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Growth and Change in U.S. Cities and Suburbs

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ABSTRACT Differential rates of growth and decentralization are processes that characterized U.S. urban areas over the past three decades. This paper examines the determinants of growth in cities and suburbs during the 1970s, the 1980s, and the 1990s. The modeling approach adopted in the study allows for simultaneity between population and employment, and between cities and suburbs, while also taking into account a range of other explanatory factors. Results indicate that population and employment growth in cities tend to be jointly determined, but that growth of employment in the suburbs tends to drive growth of suburban population. Results also suggest that suburban and city growth are interrelated, but that the nature of these interrelationships varies over time: suburban growth promoted city growth during the 1970s and 1980s, while city and suburban growth were jointly determined during the 1990s. Other factors that consistently explain variation in city growth include demographics, population density, crime rates, and income inequality. Factors consistently explaining suburban growth include regional location and climate.

Introduction

Urban growth has received considerable scholarly attention within the urban and regional literature. There is also strong public sector interest in this subject. Policy makers have long been concerned about central city decline, inter-city competition for jobs, state and local public finance, and the role of the federal government in urban development policy (HUD 1997; Bartik 1991). The recent revitalization of central cities has also received much attention, although important questions remain about the spatial extent of the current wave of urban

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redevelopment and about the degree to which traditional urban residents are benefiting from these changes (Wyly and Hammel 1999; Hackworth 2000). Much research on urban growth has been devoted to three overlapping areas of inquiry: (1) understanding the reasons that cities and urban regions grow and decline; (2) examining the economic linkages between cities and suburbs and the decentralization of metropolitan areas; and (3) investigating the factors that best explain the convergence or divergence of per capita income among cities and regions.[1] This research emphasizes the first and second of these areas.

This study speaks to significant, broad-based trends of urban change in the United States between 1970 and 1997. It focuses in particular on two issues: differential growth across cities, and decentralization of population and employment from cities into surrounding suburban areas. Differential rates of growth across cities since 1970 are apparent in Table 1, which illustrates population growth rates across large cities in each major region between 1970 and 1997.[2] Between 1970 and 1997, large and Frostbelt cities declined relative to mid-sized and Sunbelt cities. Population in the Northeastern cities included in the study declined by nearly 0.5 percent per year while city populations in the Midwest declined by over 0.6 percent per year. Within the South and West, by contrast, city population grew by 0.5 percent and 1.23 percent per year, respectively, over the twenty-seven year study period. These patterns reflect both long-term shifts of population from the Northeast and Midwest to the South and West, as well as decentralization from cities to suburbs.

City growth rates also varied over time (Table 1). As a consequence of industrial restructuring within the manufacturing belt, rates of city population decline were much more rapid during the 1970s in the Midwest and Northeast than during the 1980s or 1990s. Cities in the South and West, on the other hand, experienced their most rapid growth during the Sunbelt boom period of 1980s. Growth in the West slowed somewhat during the 1990s, although much of the West's slowdown centered in California, which was hit by defense cutbacks and other problems early in the decade.

TABLE 1. RATES OF POPULATION GROWTH IN LARGE U.S. CENTRAL CITIES, AGGREGATED BY REGION.

	1970-1997	1970-1980	1980-1990	1990-1997
Midwest	-0.63	-1.31	-0.41	0.04
Northeast	-0.48	-1.24	0.04	-0.12
South	0.54	0.62	0.67	0.26
West	1.23	1.12	1.76	0.64

Sources: U.S. Bureau of the Census (2000), State of the Nation's Cities (1998).

These interregional changes across the system of U.S. cities were accompanied by decentralization within metropolitan areas, as people and jobs left central cities for the suburbs and exurbs. Among the metro areas included in the study, the share of central city residents declined rapidly, from 43 percent of the total metro population in 1970 to 35 percent of the total metro population in 1997 (Table 2). Rates of population shift from city to suburb also varied among the four major regions of the country. The most dramatic shifts in central city population shares of total metro populations occurred in the South and Midwest: the share of central city residents decreased from 43 to 31 percent in the South and from 42 to 32 percent in the Midwest. Slower relative shifts in metro populations occurred in the Northeast and the West. Central city population shares declined from 45 to 40 percent in the Northeast and from 41 to 37 percent in the West over the study period.

Uneven growth within and across cities and population decentralization are thus two hallmarks of U.S. urban development in recent decades. Previous research on the determinants of city growth has emphasized a number of important factors from both the supply and demand sides of economic development.[3] From the *demand side*, a region's exports help determine its growth. In turn, this means that the composition of industry partly determines regional development—the more vibrant the national and international markets for the region's key products, the faster is the likely growth. There are many *supply-side* determinants of growth too. First, are the endowments of the region: its stock of human and physical capital, technical infrastructure, schools and universities, and the like. Regions with more productive stocks of human capital and public infrastructure will be favored over those less endowed. Second, there is an array of locational factors that make places attractive to both firms and migrants: labor costs, unionization rates, climate, taxes, and fiscal conditions. This study draws on both streams of research, considering the effects of both demand and supply-side factors on urban growth.

TABLE 2. RATIOS OF CENTRAL CITY POPULATION TO METRO POPULATION, AGGREGATED BY REGION

	1970	1980	1990	1997
Midwest	0.42	0.36	0.34	0.32
Northeast	0.45	0.41	0.40	0.40
South	0.43	0.38	0.34	0.31
West	0.41	0.38	0.37	0.37
Total	0.43	0.38	0.36	0.35

Sources: U.S. Bureau of the Census (2000); State of the Nation's Cities (1998).

Among the recent empirical studies of urban growth determinants, researchers have found that *educational attainment*, *industry structure*, and *region* are consistently significant predictors of urban growth.[4] None of these recent studies, however, provide an assessment of the determinants of urban growth after 1990. Assessments of how urban growth determinants have changed over time are also somewhat limited.[5] Crandall (1993), for example, contrasts factors in the 1970s and the 1980s, but his analysis is limited to a few explanatory variables and does not incorporate social or demographic factors. Other recent studies observe how initial conditions influence change over longer time periods (e.g., 1960 to 1990), or focus more narrowly on specific issues such as the influence of higher education on urban growth or the relationship between industry structure and urban income inequality.[6]

While most studies of urban change focus on either cities or metropolitan areas, explicit investigation of linkages between city conditions and suburban area growth are also relatively limited.[7] In particular, an important question remains: whether a healthy central city is necessary for suburban or metropolitan economic development over the long term (Ihlanfeldt 1995; Adams et al. 1996; Downs 1997; Mills and Lubuele 1997).[8] Most empirical investigations of city–suburban growth find that central city growth is significantly and positively related to that of the suburbs (Voith 1992, 1996; Savitch et al. 1993; Ledebur and Barnes 1992). Voith (1992) finds that city and suburban population, income, and employment change are positively correlated during the 1970s and 1980s. He concludes that central city decline is a "long-run, slow drain on the economic and social vitality of the region" (Voith 1992, 31). Hill et al. (1995) raise some important caveats about this work, however, suggesting that positive correlation between city and suburban growth patterns may simply reflect underlying common factors affecting both cities and suburbs, such as state policies or shared labor market dynamics. This ongoing debate suggests that additional attention should be paid to the role of central city conditions in influencing the growth of suburban areas and vice versa.

