

Technology and the Future of Metropolitan Economies

Robert Atkinson
Rhode Island Economic Policy Council
(formerly with the U.S. Office of Technology Assessment)

This paper is one of a series associated with the November 28, 1995, workshop "Midwestern Metropolitan Areas: Performance and Policy." Richard Mattoon served as workshop convener and editor. The workshop was first of a series held at the Federal Reserve Bank of Chicago as part of the 1996-97 project "Assessing the Midwest Economy." Inquiries should be directed to the Public Information Center, Federal Reserve Bank of Chicago, P.O. Box 834, Chicago, Illinois 60690-0834, or telephone (312) 322-5111. The Federal Reserve Bank of Chicago's Web site can be accessed at <http://www.frbchi.org>.

Introduction

The United States is in the midst of a technological revolution, driven in large part by rapid advances in microelectronics. Digital electronic technologies permit information in a myriad of forms to be generated, routed, and transmitted cheaply, nearly instantaneously, and at high volumes virtually anywhere. There has been much speculation about the impacts of the “information superhighway,” “digital society,” and emerging “cyberspace” on society as a whole, but surprisingly little is known about the potential effects of this technology revolution on the spatial distribution of jobs and people broadly, or on urban conditions in the United States specifically. Today, urban life is increasingly shaped through the continuous and real-time interactions facilitated by information technologies (computing and telecommunications technology). Because these interactions differ so markedly from past interactions that were more burdened by space and time constraints, they have, through their impact on industries and jobs, the potential to significantly reshape America’s metropolitan areas, leading to growth for some places and decline for others. These technologies will form the basis of a new technology system that is giving shape to the next wave in urbanization, the post-industrial metropolis. This article sketches out the main implications of the information technology revolution on the economies of U.S. metropolitan areas.¹

Technology and Stages of American Urban Growth

Because technological change in the United States has not been a continuous process, but rather one in which clusters of technological innovations emerge in particular periods, many believe that development of the cities and metros in the United States has proceeded in a discontinuous rather than linear fashion.² Urbanization has been driven by technology transitions that redefine urban hierarchies and bring new types of specialization to the urban economic base. As a result, the pattern of urbanization has not been a smooth evolution to the conditions of the present, but has been marked by major transformations from one form of city to another.

New technology changes the spatial distribution of industry and people in several ways. First, the widespread distribution of new types of physical infrastructure make new locations accessible and cheaper. For example, the building of the interstate highway system allowed manufacturers traditionally dependent upon rail and ship to locate in other areas. Second, industries or demographic cohorts with different locational patterns grow or decline at different rates. The increase in central city employment in the late 1970s and 1980s was due in large part to the absolute and relative employment growth in sectors such as legal services, banking, and other producer services. For example, the doubling of legal service jobs from 1977 to 1987, an industry heavily concentrated in large urban area downtowns, contributed to the turnaround of the decline or stagnation of many central cities in the 1980s.³ These new legal jobs required an estimated 120 million square feet of new office space—the equivalent of three Chicago central business districts.

Third, the location of jobs can also change as technology, product mix, and industrial organization change. Technology can be particularly important in this process, since it can alter the nature and mix of inputs, including the type and quan-

tivity of labor, materials, energy, land, and buildings needed. As these change, optimal locations also change. Finally, technologies can influence where people live, in turn influencing where firms locate, particularly residential employment that serves local markets. For example, medical technology advances have enabled a larger share of the population to live longer after retirement, allowing the retirement population of states like Florida, Texas, California, and Arizona to expand significantly.

The importance of technological change is not to suggest that other socioeconomic and public policy factors have not also played, and will continue to play, important roles. Nevertheless, technology plays an important enabling role in shaping metropolitan areas.

All four kinds of technological change noted above have had considerable impact on urban form and life in the United States. In fact, as a result of these technology systems changes, some urban scholars argue that there are distinct historical periods of urbanization.⁴ These included: Artisan and Craft City (1820-1870); Early Industrial City (1870-1920); Mass-Production Metropolis (1920-1970) and most recently the Post-Industrial Metropolis (1970-present). In this latter phase business spreads throughout the metropolis; residential growth moves to the outer suburbs and exurban areas; some parts of some central cities, especially central business districts (CBDs), revive while others decline; and many sections of older central cities and inner suburbs, particularly those formerly dependent on mass production manufacturing, stagnate or decline.

Describing the Post-Industrial Metropolis

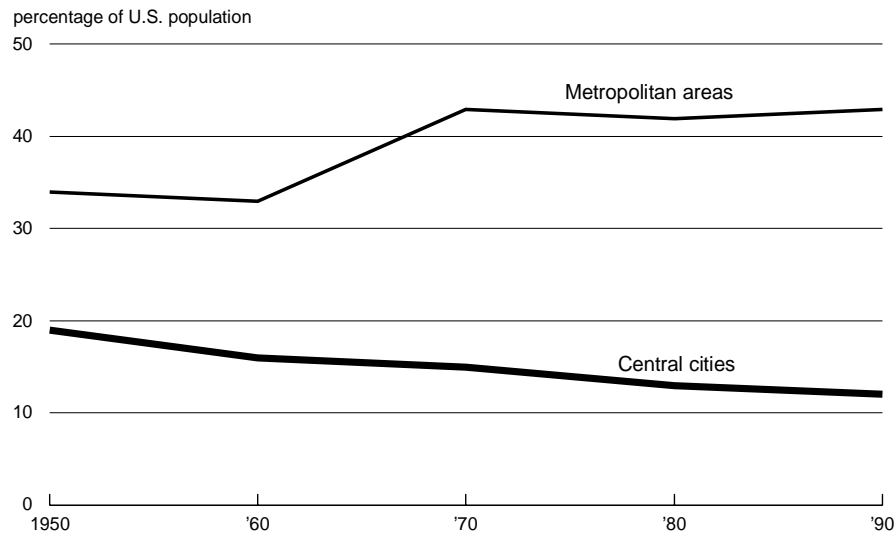
This section describes metropolitan development patterns in the United States over the last two decades. It examines the economic and demographic changes from three aspects: interregional changes, central cities and inner suburbs, and outer suburban and exurban areas.

Intermetropolitan Differences

America is neither predominantly an urban nor a rural nation but rather a metropolitan nation where the majority of the population lives and works in large urbanized areas that include both historic central cities and inner and outer rings of suburban development. In 1990, 75% or 193 million Americans lived in either large or small metropolitan areas; more than half the population, 126 million people, lived in the 40 largest metropolitan areas (population of 1 million or above), and 43% lived in the top 25 metros (population of 1.5 million or above).⁵ While the central city population of the largest 25 metros has changed very little since 1950, the suburban population has risen sharply (see figure 1). In 1950, metropolitan population was almost twice as great as central city population, meaning that urban and suburban populations were approximately equal. By 1990, the metropolitan population had surged to nearly four times central city population.

In the 1980s, both the population and civilian workforce of large metros (over 1 million population) grew slightly faster than smaller metros, consistent with the urbanization trends of the 1980s (see table 1). The share of the workforce living in large metros increased slightly from 49.9% in 1976 to 50.5% in 1994; however, all of that growth was a result of workforce growth in fringe, as opposed to core, counties of metro

Figure 1 The 25 Most Populated Metropolitan Areas and Their Central Cities as a Percentage of Total U.S. Population



Source: U.S. Census Bureau, State and Metropolitan Area Data Book, 1991.

areas.⁶ More recently, consistent with the technological trends discussed below, growth has been fastest in small and medium-sized metros, which gained 2.7 million workers between 1990 and 1994 compared to 1.4 million for large metros.

Not all metropolitan areas grew, however. About half of the largest 25 metros experienced decline or little to no growth between 1970 and 1990, even as the other half incurred substantial growth (table 2). In fact, five (13%) of the largest 40 metropolitan areas lost population between 1980 and 1990 (Detroit, Pittsburgh, Cleveland, Buffalo, and New Orleans), and 49 (22%) of the 228 next largest metros also shrank.

With the exception of New Orleans, four of the five declining large metros, and a large majority of the declining smaller metros, have much in common. Many were based on older industries that experienced considerable employment loss during the 1980s, including tires, automobiles, and steel, or were centers for the excavation and refining of copper, coal, aluminum, and oil. Moreover, 30 of the 54 declining small metros (55% are located in six states (Ohio, Pennsylvania, Iowa, Michigan, New York, and West Virginia) whose economies have been rooted in natural resources or manufacturing. Many of these declining, smaller metros are still dominated by their historic, industrial-era cores, whereas many larger metros, in spite of declining center cities, are growing because people and jobs are locating in the suburbs. In short, there appears to be increasing divergence in economic health between metropolitan areas: Some areas have been able to grow as they increased linkages to global markets and/or assumed more specialized roles and functions; other areas have been less successful and have stagnated or declined.

Table 1 Population Change for Regions and Metropolitan Categories, 1970-90

Region and metropolitan category ^a	Population 1990 (millions)	Percentage change	
		1970-80	1980-90
North			
Large	62.9	-0.9	2.8
Small and midsize	25.6	5.2	3.3
Rural	22.6	8.0	0.1
South			
Large	28.2	23.4	22.3
Small and midsize	31.9	20.9	13.4
Rural	24.9	16.3	4.6
West			
Large	33.8	20.0	24.2
Small and midsize	10.8	32.2	22.8
Rural	8.1	30.6	14.1
U.S. totals			
Large	124.8	8.1	12.1
Small and midsize	67.9	15.5	10.8
Rural	56.0	14.3	3.9
Region totals^b			
North	111.1	2.2	2.4
South	85.0	20.1	13.3
West	52.7	24.0	22.2
Total	248.7	11.4	9.8

^aLarge metropolitan areas (MAs) include 39 CMSAs and MSAs with 1990 populations exceeding 1 million.

^bThese regions are consistent with standard census definitions where the North region represents the combined Northeast and Midwest census regions. When an individual MA overlaps regions, its statistics are assigned to the region where its principal central city is located.

Source: Compiled by William Frey, "The New Urban Revival in the United States," *Urban Studies*, vol. 30, nos. 4/5 (1993).

Metropolitan areas, and in particular, larger areas, grew in the 1980s for several reasons. First, many of the industries concentrated in rural areas grew slowly in the 1980s, meaning that national growth tended to be concentrated in urban areas. For example, employment in agriculture, mining, and manufacturing all declined between 1977 and 1992. In contrast, as discussed below, employment in services, particularly producer services, which have been concentrated in major metropolitan areas, grew significantly.

