1.58)
Population Density CC, t-10	-0.61	-0.61	-0.35	-0.37	-0.31	-0.31
	(3.22)	(3.73)	(2.94)	(2.25)	(2.91)	(1.70)
Constant	5.04	-0.07	-5.89	0.82	-2.23	-9.60
	(1.89)	(0.04)	(2.94)	(0.44)	(1.92)	(3.14)
OLS R^2 adjusted	0.15	0.19	0.28	0.09	0.44	0.01

t-ratios in parentheses.

TABLE 3.8.6

Quintile Ratio Model: Three Stage Least Squares Estimates of the In-Migration Rate, Suburbs Relative to Central City

	Low Income			High Income		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
Growth, Owner Housing S/CC	0.29	0.31	-0.40	0.93	0.91	0.88
	(0.94)	(0.54)	(0.56)	(3.15)	(2.02)	(0.72)
Growth, Rental Housing S/CC	-0.09	0.81	-0.55	-0.93	-0.04	-0.78
	(0.26)	(1.88)	(0.72)	(3.26)	(0.12)	(0.63)
Employment Growth S/CC	-0.49	0.54	2.24	-0.29	-0.20	0.59
	(2.54)	(1.43)	(3.72)	(1.55)	(0.69)	(0.58)
Median Family Income Growth, S/CC	1.24	0.51	-4.05	2.07	3.04	-0.31
	(1.18)	(0.48)	(-3.70)	(2.04)	(4.03)	(-0.13)
Residents of Income Group, S/CC, t	-0.10	0.01	0.08	-0.12	0.15	0.14
	(1.21)	(0.17)	(1.10)	(1.89)	(3.85)	(1.05)
Crime Rate per Capita CC, t-10	0.16	0.01	-0.003	0.03	-0.05	0.18
	(2.35)	(0.11)	(0.02)	(0.47)	(0.77)	(0.67)
Percent Nonwhite CC/S, t-10	-0.03	-0.07	-0.05	-0.001	-0.03	0.0003
	(0.52)	(1.44)	(0.90)	(0.11)	(0.96)	(0.003)
Population Density CC, t-10	0.08	0.12	0.02	0.24	0.24	0.03
	(0.92)	(1.55)	(0.27)	(2.95)	(4.19)	(0.29)
Constant	0.36	-1.05	-0.02	-1.40	-2.04	0.44
	(0.36)	(1.28)	(0.02)	(1.51)	(3.32)	(0.31)
OLS R^2 adjusted	0.30	0.22	0.00	0.43	0.50	0.00

t-ratios in parentheses.

The groupings of central city and suburban residents are based on the quintiles for the entire metropolitan area. This procedure also guarantees that over time the sample is not increasingly biased toward higher income groups and away from lower income groups as nominal income rises. The models described below were estimated for both the top and bottom quintiles and the top and bottom two quintiles. The discussion focuses on the former, but the appendix to Chapter 3 contains estimates based on the latter, but for the absolute change form of the model rather than the ratio form.

As reported in Table 3.8, the ratio form of the income quintile model reflects a number of strange and unreasonable results. For example, as shown in Table 3.8.1, the in-movement of low-income households encouraged the growth of suburban owner housing, whereas the in-movement of high-income households discouraged the growth of such housing. This finding is the opposite of what we expect based on a priori reasoning. Moreover, in Table 3.8.4 the differences in the influence of owner and renter housing on movement from central city to suburbs is not as distinct as we anticipate a priori. The same can be said of the results for metropolitan in-migrants that are reported in Table 3.8.6. In general, the results for the ratio form of the income quintile model contain a number of results that leave us uncomfortable. These findings, as well as the more straightforward interpretation that can be placed on the coefficients in the absolute-change version of the model, have caused us to place more credence in the absolute-change results. Consequently, the remainder of this chapter is concerned with absolute changes.

3.5.2 A Model of Income-Class Specific Intrametropolitan Location

The model reported in this section attempts to explain the movement patterns of the highest and lowest 20 percent of the SMSA specific income distribution. Its purpose is to provide an initial picture of how movement is

affected by the income of the movers themselves. Unfortunately, available data regarding the income of the movers refer to income toward the end of the period over which movement is measured, and not income at the time of the move. Later sections will report on the confounding influence of other characteristics of movers.

Intrametropolitan income segregation increased steadily over the period between 1960 and 1980, primarily due to changes in the central city's income distribution. As shown in Table 3.9, the lowest 40% of the metropolitan income distribution represents an increasing fraction of the central city's population. In 1960, 45.1% of the central city's population was in the bottom two quintiles of the SMSA's distribution. By 1970 this percentage had risen to 47.5 and by 1980 to 52.0. On the contrary, the distribution of the suburban population based on the SMSA's distribution hardly changed. The lowest two quintiles constituted 34.3% of the suburban population in 1960 and 33.2% in 1980. Generally, metropolitan poverty, at least as measured by income quintiles, was more concentrated in the central cities of the Northeast and North Central regions and least concentrated in those of the West.

As mentioned above, a major advantage of expressing the model in terms of income quintiles is that the problem of holding constant the real income of various classes of metropolitan residents is avoided. For the 1950s and 1960s we have had to work with published data that include groupings based on money income classes, as determined by the U.S. Bureau of the Census. These data simply do not allow convenient controls for real income classes. Hence, we have adopted income quintiles as a means of holding constant through time the relative position of various groups in each SMSA's income distribution. The

TABLE 3.9

Quintile Shares of Residents in the Central Cities and Suburbs
Based on Income Distribution in Individual SMSAs

Quintile (lowest to highest)	1960		1970		1980	
	CC	SUB	CC	SUB	CC	SUB
I	24.2%	16.5%	26.1%	16.5%	27.9%	15.8%
II	20.9	19.1	21.4	19.2	24.1	17.8
III	18.8	20.9	18.6	20.8	18.3	20.7
IV	18.3	21.4	17.3	21.6	15.6	22.4
V	17.9	22.0	16.6	21.9	14.1	23.3
	100.0	100.0	100.0	100.0	100.0	100.0

model takes the following form:

A. Housing Equations

$$AOHC = f(LIMVC, HIMVC, AYC, VC_{t-10}, SOHVP) \quad (3.10)$$

$$ARHC = f(LIMVC, HIMVC, AYC, VC_{t-10}, ARHCP) \quad (3.11)$$

$$AOHS = f(LIMVS, HIMVS, AYS, VS_{t-10}, AOHSP) \quad (3.12)$$

$$ARHS = f(LIMVS, HIMVS, AYS, VS_{t-10}, ARHSP) \quad (3.13)$$

B. Employment Equations

$$AES = f(LIMVS, HIMVS, AYS, ES_{t-10}) \quad (3.14)$$

$$AEC = f(LIMVC, HIMVC, AYC, EC_{t-10}) \quad (3.15)$$

C. Income Equations

$$AYS = f(LIMVS, HIMVS, AES, YS_{t-10}) \quad (3.16)$$

$$AYC = f(LIMVC, HIMVC, AEC, YC_{t-10}) \quad (3.17)$$

D. Movement Equations

$$LMCS = f(ARHS, AOHS, AES, AEC, AYS, LRC, CRC_{t-10}, NWCS_{t-10}, PDEN_{t-10}) \quad (3.18)$$

$$HMCS = f(ARHS, AOHS, AES, AEC, AYS, HRC, CRC_{t-10}, NWCS_{t-10}, PDEN_{t-10}) \quad (3.19)$$

$$LMSC = f(ARHC, AOHC, AES, AEC, AYC, LRS, CRC_{t-10}, NWCS_{t-10}, PDEN_{t-10}) \quad (3.20)$$

$$HMSC = f(ARHC, AOHC, AES, AEC, AYC, HRS, CRC_{t-10}, NWCS_{t-10}, PDEN_{t-10}) \quad (3.21)$$

$$LIMC = f(ARHC, AOHC, AES, AEC, AYC, LRC, CRC_{t-10}, NWCS_{t-10}, PDEN_{t-10}) \quad (3.22)$$

$$HIMC = f(ARHC, AOHC, AES, AEC, AYC, HRC, CRC_{t-10}, NWCS_{t-10}, PDEN_{t-10}) \quad (3.23)$$

$$LIMS = f(ARHS, AOHS, AES, AEC, AYS, HRS, CRC_{t-10}, NWCS_{t-10}, PDEN_{t-10}) \quad (3.24)$$

$$HIMS = f(ARHS, AOHS, AES, AEC, AYS, HRS, CRC_{t-10}, NWCS_{t-10}, PDEN_{t-10}) \quad (3.25)$$

The first four equations (3.10 - 3.13) estimate the absolute amount of owner (AOH) and renter (ARH) occupied housing built in the central city (AOHC, ARHC) and suburbs (AOHS, ARHS) of an SMSA during a specific decade (1950-60, 1960-70, or 1970-80). (More detailed definitions of all variables are

reported in the appendix to Chapter 3.)[7] The next two equations (3.14 and 3.15) estimate the change in employment for the suburbs (AES) and central city (AEC) of an SMSA for the 10-year period. (Note that "A" refers to absolute change, as opposed to the relative rates described previously.) Equations (3.16) and (3.17) estimate change of median family income in the suburbs (AYS) and in the central city (AYC). The next four equations (3.18 to 3.21) estimate intrametropolitan movement by the highest and lowest 20% of the SMSA's income distribution. The final four equations (3.22 to 3.25) estimate in-migration to the central city and suburbs by income group during the same respective periods. In what follows we will first give a theoretical discussion of what we expect to find in each set of equations. Our discussion of the empirical results then follows.

3.5.2.1. The Housing Equations

New housing is presumbably built in response to both a need for more housing and the replacement of old housing. In-movers to an area represent an incremental demand for housing. We expect the number of high-income in-movers (HIMVC, HIMVS) to have a positive impact on both the construction of renter- and owner-occupied housing units. This influence should be greater for owner housing than for renter housing because owner housing tends to be built at a higher average quality level than rental housing. Rental housing and owner housing compete for land and residents. Low income in-movers are more likely to demand rental housing. They should have a positive influence on rental housing built in the suburbs and in the central city. Because owner and renter housing compete for space, an influx of low-income in-movers should have a negative impact on the construction of owner housing. This impact should be stronger in the central city where competition for land is more severe due to the bounded nature of most central cities.

The absolute change in median family income (AYC, AYS) is expected to have an independent positive influence on both owner and renter housing built during the period. As income of an area rises, the existing bundle of housing services no longer satisifies resident's demand for housing of any given quality. The impact should be higher for owner housing than for rental housing.

Vacancy rates are expected to be a proxy for excess supply. Consequently, they are expected to have a negative effect in all four equations. The housing stock is presumed to adjust with a lag to changes in demand. The amount of housing built in the prior 10-year period is a proxy for that lagged demand. The lagged variable is thus expected to have a positive impact on housing built during the period.

3.5.2.2. The Employment Equations

Employment change in the suburbs and central city is expected to have a complex interrelationship with in-movement by income class of the movers. At the simplest level, in-movers can be seen as affecting a firm's output markets, as well as the labor market in which it competes. On the output side, high income in-movers are expected to have a more dramatic impact on employment growth than low income in-movers because of their contribution to purchasing power. In the labor market the presence of low income in-movers is expected to lower wage rates and thus cause an increase in local jobs. Each of these effects is expected to result in in-movers of all incomes having a positive effect on the absolute employment change.

Two additional forces are likely to be operating, however. First, employment growth is probably accompanied by business investment. In densely settled central cities this physical expansion must compete for scarce space

with alternative residential uses. This competition would be greater for low income residential uses. Second, it is likely that low-income residents are a disamenity from the point of view of a business trying to decide where to locate. This may be especially true of retail activities. In densely settled central cities this disamenity effect may be greater than in less densely settled suburbs. As a consequence of these two factors, the impact of low income in-movers on central city employment growth may be negative, whereas in the suburbs the impact may be positive. High income in-movers are expected to have a positive effect on employment in both locations.

Increases in median family income are expected to have a positive effect on employment growth. To the extent that the overall income distribution has shifted up, the market for a firm's output would have increased, and employment demand would rise. The amount of employment in the location at the beginning of the period represents a normalizing variable for the employment changes. The expectation is that this variable will have a positive effect on employment change.

3.5.2.3. The Income Equations

Central city governments are as concerned with the decline in the average income of their residents as with the decline in the number of residents. Changes in median family income are the result of changes in the income of nonmoving residents and the net effect of in and out migration of high and low income residents. Since our data for the first two periods do not contain information on out-migrants, our basic model has no corresponding out-migration variable. Change of family median income (AYS, AYC) will be a negative function of low income in-movers and a positive function of high income in-movers.

3.5.2.4. The Effects of Employment Growth on Movement

In early empirical models of intraurban location (e.g., Kain, 1962) employment location was seen as the primary determinant of residential location. Later models (Mills, 1972) argued instead for population attracting employment. Since nearness to work lowers commuting costs, employment growth in a particular location should, ceteris paribus, attract residents. Since both low and high income residents are part of the labor force, each should be attracted. The prediction from this perspective is that employment growth in the suburbs (AES) will have a positive effect on low and high income movement from the central city (LMCS, HMCS), and employment growth in the city (AEC) will have a negative effect on out-movement. Analogously, suburban employment growth will have a negative effect on the suburban to central city movement of both high- and low-income persons, whereas employment growth in the city will have a positive influence on each group.

The effects of changing transportation modes over the 30-year period studied here, however, complicate matters. Leroy and Sonstelie (1984) note that during the 1950s most of the poor still did not own cars, while most higher income individuals did. The 30-year period is characterized by a gradual transition to the automobile as the dominant transport mode for all income groups. This transition is reported in Table 3.7, which is drawn from Leroy and Sonstelie (1984). The implications for the effect of employment are profound. In general, earlier in the 30-year period studied here, employment should exercise a stronger attraction and retention effect on low income than on high income movers. This differential should abate over time as the low income residents acquire cars. In the 1950s low income movement from central city to suburbs should be more heavily influenced by suburban employment growth than high-income movement because low-income residents are tied more

TABLE 3.10

Car Ownership by Income Quintile

Year	Quintile I Lowest	II Second	III Third	IV Fourth	V Highest
1952	26	44	64	79	89
1957	33	62	82	89	95
1962	32	65	76	91	94
1969	45	79	93	95	97
1977	61	89	95	97	97

Source: Leroy and Sonstelie (1984).

closely to their jobs than are high-income residents. Moreover, employment growth in the city (AEC) should have a more significant retention effect on those with low incomes. Similarly, low-income movement from suburbs to central city should be more heavily influenced by central city and suburban employment change than high-income movement from suburbs to central city. By the 1970s, however, this qualification should be of much less importance.

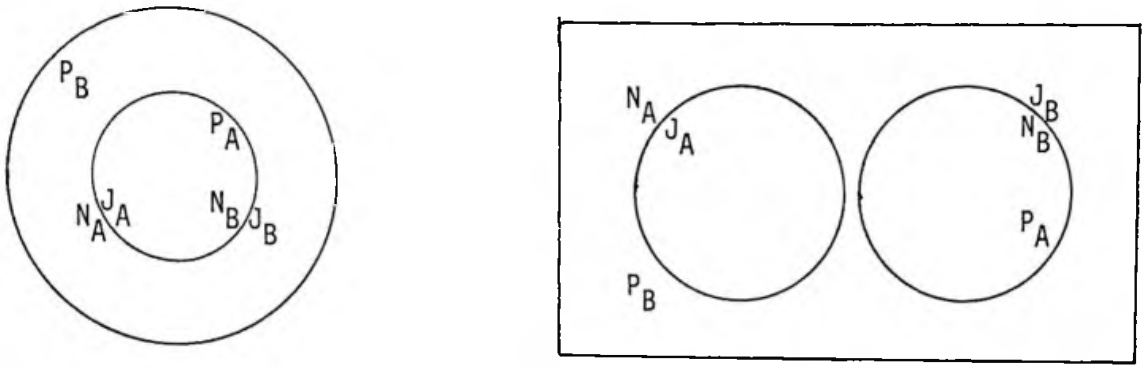
The second complication to consider has already been discussed in the section concerning the employment equations. Facilities that would accommodate employment growth in the city may compete for scarce land with low income housing. To the extent this competition occurs, central city employment growth may have a positive influence on low-income movement from central city to suburbs (LMCS) and on low-income in-migrant location in the suburbs (LIMS), and a negative influence on low-income movement from suburbs to central city (LMSC) and on low-income in-migrant location in the central city (LIMC). The literature contains some speculation (e.g., Steinnes, 1977) that employment growth in the city has a disamenity effect on high-income residents to the extent growth is due to polluting industries. Such an effect would mitigate the attractive power of central city employment growth for high-income in-movers and serve as a push factor for current hign-income residents. To a certain extent these complications can be incorporated into a simple amenity based model. Leroy and Sonstelie (1984), for example, recognize that lack of car transport would raise the bids of low-income residents for a location close to work relative to the bids of hign-income residents. Firms are simply another group bidding for particular sites in competition with residents (White, 1977). Of course, employment growth may have disamenity as well as amenity effects.

Specific expectations can be formed regarding the influence of the

employment variables. First, movers to the suburbs from the central city should be unambiguously attracted by suburban employment growth over the entire time period. low-income movers from central city to suburbs should be more positively influenced by employment growth in the suburbs than high-income movers, but this influence should diminish over time. On the contrary, it is difficult to predict the impact of employment growth in the city on out-movement. The retention effect posited by a simple amenity model and reinforced for low income residents, who perhaps lacked automobile transportation during the 1950s, may be offset by the repulsion effects of competition for scarce central city land and employment growth's disamenity effects. Second, employment growth in the suburbs should have a retention effect on all potential movers from suburbs to central city. During the 1950s this retention effect may be stronger for the low income residents than for the high income residents. Just as for movers out, it is difficult to predict for those who move into the city the impact of employment growth in the city. The question is whether the attractive aspects of employment growth outweigh its repulsive aspects.