In light of the issues raised above, this study focuses on three interrelated questions: (1) what factors account for the differential rates of growth of cities and suburbs? (2) are city and suburban growth interrelated? and (3) how have the determinants of city and suburban growth changed over time? In examining these questions, the study draws from a 2,000-variable database developed for a U.S. Department of Housing and Urban Development project, *State of the Nation's Cities*, or "SONC" [9] (Glickman et. al. 1996; Wyly et al. 1998). The database includes the nation's 50 largest cities as well as a number of smaller urban areas. In total, the SONC database includes data for 77 large cities and 74 Metropolitan Statistical Areas (MSAs).[10]

Modeling City and Suburban Growth

Numerous studies of the determinants of U.S. urban and regional growth have indicated that population growth and employment growth in cities and regions tend to be jointly determined.[11] The theoretical basis for joint determination between population and employment, as articulated by Steinnes and Fisher (1974), is the idea that households and firms are both mobile and that household location decisions maximize utility while firm location decisions maximize profits. According to the proposition of utility maximization, household location decisions are expected to be influenced by location of job opportunities and other factors such as provision of public services, amenities (and disamenities), demographic factors, and regional location. The location decisions of firms are expected to be influenced by the need for proximity to growing consumer markets (i.e., population), as well as factors including local business climate, tax rates, and regional location.

In addition to the potential for simultaneity between population and employment, simultaneity may also exist between central cities and suburban areas within a metro region (Voith 1998; Savitch et al. 1993; and Ledebur and Barnes 1992). Two contrasting hypotheses are commonly cited to account for the interdependencies between cities and suburbs (Adams et al. 1996; Mieszkowski and Mills 1993). The first, the 'flight from blight hypothesis,' suggests that suburban growth is the result of social and fiscal problems in central cities. Firms and residents who can afford to do so, move out of cities to escape high taxes, congestion, high crime rates, concentrated poverty, racial tensions, and other problems. The second, the hypothesis of 'natural evolution,' indicates that suburban growth is a function of demand for land by firms and higher-income households and is fostered by innovations in transportation technology (Adams et al. 1996; Mieszkowski and Mills 1993).[12]

The modeling approach adopted in this study takes into account both of these potential sources of simultaneity: 1) between population and employment, and 2) between cities and their suburbs. Following from Mills (1986), a four equation simultaneous model is proposed:

$$\Delta CPOP = f(\Delta CJOB, \Delta SPOP, \Delta SJOB, Xc_i, R) \quad (1)$$

$$\Delta CJOB = f(\Delta CPOP, \Delta SPOP, \Delta SJOB, Xc_i, R) \quad (2)$$

$$\Delta SPOP = f(\Delta SJOB, \Delta CPOP, \Delta CJOB, Xc_i, R) \quad (3)$$

$$\Delta SJOB = f(\Delta SPOP, \Delta CPOP, \Delta CJOB, Xc_i, R) \quad (4)$$

where $\Delta CPOP$ is the change in the natural log of city population; $\Delta CJOB$ is the change in the natural log of city employment; $\Delta SPOP$ is the change in the natural log of suburban population; and $\Delta SJOB$ is the change in the natural log of suburban employment; Xc_i is a vector of initial characteristics for city i; and R is a vector of regional dummy variables. In each equation, growth of the

dependent variable is a function of growth of the other endogenous variables, a set of exogenous variables, and regional location. In equation (1), for example, growth of city population (*ΔCPOP*) is a function of growth of city employment (*ΔCJOB*), growth of suburban population (*ΔSPOP*) and growth of suburban employment (*ΔSJOB*), initial city characteristics (Xc_i), and regional locational dummy variables (*R*).

The exogenous variables (Xc_i) include a broad array of factors representing agglomeration economies, demographics, local amenities, local business climate, taxes, and regional location, all of which may contribute to growth of population and/or employment in cities and suburbs. The exogenous variables may be divided into nine major categories (Table 3).

Demographic characteristics. Three measures of demographic conditions are included: percentage of the population over age sixty-four (*OVER64*), percentage of the population that is non-white (*NONWHITE*), and percentage of the population that is foreign-born (*IMMIG*). *OVER64* reflects older or retiree populations. Cities with higher proportions of older residents and retirees have smaller endowments of productive labor relative to total population and may thus be less attractive to firms. This could result in slower employment growth. For population growth, however, the sign of the coefficient is indeterminate. Cities with large populations of retirees may experience population decline because of retiree out-migration, but a large older population may also reflect attractiveness of a city to retirees, resulting in a positive sign. The second demographic indicator is percentage nonwhite.[13] Central cities often represent places of diversity, with higher populations of African-Americans, Hispanics and Asians. Higher proportions of *NONWHITE* may indicate the presence of discrimination or racial conflict within a city, each of which may result in slower city growth, but more rapid suburban growth. The third demographic variable, percentage foreign-born (*IMMIG*), reflects a city's attractiveness to international migrants. Cities with larger current populations of foreign-born residents may tend to draw additional migrants resulting in faster population growth. Because immigrants and guest workers may also provide an inexpensive labor pool, which would be attractive to firms, *IMMIG* is expected to have a positive effect on employment growth.[14]

Human capital. Educational attainment reflects an area's endowment of human capital. Cities with better-educated populations are expected to both retain and attract firms and thus grow more quickly. Two measures of educational attainment of the population are used, both of which are expected to have a positive effect on growth of cities and suburbs. The first is percentage of the population with only a high school education (*HSED*), high school graduates who did not attend college. This is a basic indicator of the educational attainment of the population. The second is percentage of the population with a

TABLE 3. DESCRIPTION OF THE VARIABLES

Variable	Description
Growth Variables	
ΔCPOP	Change in the natural log of city population
ΔCJOB	Change in the natural log of city employment
ΔSPOP	Change in the natural log of suburban population
ΔSJOB	Change in the natural log of suburban employment
Demographic Characteristics	
NONWHITE	Percent of city population that is either African American, Hispanic, or Asian
IMMIG	Percent of city population that is foreign-born
OV64	Percent of city population that is over 64
Human Capital	
HSED	Percent of city population that has completed high school, excluding those who also completed college
COLLED	Percent of city population that has completed college
Income Inequality	
INEQ:	Income inequality in the city, calculated as a ratio of average family income in the 90^{th} income percentile to average family income in the 10^{th} percentile.
CSINEQ:	Income inequality between the city and surrounding suburbs, measured as a ratio of suburban income per capita divided by city income per capita
Density	
DENSITY	City population/city land area
Amenities	
COOLDEG	Number of cooling degree days
HEATDEG	Number of heating degree days
PRECIP	Annual precipitation
CRIME	Crime rate in the central city/crime rate in the suburbs
Industrial Structure	
MANUF	Share of nonfarm earnings in manufacturing in the central county
PROD	Share of nonfarm earnings in business services in the central county
MILITARY	Share of nonfarm earnings in military in the central county
Business Climate	
UNION	State unionization rate
PCAP	Natural log of central city per capita income
TAXDIFF	Property tax revenue per capita in the central county /property tax revenue per capita in the suburban counties
Annexation	
ANNEX	Percent change in city land area
Region	
MIDWEST, SOUTH, AND WEST	Dummy variables for location in Midwest, South and West (=1, Northeast=0)

college education (*COLLED*), a measure of the importance of higher education for growth.[15]