Second, the growth of the minority population, either through immigration or through natural increase (i.e., higher fertility rates), boosted growth in many metropolitan areas, particularly the largest. Between 1980 and 1990 the minority population in the largest metropolitan areas (over 1 million) grew 37% compared to 27% in smaller metros. The white population is growing faster in mid-size metropolitan areas (7.1%) than in larger metros (3.8%), indicating that the population in the nation's large metros is comprised increasingly of minorities.⁷

Table 2 Population Change in the 25th Largest Metropolitan Areas, 1970-90

Region and metropolitan area	1980 population (1000s)		Metropolitan area percentage change		Central city change		Suburban change	
	Metropolitan area	Metropolitan central city(s)	1970-80	1980-90	1970-80	1980-90	1970-80	1980-90
North								
New York	18,087	7,323	-3.6	3.1	-10.4	3.5	1.7	2.8
Chicago	8,066	2,784	2.0	0.9	-10.8	-7.4	11.8	7.1
Philadelphia	5,899	1,586	-1.2	3.8	-13.4	-6.1	5.1	8.0
Detroit	4,665	1,028	-0.7	-1.9	-20.5	-14.6	8.4	2.5
Boston	4,172	574	0.8	5.0	-12.2	2.0	3.4	5.5
Cleveland	2,760	506	-5.5	-2.6	-23.6	-11.9	0.5	-0.3
Minneapolis-St. Paul	2,464	641	7.8	15.3	-13.8	-0.1	20.8	21.9
St. Louis	2,444	397	-2.2	2.8	-27.2	-12.4	6.5	6.4
Pittsburgh	2,243	370	-5.2	-7.4	-18.5	-12.8	-1.8	-6.3
Cincinnati	1,744	364	2.9	5.1	-15.1	-5.5	10.0	8.3
Milwaukee	1,607	628	-0.3	2.4	-11.3	-1.3	8.9	4.8
Kansas City	1,566	435	4.4	9.3	-11.6	-2.9	13.8	14.8
South								
Washington	3,924	607	6.9	20.7	-15.7	-4.9	14.4	27.0
Dallas-Fort Worth	3,885	1,454	14.6	32.5	4.2	12.8	47.3	48.2
Houston	3,711	1,631	43.0	19.7	29.3	2.2	61.1	38.1
Miami	3,193	359	40.1	20.8	3.5	3.4	47.9	23.4
Atlanta	2,834	394	27.0	32.6	-14.1	-7.3	44.1	42.4
Baltimore	2,382	736	5.3	8.3	-13.2	-6.4	19.4	16.5
Tampa-St. Petersburg	2,086	519	46.0	28.1	3.3	1.7	80.4	40.4
West								
Los Angeles	14,532	3,485	15.2	26.4	5.4	17.4	19.0	29.5
San Francisco-Oakland	6,253	1,096	12.9	16.5	-5.4	7.6	18.3	18.6
Seattle	2,559	516	14.0	22.3	-7.0	4.5	22.4	27.7
San Diego	2,498	1,111	37.1	34.2	25.6	26.8	49.2	40.7
Phoenix	2,122	983	55.4	40.6	35.2	24.5	85.8	58.3
Denver	1,848	468	30.7	14.2	-4.3	-5.1	55.6	22.6

Source: Compiled by William Frey, "The New Urban Revival in the United States," *Urban Studies*, vol. 30, nos. 4/5 (1993).

Interregional Differences

In addition to differences in growth between different-sized metros, there have also been differences in growth between regions of the country. The West and the South have been gaining population and employment faster than the East and the Midwest for decades. Yet there has been some lessening of differences between northeastern and midwestern metros and so-called Sun Belt metros in the Southeast, Southwest, and West. Importantly, many large metros in the North and Midwest reversed the decline in population of the 1970s in the 1980s. Large metros in the South and West continued, however, to grow faster than those in the North (see figure 2). Still, employment growth in the 1980s favored metropolitan areas of the South and particularly the West, while employment growth in the Northeast and Midwest was 94 and 93%, respectively, of the national average.⁸

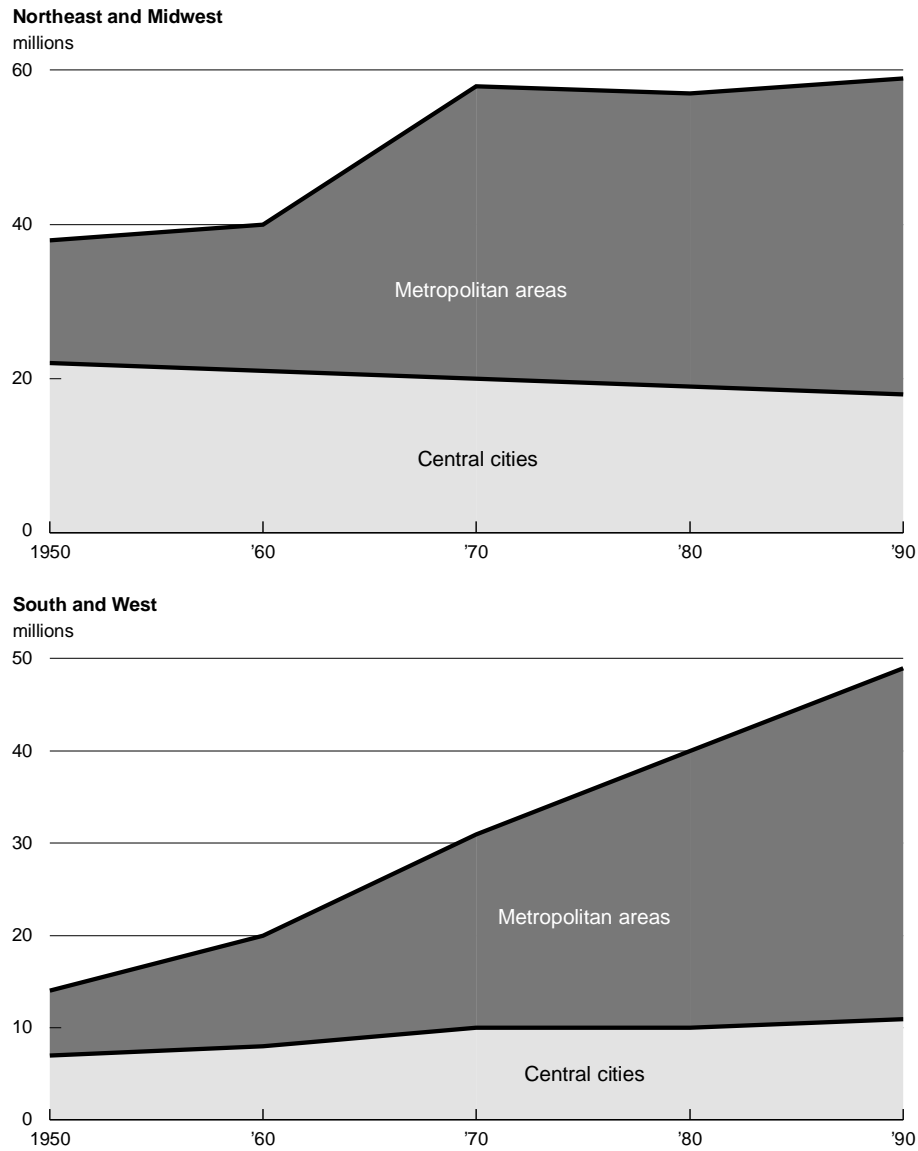
However, such simple North-South or coast-heartland dichotomies appear to be becoming less critical as some southern and coastal metropolitan areas (e.g., Los Angeles, Houston, Boston) that appeared to be immune to recession have undergone cyclical and structural difficulties in the last decade, while some northern and interior cities remain healthy or have rebounded to some extent (e.g., New York in the 1980s, Minneapolis, Columbus). Places that did well in the 1980s, such as California and New England, grew slower in the 1990s, and some midwestern metros are growing rapidly. Between 1990 and 1994, the Midwest reversed a decade of slow workforce growth and grew as fast as the nation as a whole (4%). The Northeast, however, continued its pattern of slower employment, actually losing 1.3% of its employed workforce. These regional growth patterns have varied for a number of reasons, including: changes in defense spending, which tended to be concentrated along the coasts; changes in the value of the dollar, which disproportionately affects places dependent upon trade, such as the industrial Midwest; and changes in energy and natural resource prices, which affect many western and mountain areas.

Central City and Older, Inner Suburban Economic Trends

The 1980s' growth of large metropolitan areas is not synonymous with, but is nonetheless related to, the fate of historic core cities. Whereas most of the 40 largest metropolitan areas grew (on average 1.9%), half of the central cities continued to decline in population. However, of the 18 central cities that lost population in the 1970s, four—New York, Boston, San Francisco-Oakland, and Seattle—grew in the 1980s, and all of the other 14 cities, except Denver, lost population at a slower rate than in the earlier decade (see table 2). Many other cities have lost population. Of the 196 cities in the United States with more than 100,000 residents in 1990, 65 have lost population since 1970. Overall, population of the 25 largest American cities in the 1980s grew annually by a modest 0.5% compared with a 5.3% decline in the 1970s; and the top 40 cities grew 3.3% in the 1980s compared with a 3.0% decline in the 1970s. The share of U.S. population living in the largest 25 central cities declined from approximately 18% in 1950 to 13% in 1990.

Total central city populations in the largest 13 Northeast and Midwest metros declined each decade from 1950 to 1990 (figure 2), and metropolitan population rose sharply during the 1960s and then plateaued from 1970 to 1990. In contrast, the central

Figure 2 Population Change in Central Cities and Metropolitan Areas



Note: Population figures for the largest 13 metropolitan areas in the Northeast and Midwest and the largest 12 in the South and West in 1990.
Source: U.S. Census Bureau, State and Metropolitan Area Data Book, 1991.

cities in the South and West have had slow population growth (figure 2). However, some of these central cities of the South and West grew by annexation, thus making it appear as if their central areas gained population, when in fact they have not.⁹

The difference between central city and suburbs is not always stark. In fact, many older, inner suburbs have also lost populations and jobs. Of 3,000 suburban jurisdictions in the largest 60 Primary Metropolitan Statistical Areas (PMSAs), the

range of differences between one suburban area and another was extreme—e.g., employment growth rates between 1980 and 1986 as high as 106% and as low as negative 47%, with 27% of suburban communities losing employment from 1980 to 1986.¹⁰ A 1987 HUD study indicates that even in revived or prosperous metropolises like Boston and Los Angeles there were many suburbs—perhaps 30%—in decline.¹¹

Central City Economies

Central cities that increased in population in the 1980s tended to be those that had managed a successful transition from an older industrial economy to an advanced service economy via specialization as locations for corporate headquarters; finance, insurance, and real estate (FIRE); and related producer services (e.g., law, advertising, and hotels). This was especially the case for so-called global cities (e.g., New York, Los Angeles, San Francisco, Chicago) that served as command and control centers for global corporations and for operations of global financial institutions and related businesses,¹² but also cities such as Boston, Dallas, Minneapolis, Seattle, and San Jose, whose regions specialized in high-tech manufacturing. Older cities in regions where transition to these service and high-tech manufacturing sectors did not advance, or was not sufficiently centralized, tended to continue declining.

During the 1980s, employment in the CBD of most central cities grew slowly at about 1% annually compared to 3.4% for suburbs.¹³ While manufacturing and retail employment declined in the CBDs of the largest 60 metropolitan areas between 1976 and 1986, FIRE and business services grew, and as a result total employment grew.

In part because of their high costs of doing business, central city economies appear to be heavily dependent upon job creation through expansions or new startups as opposed to attraction of new industry. For example, no new jobs were created in the Milwaukee CBD from 1979 to 1994 due to large firms moving in (2,700 were lost due to relocation outside the CBD), while the CBD created 6,600 jobs due to expansions and 381 from new firm formation.¹⁴ For all firms, the city lost 30,000 jobs through movement to the suburbs alone and gained approximately 11,500 from firms moving into the city.

Sectoral Change

Central city economies are losing certain types of employment faster than others and in the process are becoming more specialized in services in general, and advanced services in particular. They are generally losing blue-collar jobs, including construction, particularly in the Northeast and Midwest.