A final issue remains. Mills's (1970) urban density models predict that employment growth in general should lead to an expansion in the boundary of the metropolitan area and a decrease in the slope of the density function. This would imply that employment growth in the city, ceteris paribus, should have a positive impact on movement out to the suburbs. Moreover, prior models abstract from the physical relationship of the suburbs to the city. In particular, they fail to recognize that there are places in the central city closer to the suburbs than to other places in the central city and vice versa (see Figure A). To the extent that employment growth is an amenity, some suburban dwellers may well move to the central city to be closer to their

suburban employment and some central city dwellers will move to the suburbs to be closer to their central city employment. In metropolitan areas with more than one central city, this effect would tend to be larger.



J = Job Opportunity, P = Prior Residence, N = New Residence

Figure A

It is difficult to say how important this topology effect is. Little or no employment growth took place in many central cities of our sample during the period under question. As a crude control for this potential topological effect, we estimated an alternative version of the model that includes a dummy variable (equal to 1.0) for SMSAs with multiple central cities.

To the extent that employment is important in location decisions, for certain cities this topological effect may account for some percentage of movement back in. We would expect this effect to be particularly important the lower the income and the earlier the period considered. Lower-income individuals were presumably more closely tied to the public transportation system early in the period (i.e., 1950-1960), and this public transportation system typically radiates from the hub out. Earlier in the 30-year period, the city's land area is going to be relatively larger compared to the settled area of suburbs, and this would presumably make the topological effect larger.

A positive relationship between high income and home ownership has been a standard prediction of tenure choice models (e.g., Linneman, 1985, p. 232).

The basis for this prediction has been the tax savings that homeowners enjoy due to special features of U.S. tax law. On that basis and within a simple amenity-based view of residential location, high-income movers would be attracted by an increase in owner housing and low-income residents by an increase in rental housing. This would be true in both the suburbs and the central city, and it would be true for in-migrants as well as intrametropolitan movers. However, several complications arise.

To the extent that housing markets are competitive, landlords are likely (in trying to take advantage of the tax laws) to pass any gains from owning on to the renter in the form of lower rents (Linneman, 1985, p. 232). This makes the relationship between income level and homeownership slightly less straightforward. Linneman derives an equation of the net advantages of homeownership that is partly dependent on relative landlord efficiency. He notes

> "Particularly in multifamily structures and dense neighborhoods landlord production costs may be substantially lower than those of homeowners due to the fact that landlords can solve a number of freerider problems. For example, ... common facility maintenance.... When residences are densely located the probability of serious externalities increases. Landlords facilitate the internalization of these externalities by reducing the bargaining costs associated with dealing with neighbors (both within and outside the structure)." Linneman (1985, p. 233).

Meanwhile, both landlords and tenants have incentives to violate a contract once it is signed. "Since monitoring contracts between landlords and tenants is expensive, there is an incentive to economize on these costs by vertical integration, that is by shifting to homeownership" (Linneman, 1985, p. 233). Linneman seems to imply that monitoring costs increase in less dense areas. These considerations lead us to expect that in central cities with high density settlement, renting may be as attractive as owner occupancy to high-income movers from central city to suburbs. The same consideration would lead us to predict that high-income in-migrants to the city are going to be

more positively influenced by the growth in rental housing than high income in-migrants to the suburbs.

Linneman's model also predicts that ownership's advantages increase with expected length of tenancy because closing costs are so large. This point has some importance for us because in-migrants tend to have less available information on local housing markets than intrametropolitan movers. Presumably the search period for intrametropolitan movers is longer because the cost of search is lower. As a consequence, in-migrants may think in terms of a short-term tenancy rather than a long-term tenancy, and according to Linneman's model short-term tenancies favor renting. The common sense of this argument is that in-migrants presumably prefer a vantage point on the local housing market before making any decisions on a long-term investment. Therefore, in-migrants as a group, controlling for income, and at every location, should be more attracted to rental housing than intrametropolitan movers to that location.

Leroy and Sonstelie's work on changing transport modes, combined with Hamilton's (1976) work on restrictive zoning, suggest additional considerations. During the 1950s movement to the suburbs would have been dominated by high income groups due to their monopoly of auto transportation. Their initial dominance may have been preserved for a time by restrictive zoning regulations with respect to lot size, making it more difficult for low-income groups to compete for suburban land. In our model this negative effect of restrictive zoning on those with low-income would show up as a significant negative impact of growth of owner housing on low-income movers from central city to suburbs.

A second point that emerges from the work of Leroy and Sonstelie is that since the low-income residents are more tied to their work place during

the 1950s than during the 1970s, for low-income movers the employment variables should be of more importance relative to the housing variables for the 1950s than for the 1970s.

Following the same line of reasoning as for the employment variables, we next consider the competition for scare central city land as it applies to the central city housing market. Given the scarcity of land, any owner housing built in one city means less rental housing constructed. If low-income residents are primarily attracted to rental housing, then the growth of owner housing in the city should have a negative effect on low-income movers from suburbs to central city and on low-income in-migrants to the central city. The effect is not symmetrical with respect to the high-income in-movers because we have no expectation that they will be more or less exclusively attracted to owner housing as low-income in-movers are to rental housing.

Housing built in many central cities tends to be constructed at a lower quality level than housing built in the suburbs. Our variables are physical measures of the number of housing units of a particular tenure type and as such do not allow for the quality differentials. Our concern is with explaining the relative effect of rental and owner housing on movement to a particular area by income class, and thus this quality differential is of less importance.

In conclusion, certain forces mitigate against a simple relationship between tenure mode and movement by income group. We expect an unambiguously positive effect on high-income movers from central city to suburbs due to growth of owner housing. Growth of rental housing will also have an unambiguously positive effect on low-income movers from central city to suburbs. To the extent that growth of owner housing is correlated with restrictive zoning

in the suburbs, for later periods we expect a negative impact on low-income movement from central city to suburbs due to the growth of suburban owner housing. We expect the influence of rental housing on such low-income movement to grow over time relative to suburban employment change as transport modes change.

Low-income movers from suburbs to central city should be positively influenced by rental housing due to both simple tenure model considerations and Linneman's conclusion's regarding the advantages of rental housing in densely settled areas. The existence of scarce land in the city leads to a prediction that growth of owner housing in the city will have a negative impact on low-income movement back in. More ambiguous hypothesiss are reached for high-income movers from suburbs to central city and for high-income in-migrants. Linneman's work leads to the hypothesis that rental housing in the city may have as strong an influence as owner housing on high-income movers back in. Work force in-migrants of every income class would presumably be more strongly influenced by the growth of rental housing due to their limited time to search for housing to buy. For low-income in-migrants the same negative impacts of owner housing would be expected as for low-income intrametropolitan movers due to zoning in the suburbs and land competition in the city.

3.5.2.5. Amenity Considerations

While we believe the distinction between flight from blight models and Muth-Mills models is an artificial one, it is a convenient separation point for our theoretical discussion. In this section we will discuss the expected impacts of income growth, crime rate, percent nonwhite, and population density on intrametropolitan movement.

The absolute change in median family income over the 10-year period is a proxy for the overall change in level of "neighborhood" amenities. Our

expectation is that the lower its value, the less likely is high-income in-movement. For low-income households we are unable to make an unambiguous prediction. Presumably they are also attracted by neighborhood amenities. They are not, however, as capable of bidding for these amenities and not as able to afford the taxes that may go with them.

A large sociological literature has developed on crime's influence on intraurban movement patterns. That literature has universally noted that crime is a more important consideration in movement for low-income households than for high-income households. This is not surprising when one considers that crime is frequently neighborhood specific, and high-income residents have the means to afford crime prevention measures (e.g., guarded buildings, security systems). The economic literature, however, has not paid much attention to this point. Instead theoretical and empirical models have focused on a cumulative causation model. Crime forces high-income families out, which increases the crime rate, which in turn drives low-income families to move toward high-income families, thus causing the crime rate to increase there. We follow the sociological literature in believing that crime as a blight on urban areas will have a greater influence on the movement of low-income households than on high-income households.

Many popular accounts of suburbanization have emphasized the phenomenon of white flight. As a consequence we have, following tradition, included a variable for the percent nonwhite in the central city relative to suburbs. To the extent that black in-migration to the central cities was a cause of white out-movement, we expect the influence to be stronger for low-income residents than for high income residents. Our sense is that black low-income in-migrants to ghettos are often proximate to low-income white neighborhoods

and often in competition with low-income white residents for housing. In general, however, we believe in Taeuber's (1975) empirical position: "A minority group, outnumbered seven to one cannot take over all of the nation's central cities." (p. 87). Central city population density proxies two factors. First, it is a measure of congestion and crowding. To the extent that these are important disamenities, population density should act both to push out residents and to repel potential in-movement to the central city. Population density may also represent a drag on out-movement if it serves as a proxy for an existing stock of durable capital in the central cities.

3.5.3 The Empirical Results

The model described above has been estimated by three stage least squares, and the results are reported in Tables 3.11, 3.12, and 3.16-3.20. Tables 3.13, 3.14, and 3.15 report results for specific employment sources. The model was also estimated by ordinary least squares. Moreover, a number of alternative specifications were estimated primarily to see how robust the model is the changes in specification, particularly with respect to various means of normalizing the location equations. In fact, the basic results change very little when alternative specifications are estimated. Two alternatives that warrant brief consideration include a) a dummy variable for SMSAs with multiple central cities, and b) a dummy variable for SMSAs located in the South and West census regions. These alternatives are not specifically reported, but where the results are relevant, they are described.

3.5.3.1. The Housing Equations

As reported in Table 3.11, the forces that influence the construction of new owner housing in the city remained remarkably stable over all three periods. Low-income in-movers had a negative influence on the amount of owner

housing built, and this influence was statistially significant during the 1960s and 1970s. During the 1960s for every 100 low income in-movers, 68 fewer owner housing units were built during the 10-year period, whereas during the 1970s 31 fewer units were built.

Throughout the 30-year period (1950-80) high income in-movers had a significant positive influence on owner housing built in the central city. More than 100 new owner housing units were built for every 100 high income in-movers to the central city. Income growth had the predicted positive effect on central city owner housing, and during the last two periods its influence was statistically significant (at better than 5%). During the 1970s, for every $1,000 increase in median family income (in current dollars) in the central city, 2,580 owner housing units were built.

In the regressions of Table 3.11, vacancy rates frequently have the wrong sign. Only during the 1960s, and then only rental housing was significantly discouraged by high vacancy rates. These rates may simply not be a good proxy for an excess supply of housing. The lagged dependent variable has a positive impact on the construction of central city owner housing that is significant for the 1950s and 1960s. During the 1950s 35 and during the 1960s 40 owner housing units were constructed for every 100 that had been built in the prior time period.

Low-income in-movers had a significant positive effect on central city rental housing during the first two periods, but not in the last. By contrast in the 1950s high income in-movers had a significant negative influence, but during the 1960s and 1970s they had a significant positive effect. One possible reason for the change in sign after the 1950s is that new rental housing in the central city was built at a significantly lower quality level

TABLE 3.11
Housing Equations of the Income Quintile Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, and 1970s

	New Central City Housing					
	Owner			Renter		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
Low Income in-movers to CC[a]	0.16 (1.06)	-0.68 (-3.67)	-0.31 (3.22)	0.25 (1.76)	0.39 (3.70)	0.05 (0.58)
High Income in-movers to CC[a]	1.44 (5.62)	1.33 (4.94)	1.88 (4.53)	-0.50 (1.99)	0.36 (2.24)	1.39 (4.50)
Income change in CC	1.86 (0.52)	5.38 (1.69)	2.58 (3.43)	6.43 (1.98)	2.17 (1.11)	-1.30 (1.59)
Vacancy Rate in CC, t-10 (E+5)	0.09 (0.16)	0.82 (0.71)	0.48 (1.17)	-0.02 (0.24)	-0.66 (2.73)	0.82 (2.55)
New const. of this type of housing in CC, t-10 to t-20	0.35 (3.05)	0.40 (3.45)	0.00 (0.24)	1.74 (23.73)	0.92 (27.58)	0.34 (5.09)
Type of Housing, CC/SMSA, t-10	18458 (3.11)	-10180 (1.22)	7090 (0.80)	5952 (0.88)	13009 (2.28)	15694 (2.27)
Constant	13031 (1.39)	12651 (1.32)	-18559 (3.38)	-22071 (2.34)	-12755 (1.78)	-2864 (0.41)
OLS R^2 (adj.)	0.91	0.80	0.77	0.95	0.97	0.89

	New Suburban Housing					
	Owner			Renter		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
Low Income in-movers to S[a]	0.17 (1.84)	0.01 (0.07)	-0.18 (0.57)	0.68 (9.19)	1.01 (7.12)	0.43 (2.75)
High Income in-movers to S[a]	1.23 (15.33)	1.40 (7.23)	2.37 (5.26)	0.01 (0.29)	0.08 (0.87)	0.57 (3.97)
Income change in S	-0.29 (0.94)	6.66 (1.64)	-1.05 (0.34)	-2.50 (1.11)	5.91 (2.09)	1.16 (1.05)
Vacancy Rate in S, t-10 (E+5)	0.29 (0.52)	4.41 (3.13)	2.60 (1.32)	0.31 (0.82)	-0.84 (2.88)	0.18 (0.29)
New const. of this type of housing in S, t-10 to t-20	1.23 (10.59)	0.06 (0.89)	0.02 (0.12)	0.89 (8.25)	0.48 (3.85)	0.11 (1.62)
Type of Housing, CC/SMSA, t-10	1635 (0.29)	-453 (0.05)	-32307 (1.39)	13275 (2.99)	7529 (0.85)	-8934 (0.87)
Constant	-2395 (0.22)	-33162 (1.60)	16394 (0.45)	-6954 (0.91)	-31143 (2.28)	-8080 (0.59)
OLS R^2 (adj.)	0.99	0.92	0.75	0.97	0.91	0.86

[a]Includes intrametropolitan movers and SMSA in-migrants. t-ratios in parentheses.

Table 3.12

Employment Equations of the Income Quintile Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, and 1970s

Independent Variables	Suburbs			Central City		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
Low Income In-Movers to S (CC)[a]	1.91 (12.92)	0.66 (2.95)	1.52 (4.95)	-2.49 (5.90)	-0.88 (4.99)	1.47 (7.67)
High Income In-Movers to S (CC)[a]	-0.15 (0.93)	0.90 (3.90)	0.42 (1.17)	5.47 (9.58)	3.11 (12.48)	4.40 (8.06)
Income Change In S (CC)	29.44 (4.62)	23.64 (4.08)	13.99 (5.60)	6.54 (0.75)	1.58 (0.41)	-6.58 (4.26)
Employment in Area, t-10 S (CC)	0.08 (2.06)	0.13 (3.98)	-0.00 (-0.13)	-0.01 (0.91)	-0.10 (14.32)	-0.37 (28.08)
Employment, CC/SMSA, t-10	39383 (2.49)	29196 (1.61)	15087 (0.76)	-750 (0.04)	19350 (2.44)	41825 (3.31)
Constant	-130460 (5.52)	-133380 (4.46)	-163660 (5.84)	-27002 (-1.03)	-15303 (1.11)	18467 (1.47)
OLS R^2 (adj.)	0.90	0.86	0.80	0.60	0.80	0.92

[a]Includes intrametropolitan movers and SMSA in-migrants. t-ratios in parentheses.

TABLE 3.13
Disaggregated Employment Equations of the Income Quintile Model of Intrametropolitan Location: Two Stage Least Squares Estimates for the 1950s

Independent Variables	Suburbs					Central City				
	Total	Retail	Whole-sale	Manu-fact.	Service	Total	Retail	Whole-sale	Manu-fact.	Service
Low Income In-Movers to S (CC)	1.64 (10.51)	0.16 (6.12)	0.02 (1.61)	1.25 (9.83)	0.19 (9.96)	-2.38 (4.56)	-0.40 (4.62)	-0.19 (4.51)	-1.32 (3.34)	-0.16 (3.49)
High Income In-Movers to S (CC)	0.09 (0.45)	0.33 (9.09)	0.07 (4.50)	-0.43 (2.97)	0.03 (1.15)	5.33 (7.67)	0.93 (8.16)	0.46 (8.01)	3.01 (5.72)	0.56 (8.98)
Income Change In S (CC)	21.84 (3.10)	2.24 (1.84)	0.38 (0.59)	19.44 (3.43)	0.52 (0.61)	1.29 (0.13)	0.17 (0.10)	-0.52 (-0.56)	3.25 (0.43)	-1.05 (1.07)
Employment in Area, t-10 S (CC)	0.08 (1.48)	0.05 (0.94)	0.47 (5.14)	0.09 (1.72)	0.35 (2.70)	-0.01 (0.65)	-0.05 (4.58)	-0.04 (4.05)	-0.05 (2.58)	0.22 (19.85)
Employment, CC/SMSA, t-10	40824 (2.02)	4731 (1.28)	-1220 (0.56)	37932 (2.69)	3329 (1.31)	-3863 (0.18)	2842 (0.71)	2423 (0.89)	-3005 (0.22)	-6225 (2.70)
Constant	-108770 (3.92)	-13316 (2.68)	-1120 (0.41)	-91124 (4.31)	-6354 (1.88)	-12950 (0.42)	-4083 (0.74)	-711 (0.20)	-13787 (0.64)	5559 (1.76)
OLS R^2 (adj.)	0.90	0.96	0.91	0.78	0.93	0.60	0.69	0.63	0.51	0.95

t-ratios in parentheses.