Inequality. Two indicators of income inequality are used. The ratio of family income for those in the 90th percentile to those in the 10th (*INEQ*) captures disparities within cities (*INEQ*), while the ratio of per capita income in the suburbs to that in the city (*CSINEQ*) gauges differences between the two types of jurisdictions. Recent concerns over rising levels of income inequality within cities and between cities and suburbs have led to speculation that urban growth patterns may be linked with patterns of income inequality. Particularly, high levels of income inequality within the central city and large inequities between cities and suburbs may detract from overall metropolitan economic growth, suggesting negative signs on both inequality coefficients.

Density. Population density (*DENSITY*) serves as a proxy for economies of agglomeration. The expected sign of this variable is indeterminate *a priori*. Higher density cities may benefit from external economies of urbanization making them more attractive to residents and firms. The resulting coefficient would then be positive. However, denser cities also tend to be older cities. Higher densities may also indicate the existence of diseconomies of agglomeration in a city (e.g., high costs of doing business, negative externalities associated with congestion, or older infrastructure). The presence of diseconomies of agglomeration within a city suggests slower growth and a negative coefficient within the equations for city growth but positive coefficients in the equations for suburban growth as firms and residents relocate to less congested suburban areas.

Amenities. Positive and negative amenities may also influence growth of cities and suburbs. Two types of amenity variables are included in the analysis: climatic conditions and crime rates. Urban areas with warmer and dryer climates are attractive to residents, and thus cities and suburbs with these attributes are expected to experience faster population growth. To capture these climatic effects, three climate variables are included: cooling degree-days (*COOLDEG*), heating degree-days (*HEATDEG*), and total annual precipitation (*PRECIP*). Crime represents a negative amenity. High crime rates in cities, holding suburban crime rates constant, would be expected to drive middle-income residents from the cities to the suburbs. The variable *CRIME*, which is the ratio of the city's crime rate to the suburban crime rate, captures differences in crime rates between cities and suburbs. *CRIME* is expected to have a negative effect on population growth in the city and a positive effect on population growth in the suburbs.

Industrial structure. Industrial structure reflects urban linkages to the national and international economy. Three variables intended to represent the shares of essential sectors of the city economy are included. The first is

manufacturing share of total earnings (*MANUF*). The second is producer services share (*PROD*); this variable encompasses several service sectors including *FIRE* (finance, insurance, and real estate), business services, and legal services. The third is the military share of total earnings (*MILITARY*). Changes in national and international demand for goods and services may harm certain types of cities and help others (Drennan et al. 1996). Deindustrialization and the concomitant shift to services suggest that cities with higher initial manufacturing shares will probably grow more slowly. At the same time, cities specialized in producer and other services are expected to grow more rapidly. Military base closings in recent decades have taken a substantial economic toll on local and regional economies; cities with higher military shares are thus expected to grow more slowly.

Business and fiscal climate. Business climate reflects the attractiveness of a city or metro area to firms, while fiscal climate may influence location decisions of both firms and residents. Two measures of business climate are included: state unionization rates (*UNION*)[16] and per capita income (*PCAP*). Higher state unionization rates are expected to have negative effects on employment growth in both cities and suburbs. In investigating this, the log of per capita income (*PCAP*) may be used as a proxy for average labor costs in a city. Cities with higher labor costs are expected to experience slower growth of jobs as the result of firms leaving central cities for lower cost locations, either in the suburbs or elsewhere. Fiscal climate is measured by the ratio of central city to suburban property tax revenues per capita (*TAXDIFF*).[17] The overall effect of differences in the ratio of city to suburban property tax revenues on growth in cities and suburbs is uncertain. Higher taxes in the city relative to the suburbs may be a reflection of higher quality public services that would draw people to cities, resulting in growth. However, higher taxes may also drive residents and firms to move to the suburbs resulting in negative city growth, but positive suburban growth.

Annexation. A measure of city land area growth (*ANNEX*) controls for annexation of surrounding suburban areas by the central city. For central cities that are either landlocked or cannot grow due to growth control regulations, this variable takes on a value of zero. In addition to controlling for changes in the size of the central city, the annexation variable provides a way to test the "flexibility" thesis offered by Rusk (1993). Rusk's thesis suggests that growth of central city land area through annexation is necessary for overall metropolitan economic health. Based on this thesis, annexation is expected to have a positive effect on growth of both cities and suburbs.

Region. Regional dummy variables representing the four main regions of the country are also included. (The Northeast is represented by the intercept term, the others by dummies.) Regional dummy variables take into account unobserved differences between regions that may influence rates of both city and suburban growth. In light of population dispersion from the Northeast and

Midwest (*MIDWEST*) to the South (*SOUTH*) and West (*WEST*) over the past three decades, city and suburban areas in the South and West are expected to grow faster than those in the Northeast and Midwest. Thus, the dummy variables for the South and West should have positive signs.

Taken together, these nine types of variables take account of major determinants of urban development and allow examination of the effects of a wide range of factors during the different time periods.

The four-equation model is estimated for three different time periods, 1970 to 1980, 1980 to 1990, and 1990 to 1997. The exogenous variables in each case (Xc_i) represent conditions in the initial year. In the model of city and suburban growth between 1970 and 1980, for example, the exogenous variables describe conditions in 1970. This type of lag specification, which is commonly used in analyses of urban and regional growth [e.g., Carlino and Mills (1987), Glaeser et al. (1995), and Palumbo et al. (1990)], helps to minimize problems of endogeneity that might be encountered when modeling changes in the dependent variables as a function of contemporaneous changes in the exogenous variables. To facilitate comparisons over time, the metro area definitions are consistent for all periods, using the 1993 Census definitions of metro areas. One important difference between the models for the 1970s and 1980s versus the model for the 1990s is that the 1970s and 1980s models use formal central city and suburban boundaries, while the 1990s models use central county and suburban counties as a proxy for central cities and suburbs.[17] The models for the 1990s thus are not strictly comparable to the earlier decades, but, nonetheless, provide a reasonable approximation of the interactions between central cities and suburbs.

The models are estimated using two-stage least squares (2SLS) regression. Endogenous variables include $\Delta CPOP$, $\Delta CJOB$, $\Delta SPOP$, $\Delta SJOB$. Tests for the presence of heteroscedasticity indicted evidence of heteroscedasticity in all cases. A correction for heteroscedasticity was performed using White's corrected covariance matrix (White 1980).