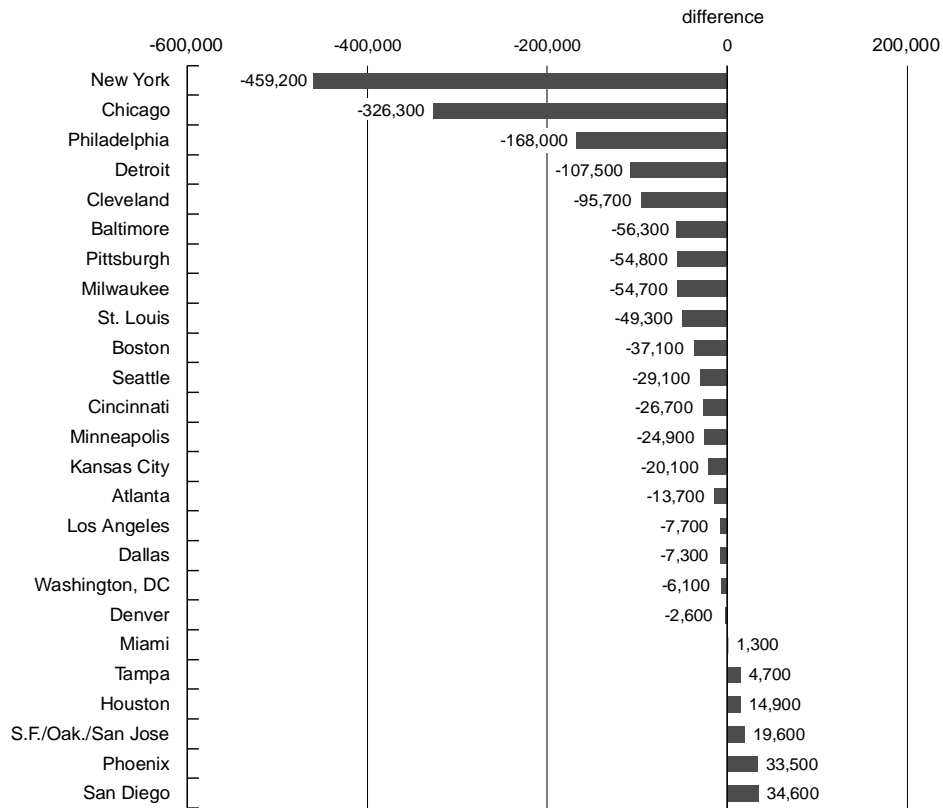
Manufacturing is no longer an economic activity identified with the central city. Decline of manufacturing employment in high-cost urban areas, particularly in the Midwest and Northeast, is not new. However, its severity and speed is new. For example, between 1979 and 1994, manufacturing employment declined by 47,000 in the Milwaukee central city and inner-ring suburbs but increased by 13,000 in outer-ring suburbs.¹⁵ In the 1980s the 28 largest central counties of the Northeast and Midwest regions lost a total of nearly 1 million manufacturing jobs (see table 3 and figure 3).¹⁶ A large share of manufacturing is now located in the outer suburbs and exurbs of major metropolitan areas.¹⁷ In the early 1960s such plants were generally located in central cities and inner suburbs, but as metro areas grew, manufacturing decentralized.

Table 3 Employment Change in Largest Central Counties: 1980-90

Region	Total	Manufacturing	Services
Northeast/Midwest (28 counties)	1,634,000	-971,000	2,605,000
South/West (35 counties)	6,026,000	-17,000	6,043,000

Source: John D. Kasarda, "Industrial Restructuring and the Changing Location of Jobs," *State of the Union: America in the 1990s, Volume 1: Economic Trends*, Reynolds Farely (ed.) (New York, NY: Russell Sage Foundation, 1995).

Figure 3 Central City Employment Change by Industry: Manufacturing (1967-1987)

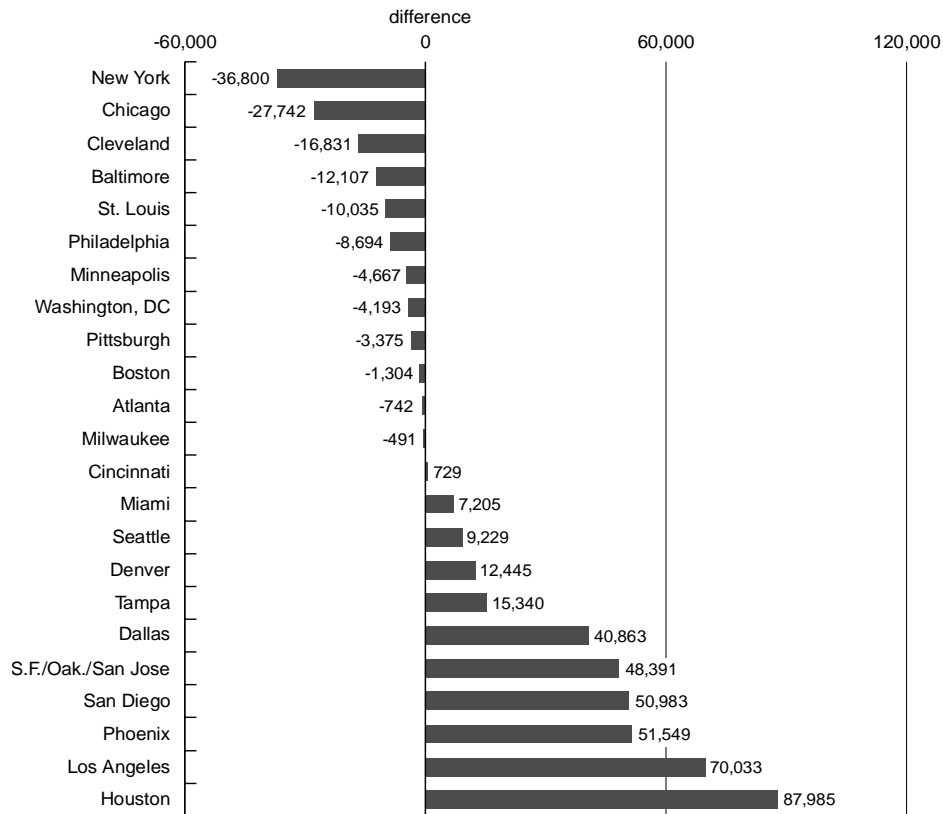


Source: U.S. Bureau of the Census, City and County Data Book, 1974, 1994.

Wholesaling and retailing are two other major industrial sectors that were once predominantly urban but now are primarily suburban (see figures 4, 5, and table 4). In Milwaukee between 1979 and 1994, retailing and wholesaling jobs declined by over 11,000 in the central city but increased by 28,000 in the suburbs, particularly the outer-ring suburbs.¹⁸ In part, retailing has followed the market—when people moved to the suburbs, so did retailing. However, it was probably not until the 1980s that some large department stores, for example, closed their city flagship stores. Likewise, as a greater share of the population, generally consumers with higher incomes, moved to the suburbs, many consumer services became predominantly suburban industries.

Wholesaling also moved to the suburbs, in part to be near beltways and interstate highways and to gain access to larger parcels of low cost land (see table 4). During the past two decades, most of the growth in warehousing and distribution activity has occurred on the periphery of America’s metropolitan areas rather than in the urban core.

Figure 4 Central City Employment Change by Industry: Retail Trade (1967-1987)

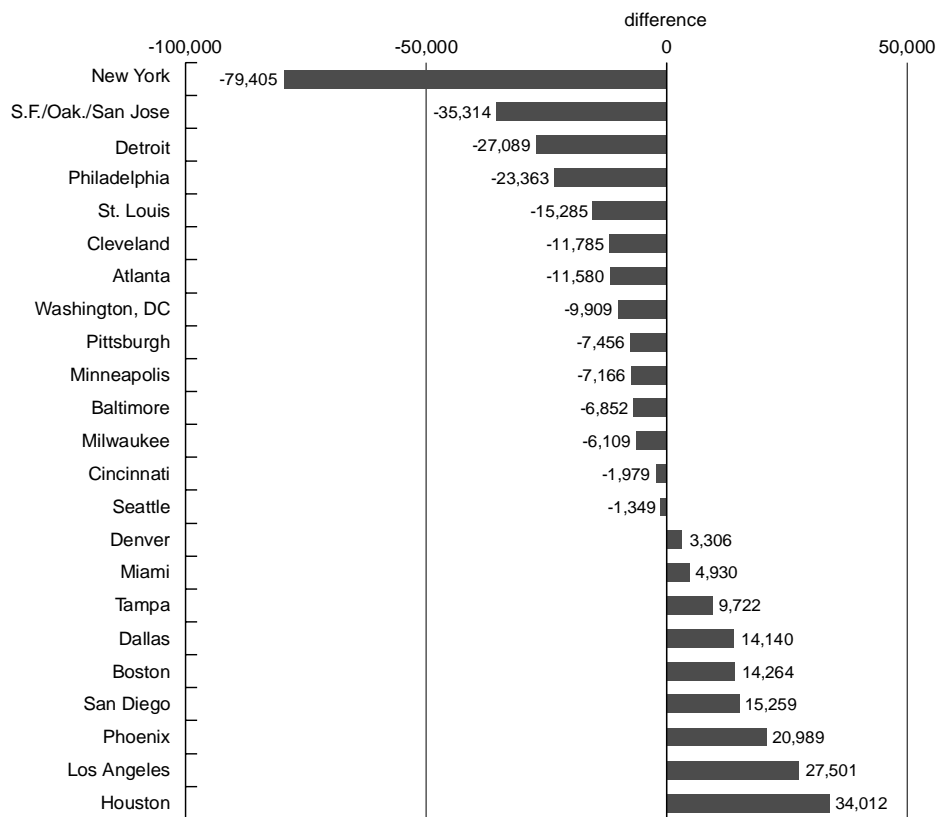


Source: U.S. Bureau of the Census, City and County Data Book, 1974, 1994. Data were unavailable for Chicago and Kansas City.

As center cities lost industries like manufacturing, retail, wholesale, and consumer services, producer services in many places filled the gap (e.g., financial services, advertising, accounting, law). (See figure 6 and table 4.) Many of these industries rely upon face-to-face contact and the need to be near other industries or government agencies. A major reason for the growth in producer services in central counties since the 1970s is that they were already specialized in industries, particularly financial services and business services, that grew faster than the national economy. For example, core counties of metropolitan areas over 1 million population gained 2.5 million jobs in producer services between 1974 and 1985, but 1.9 million of those jobs were due to the fact that these counties were already specialized in these fast-growing industries.¹⁹

The importance of producer services to the current and future economic viability of the central city cannot be underestimated. In 1984, the core counties of the 24 largest metros housed 66% of law offices with more than 50 employees, 75% of investment and securities offices with more than 50 employees, and 42% of all jobs in information-intensive industries (see figure 7). In nine major metros, white-collar

Figure 5 Central City Employment Change by Industry: Wholesale Trade (1967-1987)



Source: U.S. Bureau of the Census, City and County Data Book, 1974, 1994. Data were unavailable for Chicago and Kansas City.

