

Technological Change and the Location of Information-Based Service Industries | 5

Over the past 20 years, information-based service industries have become an important component of the U.S. economy. For example, increased employment in most central cities in the 1980s was driven by the rise of producer services.^{1 2} A key question today is whether producer services will follow manufacturing out of the central city. In large part, technology has allowed manufacturing to decentralize, and is playing a similar role in freight transportation and wholesale distribution (see chapter 6). Many argue that technology will do the same for producer services.

The application of new information technologies is transforming the operations of many of the functions in information-based service industries, potentially leading to significantly new locational patterns. This chapter examines the impact of technological change on the locational patterns of six industries: financial services, insurance, securities trading, telecommunications, professional services, and data processing. In 1994, these industries employed approximately 8.4 million workers see (table 5-1).

FINANCIAL SERVICES

Since the 18th century, the delivery of financial services—the creation, management, lending, borrowing, trading, and investment of money—has been one of the most important economic functions of America’s cities. But in the last 20 years, advances in in-

¹ Marie Howland, “Producer Services: Will They Follow Manufacturing Out of Urban Centers?,” *Economic Development Commentary*, vol. 15, No. 3, 1991.

² This section is based in part on a report prepared for the Office of Technology Assessment on financial services. Hugh O’Neill. *Real Places and Virtual Money* (New York, NY: Appleseed, March 1995.)

TABLE 5-1: Employment in Selected Sectors, 1994

Industry	SIC Codes	Employment
Telephone Communications	481	860,000
Banking	60, 61	2,542,000
Securities trading	62	493,000
Insurance	63, 64	2,180,000
Selected professional services		2,095,000
Legal	81	950,000
Accounting	8721	515,000
Engineering	8711	630,000
Data processing and preparation	7374	233,000
TOTAL		8,400,000

SOURCE. U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Earnings* (Washington, DC: Bureau of Labor Statistics, May 1995)

formation and communications technology have altered the geography of finance. Some functions long associated with major financial centers have been progressively decentralized; others now take place on a global scale; and some seem to have escaped the boundaries of space altogether, as transactions that once took days of face-to-face interaction to finalize are now conducted by clicks of a mouse. The changes in finance brought on by the twin revolutions in information and communications have affected the financial services industry in America's cities in complex ways. While older cities have lost some routine processing functions, advances in technology have reinforced their importance as centers of international finance and financial innovation. Strength in these areas could be a source of continued growth, even as many routine functions continue to migrate to lower-cost locations.

Banking can be roughly divided into three functions: 1) back office retail and wholesale, 2) front office retail (e.g., branch banking), and 3) front office wholesale (e.g., corporate banking). Technology affects all three functions, but its locational impacts have been felt most strongly in back office retail functions.

■ Routine Back Office Functions

The earliest applications of computer technology in financial services involved the relatively straightforward automation of existing work. But managers soon began to see that computers offered opportunities not just for automating existing routines, but also for broadening the range of activity that could be routinized, and in turn automated. In addition, technology, combined with liberalized regulations on interstate banking, allowed banks to become larger, and in the process created large back office functions that could be organizationally, and even physically, separated from corporate headquarters functions.

Back office functions include check clearing, remittance processing, credit card processing, and wholesale banking processing. Telecommunications and information technology have allowed the former three processes to be routinized and physically separated from other bank functions. While back office wholesaling functions have remained closer to front office functions, new technology may weaken the linkage.

In many cases, this separation has resulted in migration of routine processing operations away from high-cost urban areas. This relocation away from major financial centers—to areas with lower labor costs, less expensive office space, and in some cases lower taxes—has been one of the most visible and most commonly noted impacts of technological change on the location of financial services.³ These new locations have included new suburban sites, or even more remote locations in smaller metropolitan areas.

In some cases, such as credit card payment processing and international money transfers, automation has also created new economies of scale, with dominant providers concentrating routine processing activities in a few very large processing centers. American Express, for example, does all its credit card processing in three large facili-

³The most popular example involves Citibank's movement in 1981 of much of its credit card processing activity from Huntington, NY (Long Island) to Sioux Falls, SD. Similarly, a number of other cities have emerged as back office centers, including Phoenix, AZ, Omaha, NE, and Wilmington, DE.

ties, and has announced plans to consolidate into just two. Chase, the world's leading provider of international money transfer services, processes all such transactions in just two locations—Brooklyn, New York, and Bournemouth, England.