Tests were also conducted for multicollinearity using the method of variance inflation factors. The tests indicated problems of multicollinearity between several of the variables. In particular, *PCAP*, *HSED,* and *HEATDAYS* were found to be strongly correlated with other variables or combinations of other variables during all three of the time periods. To pinpoint the sources of multicollinearity, regressions of all other independent variables on these variables were performed. Results indicated that *PCAP* was strongly correlated with *COLLED* during all three decades. *PCAP* was also correlated with *CSINEQ* during the 1970s and 1980s, and with *HSED* and *INEQ* during the 1990s. In addition, *HSED* was strongly correlated with *NONWH* during all three decades, with *CRIME* during 1970s, with *OVER64* during the 1980s, and with *OVER64*, *IMMIG* and *INEQ* during the 1990s. *HEATDAYS* days was strongly correlated

with *COOLDAYS* during all time periods (the values for the climatic variables do not change between the decades). Additional problems with multicollinearity for the variables *CSINEQ* and *INEQ* were also found in some of the time periods. Regressions of all other independent variables on *CSINEQ* and *INEQ* indicated that, during the 1980s, *CSINEQ* was strongly correlated with *NONWH* and *COLLED*, and that during the 1990s, *INEQ* was strongly correlated with *NONWH*, *OVER64*, and *IMMIG*. The presence of high degrees of multicollinearity indicates that variables tend to be explaining similar phenomena and thus may be redundant. In order to reduce problems of multicollinearity, *PCAP*, *HSED,* and *HEATDAYS* were dropped from all of the regressions, while *CSINEQ* was dropped from the 1980s regressions and *INEQ* was dropped from the 1990s regressions.[19]

The next section presents results of the 2SLS models for each of the three time periods. In interpreting the results, one important caveat is that the analysis does not directly distinguish between suburban and city growth that occur as the result of decentralization out of the central city versus growth that occurs as the result of regional shifts in population and employment. Suburban growth, in particular, may result from a combination of decentralization out of the central city and in-migration from other areas of the country (Adams et al. 1996). Although the regional dummy variables partially control for regional differences in population and employment growth rates, which would affect both cities and suburbs, these controls may not fully separate the different sources of suburban growth.

Empirical Results

The 1970s. Table 4 presents results of the models for the 1970s. The results indicate the presence of both types of postulated simultaneity: between population and employment and between cities and suburbs. In the city equations, there is strong evidence of simultaneity between population and employment. Because many cities experienced population and employment decline during the 1970s (and during later decades), the positive feedback between population and employment indicates that population and job losses within cities tended to reinforce each other. For suburbs, by contrast, there is no evidence of simultaneity between population and employment during the 1970s. Rather, growth of suburban employment and population tended to occur independently. Concerning the question of simultaneity between city and suburban growth, the strongest evidence appears in the city employment equation, where growth of suburban population is found to have a positive and significant effect on city employment growth. This finding indicates that during the 1970s, growth of suburban populations, rather than detracting from central cities, actually helped to create jobs within cities.

TABLE 4. THE DETERMINANTS OF CITY AND SUBURBAN GROWTH DURING THE 1970S

Variable[a]	*ΔCPOP*		*ΔCJOB*		*ΔSPOP*		*ΔSJOB*	
	Coefficient	t-Stat	Coefficient	t-Stat	Coefficient	t-Stat	Coefficient	t-Stat
ΔCPOP	--		0.7361	2.297	-0.5220	-1.006	0.5656	0.801
ΔCJOB	0.8644	3.029	--		0.5347	1.168	-0.7312	-1.261
ΔSPOP	-0.1926	-0.798	0.3694	2.151	--		0.2189	0.524
ΔSJOB	0.1147	0.726	-0.2241	-0.998	0.2148	0.786	--	
NONWHITE	-0.0006	-0.412	-2.48E-05	-0.016	0.0010	0.492	-0.0011	-0.410
IMMIG	-0.1584	-0.452	0.4030	1.167	-0.5393	-1.205	-0.2931	-0.480
OV64	-0.0204	-2.643	0.0075	0.623	-0.0022	-0.149	0.0044	0.183
COLLED	0.0064	0.742	-9.17E-04	-0.097	-0.0021	-0.227	-0.0076	-0.714
INEQ	0.0344	1.105	-0.0403	-1.797	-0.0108	-0.303	-0.0483	-1.180
CSINEQ	0.3070	2.207	-0.2018	-1.564	-0.0240	-0.095	-0.1229	-0.521
DENSITY	3.06E-06	1.986	-2.59E-06	-1.484	4.04E-07	0.149	1.57E-06	0.439
COOLDEG	-1.47E-05	-0.554	--		7.77E-05	1.947	--	
PRECIP	0.0008	0.661	--		0.000534	0.268	--	
CRIME	-0.0118	-1.561	--		-0.0091	-0.909	--	
MANUF	--		-0.1571	-0.615	--		-0.5986	-1.536
PROD	--		-0.5865	-1.077	--		-0.9849	-1.083
MILITARY	--		-0.2744	-0.583	--		-1.4149	-2.354
UNION	--		-8.90E-04	-0.321	--		-0.0074	-1.416
TAXDIFF	-0.0071	-0.918	0.0072	0.757	0.0016	0.140	-0.0090	-0.473
ANNEX	0.0174	0.182	0.0333	0.272	-0.0574	-0.562	-0.2686	-1.736
SOUTH	-0.0551	-0.796	0.0675	0.758	0.0175	0.173	0.2331	1.965
WEST	-0.0366	-0.410	0.0666	0.637	0.1201	0.999	0.3608	3.095
MIDWEST	0.0039	0.098	-0.0120	-0.255	-0.0082	-0.194	0.0936	1.325

n = 68[b]

[a]Exogenous variables represent conditions in 1970; endogenous (Δ) variables represent change between 1970 and 1980.

[b]Sample does not include Anchorage, Cheyenne, Burlington, Santa Ana, Honolulu, and Little Rock due to missing data.

Demographic characteristics. The percentage of the population over 64 (*OVER64*) is negatively associated with city population growth and is highly significant. This result indicates that cities with larger populations of older residents tended to grow more slowly then those with younger people. These patterns are likely a reflection of out-migration of retirees from central cities in the Northeast and Midwest—hence cities with older populations had slower population growth or population decline during the 1970s.

Human capital. Percent college education (*COLLED*) was not a significant driver of city or suburban growth during the 1970s.

Inequality. Both income inequality within the city (*INEQ*) and between city and suburbs (*CSINEQ*) affected city growth during the 1970s. For city employment, both *INEQ* and *CSINEQ* had negative and significant (*INEQ*) or marginally significant effects (*CSINEQ*). For city population, however, *CSINEQ*, was positively and significantly associated with growth of city population. Inequality is not especially significant for suburban growth; the only inequality coefficient that approached significance is *INEQ* in the suburban employment equation (with a t-statistic of -1.2). Overall, these results suggest that high levels of income inequality within the central city generally acted as a drag on growth of jobs in cities during the 1970s. City employment was also hurt by higher average incomes in cities, relative to their suburbs. For population, higher incomes within the suburbs, relative to cities, was associated with slower rates of population decentralization out of central cities.