Table 4 Distribution of Employment within Metropolitan Areas

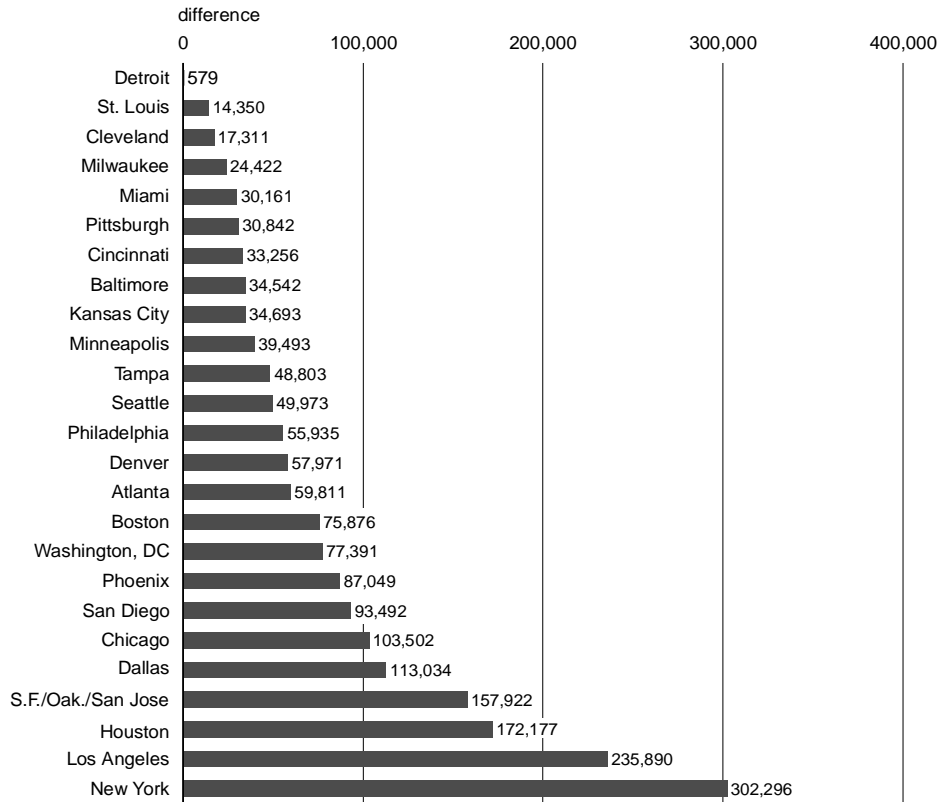
Industry	SIC CODE	Percentage of employees in the metropolitan area working in the core county		Change in percentage share: 1985-92	Change in core county employment (thousands)	
		1974	1985		1974-92	1985-92
Museums, Zoos, and Botanical Gardens	84	87%	83%	-3.9	11	3
Security Brokers	62	91	85	-7.3	107	28
Air Transportation	45	87	75	3.1	82	58
Advertising	731	86	78	-5.9	17	-11
Legal Services	81	69	68	-1.0	211	90
Water Transportation	44	72	66	-1.5	-23	-16
Accounting	872	73	63	-0.9	106	51
Transportation Services	47	78	65	-3.9	45	13
Finance, Insurance, Real Estate Administration	679	77	65	-7.7	-4	-31
Trans., Communication, Utilities Administration	497	68	61	-5.0	-17	-42
Banking	60-61	67	64	-7.4	177	4
Real Estate	65	66	60	-5.1	52	-7
Educational Services	82	57	56	-1.1	213	68
Hotels	70	63	58	-3.7	76	10
Insurance Carriers	63	71	60	-6.9	-31	24
Communications	48	64	57	-4.7	-31	-29
Management and Public Relations	8740	63	53	-2.5	124	43

Table 4 (cont'd) Distribution of Employment within Metropolitan Areas

Industry	SIC CODE	Percentage of employees in the metropolitan area working in the core county			Change in percentage share: 1985-92	Change in core county employment (thousands)	
		1974	1985	1992		1974-92	1985-92
Membership Organizations	86	61	53	50	-2.8	122	66
Services Administration	899	76	53	49	-4.2	46	27
Total Administration		65	55	49	-5.4	-116	-212
Health Services	83	54	50	49	-1.0	983	567
Wholesale Trade	50	64	55	49	-5.4	78	-40
Social Services	83	59	51	48	-2.4	217	100
Electric, Gas, and Sanitary Services	49	62	53	48	-5.5	2	-2
Trucking and Warehousing	42	61	49	46	-3.4	-26	12
Engineering and Architectural	871	58	49	43	-6.0	89	16
Manufacturing	20-39	54	47	43	-2.0	-1,550	-775
Construction	15-19	52	43	40	-2.8	-168	-122
Retail	53-59	51	44	41	-2.7	405	80
Computer and Data Processing	737	53	41	33	-7.8	113	29

Note: Data are for 15 of the 25 largest metropolitan areas: Atlanta, Baltimore, Boston, Chicago, Cleveland, Dallas, Denver, Detroit, Houston, Los Angeles, Minneapolis, New York, Pittsburgh, and San Francisco-Oakland-San Jose, Washington, DC.
Source: U.S. Census Bureau, *County Business Patterns*, 1974, 1985, 1992.

Figure 6 Central City Employment Change by Industry: Taxable Services (1967-1987)



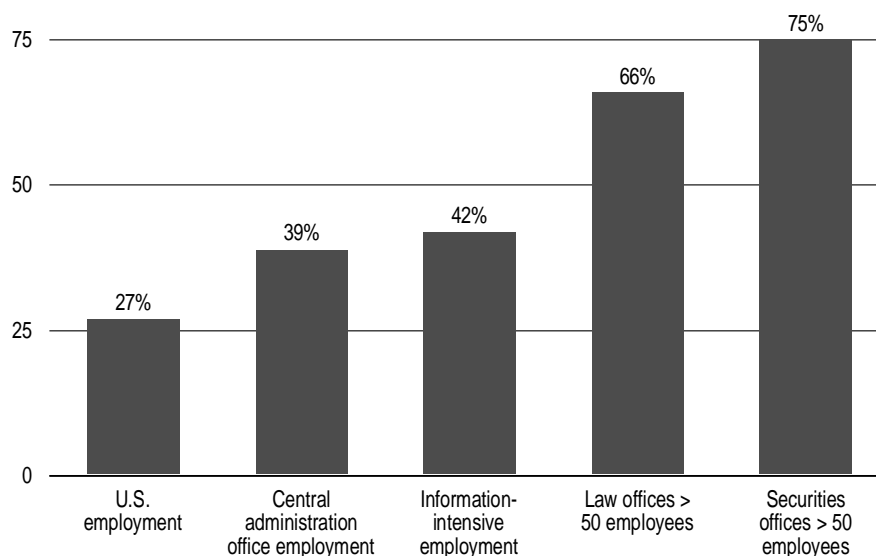
Source: U.S. Bureau of the Census, City and County Data Book, 1974, 1994.

services constituted between 20 to 40% of central city economies in 1970 but as much as 40 to 60% of these same economies in 1990.²⁰

However, particularly in core counties of larger metros, the rate of growth is slower than in the suburbs or mid-size metros. Between 1974 and 1985, core counties of the largest 40 metros gained 2.5 million producer services jobs, but they would have to gain an additional one million to keep pace with growth in the rest of the nation.²¹ In fact, the fastest growth in producer services has been in the suburbs and often in cities of 25,000 to 49,999 that are located within metropolitan areas—i.e., in suburban cities that are part of larger Metropolitan Statistical Areas (MSAs).²²

Some of this gain is due to relocations. For example, while central cities housed approximately 42% of corporate headquarters in 1984, by the early 1990s this number had decreased to 29% as many corporate headquarters relocated to the suburbs or to smaller metros (see table 4). The most famous relocation is probably that of Sears,

Figure 7 Share of Total U.S. Employment in Core Counties of the 24 Largest Metros for Selected Sectors, 1984



Source: M.P. Drennan, "Information Intensive Industries in Metropolitan Areas of the United States of America," *Environment and Planning A*, vol. 21, no. 12 (1989).

which in the late 1960s built the world's tallest building as its central Chicago headquarters and then in the late 1980s moved its Merchandise Group to Schaumburg, a north-western Chicago suburb, leaving much of the Sears Tower empty.

Suburban and Exurban Economic Trends

The spatial form of U.S. metropolitan areas has evolved significantly in the last 20 years. The once standard view of cities as consisting of a major central business district, an inner ring of low-income residents, and an outer ring of more affluent suburban residents no longer adequately describes most U.S. metros. Today the suburb, so defined, is rare. Residential development has extended even beyond the metropolitan periphery to low-density "exurban" locations. What were once bedroom suburbs have been replaced by a metropolitan area outside the central city that is increasingly urbanized, and, like the core, is a place not only for residences but for businesses and employment. Many people both live and work in the suburbs and rarely visit the central city; others still commute to the core for work but find that other economic functions, such as retail, personal, business, consumer, and social services, are available in the suburbs. This suburban job growth has led some to argue that "downtown," by which they mean a diversified center of economic activity that includes offices and retail, has relocated to the suburbs or, specifically, to business and commercial centers in the suburbs known as "edge cities" that in some cases are larger than the central business district.²³

Yet this picture needs shading: suburbs are still growing with respect to central cities but at a slower rate. Outer suburbs and exurbs adjacent to, and likely to become part of, the metro area are growing at the fastest rate, as might be expected given their available vacant land. And some inner suburbs are beginning to suffer from the same problems and the population decline that has long affected many central cities.

Business Suburbanization

One reason for the exurban population increase is the increasing rate of business suburbanization, which lets workers live even farther out in cheaper homes. In the last two decades, an increasing share and variety of metropolitan employment has located in the suburbs (see table 4). For example, in Milwaukee the central city lost 14,000 jobs between 1979 and 1994, inner-ring suburbs gained 4,800, and outer-ring suburbs gained 82,000.²⁴ Between 1989 and 1993, albeit a recessionary period, downtowns in the six largest Ohio cities lost an average of 7.17% of employment, while suburban business centers gained 2.1%, although even some older suburban centers lost employment.²⁵

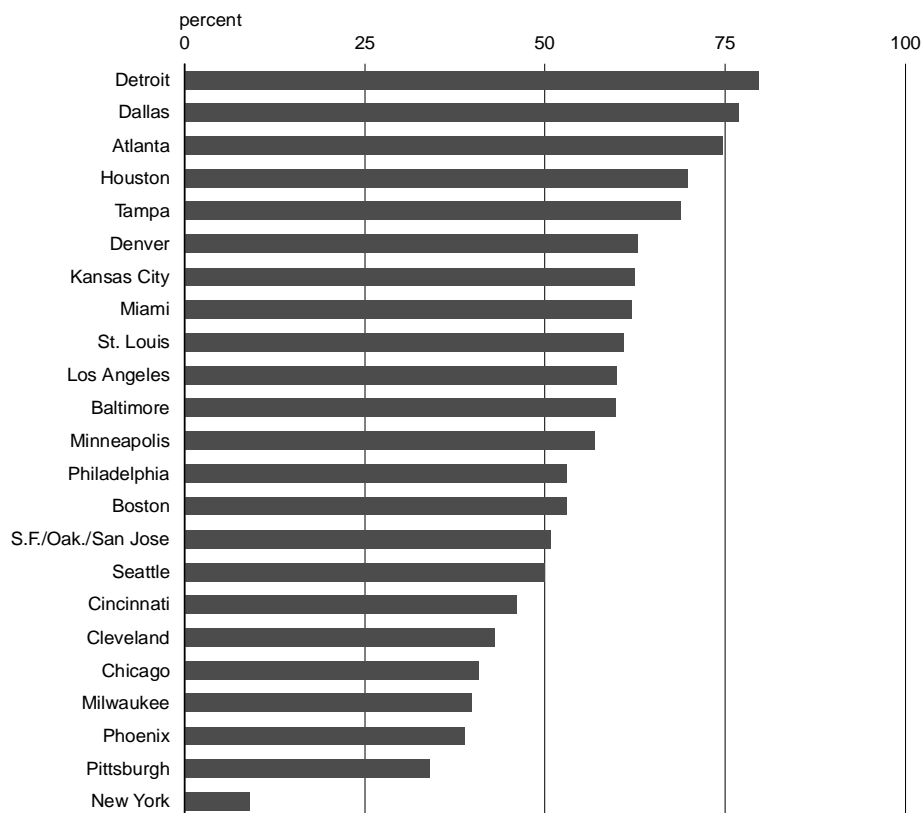
The pattern of suburban business location is diverse and complex and differs from metro to metro and within metros. Businesses locate in metropolitan areas to take advantage of the benefits metros offer, but their precise location in the suburbs may result from a number of causes, including factor cost differentials (price of land and rent, taxes, etc.), labor supply, commuting patterns, the layout of roads and highways, etc.