TABLE 3.14
Disaggregated Employment Equations of the Income Quintile Model of Intrametropolitan Location: Two Stage Least Squares Estimates for the 1960s

Independent Variables	Suburbs					Central City				
	Total	Retail	Whole-sale	Manu-fact.	Service	Total	Retail	Whole-sale	Manu-fact.	Service
Low Income In-Movers to S (CC)	0.76	0.07	-0.07	0.49	0.25	-0.89	-0.23	-0.28	-0.27	0.03
	(3.03)	(1.03)	(2.16)	(2.64)	(5.47)	(3.15)	(3.38)	(6.30)	(1.37)	(0.51)
High Income In-Movers to S (CC)	0.80	0.47	0.16	0.03	0.10	3.09	0.89	0.55	0.91	0.51
	(2.88)	(5.61)	(5.05)	(0.18)	(1.95)	(8.40)	(9.99)	(9.36)	(3.67)	(5.48)
Income Change In S (CC)	20.69	4.47	1.86	12.04	2.43	-0.38	0.44	-0.28	3.07	-2.41
	(3.06)	(2.50)	(2.23)	(2.43)	(1.93)	(0.08)	(0.41)	(0.38)	(0.97)	(2.10)
Employment in Area, t-10 S (CC)	0.12	0.03	0.45	0.14	0.12	-0.10	-0.13	-0.11	-0.14	0.11
	(2.85)	(0.47)	(7.17)	(3.15)	(1.05)	(11.87)	(13.44)	(11.20)	(12.79)	(8.07)
Employment, CC/SMSA, t-10	18043	-4227	1748	30833	-7145	20184	6880	4427	12252	-924
	(0.84)	(0.67)	(0.70)	(2.21)	(1.46)	(1.52)	(1.97)	(2.24)	(1.50)	(0.23)
Constant	-110520	-17093	-9657	-76894	-6764	-9310	-5751	-1009	-15804	8651
	(3.09)	(1.71)	(2.17)	(3.12)	(0.91)	(0.57)	(1.40)	(0.34)	(1.48)	(1.89)
OLS R^2 (adj.)	0.86	0.89	0.91	0.63	0.84	0.80	0.85	0.78	0.78	0.88

t-ratios in parentheses.

TABLE 3.15
Disaggregated Employment Equations of the Income Quintile Model of Intrametropolitan Location: Two Stage Least Squares Estimates for the 1970s

Independent Variables	Suburbs					Central City				
	Total	Retail	Whole-sale	Manu-fact.	Service	Total	Retail	Whole-sale	Manu-fact.	Service
Low Income In-Movers to S (CC)	1.64 (4.64)	0.36 (2.96)	0.07 (1.20)	0.62 (2.96)	0.32 (2.72)	1.40 (5.43)	0.33 (5.05)	0.10 (1.75)	0.45 (3.25)	0.43 (5.77)
High Income In-Movers to S (CC)	0.41 (0.99)	0.29 (1.97)	0.13 (1.82)	-0.08 (0.32)	0.05 (0.39)	4.21 (6.09)	0.97 (5.65)	0.55 (3.49)	1.39 (3.74)	0.78 (3.84)
Income Change In S (CC)	8.06 (3.25)	0.57 (0.67)	0.56 (1.41)	5.76 (3.69)	1.61 (2.22)	-2.66 (1.68)	0.02 (0.05)	-0.24 (0.66)	-0.47 (0.56)	-0.27 (0.56)
Employment in Area, t-10 S (CC)	0.00 (0.02)	0.01 (0.28)	0.19 (3.77)	-0.14 (4.61)	0.75 (8.04)	-0.36 (22.59)	-0.41 (19.83)	-0.34 (13.60)	-0.45 (26.04)	0.00 (0.01)
Employment, CC/SMSA, t-10	6782 (0.24)	-10181 (0.97)	1361 (0.28)	6011 (0.41)	3551 (0.37)	53105 (3.17)	27635 (6.22)	18345 (4.72)	6007 (0.74)	13296 (2.38)
Constant	-96296 (3.19)	1230 (0.12)	-7931 (1.41)	-66582 (-3.80)	-20649 (1.91)	-15135 (1.08)	-12510 (3.66)	-10158 (2.84)	-231 (0.03)	-8702 (1.69)
OLS R^2 (adj.)	0.80	0.75	0.75	0.37	0.90	0.92	0.91	0.82	0.94	0.93

t-ratios in parentheses.

TABLE 3.16
Income Change Equations of the Income Quintile Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, 1970s

Independent variables	Suburbs			Central City		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
Low Income In-Movers to S (CC)[a]	-0.02 (5.45)	-0.02 (4.59)	-0.04 (2.66)	-0.01 (0.71)	-0.03 (3.25)	-0.04 (2.38)
High Income In-Movers to S (CC)[a]	0.00 (1.59)	0.01 (2.02)	0.01 (0.41)	0.22 (1.43)	0.05 (3.99)	0.14 (3.54)
Employment Change in S (CC)	0.01 (4.82)	0.00 (1.57)	0.02 (3.45)	-0.00 (0.26)	-0.00 (0.52)	0.00 (1.67)
Income in S (CC), t-10	0.48 (5.06)	0.31 (6.15)	0.48 (4.35)	0.19 (1.80)	0.39 (4.45)	0.82 (4.52)
Constant	1523.70 (4.75)	2570.70 (8.13)	5610.80 (4.43)	1653.90 (4.46)	1219.80 (2.45)	-601.17 (0.36)
OLS R^2 (adj.)	0.50	0.48	0.21	0.11	0.25	0.35

[a]Includes intrametropolitan movers and SMSA in-migrants. t-ratios in parentheses.

TABLE 3.17

Movement from Central City to Suburbs in Income Quintile Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, and 1970s

Independent Variables	Low-Income Movers			High-Income Movers		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
New Rental Housing in S	-0.00	0.10	0.49	0.00	-0.07	0.21
	(0.06)	(3.78)	(5.42)	(0.07)	(2.78)	(2.40)
New Owner Housing in S	0.07	-0.07	-0.07	0.09	0.07	0.04
	(4.83)	(2.66)	(2.73)	(4.40)	(2.99)	(1.66)
Employment Change in S	0.10	0.14	-0.10	0.04	0.09	-0.07
	(6.30)	(6.84)	(2.85)	(1.53)	(4.60)	(2.27)
Employment Change in CC	-0.01	0.03	0.03	-0.14	-0.07	0.02
	(0.53)	(1.10)	(2.46)	(6.49)	(3.02)	(2.08)
Income Change in S	-1.49	-2.86	1.32	3.24	0.82	1.62
	(1.81)	(2.79)	(2.36)	(2.54)	(0.86)	(3.30)
No. of Residents of This Type in CC	-0.01	0.01	0.01	0.08	0.07	0.03
	(1.86)	(2.61)	(2.72)	(8.04)	(13.65)	(6.31)
Quintile Group, $CC/SMSA_t$	4049	-3258	-7732	6251	3211	-33
	(2.50)	(0.90)	(1.65)	(2.23)	(1.06)	(-0.01)
Crime Rate Per 10,000 in CC, t-10	4.89	5.89	3.25	9.30	1.97	-3.02
	(1.36)	(0.97)	(0.82)	(1.80)	(0.34)	(0.81)
Percent Nonwhite CC/S, t-10	28.75	64.34	72.07	7.93	2.83	57.67
	(1.30)	(1.25)	(1.50)	(0.27)	(0.06)	(1.30)
Pop. Density in CC, t-10	0.03	-0.11	-0.30	-0.09	-0.19	-0.03
	(0.44)	(0.69)	(1.51)	(0.84)	(1.28)	(-0.15)
Constant	1422	14836	-9849	-13293	-4200	-15901
	(0.53)	(2.82)	(1.62)	(2.75)	(0.83)	(2.92)
OLS R^2 (adj.)	0.94	0.79	0.74	0.98	0.95	0.78

t-ratios in parentheses.

TABLE 3.18

Movement from Suburbs to Central City in Income Quintile Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, and 1970s

Independent Variables	Low-Income Movers			High-Income Movers		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
New Rental Housing in CC	0.01 (0.27)	0.06 (3.34)	0.15 (5.92)	-0.11 (0.45)	0.09 (6.72)	0.04 (3.34)
New Owner Housing in CC	0.04 (3.53)	-0.09 (2.35)	-0.22 (4.18)	0.04 (3.05)	-0.10 (3.66)	-0.03 (1.08)
Employment Change in S	0.04 (6.89)	0.05 (6.10)	0.02 (1.43)	0.04 (5.91)	0.02 (2.26)	-0.01 (2.29)
Employment Change in CC	0.01 (0.99)	0.07 (4.73)	0.03 (3.85)	0.04 (5.07)	0.08 (6.54)	0.02 (5.28)
Income Change in CC	0.12 (0.28)	0.70 (0.86)	1.19 (4.08)	0.69 (1.37)	1.55 (2.53)	0.77 (5.08)
No. of Residents of This Type in S	0.01 (3.68)	0.02 (3.62)	0.03 (6.85)	0.01 (2.27)	0.01 (2.93)	0.01 (4.94)
Quintile Group, $CC/SMSA_t$	-715 (0.75)	1647 (0.81)	783 (0.28)	1462 (1.29)	-466 (0.34)	-344 (0.22)
Crime Rate Per 10,000 in CC, t-10	-3.53 (1.37)	-4.77 (1.27)	-4.64 (1.83)	-2.25 (0.72)	0.95 (0.36)	-0.30 (0.26)
Percent Nonwhite CC/S, t-10	11.262 (1.16)	42.48 (1.40)	63.53 (2.23)	6.75 (0.55)	41.23 (1.92)	22.57 (1.71)
Pop. Density in CC, t-10	0.05 (1.40)	-0.10 (1.08)	-0.25 (2.20)	0.04 (0.77)	-0.09 (1.41)	-0.09 (1.65)
Constant	355 (0.26)	-2454 (0.73)	-6091 (1.94)	-2734 (1.91)	-5475 (2.37)	-4826 (3.46)
OLS R^2 (adj.)	0.89	0.78	0.82	0.88	0.73	0.66

t-ratios in parentheses.

TABLE 3.19
Equations for In-Migration to the Central City in the Income Quintile Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, and 1970s

Independent Variables	Low-Income In-Migrants			High-Income In-Migrants		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
New Rental Housing in CC	0.44	0.18	0.85	0.20	0.05	0.20
	(4.44)	(4.62)	(13.29)	(4.28)	(1.70)	(12.39)
New Owner Housing in CC	0.10	0.34	-0.54	0.21	0.33	0.15
	(2.50)	(4.53)	(3.96)	(10.60)	(8.28)	(4.00)
Employment Change in S	0.09	0.14	0.07	-0.01	0.05	-0.01
	(4.10)	(12.36)	(2.53)	(1.13)	(8.12)	(1.37)
Employment Change in CC	-0.11	-0.03	0.05	-0.01	0.10	0.00
	(2.81)	(0.73)	(2.87)	(0.61)	(5.50)	(0.46)
Income Change in CC	5.63	-3.21	2.74	0.88	-3.21	0.21
	(3.82)	(2.30)	(3.48)	(1.40)	(3.45)	(0.95)
No. of Residents of This Type in CC	-0.02	-0.05	0.01	-0.03	-0.02	0.00
	(1.67)	(5.31)	(1.27)	(4.10)	(2.21)	(1.29)
Quintile Group, $CC/SMSA_t$	17073	9589	10348	3502	6961	-422
	(4.56)	(2.59)	(1.29)	(2.14)	(3.76)	(0.18)
Crime Rates Per 10,000 in CC, t-10	-3.88	-1.36	0.51	-0.82	-0.83	0.08
	(3.88)	(2.00)	(0.86)	(1.93)	(2.60)	(0.49)
Percent Nonwhite CC/S, t-10	-27.17	44.69	12.22	-29.49	9.39	-23.07
	(0.70)	(0.83)	(0.19)	(1.96)	(0.38)	(1.32)
Pop. Density in CC, t-10	-0.00	0.01	0.06	-0.03	0.11	0.00
	(0.02)	(0.08)	(0.23)	(0.49)	(1.49)	(0.04)
Constant	-16542	9020	-26029	-531	9096	-1951
	(3.21)	(1.58)	(3.16)	(0.29)	(2.71)	(0.99)
OLS R^2 (adj.)	0.91	0.85	0.91	0.96	0.90	0.90

t-ratios in parentheses.

TABLE 3.20

Equations for In-Migration to the Suburbs in the Income Quintile Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, and 1970s

Independent Variables	Low-Income In-Migrants			High-Income In-Migrants		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
New Rental Housing in S	0.39	0.34	0.33	0.18	0.12	-0.35
	(6.88)	(11.37)	(2.79)	(2.97)	(3.44)	(2.47)
New Owner Housing in S	0.09	0.13	-0.08	0.10	0.21	0.22
	(3.37)	(4.99)	(2.38)	(3.44)	(6.22)	(5.39)
Employment Change in S	0.02	-0.03	0.18	0.00	0.03	0.19
	(0.59)	(1.13)	(4.17)	(0.08)	(0.98)	(3.75)
Employment Change in CC	0.06	0.09	0.08	0.02	0.12	0.05
	(2.41)	(2.94)	(4.96)	(0.65)	(3.26)	(2.56)
Income Change in S	-3.19	-1.79	-1.14	-1.75	-0.66	-2.87
	(1.95)	(1.47)	(1.46)	(1.04)	(0.46)	(3.45)
No. of Residents of This Type in S	-0.04	-0.04	0.01	0.01	-0.00	0.02
	(3.24)	(3.47)	(1.50)	(0.67)	(0.14)	(3.24)
Quintile Group, City/SMSA$_t$	-10749	-29578	-21744	-11354	-19206	-14720
	(3.31)	(7.47)	(3.14)	(3.71)	(4.83)	(2.22)
Crime Rates Per 10,000 in CC, t-10	-2.41	0.23	0.33	-0.01	0.01	0.00
	(5.50)	(0.30)	(0.68)	(1.41)	(0.98)	(0.45)
Percent Nonwhite CC/S, t-10	3.10	-14.77	-93.57	-49.42	-76.36	-77.60
	(0.09)	(0.23)	(1.62)	(1.10)	(1.05)	(1.11)
Pop. Density in CC, t-10	0.04	-0.16	0.31	-0.01	0.34	0.68
	(0.28)	(0.87)	(1.25)	(0.05)	(1.52)	(2.30)
Constant	21136	28279	25041	16936	10667	33734
	(3.92)	(4.61)	(3.03)	(2.91)	(1.45)	(3.65)
OLS R^2 (adj.)	0.94	0.89	0.88	0.91	0.91	0.83

t-ratios in parentheses.

during the 1950s than during the 1960s and 1970s, which allowed lower income in-movers to have a considerable impact during the 1950s, whereas high income in-movers had a major impact during the 1970s. One possible cause of such a change is the economics of new construction during the 1970s (e.g., rising materials cost and rising mortgage rates) that made new construction for low-income occupancy increasingly difficult. Moreover, the coefficient on median family income growth decreased over the three periods, which seems consistent with the above explanation. Specifically, an overall explanation for these findings is that rental housing was constructed during the 1950s to satisify the demands of low-income in-movers to growing central cities with high rates of income growth. This housing had to compete for space with owner housing built for high-income in-movers. During the 1970s rental housing was built for high-income in-movers, but income growth was a more important determinant of owner housing in the city.

Low-income in-movers to the suburbs had some effect on the construction of new owner housing during the 1950s, but not during the 1960s or the 1970s. High-income movers were of extreme importance across all three time periods, and their influence increased over time. Income growth has a marginally significant positive effect only for the 1960s. Just as for owner housing built in the city, owner housing constructed in the suburbs was strongly influenced by past construction during the 1950s. However, the lagged variable is not significant for the 1970s.

Over of the 30-year period the most consistently significant influence on rental housing built in the suburbs was the number of low-income in-movers to the suburbs. Other than during the 1970s, high-income in-movement failed to significantly affect rental housing built in the suburbs. Median family income growth in the suburbs is significant for the 1960s only. Just as for

owner housing built in the suburbs, the coefficient on the lagged dependent variable declines across time, becoming significant at 10% for the 1970s.

During the 1950s central cities that accounted for a relatively large fraction of the SMSA's housing stock also accounted for significantly more new owner housing. During the 1960s and 1970s this relationship did not hold. These findings presumably reflect the increasing scarcity of central city land and rising land prices in the city. Where the city accounted for relatively much of the SMSA's housing stock, suburban areas accounted for significantly more rental housing during the 1950s. The same explanation seems to apply to this finding for the suburbs as for the central city.

Several points of potential policy interest follow from these findings. First, the negative impact of low-income in-movers on owner housing is extremely pronounced for the central city, but does not exist for the suburbs. This observation seems consistent with Muth's model that predicts that low-income groups may outbid high-income groups for land in the central city. Second, rental housing built in the central city appears to have been more influenced during the 1970s by high-income movement than by low-income movement. During the 1960s each income group had about the same impact on rental housing. This finding for the central city is in contrast to that for the suburbs, where low-income in-movement had a major effect across all three time periods. The third major point is that the lagged response to housing demand seems to have declined over time.

3.5.3.2. The Employment Equations

Table 3.12 shows that low-income in-movers had a significant positive impact on employment change in the suburbs during each period. By contrast, high-income movers were a significant positive force only during the 1960s. Income growth in the suburbs had a significant positive effect during each

period, but its influence declined over time. This variable appears to capture the effects of increased demand for output on employment growth.

The city, on the other hand, was heavily influenced by high-income in-movement during each period. Moreover, the coefficients are surprisingly large. Across all periods, for every high-income in-mover, more than three new jobs were created in the city. This is an important finding since it suggests that programs to attract high-income residents to the city may have the effect of creating jobs for lower-income residents. Low-income movers had a significant negative effect during the first two periods, but this effect reversed during the 1970s. Income change is significant only for the 1970s when its coefficient is negative.