Density. Population density in the central city had a significant but mixed effect on city growth, but was not significant for suburban growth. For city population growth, the effect of density was positive and significant, but for city employment growth, the effect of density was negative and marginally significant. This mixed finding suggests that positive externalities associated agglomeration economies, such as availability of a wide variety of goods and services, continued to attract people to cities during the 1970s, but that congestion and other diseconomies were beginning to repel firms out of cities during the same period.

Amenities. The amenity variables are included in the population equations. High crime rates within cities relative to suburbs (*CRIME*) had a marginally significant, negative effect on city population growth, suggesting that high crime rates, indeed, hurt city growth during the 1970s. Among the climatic variables, number of cooling degree-days (*COOLDEG*) had a positive effect on suburban growth, suggesting that metro areas located in warmer climates had faster suburban growth during the 1970s. This pattern is likely a reflection of national shifts in population from the North and Midwest to the South and West and suggests that migrants to the Sunbelt were more likely to locate in the suburbs.

Industrial structure. The industry structure variables are included in the employment equations. In general, industry structure was more important for

suburban growth than for city growth during the 1970s. The share of the economy in the military (MILITARY) was negative and highly significant for suburban employment growth. Manufacturing shares also have a negative effect on suburban employment growth, but the coefficient was only marginally significant with a t-statistic of -1.54. These results indicate that cities with high concentrations of employment in the military and in manufacturing tended to experience slower rates of employment decentralization.

Business and fiscal climate. Unionization (*UNION*) is included in the employment equations. As expected, unionization is negative in both cases, but it is not significant at conventionally accepted levels (though it is marginally significant for suburban growth, with a t-statistic of -1.4). City-suburban tax differentials (*TAXDIFF*), which may affect the location choices of both firms and individuals, are included in both the population and the employment equations. The city-suburban tax differential variables are not statistically significant in any of the equations.

Annexation. According the Rusk's thesis, annexation of land by the central city is expected to have a positive effect on city growth and suburban growth. The signs on the annexation variables do not support this thesis. For cities, annexation control variables have positive signs, an indication that growth of city land area was positively associated with growth of city population and employment. For suburbs, however, the annexation controls have negative signs, indicating that annexation of land by cities occurred at the expense of jobs and population in the suburbs. Notwithstanding its sign pattern, the annexation variable is only significant as a determinant of suburban employment: annexation of land by the central city had a significant, negative effect on suburban employment during the 1970s.

Region. The regional dummy variables are significant for suburban employment growth. In particular, the values for the *WEST* and *SOUTH*, are positive and strongly significant, a result which is consistent with the conclusion that suburban growth patterns during the 1970s tended to be influenced by national shifts in the location of economic activity.

The 1980s. Table 5 presents results of the model for the 1980s. As was the case during the 1970s, there is strong evidence of simultaneity between employment and population growth within cities during 1980s: population growth (decline) is associated with employment growth (decline) and vice versa. For suburbs, results for the 1980s reveal emerging linkages between suburban employment and suburban population. During the 1980s, suburban employment growth had a positive and significant effect on suburban population growth, suggesting that people were following jobs into the suburbs. Concerning interactions between cities and suburbs, the only statistically significant effect

TABLE 5. THE DETERMINANTS OF CITY AND SUBURBAN GROWTH DURING THE 1980S

Variable[a]	*ΔCPOP*		*ΔCJOB*		*ΔSPOP*		*ΔSJOB*	
	Coefficient	t-Stat	Coefficient	t-Stat	Coefficient	t-Stat	Coefficient	t-Stat
ΔCPOP	--		0.9256	3.170	1.2432	1.361	-0.6836	-0.876
ΔCJOB	0.6867	4.210	--	-0.9483	-1.393	0.9528	1.254	
ΔSPOP	0.2457	1.102	-0.1341	-0.530	--		0.4605	1.467
ΔSJOB	-0.2208	-1.130	0.3854	1.847	0.6053	1.644	--	
NONWHITE	2.74E-04	0.249	-0.0019	-1.520	-0.0012	-0.665	0.0040	1.809
IMMIG	0.0021	1.312	-9.16E-04	-0.484	-0.0016	-0.502	-0.0027	-0.925
OV64	0.0011	0.158	-0.0088	-0.947	-0.0083	-0.832	0.0190	1.609
COLLED	-0.0035	-1.227	-1.46E-04	-0.051	0.0059	1.148	0.0033	0.883
INEQ	-0.0091	-1.742	0.0077	1.045	0.0146	1.067	-0.0135	-0.876
DENSITY	-2.70E-06	-2.046	1.73E-06	0.981	4.79E-06	1.574	-1.79E-06	-0.635
COOLDEG	-1.40E-05	-0.536	--		6.29E-05	1.638	--	
PRECIP	-7.39E-04	-0.729	--		5.11E-04	0.282	--	
CRIME	-0.0082	-1.932	--		0.0115	1.192	--	
MANUF	--		-0.0560	-0.299	--		0.1476	0.548
PROD	--		0.6144	1.863	--		-0.5500	-0.971
MILITARY	--		0.2457	0.977	--		-0.1692	-0.325
UNION	--		0.0019	0.894	--		-0.0045	-1.287
TAXDIFF	0.0017	0.275	-0.0069	-0.860	-0.0032	-0.332	0.0015	0.126
ANNEX	0.0268	0.415	0.0365	0.524	-0.1045	-0.900	-0.0469	-0.416
SOUTH	0.0209	0.517	0.0247	0.502	-0.0105	-0.155	-0.0662	-1.007
WEST	0.0580	1.377	-0.0618	-1.187	-0.0446	-0.466	0.0553	0.725
MIDWEST	0.0192	0.773	-0.0255	-0.878	-0.0540	-1.371	0.0419	0.884

n = 70[b]

[a]Exogenous variables represent conditions in 1980; endogenous (Δ) variables represent change between 1980 and 1990.

[b] Sample does not include Anchorage, Santa Ana, Honolulu and Little Rock due to missing data.

during the 1980s is that suburban employment growth had a positive effect on city employment growth. As was evidenced during the 1970s, this result indicates complementary between suburbs and cities: job growth in the suburbs contributed to job growth in cities in the 1980s.

Demographic characteristics. During the 1980s, percentage nonwhite is negatively associated with city employment but positively associated with suburban employment (both effects are significant or marginally significant). This result indicates that cities with higher concentrations of minority populations were losing jobs to the suburbs at a faster rate than other cities. Population over 64 is also positively associated with growth in suburban employment, suggesting that cities with older populations experienced more rapid decentralization of jobs to suburbs.

Human capital. As was the case during the 1970s, *COLLED* is not a significant driver of city or suburban growth in the 1980s.

Inequality. High levels of income inequality within cities had a negative effect on city population growth during the 1980s, a result that suggests that highly unequal cities grew more slowly than other cities during the 1980s. Inequality was not a significant driver of suburban growth during the 1980s.