Though no metropolitan areas are the same, in general the economies of metropolitan areas are becoming less monocentric (most economic activity is located in one place—the central business district) and instead more polycentric, where economic activity is located in many centers throughout the metropolitan area. The common vision of the metropolitan area as a place with one economy, located among downtown skyscrapers and inner-ring factories, no longer describes the metropolis common to America at the end of the 20th century. For example, 57% of office stock is located in the suburbs, up from 25% in 1970 (figure 8).²⁶

However, there are several patterns of office development.²⁷ On the one hand, there is the phenomenon of specialized economic activities located in high concentrations in industrial and office parks and retail malls in a variety of so-called edge city clusters. Garreau identifies 181 such edge cities located in 34 metropolitan areas around the country.²⁸ One study of Dallas-Ft. Worth found that 60% of all jobs in the region are concentrated at 5% of the work sites.²⁹ In six metropolitan areas, Pivo found that the largest 10% of office clusters in the suburbs (areas where two or more offices are closer than one-quarter mile) contain over 40% of the office space, while the largest 25% contain over half.³⁰ Moreover, while some clusters may be large compared with the size of the central business district, they are small. The largest of these clusters, at 3.5 to 6.5 million square feet, are still one-fifth to one-tenth the size of the region's central business districts, and the average square foot of office per acre in these clusters was more than four times lower than the region's central business districts.³¹

In some metropolitan areas growth has been relatively even, but in many metropolitan areas growth is spatially uneven. Some suburbs are growing rapidly at rates much higher than the central city and also much higher than their respective metropolitan

Figure 8 Percentage of Commercial Office Space Outside the Central Business District (CBD) in 1988



Source: U.S. Bureau of the Census, State and Metropolitan Area Data Book, 1991.

area generally, while some suburbs, as discussed above, are losing jobs. In suburban Chicago, for example, three densely developed centers of suburban employment—O’Hare Airport, Schaumburg, and central Du Page County—accounted for 27% of total net employment growth in metropolitan Chicago in the 1980s.³² And though their employment density was much lower than Chicago’s central business district (average employment density of 126,000 per square mile), these three “edge cities” did reach densities of about 30,000 workers per square mile.³³ Moreover, the counties in which they were located experienced high employment growth in the 1980s—northwestern Cook County and Du Page County accounted for 65% of the decade’s metro employment growth of 394,000 jobs, or roughly 257,000 jobs. If one adds to these figures for suburban Chicago employment growth in the 1980s, the employment growth in the central business district—from 491,000 to 522,000 jobs, or an increase of 31,000—and the fact that the city of Chicago as a whole experienced a slight job loss (20,000 jobs), the uneven aspect of suburban economic development becomes a bit clearer. The suburbs are growing very fast and to a certain extent unevenly.

Information Technology and Spatial Patterns

Given that the evolution of America's urban areas has closely paralleled the evolution of technology,³⁴ it is therefore not unexpected that the next major technology revolution will have significant implications for the future of urban areas. But what will these changes mean for America's regions and cities? Predicting the future is difficult. As George Eliot once wrote, "Among all forms of mistake, prophecy is the most gratuitous." However, based on an analysis of the effects of new information telecommunications technologies on locational patterns of different industries, this paper will lay out some patterns and trends likely to occur over the next two decades.

Historically, cities have arisen and grown as centers of transactions and commerce largely because of the need for physical proximity of firms, suppliers, and customers. Agglomerations of people, infrastructure, and industry allowed for efficient production, transport, and distribution of goods and services. By allowing activity to be physically farther apart, yet functionally still close, advances in technology, particularly new transportation modes (e.g., train, electric trolley, cars, and trucks), helped shape the first industrial city and the mass production metropolis. Today, new technologies, particularly information technologies, are creating closer connections between economic activities, enabling them to be physically farther apart. As a result, these technologies are central to the reshaping of the post-industrial metropolis.

To better understand how the next wave of technologies is likely to recast industrial and residential locational patterns, it is important to understand the key information technologies being adopted by industry. Many of the early applications of information technology improved internal operations (e.g., mainframe and desktop computing) and often created "islands of automation" with little interconnection between components. It is only recently that technologies have begun to facilitate real-time and widespread linkages and communication among operations. These technologies are getting cheaper, more powerful, and more pervasive. They can be categorized into three groups: 1) technologies to transform information into electronic form (e.g., fax, video phones, computers, optical scanners, and bar code readers); 2) switching and routing technologies (e.g., Internet communications and e-mail, call-forwarding systems, local and wide area networks, and wireless communications and computing); and 3) transmission (e.g., fiber optics, digital switching systems, and satellites).

Yet in spite of all the fervor over the Internet, mobile communications, and other new applications, the information technology revolution is nowhere near complete. However, developments over the next 10 to 15 years will likely result in widespread diffusion of cutting-edge technologies, including: 1) widespread adoption of e-mail and Internet access; 2) easy networking of remote computers to allow users the same convenience enjoyed by computer users on local area networks (e.g., file access, ability of multiple parties to view and work on the same file); 3) ubiquitous use of "smart cards" for financial and other transactions; 4) significant business use of video telephones; 5) cheap high-definition displays; 6) widespread high-speed telecommunications (e.g., cable modems); and 7) across-the-board increase in information technology (IT) "literacy" and use of electronic transactions.

In general, this IT revolution is leading to a shift from transactions and learning based on both face-to-face communication and goods shipment to one based on transfer of digital information. (See table 5.) As more of the economy is conducted digitally, old patterns of location based on minimizing distance and maximizing communication become less important. Yet, to a great extent, how these technological changes will spatially reorder economic activity will depend upon the extent to which technology will allow activities to be conducted at a distance. Because the nature of linkages differ depending on what is being done (e.g., moving goods versus moving information, face-to-face contact versus electronic contact), IT will impact different operations differently. There are four main types of business functions: front office (customer interaction), routine back office (no direct customer interaction), goods production and distribution, and complex back office.

Front Office Functions

Historically, the location of a large share of service employment was dictated by local market demand. Branch banks, retail stores, personal services (e.g., barbers, auto repair), customer service centers, and other consumer functions usually located where their customers were, in neighborhoods near where they lived. Because many service businesses involve some transmission or manipulation of physical things (machines—auto repair; food—restaurants; hair—barbers), their location continues to be bound by the location of their customers.

However, some functions may be automated, allowing the services to remain close to the customer but allowing employment to drop. For example, technologies allowing self-service check-in and check-out in hotels would reduce employment there. In other cases, developments in computing technologies, database access, and telecommunications have increased the share of services that can be conducted without physical proximity to the customer. Catalog and electronic shopping (through a phone or computer) at places located hundreds or thousands of miles away from the customer, replace retail activities located a few miles from the customer. Similarly, emerging on-line grocery shopping has the potential to reduce local grocery store activity and instead create super regional grocery distribution centers located at the edge of metropolitan areas.

Table 5 Types of Linkages between Business Operations

Distance Constraining

Face-to-face	In-person meetings and interaction
Physical mail	Postal service, overnight mail
Goods shipment	Conventional freight mail

Distance Liberating

Voice and video	Video conferencing and video phones
Voice	Telephone, voice mail
Electronic data	E-mail, fax, electronic data interchange, computer networks

Customer service functions are increasingly being conducted electronically without the direct involvement of customers, or at least without requiring their physical presence. For example, the rise in the use of credit cards and 800 telephone service means that a growing number of customer service functions are now conducted over the phone from centralized customer service centers.

These customer access technologies have allowed a number of functions to be centralized at local sites. For example, many banks have moved loan processing and other functions out of local branches to centralized customer service centers, often without retaining face-to-face contact with the customer. Telephone technologies have made it increasingly possible to locate telemarketing and other phone functions in distant locations. For example, Omaha and San Antonio are centers for a large number of telemarketing firms.³⁵

Moreover, many of these functions will now be accessed by consumers directly, often from home. Thus, major banks, software companies, and information service companies are all gearing up for what they expect to be a major new market in the distribution of financial services via the information superhighway. The transition away from traditional local retail structures and toward direct customer access seems likely to continue as customers grow more comfortable handling a wider range of transactions without face-to-face contact. This will mean that an increasing share of formerly “neighborhood” functions (paying utility bills, buying goods, going to the bank) will be conducted remotely, changing the economic geography of neighborhood and residential area commerce.

Routine Back Office Functions

The functions that can be farthest apart spatially are generally those that are the most routine, the most information based (as opposed to involving the physical transfer of goods or paper), and the least customer oriented. Back office work, or routine work not directly dealing with customers, makes up a large share of this work. Historically, large-scale back office functions were literally behind the front office, usually in the central business district (CBD). This was true for several reasons. First, the CBD was the best place to assemble a large number of workers because of public and private transportation advantages. Second, the large volume of paper and personal transactions required proximity to both front office and back office managerial and professional functions. The back office was like an assembly line where paper was processed and information added at certain places (the way parts are added to a car during assembly).³⁶ Information in most offices was on paper and transferred physically, requiring filing clerks, messengers, and even sometimes operators of pneumatic tubes to shift paper around in large offices. Today, a small but growing number of offices are moving to computer-based systems for virtually all information. Electronic imaging allows data to be transmitted electronically rather than by paper. For example, by using PC-based databases, analysts at the Internal Revenue Service expect to be able to respond more effectively to irregularities in claims without searching out physical files.

The growing share of information in digital form, able to be easily transmitted electronically along with effective intrafirm communications, has meant that many back office functions can more easily be physically separated from front office and

complex back office work with small losses in overall efficiency.³⁷ For example, the U.S. postal service is testing optical character readers (OCR) to read addresses on mail, which is then bar coded and automatically sorted to the appropriate substation. Addresses the reader cannot recognize are digitally photographed and transmitted to a computer screen where a person manually types the address into a terminal. In Washington, D.C., OCR sorting takes place at the central mail facility, but the manual address entry is done in Greensboro, North Carolina, where wage rates are lower. Workers view images of letters as they are sorted in Washington and enter correct addresses, which are in turn electronically transmitted back to be bar coded on each piece of mail.

Similar trends are evident in the insurance industry. Historically, many insurance companies established decentralized organizational structures to be close to customers and minimize the distances that notices, inquiries, and premiums had to travel. Moreover, insurance records were kept in paper form, requiring relatively close proximity of records to personnel, such as underwriters and agents. Today, on-line access to policy and claim files has weakened the traditional need for proximity in insurance operations. Optical scanning and imaging technology is widely used now to process policy applications and premium collections. Finally, more companies are relying on the phone and mail, and increasingly on Internet connections, to communicate with policyholders.

As a result companies no longer need dispersed regional structures. For example, Aetna recently put a large share of its policies on databases accessible by PCs anywhere in the Aetna system. Because of this, it was able to reduce 55 branch claims offices to 22 and shrink underwriting centers by a similar amount. Other companies are undergoing similar changes. Information technology is allowing other industries to consolidate functions, including railroads, wholesale trade, banking, securities trading, and telecommunications.