During the 1960s and 1970s, employment grew considerably less in larger than in smaller central cities, ceteris paribus. Employment growth was significantly greater in larger suburban areas during the 1950s and 1960s.

An alternative version of the model that focuses on the components of employment change was also estimated. Change in total employment was replaced with change in retail, service, manufacturing, and wholesale employment. The employment equations of these alternatives are reported in Tables 3.13 (for the 1950s), 3.14 (for the 1960s), and 3.15 (for the 1970s). The major finding reported in these tables is that during each period high-income in-movers to the central city had a positive effect on each central city employment source. Quantitatively the largest impacts were on retail and manufacturing employment. high-income in-movers to the suburbs positively affected suburban trade (retail and wholesale) employment, but the magnitude of the influence on these sources of suburban employment was considerably smaller than on their central city counterparts. Low-income in-movers to the central city discour-

aged the growth of manufacturing employment during the 1950s and 1960s, but had the opposite effect during the 1970s. This reversal may reflect a change toward lower-wage labor in the central city, but this entire issue warrants further attention. Low-income in-movers positively influenced suburban manufacturing employment during each period.

3.5.3.3. The Income-Change Equations

As expected, low-income in-movers had a significant negative effect on income change in the suburbs during each period. That high income movers did not have a stronger positive impact is perhaps somewhat surprising (Table 3.16). Employment growth had a significant positive effect during each period, though for the 1960s the influence is statistically significant at only the 10% level. Suburban areas with higher income at the beginning of the period enjoyed greater growth of income during each decade. The results for the central city are dissimilar in that high-income in-movers significantly boosted income during the 1960s and 1970s. Low-income in-movers had a negative impact during each of these decades. Along with the results reported previously concerning the strong positive effect of high-income in-movers on central city employment, these findings emphasize the importance of high income residents to the central city.

In general, we have not discussed OLS R^2s because they are generally over 0.70. The equations explaining income growth are the exceptions. The model does not explain a a relatively high fraction of the variation in income change for either locale during any period. As we noted in our theoretical discussion, a number of potentially important influences are excluded from our model, most notably out-migration. Moreover, income growth can occur due to changes in the mix of jobs, and this influence is difficult to capture.

3.5.3.4. The Location Equations

A great deal of theoretical work has focused on intraurban location by income category of the economic agents. This work has become increasingly realistic, and the corresponding models can explain a tremendous variety of location patterns observed for income groups in American cities. However, few testable hypothesis are generated by this literature. Using a simple Muth-type model, Wheaton (1975) demonstrates that the relative positions of income groups with respect to the city center vary dramatically with small changes in the parameters of the model. The theoretical work completed since 1975 seems to affirm Wheaton's observation.

In this study we are concerned not with the determinants of the relative position of high and low income residents with respect to the city center, but rather with the determinants of high-income and low-income movement to the central city versus the suburban ring. In an amenity-based approach (Graves and Tolley, 1981), a particular location's attractiveness depends on its nearness to location-specific public goods (amenities). Many urban economists have drawn a distinction between Muth-Mills-type models with their emphasis on relative economic costs at various locations vs "flight from blight" models with their emphasis on central city problems. This distinction disappears when an amenity approach is used. For example, nearness to work is simply one among a number of possible characteristics associated with a particular site. This section discusses each possible determinant of movement, first from a simple amenity perspective. Expectations formed on this basis will be qualified with reference to more sophisticated treatments.

The Housing Variables. In the quintile model of intrametropolitan movement we are concerned with the simultaneous movement of the lowest and highest

20% of residents in each specific SMSA's income distribution. Low-income movers from central city to suburbs are expected to be positively influenced by rental housing throughout the period and negatively influenced by owner housing in later periods as zoning took effect. For the 1960s and 1970s, the results are consistent with our expectations (Table 3.17). The coefficient on growth of suburban rental housing is significantly positive and increases over these two periods. The coefficient on suburban owner housing is negative and significant for both the 1960s and the 1970s. Moreover, as we expect on the basis of Leroy and Sonstelie's work, rental housing increases in importance over the period 1950-1980, while suburban employment growth decreases in importance in the sense that it turns negative for the 1970s. Whereas during the 1960s 8 low-income residents moved to the suburbs for every 100 suburban rental housing units built during the decade, during the 1970s 49 low-income residents moved to the suburbs for every 100 suburban rental units built during the period. At least on the surface, this finding appears to indicate that the growth of rental housing in the suburbs prevented a much greater concentration of poor in the central cities during the 1970s. Since the owner housing variable may also proxy restrictive zoning, that the negative coefficient on owner housing is smaller in absolute value than the positive coefficient on rental housing may not be surprising. For every 100 suburban owner housing unit constructed during the respective decade, 7 fewer low-income persons moved from central city to suburbs during the 1960s and 7 fewer also moved during the 1970s.

The results for 1950s do not follow our expectations. The coefficient on owner housing is significantly positive when a two-tailed test is applied, whereas that on rental housing is negative though not significant. We will

see that this result, especially for owner housing, is robust across a wide range of specifications for the low-income group for the 1950s; thus, it warrants brief discussion now. Two thoughts occur to us. First, during the 1950s much less rental housing was built in the suburbs than during later periods. Thus, to the extent that low-income out-movement occurred, it was more likely to be confined to owner housing. Second, the 1950s may have been a period during which asset accumulation and attractive mortgage rates to veterans of World War II allowed some low-income but high-asset residents to make the move to the suburbs. We are unable to directly test these hypotheses.

For high-income movers from central city to suburbs, the growth of suburban owner housing had a significant positive effect during each decade (Table 3.17). Quantitatively, we estimate that for every 100 suburban owner housing units constructed during the respective decade, 9 high-income persons moved from central city to suburbs during the 1950s, 7 during the 1960s, and 4 during the 1970s. We had no basis for forming an expectation about the impact of rental housing on high-income out-movement. The results suggest some structural change over the various periods, with rental housing having a significant negative effect only during the 1960s, but a strong positive effect during the 1970s.

For low-income movement from suburbs to central city, central city rental housing has the expected positive influence for all three time periods (Table 3.18), but it is highly significant only for the 1960s and 1970s. For every 100 rental units built in the city during the three successive time periods, 1, 6, and 15 more low-income persons moved from suburbs to central city during each respective decade. During the 1960s and 1970s, owner occupied housing

had the predicted negative effect on low-income movers from suburbs to central city. However, during the 1950s central city owner housing attracted low income residents from the suburbs. That this effect changes over the 30-year period could reflect increasing competition between the growth of owner and rental housing in the city as land became scarcer.

The growth of owner housing had a significant positive influence on the movement of high-income persons from suburbs to central city during the 1950s, but during the 1960s growth of rental housing had a significant negative influence. The evidence here suggests a relatively profound change in either the types of high-income movers from suburbs to central city (e.g., age, number of children) or their preferences with respect to central city housing. For the 1970s, for which we can disaggregate high-income movers from suburbs to central city by age, presence of children, and sex, we can develop additional insights into this phenomenon. We discuss these findings in section 3.6.

Low-income in-migrants to the central city were, as predicted, significantly influenced by the growth of rental housing during all three time periods (Table 3.19). Curiously, whereas the growth of owner housing has the predicted negative impact for the 1970s, in the earlier periods it had a significant positive influence on the location of low-income in-migrants. This result holds across a number of different formulations for the low-income group, and consequently does not appear to be peculiar to the quintile model. If owner housing in the central city is built on average at a lower quality level, this may provide a partial explanation. Moreover, low-income in-migration is especially high to certain retirement centers (e.g., Miami, Tampa-St. Petersburg, Phoenix), and low-income, high-asset retirees might well be attracted to owner-occupied housing in these central cities.

High-income in-migrants to the central city are positively and significantly influenced by the growth of owner housing in the central city in all periods. This finding seems most consistent with a simple tenure-choice model of the housing market. The growth of rental housing also had a significant positive influence during each period. Relative to the two earlier periods, the growth of owner housing had diminished slightly as an influence in the 1970s. Whereas during the 1950s 21 and during the 1960s 33 more high-income in-migrants settled in the central city for every 100 owner housing units built during the respective period, during the 1970s only 15 more were attracted.

Throughout the 30-year period low-income in-migrants to the suburbs were strongly attracted by growth of rental housing (Table 3.20). The coefficients are, moreover, remarkably similar for the three periods. Furthermore, the coefficients are fairly large compared to the housing coefficients in other equations. During the first two periods the growth of owner housing had a positive and significant influence on low-income in-migration to the suburbs. During the 1970s, however, the growth of owner housing had a significant negative effect on low-income in-migration to the suburbs.

High-income in-migrants to the suburbs were positively influenced by owner housing during each time period and by rental housing during the 1950s and 1960s. However, a significant change occurred across time. The coefficient and significance of the owner housing variable increases over time. For every 100 owner housing units built during each respective period, 10, 21, 22 more high-income in-migrants settled in the suburbs. These findings and those described immediately above concerning low-income in-migration to the suburbs might be explained by more zoning out of lower-income housing in the suburbs

during the 1970s, but we are not able to directly test this hypothesis with available data.

In summary, our results for the housing variables in the movement equations of the quintile model conform fairly well to a priori theoretical expectations and provide some estimates worth exploring further.

The Employment Variables. The theoretical discussion of the influence of employment growth on intrametropolitan movement and in-migration presented a relatively complicated and ambiguous picture. Somewhat the same is true of the empirical results.

Low-income movers from central city to suburbs were strongly and positively influenced by employment growth in the suburbs during both the 1950s and 1960s (Table 3.17). This influence was equally strong in both periods. During the 1950s, 10 more low-income central city residents moved to the suburbs for every 100 additional jobs created in the suburbs, and during the 1960s 14 moved. The prediction based on Leroy and Sonstelie's work is that this influence should diminish over time. We did not, however, expect the influence to become significantly negative, as occurs for the 1970s. We noted in the theoretical section that the retention effect of central city employment might be offset by competition for scarce central city land and by disamenity effects. Low-income movers from central city to suburbs were not affected significantly in either direction by employment change in the city except during the 1970s, when central city employment growth encouraged their relocation to the suburbs (Table 3.17).

During the 1950s and 1960s employment growth in the suburbs had a significant positive impact and employment growth in the city a negative impact on high-income movement from central city to suburbs. These results are predicted from a simple amenity-based model. The results for the 1970s are more

troubling. The sign on the coefficient for suburban employment is the reverse of those for the earlier periods, which suggests that during the 1970s suburban job growth discouraged high-income resettlement from central city to suburbs. Moreover, the coefficient on central city employment also reverses.

For low-income movers from suburbs to central city, the theoretical models suggest a retention effect of employment growth in the suburbs. Instead, for all three periods employment growth in the suburbs had a positive effect on low-income movement from suburbs to central city (Table 3.18), and the influence is statistically significant for the first two periods. Employment growth in the city had a significant positive impact during both the 1960s and 1970s.

Central city employment growth had a significant positive effect on high-income movement from suburbs to central city during each period. Suburban employment growth also had a significant positive impact on high-income movers from suburbs to central city during the 1950s and 1960s, but its importance declined over the three periods. By the 1970s suburban employment growth actually discouraged high-income movement from suburbs to central city, possibly because the types of white-collar jobs growing in the suburbs increasingly employed high-income suburban residents.

Low-income in-migration to the central city was closely tied to employment growth in the suburbs during each period and to employment growth in the central city during the 1970s. Since much SMSA employment growth took place in the suburbs during these periods, this finding is probably not surprising. The difficulty comes in understanding why this trend does not continue for the 1970s. One possible explanation is that by the 1970s suburban two-worker households had preempted the suburban employment prospects of lower income in-migrants who located in the city.

For high-income in-migrants to the central city, central city employment appears to have had no significant effect during the 1950s. What appears to have been absolutely crucial for these high-income in-migrants was the growth of owner occupied housing, and this was true for all three periods. During the 1960s, however, employment growth in the suburbs and central city had a significant positive influence, and employment growth in the city had an appreciably larger impact than that in the suburbs. By the 1970s neither employment growth in the city nor the suburbs had a significant effect.

During each period, central city employment growth had a significant influence on low-income in-migration to the suburbs (Table 3.20). During the 1970s, suburban employment growth was also important. Hence, the combination of suburban rental housing and central city employment seem to have been important in the suburban location decisions of low-income in-migrants to SMSAs.

For high-income in-migrants to the suburbs, the suburban employment variable is positive for each period but statistically significant only for the 1970s. Central city employment growth exerted a significant influence during both the 1960s and 1970s, but quantitatively the influence declined over time. We stress, as we have for low-income in-migrants to the suburbs, that for high-income in-migrants to the suburbs housing growth appears to be of far more importance than employment growth, but central city jobs are still of some importance.

In summary, for intrametropolitan movers, employment exerts its influence primarily as an amenity (i.e., nearness to work). In-migrants in general are more heavily influenced by housing growth than by employment growth.

The Amenity Variables. During the 1950s and 1960s, suburban income growth discouraged low-income movement from central city to suburbs, whereas during the 1950s and 1970s it attracted high-income movers (Table 3.17). For

every $100 dollar increase in median family income in the suburbs over the 1960s, 286 fewer low-income residents moved out from the central city. During the 1970s for every $100 increase in median family income in the suburbs, 132 more high-income residents moved out from the central city. High-income movement back into the central city, however, was positively and significantly influenced by income growth in the central city during the 1960s and 1970s (Table 3.18). Moreover, low-income movement back into the central city also shows some responsiveness to change in income growth during the 1970s.

For low-income in-migrants to the city, income growth had a significant negative impact during the 1960s and a significant positive impact during the 1950s and 1970s (Table 3.19). No logical explanation for this reversal is immediately apparent. Furthermore, the only effect of income growth in the city on high-income in-migrants to the city was a significantly negative impact for the 1960s. Except for discouraging low-income in-migrants during the 1950s and high-income in-migrants during the 1970s, income growth in the suburbs had no significant effect on in-migration to the suburbs for either income group during any period (Table 3.20).

In conclusion, income growth as a proxy for neighborhood amenities exerted some influence on location patterns, but the influence is not as strong as that for other variables. Housing and employment seem to be somewhat more important considerations.

Crime rates per capita exerted relatively little influence on movement from central city to suburbs over the three periods discussed. It had a marginally significant positive impact on high-income movers from central city to suburbs during the 1950s (Table 3.17). Low-income movement from the suburbs to the central city, however, does seem to have been deterred somewhat by crime especially during the 1970s. The coefficient on the crime variable

is negative for all three periods and highly significant for the 1970s. High-income movement from suburbs to central city does not appear to be deterred by central city crime. However, both low- and high-income in-migrants to the central city were significantly deterred by crime during the 1950s and 1960s. In-migrants to the suburbs seem not to have been influenced at all by crime rates in the central city during the two later periods. During the 1950s, however, low-income in-migrants to the suburbs were significantly deterred by crime in the central city. In general, the influence of central city crime on suburban location had much to do with income level, to the extent that it had any influence at all.

Percent nonwhite in the central city relative to suburbs had a marginally significant positive effect on low-income movement from central city to suburbs during each time period (Table 3.17). It was, however, of no significance in explaining high-income movement from central city to suburbs, except perhaps during the 1970s.

For both low- and high-income movers from suburbs to central city, the coefficients on percent nonwhite is positive, which is opposite to the predicted sign, and statistically significant for the 1960s and 1970s (Table 3.18). Percent nonwhite failed to significantly affect low-income in-migrants to the central city during any period. It also had a marginally significant negative impact on high-income in-migrants to the central city during the 1950s and 1970s (Table 3.19).

In conclusion, it does not appear that black concentration in the cities is of much importance in explaining suburbanization. More low-income out-movement occurred, but high-income movement was not much affected. These results will be discussed further in connection with certain refinements of the model described below.

3.5.3.5. Summary of Results from Income Quintile Model

In the various equations of the model, certain coefficients reflect persistent effects over the three decades, whereas others reflect monotonic increases or decreases. In still other cases, the coefficients occasionally fail to reflect a consistent pattern, but rather more often are statistically significant for a specific decade and are insignificant or of opposite sign for another decade. In this section we summarize the main findings reported in Tables 3.17 to 3.20, and we also try to make some sense of them.

Housing Equations. Low-income in-movers to the central city had a fairly persistent negative effect on growth of owner housing, whereas high-income in-movers had a consistently positive effect. During earlier periods low-income in-movers also had a positive effect on rental housing in the central city, but later high-income in-movers had a positive effect. This change may reflect a change in the nature of rental housing built in the city, presumably toward higher quality to satisfy the demands of higher-income in-movers. High-income in-movement to the suburbs had a consistently strong positive influence on the growth of owner housing in the suburbs. Low-income in-movement had a consistent positive influence on suburban rental housing.

Employment Equations. Low-income in-movers had a consistent positive impact on suburban employment growth, which at least hints that low wages resulting from an increased supply of low-wage labor may have encouraged manufacturing, retail, and service employment growth in the suburbs. On the contrary, high-income in-movers had a persistent positive effect on central city employment growth. Since the service sector has shown the most strength in central cities, whereas other employment sources have declined absolutely in many of them, this finding suggests that the location of high-income

individuals in the central city has contributed to the vitality of its service sector. The results, however, suggest that high-income in-movers had more general positive impacts on central city employment. During the 1950s and 1960s low-income in-movers had a negative influence on central city employment growth, but during the 1970s this pattern reversed and they had a positive influence. This reversal may reflect a change toward lower-wage labor in the central city, but this entire issue warrants further attention. Finally, income change had a persistent positive effect on suburban employment growth, but not on central city employment growth.