Density. Results for the population density variable provide evidence of the presence of diseconomies of agglomeration within cities during the 1980s. *DENSITY* is negatively associated with city population growth but is positively associated with suburban population growth. Although the coefficient on *DENSITY* in the suburban model is only marginally significant, these results suggest that congestion and other negative externalities within cities contributed to decentralization of populations from cities to suburbs during the decade of the 1980s.

Amenities. Results for the amenity variables during the 1980s are similar to those found during the 1970s. High rates of crime in cities, holding suburban crime constant, were negatively associated with city population growth during the 1980s, suggesting that *CRIME* contributed to decentralization of city populations. (*CRIME* is positively associated with suburban population growth during the 1980s, but the coefficient is not statistically significant.) Results for the climatic variables indicate that, as during the 1970s, metropolitan areas with warmer climates (high numbers of cooling degree-days) experienced faster suburban population growth than did other cities. As discussed above, this result is mostly likely a reflection of migration of population to suburban areas of Sunbelt cities from other parts of the country.

Industrial structure. During the 1980s, cities with higher shares of producer services grew faster than other cities, a finding that confirms that producer services were an important driver of city growth during the 1980s. Industry

structure is not significant as a determinant of suburban employment growth during the 1980s.

Business and fiscal climate. Business and fiscal climate were generally not significant during the 1980s. The only variable in this category that is even marginally significant is percent unionization, which was negatively associated with suburban employment growth during the 1980s (but with a t-statistic of only -1.3).

Annexation and region. As in the 1970s, the annexation controls have positive signs on city growth and negative signs on suburban growth. However, the coefficients on *ANNEX* are not statistically significant in any of the equations. The regional controls are also not statistically significant in any of the equations for the 1980s.

The 1990s. The results of the 1990s model are presented in Table 6. Evidence of both types of simultaneity also appears during the 1990s. For cities, population and employment are, once again, jointly determined. For suburbs, as in the 1980s, employment growth is a significant driver of population growth, suggesting that people continued to follow jobs into the suburbs. Concerning the issues of simultaneity between cities and suburbs, one of the most interesting results that emerges in the 1990s model, is the strong, but inverse relationship between suburban employment growth and city population growth. In the equation for city population, growth of suburban employment has a significant, but negative effect on city population growth. Similarly, in the equation for suburban employment, city population growth has a negative and significant effect on growth of suburban employment. This negative feedback relationship between growth of suburban jobs and decline of city population suggests that growth of job opportunities in the suburbs drew people out of the central cities during the period from 1990 to 1997. Results for the 1990s also reveal some evidence of complementarity between city and suburban employment. Growth of city employment had a positive effect on suburban employment, while growth of suburban employment had a positive effect on city employment, though in both cases the coefficients are only marginally significant.

Demographic characteristics. *NONWHITE* is significant in both of the city equations, but the sign changes between them. As in the 1980s, *NONWHITE* is negatively associated with growth of city employment, suggesting that cities with high concentrations of minority residents were losing jobs to the suburbs more rapidly than other cities. However, high populations of nonwhite residents in central cities are positively associated with growth of city population, a possible indication of the continued tendency for new minority residents to concentrate in central cities. City demographic conditions are not significant drivers of suburban growth during the 1990s.

Human capital. As was the case during the 1970s and 1980s, *COLLED* is not a significant determinant of city or suburban growth in the 1990s.

TABLE 6. THE DETERMINANTS OF CITY AND SUBURBAN GROWTH DURING THE 1990S

Variable[a]	*ΔCPOP*		*ΔCJOB*		*ΔSPOP*		*ΔSJOB*	
	Coefficient	t-Stat	Coefficient	t-Stat	Coefficient	t-Stat	Coefficient	t-Stat
ΔCPOP	--		0.9603	2.589	0.4671	1.373	-1.903	-2.623
ΔCJOB	1.0704	3.705	--		-0.3727	-0.666	1.554	1.617
ΔSPOP	0.4565	1.337	0.0869	0.245	--		0.331	0.522
ΔSJOB	-0.4412	-2.082	0.3765	1.520	0.4507	1.924	--	
NONWHITE	0.0015	1.710	-0.0013	-1.895	-4.27E-04	-0.310	0.001	0.646
IMMIG	6.49E-04	0.475	0.0010	0.703	-0.0013	-1.112	-0.002	-0.601
OV64	7.95E-04	0.248	0.0065	0.980	-0.0049	-1.333	-0.014	-1.342
COLLED	-6.03E-04	-0.264	6.44E-04	0.237	0.0014	0.840	-0.003	-0.656
CSINEQ	-0.0373	-0.744	0.0454	0.763	0.04182	0.893	-0.094	-0.934
DENSITY	1.73E-06	1.853	-3.63E-07	-0.365	-1.66E-06	-1.554	6.22E-07	0.377
COOLDEG	-1.90E-05	-1.238	--		2.55E-05	1.694	--	
PRECIP	6.10E-04	1.147	--		-2.73E-04	-0.369	--	
CRIME	-0.0013	-0.381	--		-1.55E-04	-0.039	--	
MANUF	--		-0.2245	-1.912	--		0.382	1.460
PROD	--		-0.2669	-1.444	--		0.471	1.238
MILITARY	--		0.2138	0.531	--		-0.733	-1.294
UNION	--		0.0579	0.241	--		-0.311	-0.870
TAXDIFF	0.0041	1.262	-0.0037	-0.725	7.40E-04	0.189	0.008	0.798
SOUTH	-0.0094	-0.367	-0.0193	-0.488	0.0173	0.657	0.059	0.907
WEST	-0.0091	-0.208	-0.0610	-0.960	0.0546	1.214	0.152	1.749
MIDWEST	0.0107	0.462	-0.0135	-0.491	0.0020	0.100	0.046	1.122

n = 60[b]

[a]Exogenous variables represent conditions in 1990; endogenous (Δ) variables represent change between 1990 and 1997.
[b]Sample does not include metro areas located only one county.

Income inequality. Income inequality is not significant in any of the equations during the 1990s.

Density. The effects of *DENSITY* on city and suburban populations shift in sign from the 1980s to the 1990s. During the 1990s, population density is positively and significantly related to growth of city population, but is negatively related to growth of suburban population (marginally significant). This shift between the 1980s and 1990s (*DENSITY* had a negative effect on city population but a positive effect on suburban population in the 1980s) suggests that the presence of population related amenities, such as availability of a wide variety of goods and services, began to draw people back to the cities and slowed growth of suburban populations during the 1990s.

Amenities. Results for the amenity variables indicate that, as was the case during the 1970s and the 1980s, suburban population growth in the 1990s was more rapid in metropolitan regions with warmer climates. City/suburban crime differentials were not significant for city or suburban growth in the 1990s.

Industrial structure. Among the industry structure variables, the most significant result is the negative effect of manufacturing for city employment growth. Cities with higher shares of their economy devoted to manufacturing grew more slowly than other cities, a result that is consistent with the thesis of deindustrialization. High initial shares of manufacturing are also found to be associated with more rapid growth of suburban employment (although the coefficient on manufacturing is only marginally significant in the suburban employment model), further suggesting that manufacturing cities were decentralizing more rapidly than other cities. The sign pattern on the producer services coefficient suggests an interesting change from the 1980s. Whereas producer services were positively related to city employment growth during the 1980s, producer services were negatively associated with city employment growth during the 1990s and were positively associated with suburban employment growth. Although the producer services coefficients are not highly significant, these shifts in sign are consistent with a decentralization of producer services jobs from central cities to suburbs during the 1990s.