Goods Production and Distribution

Technology is also creating closer linkages in goods processing and distribution. Within production, it is worthwhile to distinguish between technologically advanced, complex production and more routine production. The development of mass production technologies has allowed decentralization, both within this country and overseas, of a considerable share of routine production. Many manufacturing firms have spun off low-skill assembly and warehousing functions to low-cost regions, in part because telecommunications facilitates communication between physically distant headquarters and these branch facilities.³⁸ In contrast as manufacturers shift to more flexible production and move farther back on the product cycle, localization economies become more important, favoring core locations closer to markets, suppliers, and a skilled, adaptable workforce.³⁹ In addition, high-technology industries are more likely to locate in metropolitan areas. The creation of these technologically based production complexes, referred to by some as “technopoles,” is driven in part by the increasing need for technologically based manufacturers to interact on a close basis with suppliers, customers, competitors, and other institutions (including universities and research institutes).⁴⁰ This need for agglomeration economies means that most are in metropolitan areas.

Within wholesale trade and distribution, IT capabilities allow firms to deliver goods much faster than before, allowing in turn a consolidation of distribution facilities. In fact, information technology is transforming the logistics chain, making it possible for goods distribution and transportation to consolidate operations and locate farther from the customer. Information technology and new practices reduce order transmittal and processing time and provide a larger window for transportation time, allowing facilities to consolidate and serve a larger area from one location. In addition, new facilities are requiring ever larger and more complex equipment. These larger distribution facilities tend to locate outside the core of large metropolitan areas in areas with lower land and labor costs. For example, The Limited, a major apparel retailer, supplies its more than 3,500 stores nationwide from a single, massive distribution center near its Columbus, Ohio, headquarters.

Similarly, technological change allows freight transportation functions to consolidate and serve wider markets from fewer areas. In rail freight, automated train control systems allow operations to be centralized in one facility that controls a company's trains throughout the nation. The newest of these is Burlington Northern's operations center in Fort Worth. Transportation and distribution increasingly become an "export" function—one for which regions must compete—rather than a component of each region's local service sector.

Complex Office Work

Even though information technology builds linkages in "cyberspace" that at least weaken, if not substitute for, physical space, not all functions are easily amenable to such ethereal linkages. These are more complex functions that still depend upon face-to-face proximity and are usually largely undertaken by managers, professionals, and executives in industries such as accounting, law, consulting, R&D, and corporate and regional headquarters offices. In addition, innovation and development of new products and services is a nonroutine function that in most industries is predominantly a metropolitan function—in many cases, an urban core function. Information technology appears to be bringing about an increase in the share of more complex functions and employment by changing labor requirements, product and service offerings, the product (and service) cycle, and the innovation process.⁴¹

Traditional localization economies of clusters of firms in similar industries continue to be important for these nonroutine and more innovative functions. Although information technology is increasingly being used in these activities, it does not substitute for close physical proximity or face-to-face contact but supplements it due to the complex and highly varied nature of the interactions and information being transferred. Face-to-face interactions are still critical in many industries and functions. In some industries, such as accounting and consulting, professionals usually meet in the offices of their clients. In contrast, in industries such as banking and legal services, which still tend to be concentrated in urban cores, clients usually meet in service-provider firms.

However, even for some complex work, IT is reshaping work and location. IT is allowing more workers performing complex functions to access information remotely and have some of the advantages of information-rich urban environments in other

places. In law, on-line or CD-ROM legal research allows firms to access legal information without having to maintain expensive law libraries. In addition, many clients are now transmitting documents to legal firms electronically. Similarly, accounting firms are experimenting with image technologies that would allow documents to be accessed by computer.⁴² In securities trading, SEC electronic filing requirements let researchers find out information about companies remotely. Increasingly, professionals such as architects in design teams are able to adequately meet many communication needs electronically through e-mail, video telephones, and easy-to-use data transfer protocols.

Impacts of New Technology on Rural, Urban, and Suburban Economies

Overall, the effect of greater numbers of electronic transactions appears to be a loosening of spatial linkages between firms and their suppliers, customers, competitors, and other units within each firm. Historically, because of the need to exchange goods, information, or people cheaply and easily, many firms located in cities, creating what economists term agglomeration economies. The cost and difficulty of cooperation and communication increased over distance. Now, through application of IT, industries are less hindered by the need for proximity. These new locational choices are likely to have a number of implications.

Urban/Rural Growth

Information technology and telecommunications are making the location decisions of an increasing share of the economy less dependent upon face-to-face contact and close proximity with customers, suppliers, and competitors. In large part, this reduced dependence and concomitant rise in a company's ability to be "footloose" with respect to location invites speculation about the radical decentralization of jobs out of metropolitan areas.

Indeed, there are many examples of either back office or consolidated front office functions locating overseas. For example, several U.S. insurance companies have followed New York Life's lead in establishing life insurance processing operations in Ireland. In addition, some functions locate in smaller towns of the United States. For example, Rosenbluth Travel, headquartered in Philadelphia and one of the largest travel agencies in the nation, moved its reservations center (which employs 200 people) from downtown Philadelphia to Linton, a small town in North Dakota, largely to save on labor costs but also because of concerns about labor quality. Functions that require relatively low skills and a high percentage of clerical workers, such as telemarketing where operating costs must be kept to a minimum and needs for travel and other services are limited, are more likely to locate in smaller places.

Yet in spite of the notable examples of some jobs going overseas or to rural areas, technological change is not likely to lead to widespread export of jobs or to a rural renaissance like that of the 1970s. There are several reasons. First, much of the work that goes overseas is relatively routine and low skilled, and is most amenable to elimination by automation. For example, much of the manual processing of grocery store coupons is conducted in Mexico. However, new technologies and bar coding on coupons may allow coupons to be scanned and the information automatically sent electronically to the manufacturer for reimbursement, eliminating these manual data

entry jobs. Similarly, in 1981 American Airlines moved its ticket processing center from Tulsa to Barbados. However, if ticketless travel becomes widespread, many of these jobs would be eliminated.

Second, firms may not want to lose control of operations and may worry about the security of operations. This is especially true in banking and credit card operations. Realistically, the range of functions that can be transferred overseas is probably limited. It would not make sense, for example, to send domestic payment transactions overseas simply to reduce labor costs. Indeed, interviews with representatives of a major U.S. bank indicated that the bank is planning to consolidate in the U.S. certain data processing activity it now performs overseas.

Third, customer service is becoming more important. For example, most insurance companies want to locate claims processing and customer service together. As a result, firms are hesitant to place these functions overseas where there may be problems with language, accents, cultural attitudes, and skills, all of which would make it harder to establish a rapport with customers.

Even though information technology is making it easier for work to be done at a distance, at least in the foreseeable future many operations will locate in metropolitan areas, albeit usually suburbs and midsize metros. There are a number of important reasons why.

1. Technology allows many service functions to gain greater economies of scale. Many companies are establishing "central utility" offices, each of which carries out specific functions. In the past, many service companies created separate profit centers where each product had its own center. Now many firms are trying to consolidate operations, in part to be able to "cross-sell" and get better staff and equipment utilization rates. In addition, as firms reduce middle managers, remaining managers have increased spans of control and are responsible for more operations. Dispersing these operations spatially makes it more difficult to manage them. Similarly, new technologies are allowing freight transportation and distribution functions to consolidate in smaller numbers of sites.

These consolidated centers are usually located in metropolitan areas. For example, when Aetna Insurance consolidated its 55 claims adjustment centers to 22, virtually all of the 23 closed offices were located in smaller cities, and the remaining 22 were in larger metropolitan areas. Similarly, a major bank that currently does loan processing out of 92 local branches plans to establish two central loan processing centers, both in large metropolitan areas. A credit card company is considering consolidating from eight locations for credit card processing, including credit analysis and marketing, into one center in a major metropolitan area.

As a rule, larger offices and facilities are in larger cities, while smaller cities house smaller offices.⁴³ In deciding which branch facilities to close in a consolidation, firms are often hesitant to close larger branches because they would need to lay off large numbers of valued employees and hire and train others in the smaller, expanding office. As a result, the more common pattern is to close smaller offices in smaller cities and towns, and build up larger offices in metropolitan areas. In addition, because of downsizing, many firms have excess space in metropolitan areas that can be

filled through consolidation. For example, an East Coast insurance company located its new data center in a midwestern city because the largest of the several data processing facilities it planned to consolidate was already located in this city.

2. Metropolitan economies have larger, more diverse, and more skilled labor markets, which gives firms access to a sufficient number of qualified personnel. Many firms attach as much importance to the availability of qualified personnel as they do to cost, for both nonroutine and routine functions. Indeed, one leading relocation consultant says, "Workforce availability is the number one factor in locating back offices. Cost is number two." In addition, as technology restructures work and automates many routine jobs, many jobs are becoming more skilled. In fact, managerial and professional employment grew from 22% of total employment in 1972 to 30% in 1994.⁴⁴ As a result, the increasing share of services with information-based employment means that metropolitan locations are important.

3. Many firms are reluctant to locate back office operations in places with poor access. As one bank executive noted, they want to keep operations within a two- or three-hour drive as they want to be able to drive out and back in a day to "kick the tires." This is part of the reason for the rise of back offices in places like Albany, New York, Wilmington, Delaware, and other cities close to large metros such as New York and Philadelphia. Access is also a factor leading to many back office functions locating in places with good air travel. Staff, in particular sales staff, need to travel to customers, while corporate management needs to be able to fly in to inspect facilities. Because corporate decisionmakers fly so much, air access is often important in location decisions. Metros have an advantage because they are usually served by more and cheaper flights and by more jets and fewer propeller planes. Airline deregulation appears to have strengthened air transportation from large metropolitan areas hosting hub airports. Similarly, freight transportation and distribution rely on infrastructure (ports, intermodal facilities, air express) usually located in metropolitan areas.

4. Metropolitan areas offer an environment conducive to innovation and learning, which, as technology increases the importance of continual product and service development, is an advantage to many more firms. Innovation is also more likely to occur in communities or regions marked by vigorous competition among a multiplicity of local firms than in places where one or just a few firms are dominant and more likely to occur in areas where large numbers of sophisticated, demanding buyers are concentrated. Moreover, rapidly changing technologies and markets mean that interfirm cooperation is increasingly important, and this cooperation is enhanced by locating in large and mid-sized metropolitan areas.

Intermetropolitan Differences

Consistent with historical patterns, new information and telecommunications technologies are making more economic functions footloose, at least with respect to the choice of metropolitan areas in which to locate. These technologies are making it easier to locate many operations in any region of the country, which is likely to lead to increasing factor-price equalization between regions. Historically, some regions had monopolistic advantages stemming from agglomeration economies, location near natural resources, transportation, and most recently from an advanced telecommunications infrastructure. However, as information technology allows more functions to

be done at a distance or to be consolidated, these competitive advantages are likely to lessen, and lower-cost regions, providing they have sufficient external economies (e.g., air travel, transportation, labor force) are likely to grow. Moreover, widespread diffusion of an advanced telecommunications infrastructure (e.g., fiber-optic cable, digital switching, ISDN), at least to the top 50 to 100 metros, will further reduce the inherent advantages of the largest places.

The advantages once held by some higher-cost metropolitan areas is likely to decline and lead to concentrated dispersal to a larger number of metropolitan areas (see table 6). However, this dispersal is highly selective and uneven, and not all places will be able to succeed, particularly those places that have not managed the transition to the post-industrial metropolis. Places whose economic base remains in declining activities, particularly older manufacturing and traditional services, are likely to continue to experience economic hardships.