Equations for Movement from Central City to Suburbs. The availability of suburban rental housing was of increasing importance in attracting low-income individuals from central city to suburbs, whereas suburban owner housing discouraged such movement during later periods. Suburban employment growth attracted low-income persons during the 1950s and 1960s, but during the 1970s had the opposite effect. Whether this switch was due to the changing structure of suburban employment, or to more difficult conditions in housing markets during the 1970s that caused lower-income households to stay put, is unclear, but merits further attention. The availability of owner housing had a persistent influence in attracting high-income persons to the suburbs and from the central city. Suburban employment growth was also attractive during the 1950s and 1960s, but not during the 1970s, when neighborhood amenities assumed increased importance.

Equations for Movement from Suburbs to Central City. With respect to low-income movers, after 1960 the availability of rental housing in the central city was consistently attractive, while the availability of owner housing had the opposite influence. Suburban employment growth seems to have

encouraged the movement of low-income persons to the central city, and central city employment growth also encouraged such movement. With respect to high-income movers, central city employment growth had a persistently strong positive effect, which is consistent with Muth's model of intrametropolitan location. Central city owner housing was of some importance during the 1950s, but the availability of rental housing assumed added importance later, as did neighborhood amenities.

One of the more perplexing findings is that during the 1950s and 1960s suburban employment opportunities attracted low-income persons from the central city, but the same employment opportunities encouraged low-income individuals to relocate from suburbs to central cities. This finding seems to suggest a continuing circulation of low-income persons from the central city to the suburbs and back to the central city. Unfortunately, we are unable to do more than just speculate regarding the possible causes of the phenomenon. Frequently, places that experience much in-migration also experience much out-migration of persons with the same characteristics. Perhaps in the case of low-income movers from central city to suburbs, the cost of suburban housing (presumably rental housing) and the cost of living in general is found to be unaffordable, and the same individuals who moved out subsequently move back in. Other movement patterns are, of course, also possible. For example, low-income older households could be seeking suburban residences close to their suburban jobs, whereas low-income younger households are moving toward affordable rental housing in the central city. Unfortunately, the disaggregation by income and age that we discuss in the next section fails to shed additional light on these hypotheses.

Equations for In-Migration to Central City. Central city employment was not consistently important in causing high-income metropolitan in-migrants to locate in the central city. Recall that high-income central city in-movers had a positive effect on central city employment, which may suggest a process of causation that distinguishs healthier central cities from those that suffered from stagnation. Whereas during the 1950s and 1960s both rental and owner housing had significant positive effects in attracting in-migrants to the central city, during the 1970s this pattern changed somewhat when the influence of owner housing reversed. These results may suggest a kind of displacement of low-income central city residents and a deflection of low-income metropolitan in-migrants who in earlier periods may have opted for a central city location.

Equations for In-Migration to the Suburbs. Suburban rental housing had a consistent positive influence on the location decisions of low-income metropolitan in-migrants, whereas owner housing had a consistent positive influence on the decisions of high-income in-migrants. Both types of in-migrants tended to opt for central city jobs that required a commute from their suburban residences. Amenities were generally of much less importance than housing and jobs for the in-migrant groups.

Finally, if the quintile model were the only reported model, we would conclude, as Mills and Price do, that flight from blight variables are essentially unimportant by comparison with more fundamental determinants of intrametropolitan location, such as employment.

3.6 Life-Cycle Influences on Intrametropolitan Location

Because we have relied on the Public Use Microdata Samples for our mobility data for the 1970s, we have been able to develop the intrametropolitan

location model more fully for the 1970-1980 period. Many discussions of intrametropolitan mobility mention life-cycle factors as having some importance. For example, Rossi (1956) notes that most local moves he studied were housing adjustments made to accommodate life-cycle changes. Unfortunately, the published census data used previously to study the 1950s and 1960s cannot conveniently be used to study life-cycle factors. Since the data for the 1970s can be cross-classified by age, they lend themselves to a more exhaustive analysis.

One view of the life-cycle sequence of housing adjustments is that when a household is formed, the young, childless couple seeks a small, relatively inexpensive rental unit near the central-city work place. As children arrive, the household demands more space, and movement to the suburbs occurs. Several factors make it difficult to ascertain precisely how change in household composition affects intrametropolitan location decisions. First, not only does household composition change as the household ages, but also income grows, and the effects of the two are not easy to disentangle. Second, the dominance of the traditional family has eroded over time as the divorce rate, the age of first marriage, and the relative number of childless couples have all risen. As Frey and Kobrin (1982) point out, these factors increase the difficulty of determining the more or less pure effects of family life-cycle changes. Third, the suburbanization of employment opportunities means that many young people will work in the suburbs, and to be close to their jobs, they will also seek housing in the suburbs. When the centralization of employment diminishes, so to does the force of the argument that young couples first locate in the central city and later move to the suburbs as life-cycle changes occur.

In this part of the study, in order to investigate the influence of life-cycle factors on intrametropolitan location, we have disaggregated the equations of the location block by income and age, by income and presence of children, and by income and sex of household head. Although cross classification by income, age, and presence of children is desirable, the small size of the public use sample for individual central cities and suburban ring areas of SMSAs prevents this level of disaggregation.

3.6.1 Location by Income and Age

Age is used as a general proxy for stages in the life cycle. Our concerns are with those factors that differentially influence the mobility patterns of households at different stages of the life cycle. Most attention in the literature focuses on the home-ownership decision (McCarthy, 1976; Doling, 1976; Clarke and Onaka, 1983; Kendig, 1984). Movement to the suburbs has often been explained as movement toward owner-occupied housing. Kendig (1984) creates a model of home ownership that assigns preferences a secondary role in decisions on home ownership. In his study of Adelaide, Australia, 80 to 90% of the movers preferred to buy (Kendig 1984, p. 277). Lack of assets and sufficient household income deterred them.

> "The high rates of ownership among those meeting the thresholds of income and wealth show that most movers purchase when they can afford it... only among the disadvantaged did life cycle independently influence the proportions buying: 84 percent for couples and families vs 61 percent for singles. Those who had already passed through or into the child bearing years, or who were about to enter them, were especially likely to buy if they had the means. Age of the head of household had no effect on tenure choice after economic means and life cycle were taken into account" (Kendig, 1984, p. 278).

Kendig thus believes that his results indicate that the life cycle influences the home-ownership decision through being associated with a particular level of economic resources.

Kendig's work leads us to expect high-income households to respond to growth of owner-occupied housing no matter what the age of the head of the household. Linneman's work on the relative productive efficiency of landlords might mitigate this effect for central city in-movement. For low- and middle-income households, an increase in the age of the head is associated with an increase in assets and children present, at least up to age 50. Both of these correlations would lead us to expect increased attraction of owner-occupied housing as age increases. Consequently, for middle-income groups the older age bracket (40-65) should be more strongly influenced by owner housing than the younger group. In the low-income group young movers (18-29) should be more strongly influenced by rental housing than the older group.

The relative effect of employment growth by age depends upon relative valuations of the opportunity cost of commuting time as age increases. If commuting cost rise with age, employment growth in a locale should have a larger impact on the older age group. Theoretically, this could occur because family responsibilities increase with age, and thus time at home is assigned a higher value. However, the disamenity effects of employment growth would also rise with increases in family size.

We would expect larger families to place a higher value on neighborhood amenities. If age proxies family size, then older households (40-65) should be more positively influenced by income growth and more negatively influenced by crime rates and population density. If blacks are regarded as a disamenity, the same can be said for the percent nonwhite variable.

The results for income ($0-6000, $6000-15000, and $15000 and up) and age (18-29 and 40-65) are reported in Tables 3.21-3.24. For movers from central city to suburbs the housing variables are more important for the young (18-29)

than for the old (40-65) (Table 3.21). As expected, young, low-income households are attracted to rental housing and are deterred by owner housing. All high-income households are strongly attracted to owner housing, but young households more so than older households. Certain ambiguities are also evident. Our age categories are ambivalent and diffuse. The 18-29 year old group contains some young couples with children, whereas the 40-65 age group contains some older households whose children have departed. In general, however, the results seems to bear out Kendig's prediction that life cycle factors are secondary to economic factors.

Across income group and age of head, employment growth in the central city has a strong positive effect on movement to the suburbs (Table 3.21). This is exactly the same phenomenon as reported earlier for the basic income model (Table 3.8). In this respect, the disaggregation by age does not cause us to alter the findings previously reported. Suburban income growth has no significant impact on movement from central city to suburbs, except for those with the highest income.

Crime rate per capita in the central city has a significant positive influence on low-income movement from central city to suburbs for young and old households. Since crime is neighborhood specific, this probably is not a surprising finding. The aggregate impact is greater for the young than for the old, however. Other amenity variables are generally insignificant.

In conclusion, certain interesting results emerge from the age-income disaggregation of movers from central city to suburbs. Housing has a stronger influence on younger households than on older households. Employment growth in the central city has a strong push effect across all groups. Taken together these findings imply that if age is important in suburbanization, then it

TABLE 3.21

Movement from Central Cities to Suburbs, by Income Class and Age, 1970-1980: Two Stage Least Squares Estimates and Absolute t-Ratios

Independent variables	0 - $6000		$6000 - $15000		$15000 and over	
	18-29	40-65	18-29	40-65	18-29	40-65
New Rental Housing in S	0.23 (4.55)	0.12 (4.06)	-0.01 (0.25)	0.07 (2.13)	-0.02 (0.93)	0.01 (0.39)
New Owner Housing in S	-0.06 (2.96)	-0.03 (2.75)	0.01 (0.37)	0.01 (0.79)	0.04 (4.31)	0.02 (1.36)
Employment Change in S	0.00 (0.19)	0.00 (0.27)	0.04 (2.55)	-0.01 (0.53)	0.00 (0.23)	0.01 (1.19)
Employment Change in CC	0.02 (2.93)	0.02 (2.97)	0.02 (3.00)	0.02 (3.37)	0.01 (2.55)	0.01 (2.29)
Income Change in S	-0.40 (1.37)	-0.06 (0.34)	-0.16 (0.53)	-0.19 (0.43)	0.31 (2.11)	0.37 (1.90)
No. of Residents of This Type in CC	0.02 (3.36)	0.01 (3.14)	0.07 (5.04)	0.01 (3.16)	0.10 (5.15)	0.02 (4.64)
Residents in Group, CC/SMSA	-2456 (0.53)	-1232 (0.51)	-16041 (3.67)	-744 (0.24)	-3229 (1.72)	-800 (0.30)
Crime Rate per 10,000, t-10	3..79 (1.41)	3.79 (2.16)	5.81 (1.79)	1.57 (0.70)	-2.37 (1.61)	-0.31 (0.14)
Percent Nonwhite CC/S, t-10	32.21 (0.87)	7.40 (0.34)	11.83 (0.31)	32.39 (1.19)	18.61 (1.09)	25.42 (1.00)
Pop. Density in CC, t-10	-0.23 (1.61)	-0.06 (0.66)	-0.08 (0.54)	0.09 (0.81)	0.05 (0.64)	0.06 (0.65)
Constant	5511 (1.44)	252 (0.12)	12864 (3.37)	-105 (0.04)	-2128 (1.22)	3995 (1.53)
OLS R^2 (adj.)	.75	.70	.71	.67	.80	.78

is young households, perhaps with young children, that are most heavily influenced by housing opportunities. The highest income households, regardless of age, are also attracted to the suburbs by suburban amenities, but are generally not encouraged to leave the central city due to disamenities that are found there.

The conventional life-cycle literature notes that as children leave the home and less space is needed, couples may choose to sell their suburban home and rent closer to the city center. This argument assumes central city employment dominance. More recently the regentrification literature has held out hope that nontraditional, childless households and young singles would find central city living attractive. Frey and Kobrin (1982) investigate this possibility across three time periods (1955-60, 1965-70, 1970-75) for age-specific household types. While they find that primary individuals are more city directed than husband-wife households, they note that these households are still a small minority and central city populations are unlikely to increase as a result. Frey and Kobrin also note that mobility rates of different household types are converging in large northern metropolitan areas, that primary individuals are becoming less city directed, and that married couples with children are slightly less suburban directed. In southern and western metropolitan areas, however, all household types except for primary individuals still show a strong suburban directedness.

To the extent that the older (40-65) households who move back into the city are childless, we expect rental housing built in the period to have a strong positive effect. For young households that may frequently lack the resources to purchase their own housing, movement back into the city will be influenced still more by rental housing. Our results (Table 3.22) indicate

TABLE 3.22

Movement from Suburbs to Central City, by Income Class and Age, 1970-1980: Two Stage Least Squares Estimates and Absolute t-Ratios

Independent variables	0 - $6000		$6000 - $15000		$15000 and over	
	18-29	40-65	18-29	40-65	18-29	40-65
New Rental Housing in CC	0.07	0.03	0.01	0.00	-0.01	0.02
	(3.09)	(2.22)	(0.71)	(2.02)	(0.76)	(2.28)
New Owner Housing in CC	-0.04	-0.01	0.01	0.00	0.04	0.02
	(0.96)	(0.50)	(0.12)	(0.09)	(2.55)	(0.82)
Employment Change in S	-0.01	-0.00	0.00	0.00	0.00	-0.00
	(0.53)	(0.07)	(0.16)	(0.15)	(0.30)	(0.86)
Employment Change in CC	0.01	0.01	0.01	0.01	0.00	0.01
	(1.42)	(1.88)	(1.80)	(2.91)	(0.25)	(2.43)
Income Change in CC	-0.05	-0.04	0.05	0.03	0.11	0.04
	(0.21)	(0.33)	(0.28)	(0.42)	(1.55)	(0.40)
No. of Residents of This Type in S	0.07	0.03	0.03	0.01	0.01	0.00
	(7.65)	(6.90)	(3.36)	(3.74)	(1.29)	(2.48)
Residents in Group, CC/SMSA	2103	1003	2540	346	-1330	-94
	(0.66)	(0.64)	(0.87)	(0.30)	(1.21)	(0.07)
Crime Rate per 10,000, t-10	-5.42	-2.04	-1.34	0.19	-0.05	-0.27
	(2.04)	(1.58)	(-0.60)	(0.21)	(0.06)	(0.24)
Percent Nonwhite CC/S, t-10	61.56	26.49	42.04	4.35	11.19	19.47
	(2.06)	(1.76)	(1.68)	(0.43)	(1.28)	(1.64)
Pop. Density in CC, t-10	-0.15	-0.10	-0.10	-0.06	0.01	-0.06
	(1.36)	(1.83)	(1.16)	(1.56)	(0.35)	(1.14)
Constant	1308	226	-35.99	-510	-569	-217
	(0.45)	(0.16)	(0.02)	(0.57)	(0.82)	(0.20)
OLS R^2 (adj.)	.80	.69	.55	.61	.51	.57

that older households in every income group that moved from central city to suburbs were significantly influenced by rental housing built in the central city during the time period of their move. Owner housing has no significant influence on these older in-movers at all. Young, low-income households are attracted significantly by rental housing, whereas high-income young households are attracted to owner housing.

Employment growth in the central city has a strong positive influence on older households moving from suburbs to central city, regardless of income. This result ties in closely with the result on housing and suggests that older professionals may move closer to the city center and rent in order to be near their jobs. This finding is also consistent with Muth's model of intraurban location.

Income growth in the central city had no significant influence on movement back in by any age/income group. Low-income young households are significantly deterred by a high central city crime rate. Low-income older households are marginally influenced, while middle- and high-income households are not affected at all by crime. This result is symmetrical with that for movement from central city to suburbs. Curiously, precent nonwhite has an unanticipated sign for all income/age groups and is significant for the low-income in-movers from suburbs to central city.

The results for older middle- and high-income movers from suburbs to central city indicates that they are motivated by somewhat different forces than older middle- and high-income movers in the opposite direction. The former are drawn to rental housing and attracted by central city employment growth, whereas latter are drawn to owner housing and pushed by central city employment growth. These results suggest that some other variable, such as

presence of children, may distinguish these two gropus. We will discuss this point in a later section.

For young households housing motivations are strong. Young, low-income movers from suburbs to cities and from central cities to suburbs are attracted by rental housing growth, whereas young, high-income movers are attracted by owner housing. As for older households, central city employment growth exerts a strong influence on their movement into the city. Suburban employment growth, on the other hand, was significant in attracting only the young, middle-income group to the suburbs.

Surprisingly, for low-income in-migrants to the central city, both young and old, rental housing growth had a significant negative influence (Table 3.23). Most discussions of displacement and regentification express concern that the influx of high-income households will squeeze out the existing poor. It seems reasonable that prior to that happening, it would operate to decrease low-income in-migration. The puzzle is that no such effect occurs for low-income intrametropolitan movers who are attracted by rental housing.

At the middle-income levels a decided split occurs. Young, middle-income in-migrants to the city are attracted by rental housing growth, whereas older middle-income in-migrants are deterred by it and attracted by owner housing growth. At the high income level, the young are not significantly influenced by housing, but older high-income in-migrants are strongly influenced by owner housing.