Business and fiscal climate. The business climate and fiscal variables are not significant in any of the equations for the 1990s.

Region. Among the regional variables, location in the West is positively and significantly associated with suburban employment growth in the 1990s. Location in the West is also positively associated with suburban population growth, though this effect is not statistically significant.

Comparison over Time: Standardized Beta Coefficients. Examination of the values of the standardized beta coefficients (SBTs) for each model (Table 7) provides a useful tool for comparison of the results across the different time periods.[20] The most important growth determinants during all three decades were

TABLE 7. STANDARDIZED BETA COEFFICIENTS[a]

	1970-1980				1980-1990				1990-1997			
Variable	*ΔCPOP*	*ΔCJOB*	*ΔSPOP*	*ΔSJOB*	*ΔCPOP*	*ΔCJOB*	*ΔSPOP*	*ΔSJOB*	*ΔCPOP*	*ΔCJOB*	*ΔSPOP*	*ΔSJOB*
ΔCPOP		0.63				0.84				0.77		-1.39
ΔCJOB	1.00				0.76				1.33			1.41
ΔSPOP		0.32						0.42				
ΔSJOB						0.36	0.66		-0.60	0.42	0.61	
NONWHITE						-0.25		0.54	0.36	-0.26		
IMMIG												
OV64	-0.27							0.35				
COLLED												
INEQ		-0.19			-0.13							
CSINEQ	0.29	-0.16										
DENSITY	0.11	-0.08			-0.14		0.25		0.15		-0.14	
COOLDEG			0.38				0.43				0.26	
PRECIP												
CRIME	-0.13				-0.12							
MANUF				-0.34						-0.17		0.26
PROD						0.17				-0.14		
MILITARY				-0.48								
UNION				-0.38								
TAXDIFF												
ANNEX				-0.40								
SOUTH				0.60								
WEST				0.84								0.52
MIDWEST												

[a]Values are included for those coefficients with t-Statistics of 1.4 or greater.

the endogenous city growth variables (all of which are highly statistically significant). In each of the city population equations, changes in city employment have the largest effect (i.e., the largest standardized coefficients). Similarly, in each of the city employment equations, city population growth had the largest effect. These results further reinforce the finding of strong feedback relationships between population and employment growth in cities. For cities that experienced in-migration of people or jobs over the study period, these feedback linkages suggest that these gains tended to be self-reinforced. For cities losing population or employment, however, these results indicate the existence of a downward spiral of urban decline, with population losses exacerbating job losses and vice versa.

For suburbs, the key determinants of growth varied over the three decades. During the 1970s, climate and region were the key drivers of suburban population and employment growth, respectively. During the 1980s and 1990s, the linkages between population and employment, and connections to the central city become more important for suburban growth. In the suburban population equations for both the 1980s and the 1990s, suburban employment growth is the most important growth determinant. Clearly, growth of job opportunities in the suburbs was drawing people to suburban areas during these two decades. For suburban employment growth, central city demographics, including *NONWHITE* and *OVER64*, were key variables during the 1980s. In the 1990s, the most important determinant of suburban employment growth is growth in city employment. Decline in city population, which had a positive effect on suburban employment, was also a leading determinant of suburban employment growth in the 1990s.

Conclusions

Differential rates of growth and decentralization are processes that characterized U.S. urban areas over the past three decades. Efforts to account for these processes have emphasized factors such as differences in endowments, industrial structure, and fiscal policies across cities, as well as regional location. Recent work in this area has also paid increasing attention to the role of central city conditions in influencing the overall economic health of metropolitan areas, and particularly the growth of suburban areas. This paper considered the determinants of city and suburban growth and interrelationships between city and suburban growth during each decade between 1970 and 1997.

The modeling approach adopted in the study allowed for two types of simultaneity, between population and employment, and between cities and suburbs, while also taking into account a range of other factors. Concerning the question of simultaneity between population and employment, the evidence for simultaneity was very strong for cities, but less so for suburbs. There was evidence of bidirectionality between population growth and employment growth

in cities during all three decades. Given that many cities experienced both job and population losses over the study period, this finding indicates that these phenomena were interrelated: job losses in the central city led to population out-migration from the central city, but population out-migration also led to job losses. For suburbs, growth of employment had a positive effect on suburban population growth during both the 1980s and 1990s. During these two decades, people were following jobs into the suburbs. In the 1970s, suburban population and employment growth occurred relatively independently, and instead were primarily influenced by larger-scale, national shifts in population and employment.

Regarding the question of simultaneity between cities and suburbs the results suggest that suburban growth had an important effect on cities during all three decades, while city growth was most important for suburbs during the 1990s. Concerning the effects of suburban growth on cities, results indicated that during the 1970s, suburban population growth had a positive effect on growth of city employment. Similarly, during the 1980s and 1990s, growth of suburban employment had a positive effect on city employment growth. Overall, these findings suggest that growth in suburban population and suburban jobs tended to enhance city employment opportunities. These enhancements may have occurred through income and industry-related linkages: income generated via suburban employment growth led to increased spending in cities, thereby creating city jobs; similarly, growth of suburban industries increased demand for inputs produced in the city, thereby generating increased city employment. Although growth of suburban employment had a positive effect on city employment, it generally had the opposite effect city population. During 1990s, and to some extent during the 1980s, growth of suburban employment was associated with declining city population. This result indicates that job opportunities in the suburbs were drawing people out of the cities during both decades.

This finding — that growing job opportunities in the suburbs contributed to decentralization of population out of the central cities — is reinforced by the fact that city population growth during the 1990s was also inversely related to suburban employment growth. Concerning the other effects of city growth on suburbs, the most noteworthy effect occurred during the 1990s when city employment growth contributed to suburban employment growth. This result indicates the presence of a positive feedback between cities and suburbs during the 1990s, since suburban employment growth was also found to have a positive effect on city employment growth in this decade. The existence of positive feedback linkages between cities and suburbs during the 1990s suggests that the relative economic prosperity experienced by urban areas during the 1990s was

felt by both cities and suburbs, with job growth in either location enhancing the job opportunities in the other location.

With regard to the other determinants of city and suburban growth, the results suggest that city growth tended to be strongly tied to conditions within the city, particularly demographics, population density (which had both positive and negative effects), crime rates, and income inequality. Industry structure was also important for cities, especially during the 1980s and 1990s. Suburban growth, by contrast, tended to be strongly influenced by national and regional factors, such as climate and regional location, although city demographics and city population density were also important during the 1980s and 1990s.