Once technology enables more locational freedom, the search by firms for lower-cost locations is likely to continue to reshape regional employment patterns, in part leading to higher rates of growth for many lower-cost smaller and mid-size metros.⁴⁵ For example, wages are almost one-third (32%) higher in large cities with over 500,000 inhabitants than in smaller places.⁴⁶ According to one study in 1991, locating a 300,000-square-foot facility that employs 1,000 clerical and operating personnel in the Phoenix area rather than San Francisco would save \$6.35 million annually—just in space and payroll costs. Between New York City and Tampa the differential is even greater—\$11.25 million per year. Consistent with these patterns, some Sun Belt areas that have grown rapidly during the past decade, such as Phoenix and Dallas, have seen some of their cost advantage disappear.

This means that many operations that seek to reduce costs will not locate in historically high-cost metros such as New York, Boston, Los Angeles, and San Francisco but instead will locate in less expensive metros, many in the midparts of the country. In fact, geographic centrality aids operations by reducing average air travel distance and enjoying a central time zone. Geographic wage and other cost differentials will continue to encourage office relocation to low-cost regions until an equilibrium is reached or approached.

Finally, if localization economies are weakened by advanced information technologies and telecommunications, urbanization economies and diseconomies may become more important. Large metros continue to provide advantages for industry, including large labor markets, frequent and cheap air transportation, and availability of repair and technical services. Advantages for individuals include high-quality medical care, cultural and educational institutions, and a large and diverse labor market. At the same time, the diseconomies of urbanization include high costs of living and doing business, crime, pollution, traffic congestion, and lack of access to open spaces. The interplay between economies and diseconomies of large metros may play a more important role in shaping the future of metropolitan areas.

As, or perhaps because, technologies allow more locational freedom, development may be becoming more uneven, with places that made the transition to the post-industrial metropolis doing well and places that have not continuing to decline. Places with the advantages described above—including a skilled, moderately priced labor force;

Table 6 Cost Comparison among Selected Metropolitan Areas

Metro area	1992 population (million)	1991 office lease rate (per s.f.)	Average clerical salary, 1991
New York City	19.7	\$39.25	\$22,500
Los Angeles	15.0	28.00	22,200
Chicago	8.4	34.50	19,700
San Francisco	6.4	24.50	22,800
Dallas-Ft. Worth	4.2	18.00	19,500
Miami-Ft. Lauderdale	3.3	30.00	18,400
Phoenix	2.3	20.00	17,800
Tampa-St. Petersburg	2.1	21.75	16,500
Kansas City	1.6	19.00	18,100
Columbus	1.4	20.50	17,600
San Antonio	1.4	13.50	16,600
Salt Lake City	1.1	18.00	16,700
Albany	0.9	16.50	21,500

Sources: U.S. Department of Commerce, Bureau of the Census, Metropolitan Area Data Book, 1994; and *Fortune*, Nov. 4, 1991.

low diseconomies (e.g., crime, congestion, and environmental pollution); an industrial base of advanced innovative companies; and high quality of life—will continue to do well. In contrast, places without these advantages are likely to continue to lose out and risk a continuing cycle of decline as reduced advantages (both public and private) lead to reduced economic growth, which in turn reduces advantages even more.

In an era of rapid technological change, metropolitan areas and cities that succeed—grow in population, jobs, and incomes—will be places that have successfully managed to adapt to the new technology system. In contrast, metros, cities, or parts of cities that will not or cannot adapt run the risk of being left behind to face stagnation or decline. Adaptation of people, institutions, and the built environment will be important to urban survival.

Intrametropolitan Differences: Central City Prospects

Technological change is likely to continue to weaken the economies of urban cores. Letting more of the economy be operated at a distance threatens the economic well-being of many central and inner cities and of inner, older suburbs of metropolitan areas. There are a number of important changes that are facilitated by technology.

The New Metropolitan-Wide Economy

One result of, and cause of, the rise of metropolitan-wide economies is that technology is enhancing the locational freedom of firms within metropolitan areas. At one time, most core cities had historic advantages stemming from agglomeration and reduction of travel that compensated for their high costs. However, technological change and other factors are reducing the privileged position of the core, in some sense

making it one of several “edge cities” within the metropolis. By making the spatial location decisions of firms less relevant, technology has accentuated the tendency in many industries for jobs to follow people. Quality of life as well as cost become more important factors. As a result, the traditional monopoly of center cities as the location for many firms is likely to evaporate. Central cities increasingly have to compete on other factors, including cost, niche markets (such as tourism), and amenities.

Weakened Central City and Inner-Suburb Economies

There are a number of technological factors that will put the economies of central cities, particularly outside the central business district, and inner suburbs at risk. First, as discussed above, technology is reducing the importance of distance for many functions, particularly more routine functions. As a result, firms have the freedom to find lower-cost locations with cheaper land, buildings, and labor. These are often in outer suburban or exurban locations or in mid- and smaller-size metros. Moreover, such locations provide firms an opportunity to avoid the diseconomies of crime, traffic congestion, and air pollution endemic to many urban core areas. In addition, because technology also leads to consolidation in larger facilities, and in some cases requires new and larger facilities, many routine goods and service industries are locating in the outer suburbs or exurban and satellite areas at the edge of metros, where larger and cheaper parcels of land are available.

Technology also enables a greater share of “nontraded” or “residential” functions to be centralized and moved. As a result, many of the jobs that cities and inner suburbs could rely on because of local spending (e.g., branch banks, local phone service centers, insurance agents) are likely to disappear, having been centralized and located either in other regions or in outer suburban jurisdictions. In large part this is caused by the shift from local service delivery to distribution of products from regional or even national service centers, a practice that favors lower-cost locations outside older urban areas. Places that cannot capture these or other new functions will be at risk of decline.

These technological and economic trends suggest that the noncentral business district portions of many central cities and their inner suburbs will continue to be the weakest part of metropolitan economies for at least the next two decades and that their relative competitive position will get worse without economic development policies.

Core Specialization: Innovative and Complex Service Functions

In addition to weakening many core economies, technological change and other factors contribute to a restructuring of urban core economies, particularly in the central business district, as places containing more specialized functions employ people with higher skill and education levels. As routinized work moves out of central cities, the economic base is increasingly shaped by more complex, higher-end office work, including managerial and professional functions. There are several reasons for this.

First, while technology allows work to be routinized, and hence moved, it also supports, especially in the services, the continuous creation of new products. For example, beginning in the late 1970s, U.S. financial institutions began to move beyond the automation of routine processes and to use computer technology to create new products and services—a process that continues to this day. This is important because,

if product cycle theory applies to services, it suggests that innovative functions tend to be done where they were developed. Just as manufacturing establishments producing new goods tend to be located in more urbanized areas,⁴⁷ innovative functions in services tend to be located in the larger urban areas. Innovative activities in established centers usually have greater access to the specialized skills, detailed market knowledge, and support services needed for the development and introduction of new products and services.

Second, the rise of globalization, in both manufacturing and services, has meant that a larger share of the U.S. economy is devoted to command and control functions. These include headquarters of multinational companies as well as large producer service firms (e.g., legal service, consulting, engineering) with clients across the globe. These high-level functions are naturally attracted to a small number of global cities, including New York, Chicago, Miami, San Francisco, and Los Angeles.

Finally, even though managerial and professional offices continue to disperse throughout the metropolitan area, many are still concentrated in central cities because these locations facilitate face-to-face communications. As Richard Meier wrote: “The need for face-to-face contact offers perhaps the best explanation for the strong attraction retained by the urban center.”⁴⁸ For example, functions such as law, corporate banking, securities trading, and professional services (e.g., accounting, advertising) are more concentrated in central areas of large metropolitan areas than are other firms (see table 4). These operations have a high percentage of managerial and professional workers and require the support of large banks, law firms, and accounting, advertising, and courier services on a regular basis. Their need for frequent air travel nationally and internationally reinforces their presence in large metropolitan areas.

Yet, as discussed above, a number of new technologies at least conceptually have the potential to reduce the importance of spatial proximity in communication. For example, portable computing and phones, e-mail and Internet connections, fax machines, and video phones all make communication over distance easier. Potential new technologies such as ubiquitous computing, high-definition displays, and high-speed and high-capacity communications will accelerate this trend. While these technologies make it easier and cheaper to communicate over distance, there are at least two reasons to think that these technologies may not substitute for a large share of face-to-face needs.

First, the extent to which these technologies can replicate face-to-face communication is not clear. Such communication has not only richness and contextual advantages but also includes informal, “water cooler” conversations and meetings over lunch. Technology developers are working on devices to overcome these limitations, such as video phone systems that randomly call other group members for informal, spontaneous chats, and ways to allow users to enter “hallways” for conversations on e-mail. As work groups gain more comfort with these systems, they may be willing to use them over a distance. However, to date the ability of these systems to initiate productive relationships at a distance has not been proven.

Second, some industries and functions may be more willing to use these systems and decentralize than others, probably depending upon the extent, nature, and criticality of communications and the extent of cost competition in the industry. Professionals such as doctors, lawyers, architects, engineers, and scientists, who depend upon face-to-face communications, may be especially resistant.

Urban Economies and Skills

Technology will likely continue to lead routine work and goods-related work to disperse from the core and at the same time concentrate highly skilled professional and managerial jobs in the core. In addition, technology is creating many more skilled jobs regardless of location. As a result, there is a growing mismatch between the location of the new skilled economy and the large and rapidly growing population of lower-skilled and often minority residents in urban cores. For example, in ten large cities between 1970 and 1990, the number of jobs held by people with less than a high school diploma declined by 600,000 while those jobs held by college graduates increased by 1.1 million.⁴⁹ These central city jobs are increasingly filled by suburbanites where educational attainment is higher.

Business responses echo this change. One bank executive from a large Midwestern city noted: “We are thinking about moving more routine work out of the city since labor costs are high, and getting good-quality labor is hard. The graduates of the public schools are very bad, and as a result we need to retrain people to read, write, and communicate.” Cities face a challenge in how to bridge what appears to be a growing gap between the skills required for employment in advanced services concentrated in urban cores and the limited skills that many young big-city residents bring to the job market.

Urban Infrastructure and Buildings

Because new technologies are changing the organization of work and the nature of production processes, the potential for a mismatch between infrastructure developed for the mass production metropolis and the infrastructure needs of the post-industrial metropolis is significant.⁵⁰ Much of the urban redevelopment effort undertaken by core cities in the 1980s was to adapt urban infrastructure and buildings designed for industrial and goods-handling functions to fit the needs of an information-based services economy. However, these mismatches are likely to continue for two reasons. First, because technological change threatens to reduce economic activity in some urban cores, there is likely to be increased vacancy and underutilization of the built environment, including infrastructure and buildings. In part, this is driven by the fact that fast-growing industries in both manufacturing and services are increasingly located in the suburbs. Moreover, while the practice of office “hoteling” is unlikely to be adopted for more than a small share of office functions, it could serve to reduce office demand, particularly in urban cores.