Perhaps the most important variable encouraging in-migrants to locate in the central city is employment growth. It is highly significant across all income/age groups but is most important for low-income in-migrants, particularly the young. The amenity variables do not carry particularly high

TABLE 3.23

In-Migration to the Central City, by Income Class and Age, 1970-1980: Two Stage Least Squares Estimates and Absolute t-Ratios

Independent Variables	0 - $6000		$6000 - $15000		$15000 and over	
	18-29	40-65	18-29	40-65	18-29	40-65
New Rental Housing in CC	-0.25	-0.11	0.14	-0.09	0.01	0.02
	(1.99)	(2.80)	(2.56)	(2.39)	(0.56)	(1.12)
New Owner Housing in CC	-0.14	0.09	0.08	0.14	0.01	0.10
	(1.23)	(2.28)	(1.43)	(3.68)	(0.85)	(6.25)
Employmkent Change in S	-0.03	-0.01	0.00	-0.01	-0.01	-0.00
	(1.49)	(1.79)	(0.30)	(2.11)	(2.65)	(1.76)
Employment Change in CC	0.21	0.06	0.03	0.04	0.01	0.01
	(8.16)	(5.28)	(2.28)	(3.38)	(3.50)	(3.21)
Income Change in CC	0.78	0.04	0.46	0.13	0.03	0.00
	(1.39)	(0.21)	(1.88)	(0.76)	(0.30)	(0.03)
No. of Residents of This Type in CC	0.35	0.07	0.08	0.05	0.19	0.02
	(10.23)	(8.37)	(2.43)	(5.00)	(6.47)	(4.32)
Residents in Group, CC/SMSA	-11638	-9199	-5369	-6815	-1496	-1090
	(1.45)	(3.53)	(1.35)	(2.63)	(1.23)	(0.99)
Crime Rate per 10,000, CC, t-10	5.67	3.85	1.15	3.90	1.34	1.34
	(0.85)	(1.76)	(0.39)	(1.23)	(0.48)	(1.47)
Percent Nonwhite CC/S, t-10	35.12	45.29	29.56	27.24	-4.89	-13.93
	(0.47)	(1.80)	(0.93)	(2.00)	(1.62)	(1.54)
Pop. Density in CC, t-10	0.02	-0.08	-0.06	-0.00	0.01	0.03
	(0.89)	(0.95)	(0.58)	(0.03)	(0.18)	(0.75)
Constant	-2444	1754	-1641	-1450	-384	-478
	(0.33)	(0.74)	(0.59)	(0.75)	(0.47)	(0.55)
OLS R^2 (adj.)	.95	.92	.93	.87	.94	.95

t-values, and for those coefficients that approach significance, the sign is frequently contrary to expectations.

With the exception of middle-income, older households, in-migrants to the suburbs were significantly attracted to rental housing. This finding reinforces a pattern noted in the basic income model. However, the influence of owner housing does vary across income/age groups. It has a significant deterrent effect on young, low-income in-migrants to the suburbs and a significant positive influence on young, high-income in-migrants. Older in-migrants, especially in the middle-income class, are also importantly influenced by owner housing.

Suburban employment growth discouraged low- and middle-income, older persons from locating in the suburbs. Young persons regardless of income were attracted to suburbs whose central city was experiencing sizable employment growth. Suburban income growth has a significant positive influence on young, high-income in-migrants. Except for the marginal significance of central city crime on older high-income in-migrants, the amenity variables lack statistical significance in Table 3.24.

3.6.2 Location by Income and Presence of Children

In models of urban spatial structure high-income families with children locate on the edge. It is assumed that commuting costs for these families do not rise with distance as rapidly as the marginal cost of space falls. Our work attempts to investigate those factors that differentially influence intrametropolitan movement by families with children. We report the results for location equations where movement flows have been disaggregated by three income levels and the presence or nonpresence of children.

TABLE 3.24

In-Migration to the Suburbs, by Income Class and Age, 1970-1980: Two Stage Least Squares Estimates and Absolute t-Ratios

Independent Variables	0 - $6000		$6000 - $15000		$15000 and over	
	18-29	40-65	18-29	40-65	18-29	40-65
New Rental Housing in S	0.57	0.19	0.24	0.18	0.07	0.23
	(3.49)	(1.97)	(2.92)	(1.62)	(2.10)	(2.41)
New Owner Housing in S	-0.13	0.05	0.02	0.10	0.02	0.06
	(2.48)	(1.47)	(0.62)	(2.56)	(2.00)	(1.81)
Employment Change in S	-0.05	-0.07	0.01	-0.07	-0.00	-0.03
	(1.23)	(2.88)	(0.29)	(2.10)	(0.35)	(1.11)
Employment Change in CC	0.05	0.01	0.03	0.01	0.02	0.02
	(3.03)	(0.56)	(2.47)	(0.72)	(2.94)	(1.65)
Income Change in S	-0.15	-0.07	0.52	-0.99	0.51	0.57
	(0.23)	(0.15)	(1.09)	(1.64)	(2.42)	(1.08)
No. of Residents of This Type in S	0.14	0.02	0.03	-0.01	0.03	-0.01
	(3.74)	(1.22)	(1.62)	(0.65)	(1.16)	(0.50)
Residents in Group, CC/SMSA	-882	-7057	2503	552	2560	2254
	(0.12)	(1.42)	(0.51)	(0.08)	(1.27)	(0.46)
Crime Rate per 10,000, CC, t-10	8.87	-0.89	7.98	-0.58	1.95	8.91
	(1.24)	(0.19)	(1.53)	(0.09)	(0.96)	(1.63)
Percent Nonwhite CC/S, t-10	-29.95	-38.80	-39.44	-49.92	23.76	-44.99
	(0.37)	(0.69)	(0.64)	(0.65)	(1.02)	(0.73)
Pop. Density in CC, t-10	-0.32	-0.26	-0.02	-0.03	0.20	0.37
	(1.01)	(1.16)	(0.08)	(0.09)	(2.10)	(1.49)
Constant	1384	5332	-7022	12508	-8764	-11900
	(0.18)	(1.06)	(1.29)	(1.85)	(3.60)	(1.81)
OLS R^2 (adj.)	.87	.54	.83	.45	.83	.71

Families with children will have a higher demand for internal and external space than families without them. Linneman (1985) has noted that the landlord's relative productive efficiency disappears in low density settlement, where transaction costs are liable to be higher. At each income level we predict that families with children will be more influenced by the growth of owner housing than those without them. However, economic resources are of primary importance. Needing more space does not mean a household has the income or assets to afford it.

We have discussed employment growth's potential impact in detail elsewhere. Here we note that to the extent employment growth in the city has disamenity effects on residents and competes for scarce land, the negative influence should be greater for families with children at any particular income level. Presumably families with children are going to be somewhat more sensitive than families without chldren to various amenity variables. However, children are a drain on economic resources. As a consequence, families with children of any particular income level may not have the same effective demand for amenities as families without children. We are unable to predict whether they will be more or less influenced by these variables.

Low-income families with children are attracted to the suburbs by the availability of rental housing (Table 3.25). The same is true of low-income families without children, except that the coefficient on the rental housing variable is substantially higher in the regression for those with children (0.15) than in the regression for those without children (0.05). Regardless of presence of children, high-income families are attracted to the suburbs by owner housing, but again the effect is about twice as strong for those with children (0.06) as for those with no children present (0.03). The

TABLE 3.25

Movement from Central City to Suburbs, by Income Class and Presence of Children, 1970-1980: Two Stage Least Squares Estimates and Absolute t-Ratios

Independent Variables	Children Present			No Children Present		
	0-$6000	$6000-$15000	$15000-Up	0-$6000	$6000-$15000	$15000-Up
New Rental Housing, S	0.15 (3.48)	0.13 (1.33)	-0.02 (0.31)	0.05 (2.14)	0.09 (1.52)	0.08 (1.85)
New Owner Housing, S	-0.04 (2.66)	0.03 (0.93)	0.06 (3.19)	-0.01 (0.62)	0.02 (1.25)	0.03 (2.00)
Employment Growth, S	-0.00 (0.20)	-0.00 (0.02)	0.01 (0.57)	0.00 (0.34)	0.01 (0.42)	-0.01 (0.07)
Employment Growth, CC	0.03 (3.83)	0.04 (2.70)	0.01 (0.95)	0.00 (0.80)	0.01 (0.90)	0.01 (1.51)
Income Change, S	-0.30 (1.41)	0.09 (0.19)	0.68 (2.44)	-0.14 (1.10)	0.06 (0.22)	0.62 (2.96)
No. of Residents by Income/Children, CC	0.01 (3.49)	0.03 (4.45)	0.05 (5.25)	0.00 (1.29)	0.01 (2.25)	0.02 (4.05)
Residents in Group CC/SMSA	-2892 (0.94)	-19169 (2.51)	-5216 (1.16)	-437 (0.23)	-2004 (0.47)	-2007 (0.59)
Crime Rate per 10,000 in CC, t-10	3.13 (1.33)	-3.51 (0.61)	-3.97 (1.14)	1.24 (0.90)	-3.18 (1.00)	-2.53 (0.97)
Percent Nonwhite CC/SUB, t-10	19.21 (0.65)	93.67 (1.39)	60.78 (1.50)	-15.31 (0.89)	22.65 (0.59)	41.49 (1.37)
Pop. Density CC, t-10	-0.13 (1.19)	-0.25 (0.96)	0.03 (0.17)	-0.06 (0.81)	0.01 (0.09)	0.01 (0.12)
Constant	4119 (1.61)	9349 (1.54)	-5413 (1.39)	1855 (1.24)	2484 (0.70)	-6063 (2.05)
OLS R^2 (adj.)	0.63	0.67	0.80	0.54	0.69	0.80

availability of housing has a much smaller impact on the middle-income group. Higher central city employment growth encourages movement to the suburbs of low- and middle-income families with children, but suburban employment growth fails to attract any group.

The availability of suburban amenities as measured by suburban income growth is important for the high-income movers from central city to suburbs regardless of presence of children. Moreover, the percent nonwhite variable is significant at 10 percent for middle- and high-income families with children and for high-income families with no children.

Movement from suburbs to central city is strongly motivated by the availability of central city employment opportunities. Housing is at best marginally significant in any of the regressions of Table 3.26. However, central city employment growth is highly significant for middle- and high-income families with children and for households with no children regardless of income. The amenity variables are generally insignificant in the regressions of Table 3.26. Thus, jobs in the city are the major factor in attracting households to relocate from suburbs to central city.

For SMSA in-migrants, central city jobs are also of considerable importance in the decision to locate in the central city. Central city employment growth is statistically significant in every regression of Table 3.27. However, relative to relocators from the suburbs, central city housing is also of some importance for in-migrants. Owner housing is significant for both middle- and high-income families with children present and for high-income families with no children. Moreover, rental housing is important for high-income families with no children. Again, the amenity variables are generally insignificant, with one notable exception. Low-income

TABLE 3.26

Movement from Suburbs to Central City, by Income Class and Presence of Children, 1970-1980: Two Stage Least Squares Estimates and Absolute t-Ratios

Independent Variables	Children Present			No Children Present		
	0-$6000	$6000-$15000	$15000-Up	0-$6000	$6000-$15000	$15000-Up
New Rental Housing, CC	0.00 0.35	-0.01 0.32	0.00 0.30	0.01 0.83	0.02 1.36	0.02 1.74
New Owner Housing, CC	-0.01 0.24	0.05 1.11	0.03 1.50	-0.00 0.13	-0.02 0.53	-0.00 0.15
Employment Growth, S	-0.01 1.54	0.00 0.18	0.01 1.97	0.00 0.98	0.01 0.94	0.00 0.39
Employment Growth, CC	0.01 1.68	0.01 2.04	0.01 2.94	0.01 2.38	0.02 2.96	0.01 2.89
Income Change, CC	0.05 0.44	0.01 0.06	0.16 1.72	-0.07 1.03	-0.02 0.13	-0.03 0.28
No. of Residents by Income/Children, S	0.05 8.01	0.01 3.96	0.00 0.99	0.01 3.80	0.12 4.09	0.01 2.92
Residents in Group CC/SMSA	3651 1.98	2427 0.77	-376 0.22	1390 1.24	2175 0.86	830 0.51
Crime Rate per 10,000 in CC, t-10	-1.35 0.85	-1.70 0.76	-0.30 0.24	-0.09 0.11	-1.18 0.59	-1.29 0.97
Percent Nonwhite CC/SUB, t-10	23.04 1.23	33.86 1.34	21.21 1.60	13.70 1.40	50.277 2.22	16.83 1.20
Pop. Density CC, t-10	-0.11 1.68	-0.09 1.06	0.04 0.79	-0.02 0.62	-0.15 1.80	-0.06 0.97
Constant	-2188 1.32	207 0.10	-1498 1.35	-303 0.33	-102 0.05	444 0.35
OLS R^2 (adj.)	0.67	0.56	0.69	0.44	0.59	0.57

TABLE 3.27

In-Migration to the Central City, by Income Class and Presence of Children, 1970-1980: Two Stage Least Squares Estimates and Absolute t-Ratios

Independent Variables	Children Present			No Children Present		
	0-$6000	$6000-$15000	$15000-Up	0-$6000	$6000-$15000	$15000-Up
New Rental Housing, CC	-0.18 (2.87)	-0.16 (2.21)	-0.03 (1.90)	-0.08 (1.95)	-0.10 (1.96)	0.04 (1.90)
New Owner Housing, CC	0.01 (0.27)	0.29 (4.53)	0.12 (5.75)	0.02 (0.47)	0.07 (1.47)	0.06 (2.82)
Employment Growth, S	0.01 (1.76)	0.00 (0.33)	-0.01 (1.65)	0.00 (0.79)	0.01 (0.84)	0.00 (0.87)
Employment Growth, CC	0.13 (6.53)	0.08 (3.49)	0.03 (8.27)	0.07 (5.20)	0.11 (7.43)	0.02 (3.06)
Income Change	0.09 (0.36)	0.18 (0.67)	0.03 (0.38)	-0.02 (0.09)	0.12 (0.56)	0.03 (0.26)
No. of Residents by Income/Children, CC	0.14 (8.52)	0.07 (4.68)	0.06 (8.78)	0.08 (7.21)	0.07 (8.04)	0.03 (5.33)
Residents in Group CC/SMSA	-4864 (1.40)	-6386 (1.33)	-3940 (2.52)	-4201 (1.50)	-5018 (1.50)	-1767 (1.00)
Crime Rates per 10,000 in CC, t-10	-0.84 (0.27)	2.32 (0.68)	-2.44 (0.22)	3.92 (1.66)	3.31 (1.19)	2.06 (1.52)
Percent Nonwhite CC/SUB, t-10	96.91 (2.60)	38.18 (1.00)	-6.80 (0.55)	41.62 (1.49)	54.67 (1.77)	-8.75 (0.59)
Pop. Density CC, t-10	-0.10 (0.80)	0.01 (0.07)	0.05 (1.05)	-0.12 (1.10)	-0.09 (0.76)	-0.03 (0.48)
Constant	1433 (0.47)	-440 (0.14)	528 (0.51)	-369 (0.16)	-1142 (0.42)	-787 (0.59)
OLS R^2 (adj.)	0.92	0.91	0.96	0.88	0.94	0.95

families with children are attracted to central cities that have relatively high concentrations of nonwhite persons. This finding probably reflects the location patterns of poor black families.

SMSA in-migrants who located in the suburbs, regardless of income level or presence of children, were encouraged to do so by growth of central city employment (Table 3.28). The general lack of significance of the variable for suburban employment growth suggests that these families were commuting to work in the central city. Availability of suburban rental housing was important in the suburban location decisions of low-income families with children, whereas owner housing was critical for middle-income families with children, as well as for middle-income households with no children. The highest income households, whether or not children were present, had a strong tendency to select a suburban residence when population density was high in the central city. Moreover, high central city crime rates encouraged middle- and high-income families with children to select a suburban residence, as well as high-income households with no children.

In general, we find that for low-income families with children the availability of suburban rental housing is important in their decision to locate in the suburbs. The availability of owner housing is more important for high-income households with children. Many households that locate in the suburbs presumably have members who commute to work in the central city, because central city employment opportunities are consistently important across income classes and regardless of presence of children. Finally, amenities are generally not critical in location decisions of households disaggregated by income and presence of children, except perhaps for the

TABLE 3.28

In-Migration to the Suburbs, by Income Class and Presence of Children, 1970-1980: Two Stage Least Squares Estimates and Absolute t-Ratios

Independent Variables	Children Present			No Children Present		
	0-$6000	$6000-$15000	$15000-Up	0-$6000	$6000-$15000	$15000-Up
New Rental Housing, S	0.15 (1.92)	0.11 (0.81)	0.14 (1.06)	0.05 (0.46)	0.16 (0.87)	0.23 (2.15)
New Owner Housing, S	-0.01 (0.29)	0.11 (2.65)	0.06 (1.47)	0.03 (1.07)	0.12 (2.38)	0.04 (1.22)
Employment Growth, S	-0.02 (0.85)	0.07 (1.61)	0.05 (1.12)	-0.02 (0.67)	-0.02 (0.42)	0.02 (0.60)
Employment Growth, CC	0.04 (4.61)	0.07 (3.53)	0.05 (2.54)	0.04 (2.70)	0.05 (2.19)	0.05 (3.18)
Income Change, S	-0.30 (0.98)	-0.99 (1.67)	0.67 (1.16)	-0.64 (1.43)	-0.76 (1.04)	0.42 (0.96)
No. of Residents by Income/Children, S	0.07 (3.84)	0.01 (1.01)	0.01 (0.69)	0.06 (3.22)	-0.00 (0.15)	-0.01 (1.02)
Residents in Group CC/SMSA	-1243 (0.35)	1995 (0.30)	3825 (0.61)	-327 (0.06)	-7147 (0.87)	3277 (0.73)
Crime Rate per 10,000 in CC, t-10	0.30 (0.09)	14.21 (2.02)	11.55 (1.70)	388.62 (0.01)	-0.98 (0.11)	9.07 (1.79)
Percent Nonwhite CC/SUB, t-10	-33.29 (0.81)	-68.06 (0.83)	-6.41 (0.08)	-29.28 (0.47)	-139.22 (1.35)	-18.13 (0.32)
Pop. Density CC, t-10	-0.10 (0.68)	0.25 (0.82)	0.60 (2.08)	-0.11 (0.48)	0.22 (0.56)	0.57 (2.56)
Constant	5321 (1.48)	7872 (1.13)	-15639 (2.05)	6641 (1.23)	14528 (1.64)	-12343 (2.13)
OLS R^2 (adj.)	0.79	0.83	0.80	0.54	0.60	0.79

highest income families, for whom presence or absence of children makes little difference.

3.6.3 Location by Income and Sex of Household Head

One of the major social changes of the 1970s was the increase in female-headed households. Many scholars worried that relatively low incomes of these households would have an adverse impact on the increasing percentage of children raised in them. One component of the life-cycle difference is spatial. Female-headed households are more likely to be near the city center and live in rental housing.