Several interesting "negative" findings also emerged from the analysis. One notable result was the lack of significance of the human capital variable (*COLLED*) in any of the city or suburban models. Although other studies have found that educational attainment influences long-run patterns of urban growth (e.g., Glaeser et al. 1995), results of the present study suggest that factors such as demographics, industry structure, and regional location tend to be more important as drivers of growth during shorter time periods. Another negative result was the lack of significance of city-suburban tax differentials as a determinant of either city or suburban growth during any of the decades. Although this finding runs counter to the expectation that differential tax rates would influence the location decisions of households and firms, the finding is consistent with other studies that have found that tax differentials have insignificant effects on city and suburban growth. Finally, one of the most surprising negative results concerns the role of annexation in metro growth.[21] Contrary to the thesis proposed by Rusk (1993), which suggests that growth of city land area is necessary for overall metropolitan economic health, there was no evidence that annexation of suburban areas by cities leads to more rapid growth of metros overall. Annexation generally was not significant as a determinant of either city or suburban growth, though it did act as a deterrent to growth of suburban employment during the 1970s.

NOTES

1. Recent analyses include Carlino and Mills (1987), Clark and Murphy (1996), Crihfield and Panggabean (1995), Dalenberg and Partridge (1995), Drennan et al., (1996), Glaeser, et. al. (1992), Glaeser et al. (1995), Frey and Fielding (1995), Leichenko and Erickson (1997), Mills (1986), Mills and Lubuele (1995), Mulligan et al. (1997), O'Huallachain (1992), and O'Huallachain and Satterthwaite (1992). For studies of regions in Europe, many in parallel with those concerning the United States see Cheshire and Carbonaro (1996), Dignan (1995), Dunford (1993), Hall (1993), and Rodriguez-Pose (1997). A related stream of research involves the narrowing gap between rich and poor regions. See Barro (1991) and Barro and Sala-i-Martin (1991), Bauer and Mason (1992), Fan and Casetti (1994), Glickman (1997), Romer (1990), Sala-i-Martin (1996) and others.

2. See footnote 9 for a description of the cities included in the study.
3. Bartik (1991) and Kusmin (1994) provide reviews of the empirical literature published before 1992.
4. On educational attainment see Crandall (1993), Glaeser et al. (1995), and Beeson and Montgomery (1993). Drennan et al. (1996), and Glaeser et al. (1995) discuss industrial structure.
5. Glaeser et al. (1995), for example, modeled metro growth between 1960 and 1990 as a function of city conditions in 1960. See also Bradford and Kelejian (1973), Ledebur and Barnes (1992), Savitch et al. (1993), and Voith (1992).
6. See Glaeser et al. (1995), Beeson and Montgomery (1993), and Drennan et al. (1996) for examples of these three types of analysis.
7. Some important recent studies of the relationships between central cities and the suburbs include Voith (1998), Downs (1997), Hill and Wolman (1997), Mieszkowski and Mills (1993), Mills (1992), Orfield (1997), and Rusk (1993).
8. Hill et al. (1995) provide a detailed review and critique of the empirical literature on the "suburban dependence" hypothesis.
9. The *State of the Nation's Cities* or SONC database was constructed at the Center for Urban Policy Research (CUPR) at Rutgers University for the U.S. Department of Housing and Urban Development in anticipation of the 1996 United Nations "Habitat II" Conference in Istanbul. The database consists of more than 2,000 variables on 77 cities and 74 metropolitan areas. The database includes the Nation's 50 largest cities as well as a number of smaller urban areas. Categories of variables in the data set include: employment and economic development, demographic factors, housing and land use, poverty and income distribution, fiscal conditions and the public sector, and social, health, environment and other indicators of urban life. The database can be found on at the CUPR Web site at http://policy.rutgers.edu/cupr/.
10. Three of the metro areas in the database contain two central cities. These include the Los Angeles metro area, which contains Los Angeles and Long Beach, the Minneapolis metro area, which contains Minneapolis and St. Paul, and the Kansas City metro area which contains Kansas City, Missouri and Kansas City, Kansas. Several of the cities in the SONC database were not included in the final regression analyses due to missing data for certain variables.
11. Studies demonstrating the interdependence between population and employment both within and across U.S. cities and counties include Mills (1986), Carlino and Mills (1987), Clark and Murphy (1996), Glavac et al. (1998), Mulligan et al. (1997), Boarnot (1994), and Levernier and Cushing (1994), among others.
12. "Natural evolution" is a phrase used by Mieszkowski and Mills (1993) to summarize a broad category of models that regard suburbanization as a natural outcome of processes of residential filtering, reinforced by transportation innovations which have reduced commuting times and costs.
13. In the model for the 1970s, nonwhites include blacks and non-black Hispanics; a separate Asian category was not available for 1970. In models for the 1980s and 1990s, nonwhites include blacks, Hispanics and Asians.

14. It is important to note that international migrants concentrate in a few "gateway" metropolitan areas. Nearly half of all international migrants went to just five of the SONC metros: Chicago, Los Angeles, Miami, New York, and Washington DC. These migrants settled primarily in central cities (Glickman et al. 1996).
15. Note that the high school and college education variables are not strictly comparable over time for two reasons. First, decennial census tabulations of city and metro high school education report high school educational attainment of persons aged 18 and over. For the 1970 census tabulations the universe is persons aged 25 and over. Second, 1980 and 1990 decennial census figures reflect changes to the census questionnaire in 1990. For 1980, "high school graduates" refers to those persons completing four years of high school. For 1990, tabulations distinguish between persons earning a degree (or equivalency) and those completing grades 9 to 12 without receiving a degree. For 1990, the city and metro high school education variables report the percentage of all persons aged 18 and over who earned a high school diploma or equivalency (including all persons attaining higher levels of education). For 1980, "college graduates" refers to those persons completing four or more years of college; for 1990, the tabulations distinguish between persons who earned a bachelor's degree and those completing one or more years of college without receiving a degree. In 1990, COLLED reports the percentage of all persons aged 18 and over who earned bachelor's degrees (including those completing graduate or professional degrees).
16. State unionization rates were used because these data are not available for cities.
17. Data on tax revenues are based on the central county and suburban counties in each metropolitan area.
18. Because employment data by place of work are not available for cities in 1997 (an off-census year), central county employment totals were used for the 1990s analysis. Use of central city and suburban county data during the 1990s meant that metro areas where the central city and suburbs are located in only one county were excluded from the analysis. Other studies that use central and suburban counties to approximate central cities and suburbs include Voith (1998) and Levernier and Cushing (1994).
19. Dropping the multicollinear variables does not, of course, solve the problem of high correlations between explanatory variables; rather the variables that were retained may be interpreted as partially representing the phenomenon measured by those variables that were dropped.
20. While the actual values of the standardized coefficients are not comparable across models, it is possible to compare which variables have the highest values during each time period.
21. One limitation of Rusk's thesis which was not directly addressed in the present study was the need to distinguish between cities that are landlocked, cities that are unable to grow due to growth control legislation, and cities that are, essentially, unbounded. One direction for further research might involve partitioning the MSA sample based on these types of geographical differences. This type of partitioning would allow isolation of differences in city and suburban growth determinants and in the linkages between cities and suburbs, based on the geographic structure of the metro area.

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