The changing nature of demand for infrastructure is also likely to lead to underutilization. For example, one reason for the high rates of business suburbanization is that facilities in the suburbs are usually more readily adapted to current technology. In some service sectors, buildings that can easily be reconfigured, especially to accommodate fiber optics and other wiring, are increasingly important. In many older buildings it is difficult to wire for computers and telephones and to change wiring. Similarly, old retail downtown stores with narrow fronts and deep backs make less sense with today’s greatly reduced inventories. Just-in-time delivery (JIT) allows for different store shapes. Many new back office “transaction factories” in the services require a large floor plate in large horizontally laid-out buildings, in contrast to the high-

rise office complexes in the core. Freight transportation and distribution facilities increasingly require larger facilities, which are more available in the suburbs. Also, the move to a flow system in wholesale trade through practices like cross-docking requires new configurations of buildings quite different from older, smaller, multilevel, urban warehouses. Manufacturing increasingly requires smaller facilities, continuing the trend that makes many large factories obsolete. Physical infrastructure also sometimes does not accommodate new technology. For example, the trend toward larger trucks and double-stack trains will further erode the already tenuous position of many older cities as regional or national distribution centers. Bridges, tunnels, and arterial highways in these cities were in many cases not designed to accommodate trailers as large as those in use today, let alone even larger vehicles.

Outer Suburban and Exurban Prospects

Over the next two decades many outer suburbs of metropolitan areas will continue to be the healthiest parts of the metropolitan economy and the strongest parts of the national economy. The locational freedom gained by advances in intrafirm communications technology will likely lead to a further dispersal of firm activities, with an increasing share of routine and even nonroutine back office activities in the suburbs. There are a number of factors that lead business to choose suburban locations.

First, costs are often lower in the suburbs. Though rent gradients may have declined in the last two decades, in most cities central city office rents, land costs, parking costs, and taxes are still higher than in the suburbs. Second, as many core cities adjusted to a more service-oriented economy, the demand for skilled office workers increased, driving up wage rates in the city. Often city residents, and particularly minority residents, accustomed to blue-collar jobs did not have the skills needed for the white-collar jobs available. The suburbs, on the other hand, provided a pool of more educated and skilled workers. Third, there has also been a shift in what real estate means to corporate images. Historically, many companies used large office buildings as a way of projecting corporate image. Office towers became images of modernity and prosperity. However, such considerations seem to have lessened considerably. For example, one reason for Sears' decision to build the Sears Tower, the tallest building in the world at the time, was to enhance its corporate image and obtain advertising goodwill. However, when the Sears Merchandise Group moved to a campus-like location in suburban Hoffman Estates, it abandoned Sears Tower.

Residential dispersion to the outer suburbs and exurban areas is also likely to continue, if not accelerate. Forces driving this include cheaper land in these peripheral locations, which means more affordable and larger houses and allows more Americans to live in low-density residential settings but still be close to work in the outer suburbs. Moreover, as technology facilitates telecommuting, residential dispersion is likely to increase even more. Most of these telecommuters, however, will not be telecommuting from home five days a week. Rather, they will be telecommuting perhaps two to three days a week from home or from telecommuting centers at the edge of metropolitan areas. As a result, workers will still have to live in or near metropolitan areas so as to commute to telework centers or to their offices in metros. Because an increasing proportion of workers will commute fewer days to central locations, they can choose to live in houses farther from urban cores.

Suburban jurisdictions housing this growth will by and large enjoy fiscal health. However, they may be hard pressed to find the resources to pay for the expansion, especially if they do not make new developments pay all the associated public costs (e.g., roads, schools). Residential development is likely to continue to expand at the peripheries of most metropolitan areas, leading to increased urban sprawl and lower-density developments. These trends in business and residential location are likely to exacerbate a number of problems, including outer suburban traffic congestion, consumption of open space, and increased gasoline consumption.

Conclusion

Over the next decade applications of information and telecommunications technology are likely to broaden and deepen considerably, with significant changes on American society. Productivity is likely to increase, particularly in services. Civic and social life is likely to be significantly affected. And, as described here, the IT revolution will create a more "digital" economy that will increasingly connect economic activities, enabling them to be physically farther apart. This will reduce the competitive advantage of high-cost, congested urban locations and allow people and businesses more (but not total) freedom to choose where they will live and work. The challenge then will be to manage this transition in ways that reduce the negative impacts on older regions and cities as well as on newer, fast-growing regions and suburbs.

Footnotes

- ¹ This article is based on the Office of Technology Assessment report, *The Technological Reshaping of Metropolitan America* (Washington, DC: U.S. Government Printing Office, September 1995).
- ² John Borchert, "American Metropolitan Evolution," *Geographical Review*, vol. 57 (1967), pp. 301-32.
- ³ Barney Warf and Chand Wije, "The Spatial Structure of Large U.S. Law Firms," *Growth and Change*, vol. 22, no. 4 (Fall 1991), pp. 157-74.
- ⁴ Brian Berry, "Classification Systems for U.S. Cities," contractor report prepared for the Office of Technology Assessment, 1995.
- ⁵ William Frey, "The New Urban Revival in the United States," *Urban Studies*, vol. 30, nos. 4/5 (1993).
- ⁶ Economic Research Service, U.S. Department of Agriculture, based on data supplied by the Bureau of Labor Statistics, U.S. Department of Labor, 1995.
- ⁷ Frey, *op. cit.*
- ⁸ Economic Research Service, *op. cit.*
- ⁹ David Rusk, *Cities Without Suburbs* (Baltimore: Johns Hopkins Press, 1994).
- ¹⁰ Peter D. Linneman and Anita A. Summers, "Patterns and Processes of Employment and Population Decentralization in the U.S., 1970-1987," Wharton Real Estate Center Working Paper #106, October 1991.

- ¹¹ Scott A. Bollens, "Municipal Decline and Inequality in American Suburban Rings, 1960-1980," *Regional Studies*, vol. 22 (1988), pp. 277-285.
- ¹² Mitchell Moss, "Telecommunications, World Cities, and Urban Policy," *Urban Studies*, vol. 24 (1987), pp. 534-546.
- ¹³ Linneman and Summers, *op. cit.*
- ¹⁴ One hundred and eighty-nine new jobs were created in the inner city from industry attraction, while 1,225 were created from expansion and 1,730 from new firm formation. Contractor report prepared for the Office of Technology Assessment. Sammis White, "Changing Spatial Patterns of Employment Location: Milwaukee, Wisconsin, 1979-1994," (University of Wisconsin, Milwaukee, July 1995).
- ¹⁵ *Ibid.*
- ¹⁶ John D. Kasarda, "Industrial Restructuring and the Changing Location of Jobs," in Reynolds Farley (ed.), *State of the Union* (New York, NY: Russell Sage Foundation, 1995), pp. 23-26.
- ¹⁷ Arthur C. Nelson, William J. Drummond, and David S. Sawicki, "Exurban Industrialization: Implications for Economic Development Policy," *Economic Development Quarterly*, vol. 9, no. 2 (May 1995).
- ¹⁸ White, *op. cit.*
- ¹⁹ See Amy Glasmeier and Marie Howland, *From Combines to Computers* (Albany, NY: State University of New York, 1995).
- ²⁰ Kasarda, *op. cit.* The metros include New York, Philadelphia, Boston, Baltimore, St. Louis, Atlanta, Dallas, Denver, and San Francisco.
- ²¹ Glasmeier and Howland, *op. cit.*
- ²² Marie Howland, "Producer Services" *Economic Development Commentary* (Fall 1991), p. 7.
- ²³ Joel Garreau, *Edge City: Life on the New Frontier* (New York, NY: Doubleday, 1991).
- ²⁴ White, *op. cit.*
- ²⁵ Richard D. Bingham and Deborah Kimble, "The Industrial Composition of Edge Cities and Downtowns: The New Urban Reality," unpublished paper, Maxine Levin College of Urban Affairs, Cleveland State University, 1994.
- ²⁶ Gary Pivo, "The Net of Mixed Beads: Suburban Office Development in Six Metropolitan Regions" *APA Journal* (Autumn 1990), pp. 457-468. Also, Neil Pierce, *Citistates: How Urban America Can Prosper in a Competitive World*, (Washington, DC: Seven Locks Press, 1993).
- ²⁷ Robert Cervero, *America's Suburban Centers: The Land Use-Transportation Link* (New York, NY: Unwin Hyman, Ltd., 1989).
- ²⁸ Garreau, *op. cit.*, The term *edge city* was coined by Garreau, but the concept of concentrated perimeter development belongs to many other analysts, including Cervero, Hartshorn and Muller, Fishman, etc.
- ²⁹ Brian Berry, Donald A. Hicks, and Paul Waddell, *State of the Region 1992* (Dallas, TX: Bruton Center for Development Studies, University of Texas at Dallas).
- ³⁰ Pivo, *op. cit.*
- ³¹ *Ibid.*
- ³² John F. McDonald and Paul J. Prather, "Suburban Employment Centres: The Case of Chicago," *Urban Studies*, vol. 31, no. 2 (1994), pp. 201-218.
- ³³ *Ibid.*
- ³⁴ Borchert, *op. cit.*; Richard Barras, "Technical Change and the Urban Development Cycle," *Urban Studies* 24 (1987), pp. 5-30.
- ³⁵ "Business Services," *Business Facilities*, February 1995, pp. 18-22.
- ³⁶ Mitchell L. Moss, "The Information City in the Global Economy," paper presented for the Third International Workshop on Innovation, Technological Change and Spatial Impacts, Cambridge, England, 1990.

- ³⁷ Marie Howland, "Producer Services: Will They Follow Manufacturing Out of Urban Centers?" *Economic Development Commentary*, vol. 15, no. 3 (1991).
- ³⁸ Allan J. Scott, *Metropolis: From the Division of Labor to Urban Form* (Berkeley, CA: University of California Press, 1988).
- ³⁹ David L. Barkely and Sylvia Hirschberger, "Industrial Restructuring: Implications for the Decentralization of Manufacturing to Nonmetropolitan Areas," *Economic Development Quarterly*, vol. 6, no. 1, (1992).
- ⁴⁰ Manuel Castells and Peter Hall, *Technopoles of the World* (New York, NY: Routledge, 1994).
- ⁴¹ National Academy of Sciences, *Information Technology in the Service Sector* (Washington, DC: National Academy Press, 1994).
- ⁴² William B. Beyers and David P. Lindahl, "Competitive Advantage and Information Technologies in the Producer Services," paper presented at the American Association of Geographers meeting, 1994, San Francisco, CA.
- ⁴³ The larger the metropolitan area, the larger the size of the producer service firm. Andrew J. Kremenec and Roger Cohn, "Business Services Within a System of Cities," paper presented at the 22nd annual meeting of the Mid-Continent Regional Science Association, Chicago, May 31, 1991, cited in William Testa, "Producer Services: Trends and Prospects for the Seventh District," *Economic Perspectives*, Federal Reserve Bank of Chicago, vol. XVI, no. 3 (May/June 1992).
- ⁴⁴ U.S. Department of Labor, Bureau of Labor Statistics, unpublished data, 1995.
- ⁴⁵ For example, Beyers found that there was a relative shift of professional service employment toward more medium-sized places and away from the largest metro areas. William B. Beyers, *The Producer Services and Economic Development in the United States*, (Washington, DC; Economic Development Administration, 1989).
- ⁴⁶ Edward Glaeser and David C. Mare, "Cities and Skills," unpublished manuscript, Harvard University, 1994.
- ⁴⁷ R.D. Norton and J. Rees, "The Product Cycle and the Spatial Decentralization of American Manufacturing," *Regional Studies*, vol. 13 (1979), pp. 141-151.
- ⁴⁸ Richard L. Meier, *A Communication Theory of Urban Growth* (Cambridge, MA: MIT Press, 1961), p. 64.
- ⁴⁹ Kasarda, op. cit.
- ⁵⁰ Richard Barras, op. cit.