Much discussion has also centered on whether female household heads in middle-income groups are discriminated against in the homeowner market. Even if that is not the case, women may have asset bases that are not as great as those of comparably aged men. For these reasons we expect female-headed households to be more attracted by rental housing than male-headed households of equal income. Since female-headed households are far more likely to have only one parent present, commuting costs from a family perspective will be larger and the attraction of employment in the location of residence correspondingly greater.

Moreover, security considerations may be greater for female-headed households. A single adult household has less security than a two adult household. Crime also tends to be neighborhood specific and women at any particular income level are less likely to be able to afford a safe neighborhood in the city.

We have estimated location equations for male- and female-headed households by three income categories for the 1970-1980 period. Information on movement comes from the public use survey. Since this is a one in 200 sample

of movers, the number of female-headed households surveyed is extremely small in the upper income range. As a consequence, our results for lower- and middle-income female-headed households are more reliable than those for high-income female-headed households.

Male-headed households exhibit the pattern we have described previously. Low-income movers from central city to suburbs are attracted to rental housing and discouraged by the growth of owner housing. Middle-income households are ambiguous in their response. High-income movers are strongly attracted to suburban owner housing growth (Table 3.29).

Female-headed households exhibit a strikingly different pattern. Rental housing growth has a very significant positive effect on both low- and middle-income female movers from central city to suburbs. Owner housing growth has a significantly negative effect for low-income female movers from central city to suburbs, and even high-income female households are not attracted to owner housing in the suburbs.

Employment growth in the central city still exhibits the significant push effect for all groups except high-income males. Employment growth in the suburbs is no more attractive for female-headed households than for male-headed households, however.

For low-income female-headed households, movers from central city to suburbs were discouraged income growth in the suburbs. More curiously, whereas high-income male-headed households were significantly attracted by income growth in the suburbs, high-income female-headed households were not. A noteworthy result is that middle class female-headed households exhibit a reasonably strong response to central city crime. Percent nonwhite and population density in the central city had no significant effect on any income/sex group.

TABLE 3.29

Movement from Central City to Suburbs, by Income Class and Sex of Household Head, 1970-1980: Two Stage Least Squares Estimates and Absolute t-Ratios

Independent Variables	Male Head			Female Head		
	0-$6000	$6000-$15000	$15000-Up	0-$6000	$6000-$15000	$15000-Up
New Rental Housing, S	0.15 (3.26)	0.22 (1.44)	0.11 (1.00)	0.06 (3.16)	0.03 (1.96)	-0.00 (0.25)
New Owner Housing, S	-0.03 (2.03)	0.06 (1.27)	0.09 (2.58)	-0.02 (2.54)	-0.01 (1.53)	-0.00 (0.65)
Employment Growth, S	-0.00 (0.29)	-0.01 (0.16)	-0.02 (0.46)	0.00 (0.44)	0.00 (0.88)	0.00 (1.53)
Employment Growth, CC	0.02 (3.12)	0.04 (1.92)	0.02 (1.13)	0.01 (2.55)	0.01 (3.05)	0.00 (1.94)
Income Change, S	-0.30 (1.28)	0.28 (0.39)	1.57 (3.16)	-0.17 (1.80)	-0.06 (0.84)	-0.00 (0.25)
No. of Residents by Income/Sex, CC	0.01 (2.71)	0.02 (3.57)	0.03 (4.63)	0.01 (2.81)	0.01 (1.46)	0.02 (2.68)
Respective Group CC/SMSA	-2315 (0.65)	-17790 (1.58)	-6832 (0.87)	-481 (0.37)	343 (0.34)	-286 (1.34)
Crime Rates per 10,000 by CC, t-10	3.00 (1.24)	-7.51 (0.91)	-6.81 (1.15)	1.43 (1.38)	1.52 (1.86)	0.13 (0.62)
Percent Nonwhite CC/SUB, t-10	1.02 (0.03)	123.85 (1.27)	101.41 (1.47)	2.89 (0.22)	-2.68 (0.28)	0.79 (0.32)
Pop. Density CC, t-10	-0.16 (1.34)	-0.26 (0.66)	-0.02 (0.07)	-0.03 (0.71)	0.03 (0.66)	-0.00 (0.19)
Constant	4051 (1.52)	9425 (1.04)	-14119 (2.09)	1928 (1.59)	-19 (0.02)	223 (0.90)
OLS R^2 (adj.)	0.62	0.68	0.81	0.67	0.61	0.38

In conclusion, female-headed households respond significantly differently than male-headed households, except at low levels of income. For women the attraction of rental housing and the fear of crime persists into the middle-income group. Our results for high-income women are more suspect, because of the small numbers of high-income, female-headed households in our sample.

For neither male- and female-headed households moving from suburbs to central city is rental housing growth in the central city particularly important, although the variable for rental housing is marginally significant for middle- and high-income females (Table 3.30). Central city employment growth is attractive for all groups except high-income women. In regressions not reported here, central city manufacturing employment, as opposed to nonmanufacturing employment, proves to be attracting both male- and female-headed households with low and medium levels of income.

Income growth in the central city was not a significant influence on any group. Low-income female-headed households who are drawn by rental housing and employment in the city are significantly repelled by crime there. This same result does not hold for low-income male-headed households. Percent nonwhite has no significant impact on any group, but population density in the central city has a significant negative influence on both middle class male- and female-headed households.

Owner housing growth in the central city had a significant influence on middle- and high-income male in-migrants to the central city and middle-income female in-migrants (Table 3.31). Employment growth in the central city attracted each income/sex group to central city. Again we observe the importance of central city jobs, and again manufacturing jobs prove to be particularly attractive.

TABLE 3.30

Movement from Suburbs to Central City, by Income Class and Sex of Household Head, 1970-1980: Two Stage Least Squares Estimates and Absolute t-Ratios

Independent Variables	Male Head			Female Head		
	0-$6000	$6000-$15000	$15000-Up	0-$6000	$6000-$15000	$15000-Up
New Rental Housing, CC	0.02 (0.92)	0.03 (0.89)	0.02 (1.24)	0.00 (0.79)	0.01 (1.52)	0.00 (1.77)
New Owner Housing, CC	-0.04 (1.06)	-0.03 (0.44)	0.02 (0.46)	-0.00 (0.34)	-0.01 (0.70)	0.00 (1.36)
Employment Growth, S	0.00 (0.23)	-0.00 (0.00)	0.01 (1.15)	-0.00 (0.02)	-0.00 (0.99)	0.00 (0.18)
Employment Growth, CC	0.01 (2.34)	0.03 (2.92)	0.02 (3.28)	0.00 (2.03)	0.01 (3.51)	-0.00 (0.09)
Income Change, CC	0.05 (0.27)	0.27 (0.93)	0.15 (0.84)	0.01 (0.22)	0.01 (0.35)	0.01 (0.65)
No. of Residents by Income/Sex, S	0.02 (4.43)	0.01 (4.52)	0.00 (2.06)	0.04 (6.27)	0.03 (5.26)	0.00 (1.02)
Respective Group CC/SMSA	4704 (1.67)	5455 (1.08)	683 (0.22)	1374 (1.72)	310 (0.54)	-25 (0.24)
Crime Rate per 10,000 in CC, t-10	-0.09 (0.04)	-1.72 (0.46)	-1.41 (0.60)	-1.32 (1.73)	-0.52 (1.00)	-0.06 (0.46)
Percent Nonwhite CC/SUB, t-10	23.14 (0.95)	73.42 (1.76)	35.21 (1.42)	8.11 (0.91)	6.20 (1.06)	0.63 (0.47)
Pop. Density CC, t-10	-0.07 (0.87)	-0.26 (1.75)	-0.02 (0.23)	-0.04 (1.34)	-0.04 (1.55)	0.00 (0.55)
Constant	-2949 (1.32)	-2106 (0.57)	-1142 (0.52)	-328 (0.40)	-46 (0.09)	-66 (0.58)
OLS R^2 (adj.)	0.44	0.58	0.66	0.62	0.63	0.47

TABLE 3.31

In-Migration to the Central City, by Income Class and Sex of Household Head, 1970-1980: Two Stage Least Squares Estimates and Absolute t-Ratios

Independent Variables	Male Head			Female Head		
	0-$6000	$6000-$15000	$15000-Up	0-$6000	$6000-$15000	$15000-Up
New Rental Housing, CC	-0.13 (1.75)	-0.21 (1.94)	0.02 (0.57)	-0.06 (2.08)	-0.03 (2.92)	0.00 (0.20)
New Owner Housing, CC	-0.04 (0.58)	0.26 (2.75)	0.20 (5.49)	0.01 (0.40)	0.02 (2.47)	-0.01 (1.59)
Employment Growth, S	0.02 (2.09)	0.01 (0.75)	0.00 (0.18)	-0.00 (0.65)	-0.00 (2.33)	-0.00 (2.25)
Employment Growth, CC	0.13 (5.84)	0.17 (5.60)	0.04 (5.52)	0.05 (5.04)	0.02 (5.99)	0.01 (6.70)
Income Change, CC	0.23 (0.67)	0.60 (1.43)	0.02 (0.10)	0.04 (0.33)	0.06 (1.40)	0.00 (0.27)
No. of Residents by Income/Sex, CC	0.11 (7.88)	0.07 (6.43)	0.04 (7.03)	0.08 (6.41)	0.06 (7.31)	0.07 (5.95)
Respective Group CC/SMSA	-4563 (0.86)	-10071 (1.43)	-5287 (1.84)	-2278 (1.58)	-1561 (2.56)	-459 (2.32)
Crime Rate per 10,000 in CC, t-10	2.02 (0.47)	6.37 (1.21)	1.38 (0.67)	1.81 (1.32)	0.25 (0.48)	-0.04 (0.20)
Percent Nonwhite CC/SUB, t-10	65.00 (1.29)	76.14 (1.30)	-12.03 (0.54)	54.92 (3.30)	6.25 (1.05)	2.38 (1.04)
Pop. Density CC, t-10	-0.17 (1.00)	-0.11 (0.52)	0.01 (0.17)	-0.04 (0.69)	-0.02 (0.92)	0.00 (0.26)
Constant	-1331 (0.32)	-3755 (0.76)	21 (0.01)	-17 (0.01)	197 (0.36)	156 (0.76)
OLS R^2 (adj.)	0.91	0.94	0.97	0.89	0.90	0.79

TABLE 3.32

In-Migration to the Suburbs, by Income Class and Sex of Household Head, 1970-1980: Two Stage Least Squares Estimates and Absolute t-Ratios

Independent Variables	Male Head			Female Head		
	0-$6000	$6000-$15000	$15000-Up	0-$6000	$6000-$15000	$15000-Up
New Rental Housing, S	0.09 (0.57)	0.18 (0.69)	0.21 (0.96)	0.08 (2.79)	0.05 (1.80)	0.01 (1.07)
New Owner Housing, S	0.03 (0.79)	0.26 (3.41)	0.11 (1.83)	-0.01 (1.36)	-0.02 (2.27)	-0.00 (1.09)
Employment Growth, S	-0.02 (0.37)	0.11 (1.28)	0.13 (1.85)	-0.01 (0.65)	0.23 (2.91)	0.00 (0.61)
Employment Growth, CC	0.07 (3.67)	0.11 (3.09)	0.09 (2.97)	0.01 (4.42)	0.01 (2.33)	0.00 (2.00)
Income Change, S	-0.94 (1.45)	-2.65 (2.40)	0.40 (0.43)	-0.09 (0.75)	-0.16 (1.61)	0.01 (0.62)
No. of Residents by Income/Sex, S	0.08 (3.86)	-0.01 (0.52)	-0.00 (0.05)	0.01 (1.66)	-0.01 (0.37)	0.00 (0.10)
Respective Group CC/SMSA	2636 (0.36)	1762 (0.15)	10709 (1.09)	-1547 (1.25)	-211 (0.20)	55 (0.31)
Crime Rate per 10,000 in CC, t-10	0.39 (0.06)	13.65 (1.09)	21.58 (2.03)	1.27 (1.04)	1.17 (0.98)	0.21 (0.93)
Percent Nonwhite CC/SUB, t-10	-51.67 (0.62)	-185.72 (1.26)	-13.71 (0.11)	-0.75 (0.67)	-13.28 (0.99)	-3.98 (1.53)
Pop. Density CC, t-10	-0.16 (0.51)	0.74 (1.35)	1.26 (2.73)	-0.00 (0.06)	0.01 (0.16)	0.01 (1.22)
Constant	8923 (1.18)	28367 (2.19)	-22837 (1.88)	1956 (1.48)	1562 (1.27)	-216 (0.85)
OLS R^2 (adj.)	0.68	0.80	0.83	0.76	0.69	0.38

Medium- and high-income male-headed households that in-migrate to the SMSA are attracted to the suburbs by owner housing, whereas low- and middle-income households headed by women are attracted to renter housing. Central city employment growth encourages the suburban location of males regardless of income, and suburban jobs also attract high-income males to the suburbs. The pattern is generally similar for women, except suburban jobs, as well as central city jobs, cause those with middle incomes to locate in the suburbs. Men with high incomes are encouraged to select a suburban residence by high central city crime, but otherwise the amenity variables are insignificant across income/sex groups.

FOOTNOTES TO CHAPTER 3

1. Exceptions do exist in which some physical measure of housing consumption is utilized as a dependent variable, but this measure is typically not the number of housing units. See Muth (1965), for example.

2. The convention followed in the notation used here is that S refers to suburban, C to central city, SC to suburban relative to central city (except in the case of MSC, where it refers to movement from suburbs to central city), and CS to central city relative to suburban (except in the case of MCS, where it refers to movement from central city to suburbs).

3. Each identity, such as that for housing (HSC = [H60/HS60][H/HC] - [HC60/HS60]) contains two endogenous variables. The variables of particular interest in this part of the study are those for suburban relative to central city rates of growth, and hence a behavioral relationship is specified for these. Variables for the inverse of the central city growth relative to metropolitan-wide growth (e.g., H/HC) are thus implicitly suppressed along with the corresponding identities, and the number of equations remains equal to the number of endogenous variables.

4. Ideally, the crime variable should be a measure of the crime rate in the central city relative to the crime rate in the suburbs. In 1950 crime statistics are reported only for cities, not for SMSAs or for counties. Hence, suburban crime data are unavailable for 1950. In 1960, however, crime rates can be calculated for both central city and suburbs. Such computations were made for 1960 and the results were compared in the 1960-70 relationships with those obtained using only 1960 central city crime rates. The conclusions of the study are not sensitive to this data shortcoming. As alternatives to the overall crime rate, the crimes against persons rate and the crimes against

property rate were also used.

5. Note that suburban population density does not enter the model. The reason is that for many SMSAs in the sample the suburban area includes very sparsely populated land. The Ontario-Riverside-San Bernardino SMSA and the Phoenix SMSA are examples where the suburban ring includes virtually uninhabited desert.

6. Because three stage least squares is a system estimation technique, alteration of one equation affects the estimates of other equations in the system. Since disaggregation of the employment equation results in no qualitative changes (i.e., sign changes) in other equations of the model and in very slight quantitative changes, estimates of the other equations are not reported a second time.

7. Note that LIMVC = LMSC + LIMC; LIMVS = LMCS + LIMS; HIMVC = HMSC + HIMC; and HIMVS = HMCS + HIMS. These identities simply indicate that the independent variables of the model are the appropriate sums of intrametropolitan movers and in-migrants to each metropolitan location.

APPENDIX TO CHAPTER 3

VARIABLE DEFINITIONS AND DATA SOURCES FOR THE INTRAMETROPOLITAN LOCATION MODEL

PART I- Ratio Form of the Model

1. Endogenous Variables

RMCS = rate of CLF in-movement to the suburbs from the central city; that is, the number of CLF members residing in the suburbs of SMSA, in 1960 (1970) (1980) who resided in the central city of SMSA, in 1955 (1965) (1975), divided by the number of CLF members residing in the suburbs of i in 1950 (1960) (1970).

RMSC = rate of CLF in-movement to the central city from the suburbs; that is, the number of CLF members residing in the central city of SMSA, in 1960 (1970) (1980) who resided in the suburbs of SMSA, in 1955 (1965) (1975), divided by the number of CLF members residing in the central city of i in 1950 (1960) (1970).

RNMOV = RMCS/RMSC

RIMSC = rate of CLF in-migration to the suburbs relative to the rate of CLF in-migration to the central city; that is, number of CLF members residing in the suburbs of SMSA, in 1960 (1970) (1980) who resided outside of SMSA, in 1955 (1965) (1975) divided by the number of CLF members residing in the suburbs of SMSA, in 1950 (1960) (1970) relative to the comparable measure defined for the central city.

RGRSC = rate of suburban CLF growth relative to the rate of central city CLF growth; that is, ratio of 1960 to 1950 (1970 to 1960) (1980 to 1970) suburban CLF residents relative to the ratio of 1960 to 1950 (1970 to 1960) (1980 to 1970) central city residents.

RGESC = rate of suburban employment growth relative to the rate of central city employment growth; that is, ratio of 1960 to 1950 (1970 to 1960) (1980 to 1970) suburban employment relative to the ratio of 1960 to 1950 (1970 to 1960) (1980 to 1970) central city employment.

RGMANUSC = rate of suburban manufacturing employment growth relative to the rate of central city manufacturing employment growth.

RGRETSC = rate of suburban retail employment growth relative to the rate of central city retail employment growth.

RGSERSC = rate of suburban service employment growth relative to the rate of central city service employment growth.

RGWHLSC = rate of suburban wholesale employment growth relative to the rate of central city wholesale employment growth.

RGYSC = rate of suburban income growth relative to the rate of central city income growth; that is, ratio of 1960 to 1950 (1970 to 1960) (1980 to 1970) suburban family median income relative to the ratio of 1960 to 1950 (1970 to 1960) (1980 to 1970) central city family median income.

RGH = rate of growth of the SMSA housing stock; that is, ratio of the 1960 to the 1950 (1970 to 1960) (1980 to 1970) number of housing units in the SMSA.

RGHSC = rate of growth of the suburban housing stock relative to the rate of growth of the central city housing stock; that is, rati of 1960 to 1950 (1970 to 1960) (1980 to 1970) suburban housing stock relative to the ratio of 1960 to 1950 (1970 to 1960) (1980 to 1970) central city housing stock.

2. Exogenous Variables

RGR = rate of growth of the CLF of the SMSA; that is, ratio of 1960 to 1950 (1970 to 1960) (1980 to 1970) CLF of the SMSA.

RGY = rate of growth of SMSA income; that is, ratio of 1960 to 1950 (1970 to 1960) (1980 to 1970) SMSA family median income.

RC_{t-10} = number of 1950 (1960) (1970) central city CLF members.

RS_{t-10} = number of 1950 (1960) (1970) suburban CLF members.

RNM_{t-10} = percentage of suburban population nonwhite in 1950 (1960) (1970) relative to the percentage of central city population nonwhite in 1950 (1960) (1970).

$RGNW_{t-10} = 1/RNW_{t-10}$.

RY_{t-10} = ratio of 1950 (1960) (1970) suburban to central city family median income.

V_{t-10} = percentage of SMSA housing stock unoccupied in 1950 (1960) (1970).

RV_{t-10} = percentage of the suburban housing stock unoccupied in 1950 (1960) (1970).

PDC_{t-10} = population density of the central city in 1950 (1960) (1970).

$CRMC_{t-10}$ = crime rate of the central city in 1950 (1960) (1970).

DT = dummy variable, where DT = 0 for observations on the 1950-1960 period and DT = 1 for observations on the 1960-1970 period.

Note: In the rate of growth (RG) variables, SC refers to suburbs relative to central city, whereas CS refers to central city relative to suburbs.

Part II - Absolute Change Form of the Model

AOHC = Absolute amount of owner housing built during the ten-year period in the central city;

ARHC = Absolute amount of rental housing built during the ten-year period in the central city;

AOHS, ARHS are equivalent variables for the suburbs;

AEC = Absolute change in employment during the ten-year period in the central city;

AES = Same as above, but for the suburbs;

AYC = absolute change in median family income during the ten-year period in the central city;

AYS = Save as above, but for the suburbs;

AOHCP = AOHC lagged one ten-year period;

ARHCP = ARHC lagged one ten-year period;

AOHSP = AOHS lagged one ten-year period;

ARHSP = ARHS lagged one ten-year period;

YS_{t-10} = Median family income in suburbs at beginning of period;

YC_{t-10} = Median family income in central city at beginning of period;

VS_{t-10} = Vacancy rate in suburbs at beginning of period;

VC_{t-10} = Vacancy rate in central city at beginning of period;

ES_{t-10} = Absolute amount of employment in suburbs at beginning of period;

EC_{t-10} = Absolute amount of employment in central city at beginning of period;

LMCS = absolute number of low income movers from central city to suburbs;

LIMS = absolute number of SMSA low income in-migrants who located in the suburbs;

LIMVS = LMCS + LIMS

HMCS = absolute number of high income movers from central city to suburbs;

last five years of ten year period;

HIMS = absolute number of SMSA high income in-migrants who located in the suburbs;

HIMVS = HMCS + HIMS

LMSC = absolute number of low income movers from suburbs to central city;

LIMC = absolute number of SMSA low income in-migrants who located in the central city;

LIMVC = LMSC + LIMC;

HMSC, HIMC and HIMVC are equivalent to corresponding variables for high income movers;

LRC = number of low income residents of the central city at end of period;

HRC = number of high income residents of the central city at end of period;

LRS = number of low income residents of the suburbs at end of period;

HRS = number of high income residents of the suburbs at end ot period;

$CRCM_{t-10}$ = Crime rate per 10,000 in central city at beginning of period;

$NWCS_{t-10}$ = Percent nonwhite, central city relative to suburbs, beginning of period; and

$PDEN_{t-10}$ = Population density of the central city at beginning of period.

TABLE 3.1A
Housing Equations of the Forty Percent Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, and 1970s

	New Central City Housing					
	Owner			Renter		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
Low Income in-movers to CC[a]	-0.38 (2.91)	-0.29 (4.46)	-0.28 (4.22)	0.22 (1.47)	0.09 (1.02)	-0.09 (1.13)
High Income in-movers to CC[a]	1.36 (8.51)	0.93 (11.70)	1.38 (7.21)	-0.03 (0.17)	0.33 (3.25)	0.58 (3.83)
Income change in CC	-0.61 (0.56)	-0.25 (-0.44)	-0.10 (0.32)	-1.10 (1.01)	-0.25 (0.32)	0.18 (0.45)
Vacancy Rate in CC, t-10 (E+4)	2.26 (0.97)	17.42 (3.87)	-0.78 (0.32)	-1.35 (0.57)	-4.93 (2.67)	2.42 (0.73)
New const. of this type of housing in CC, t-10 to t-20	0.43 (3.08)	0.11 (2.07)	0.16 (1.39)	1.14 (9.33)	0.76 (10.56)	0.43 (4.95)
Constant	1.51 (0.33)	-0.68 (0.26)	-0.18 (0.09)	0.22 (0.05)	6.07 (1.73)	-3.02 (1.32)
OLS R^2 (adj.)	0.88	0.88	0.84	0.82	0.88	0.79

	New Suburban Housing					
	Owner			Renter		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
Low Income in-movers to S[a]	-0.01 (0.13)	0.11 (0.80)	-0.26 (2.13)	0.44 (8.08)	0.19 (2.17)	0.35 (6.74)
High Income in-movers to S[a]	0.84 (10.58)	0.77 (0.98)	1.58 (10.18)	-0.02 (0.29)	1.55 (3.69)	0.13 (2.15)
Income change in S	-1.52 (1.71)	-0.17 (0.11)	0.20 (0.28)	0.02 (0.02)	-2.63 (3.28)	-0.83 (2.72)
Vacancy Rate in S, t-10 (E+4)	4.69 (1.08)	23.89 (2.98)	14.85 (2.07)	3.98 (1.57)	-7.73 (4.58)	-1.04 (0.43)
New const. of this type of housing in S, t-10 to t-20	0.85 (5.36)	8.98 (1.12)	0.15 (1.59)	0.54 (4.79)	0.67 (5.42)	0.01 (0.22)
Constant	0.71 (0.13)	-4.96 (1.16)	-15.14 (1.98)	-9.14 (2.28)	-1.46 (0.51)	8.53 (2.67)
OLS R^2 (adj.)	0.96	0.84	0.80	0.91	0.84	0.83

[a]Includes intrametropolitan movers and SMSA in-migrants.

TABLE 3.2A

Employment Equations of the Forty Percent Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, and 1970s

Independent Variables	Suburbs			Central City		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
Low Income In-Movers to S (CC)[a]	0.35 (1.92)	0.18 (0.86)	0.71 (3.24)	0.15 (0.43)	-0.34 (2.20)	0.82 (5.23)
High Income In-Movers to S (CC)[a]	0.33 (1.58)	-0.12 (0.09)	0.48 (1.77)	1.04 (2.89)	1.51 (8.56)	1.71 (5.71)
Income Change In S (CC)	-0.75 (0.27)	1.84 (0.73)	0.95 (0.74)	0.68 (0.26)	1.62 (1.07)	0.32 0.36
Employment in Area, t-10 S (CC)	0.06 (1.08)	0.11 (2.82)	0.09 (2.16)	-0.07 (2.78)	-0.11 (5.82)	-0.32 (12.99)
Constant	-10.70 (0.58)	-19.78 (2.97)	-19.39 (1.31)	-19.36 (1.49)	-5.09 (0.57)	-5.88 (1.11)
OLS R^2 (adj.)	0.60	0.67	0.59	0.56	0.72	0.84

[a]Includes intrametropolitan movers and SMSA in-migrants.

TABLE 3.3A

Income Change Equations of the Forty Percent Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, 1970s

Independent variables	Suburbs			Central City		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
Low Income In-Movers to S (CC)[a]	0.00	-0.07	-0.02	-0.03	-0.04	-0.32
	(0.73)	(5.64)	(1.83)	(3.81)	(4.61)	(1.37)
High Income In-Movers to S (CC)[a]	0.01	0.52	-0.03	0.04	0.08	0.12
	(1.68)	(30.37)	(1.16)	(4.47)	(5.89)	(4.38)
Employment Change in S (CC)	-0.01	0.02	-0.00	-0.00	-0.01	-0.00
	(3.37)	(1.54)	(0.08)	(0.82)	(2.39)	(0.74)
Income in S (CC), t-10	0.96	-0.07	0.85	0.65	0.64	0.73
	(16.78)	(0.76)	(10.83)	(19.40)	(14.66)	(8.51)
Constant	-0.59	1.42	1.28	0.34	-0.54	-0.07
	(1.44)	(1.42)	(1.66)	(1.43)	(1.31)	(0.11)
OLS R^2 (adj.)	0.86	0.99	0.73	0.90	0.85	0.66

[a]Includes intrametropolitan movers and SMSA in-migrants.

TABLE 3.4A

Movement from Central City to Suburbs in Forty Percent Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, and 1970s

Independent Variables	Low-Income Movers			High-Income Movers		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
New Rental Housing in S	0.03 (0.47)	0.07 (0.98)	0.47 (2.39)	-0.08 (0.88)	-0.17 (2.50)	-0.15 (0.61)
New Owner Housing in S	0.12 (2.83)	0.04 (0.44)	-0.07 (1.59)	0.24 (4.35)	0.04 (0.53)	0.11 (1.75)
Employment Change in S	0.14 (3.20)	0.18 (3.02)	0.01 (0.29)	0.07 (1.17)	0.07 (1.32)	0.12 (1.81)
Employment Change in CC	-0.13 (3.02)	-0.09 (2.23)	-0.01 (0.54)	-0.32 (5.80)	-0.18 (4.43)	-0.01 (0.46)
Income Change in S	-0.48 (0.63)	-0.05 (0.19)	-0.24 (0.58)	-0.93 (0.96)	0.39 (1.66)	0.01 (0.01)
No. of Residents of This Type in CC	0.01 (0.81)	-0.00 (0.62)	0.00 (0.09)	0.06 (5.25)	0.04 (6.14)	0.02 (2.93)
Crime Rate Per 10,000 in CC, t-10 (E+4)	3.68 (0.32)	2.86 (0.34)	31.26 (0.59)	27.85 (1.94)	-0.53 (-0.07)	-9.47 (-1.34)
Percent Nonwhite CC/S, t-10	26.97 (0.74)	48.29 (0.59)	40.50 (0.73)	28.39 (0.61)	38.21 (0.49)	3.34 (0.05)
Pop. Density in CC, t-10	-0.27 (1.56)	-0.38 (1.63)	-0.29 (1.35)	-0.39 (1.71)	-0.44 (2.02)	-0.19 (0.67)
Constant	9.29 (1.86)	11.13 (2.43)	4.86 (1.24)	7.29 (1.09)	7.24 (1.68)	7.67 (1.57)
OLS R^2 (adj.)	0.76	0.48	0.50	0.82	0.67	0.34

TABLE 3.5A

Movement from Suburbs to Central City in Forty Percent Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, and 1970s

Independent Variables	Low-Income Movers			High-Income Movers		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
New Rental Housing in CC	-0.02 (0.45)	0.11 (2.53)	0.11 (2.25)	0.00 (0.08)	0.16 (4.71)	-0.00 (-0.00)
New Owner Housing in CC	0.07 (3.25)	-0.02 (0.34)	-0.17 (-2.83)	0.09 (3.35)	-0.01 (0.15)	0.06 (1.53)
Employment Change in S	0.04 (2.76)	0.06 (3.31)	0.03 (1.77)	0.03 (1.69)	0.01 (0.74)	0.01 (0.88)
Employment Change in CC	0.03 (1.47)	0.06 (1.89)	0.06 (3.75)	0.05 (2.21)	0.06 (2.04)	0.04 (3.40)
Income Change in CC	-0.10 (0.22)	0.70 (1.28)	0.03 (0.13)	-0.05 (0.08)	1.15 (2.30)	0.08 (0.55)
No. of Residents of This Type in S	0.01 (3.02)	0.01 (2.12)	0.01 (1.91)	0.01 (1.68)	0.02 (2.57)	0.00 (0.59)
Crime Rate Per 10,000 in CC, t-10 (E+4)	-2.80 (0.60)	-12.95 (2.81)	-9.62 (3.13)	-1.58 (0.29)	-5.60 (1.45)	-5.90 (3.26)
Percent Nonwhite CC/S, t-10	21.53 (1.29)	74.07 (1.74)	59.84 (1.82)	20.85 (1.07)	92.23 (2.59)	38.57 (2.03)
Pop. Density in CC, t-10	0.04 (0.54)	-0.09 (0.76)	-0.16 (1.44)	0.02 (0.17)	-0.11 (1.08)	-0.01 (0.23)
Constant	2.27 (0.94)	0.41 (0.12)	5.23 (2.34)	0.89 (0.30)	-5.90 (1.80)	1.45 (1.87)
OLS R^2 (adj.)	0.47	0.46	0.51	0.48	0.49	0.48

TABLE 3.6A

Equations for In-Migration to the Central City in the Forty Percent Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, and 1970s

Independent Variables	Low-Income In-Migrants			High-Income In-Migrants		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
New Rental Housing in CC	0.32 (1.77)	0.26 (2.39)	0.08 (0.34)	0.18 (1.99)	-0.04 (0.83)	-0.00 (0.08)
New Owner Housing in CC	0.48 (8.03)	0.53 (4.19)	-0.45 (3.23)	0.52 (16.04)	0.61 (9.74)	0.22 (4.48)
Employment Change in S	0.12 (2.75)	0.09 (2.42)	0.11 (3.24)	-0.04 (1.95)	-0.00 (0.14)	0.05 (4.33)
Employment Change in CC	-0.02 (0.25)	0.09 (1.05)	0.40 (5.34)	0.07 (1.94)	0.25 (6.73)	0.08 (3.92)
Income Change in CC	-1.07 (0.85)	-1.56 (1.46)	0.65 (1.24)	0.54 (0.85)	-1.49 (2.61)	0.48 (2.79)
No. of Residents of This Type in CC	-0.03 (1.78)	-0.03 (2.40)	0.10 (6.02)	-0.02 (1.98)	0.01 (0.88)	0.04 (6.95)
Crime Rates Per 10,000 in CC, t-10 (E+4)	22.76 (1.61)	-11.51 (1.15)	7.62 (1.13)	0.43 (0.07)	-5.05 (1.28)	3.85 (1.66)
Percent Nonwhite CC/S, t-10	43.35 (0.89)	96.60 (1.05)	65.36 (0.92)	-9.45 (0.44)	-26.63 (0.72)	-30.17 (1.24)
Pop. Density in CC, t-10	0.06 (0.24)	-0.16 (0.62)	-0.17 (0.71)	0.01 (0.13)	0.04 (0.34)	-0.10 (1.23)
Constant	10.42 (1.67)	19.31 (2.92)	-6.98 (1.53)	3.59 (1.18)	11.80 (3.65)	-3.75 (2.54)
OLS R^2 (adj.)	0.80	0.75	0.85	0.92	0.90	0.93

TABLE 3.7A

Equations for In-Migration to the Suburbs in the Forty Percent Model of Intrametropolitan Location: Three Stage Least Squares Estimates for the 1950s, 1960s, and 1970s

Independent Variables	Low-Income In-Migrants			High-Income In-Migrants		
	1950-1960	1960-1970	1970-1980	1950-1960	1960-1970	1970-1980
New Rental Housing in S	1.04	0.77	1.85	0.48	0.36	0.24
	(9.38)	(7.36)	(5.28)	(3.95)	(4.03)	(0.84)
New Owner Housing in S	0.24	0.77	-0.09	0.39	0.25	0.43
	(3.23)	(6.91)	(0.93)	(4.89)	(2.47)	(5.72)
Employment Change in S	-0.16	-0.01	-0.06	-0.11	0.06	-0.00
	(2.44)	(0.07)	(0.76)	(1.51)	(0.77)	(0.00)
Employment Change in CC	0.31	0.25	0.12	0.27	0.14	0.08
	(4.84)	(3.88)	(3.01)	(3.53)	(2.20)	(2.33)
Income Change in S	3.75	-0.94	1.83	5.78	0.76	-0.16
	(3.47)	(2.63)	(2.25)	(4.60)	(2.42)	(0.24)
No. of Residents of This Type in S	-0.00	-0.02	0.01	0.03	-0.02	0.01
	(0.25)	(1.05)	(0.63)	(1.52)	(1.82)	(0.98)
Crime Rates Per 10,000 in CC, t-10 (E+4)	-32.14	13.87	4.78	-21.61	9.46	15.91
	(2.23)	(1.14)	(0.61)	(1.30)	(0.86)	(2.13)
Percent Nonwhite CC/S, t-10	18.06	33.08	-74.04	-62.17	-17.16	-1.39
	(0.35)	(0.28)	(0.90)	(0.97)	(0.16)	(0.02)
Pop. Density in CC, t-10	0.41	0.57	0.48	0.59	0.79	0.49
	(1.62)	(1.75)	(1.46)	(1.93)	(2.66)	(1.59)
Constant	-16.51	-5.40	-22.66	-30.43	-12.19	-6.70
	(2.33)	(0.79)	(3.13)	(3.75)	(2.04)	(1.17)
OLS R^2 (adj.)	0.88	0.78	0.75	0.82	0.89	0.76

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