In addition, as the trend toward disaggregation of financial functions has progressed, the facilities of third-party processors have also become an important element of the financial services industry processing infrastructure. These third-party processing activities are dispersed in many locations that are often far removed from the country's leading financial centers. For example, First Data Corporation, the world's leading third-party processor of bank credit card transactions, has facilities in 17 metropolitan areas throughout the U.S. (see table 5-2).

While credit card processing often takes place in small or mid-sized metros or suburbs of larger metros, a large number of banks process checks in downtown locations, including BancOne in Phoenix, First Chicago in Chicago, PNC in Philadelphia, and NationsBank in Baltimore. For example, First Chicago has a large back office operation in the Loop for remittance processing (processing checks sent to corporate bank customers). There are several reasons why check processing has remained centralized. First, clearing checks rapidly is essential, both because of Treasury Department rules and the need to debit other banks quickly in order to gain extra days of interest. As a result, many check processing facilities locate near the main postal distribution center, which is normally in or near the downtown. In addition, downtown locations in cities with Federal Reserve Regional Banks are optimal, since banks take checks to the Fed to trade with other banks. Finally, in many cities, banks collect checks from their branches in the afternoon, and driving into the city is easy and central.

However, continued technological progress, coupled with changes in regulatory requirements,

TABLE 5-2: U.S. Locations of Processing Facilities of First Data Corporation Subsidiaries
(Number of facilities in each metropolitan area in parentheses)

Omaha, NE (2)	Sioux Falls, SD
Los Angeles, CA	Lynchburg, VA
Atlanta, GA	Washington, DC
Baltimore, MD	Boston, MA (3)
St. Louis, MO (2)	Providence, RI
Kansas City, MO	Dallas, TX
Philadelphia, PA	San Francisco, CA (2)
Charlotte, NC	Phoenix, AZ (2)
Tulsa, OK (2)	

SOURCE: First Data Corporation.

could change the geography of these processes. For example, financial institutions since the late 1980s have been using digital image processing systems for a variety of purposes—to create, store and transmit high-quality images of original documents such as checks, credit card charge slips, stock certificates, claim forms, or virtually anything else. Notable examples include replacement of paper files with digitized images; and American Express use of imaging technology to reproduce charge slips on its monthly billing statements.

New technologies in check processing may affect the location of facilities. Currently, when banks receive a check drawn on another bank they send it to a central processing facility, which encodes the amount on the check, which in turn sends it to the paying bank, which then sends it back to the customer. Because this is an expensive process, banks are exploring technology to reduce costs.⁴ Image technology processes electronic images of checks rather than the checks themselves. Transferring images instead of the checks themselves may influence location, since the facilities will no longer have to be in areas with good mail and overnight air service.

⁴Thomas B. Steiner and Diego B. Teixeira, *Technology in Banking: Creating Value and Destroying Profits* (New York, NY: Business One/Irwin, 1990), p. 49.

TABLE 5-3: Location of Selected Bank Back Office Operations

Bank	City	Number of Jobs
First Interstate	Phoenix, AZ	220
Security Pacific	Phoenix, AZ	700
Discover Card Services	Phoenix, AZ	1,200
Chase Manhattan	Phoenix, AZ	2,000
Chase Manhattan	Brooklyn, NY	4,600
Citibank	Sioux Falls, SD	3,500
American Express	Salt Lake City, UT	850
Bankers Trust	Jersey City, NJ	1,400
CitiCorp	Tampa, FL	600
Selected banks ¹	Wilmington, DE	13,560

SOURCE: Office of Technology Assessment, 1995

¹Based on calculations by Gi-Yong Yang and Robert Warren, "Beating the World System? Back Office Agglomeration as an Urban Economic Strategy," paper presented at the Annual Meeting of the Urban Affairs Association, March 1994

Image processing still requires bringing checks to central locations for scanning, but the images could be sent to a remote location for further processing (e.g., manually encoding checks, comparing check amount with bill, crediting the amount). For example, a major credit card company uses an automatic check reader and power encoder to read checks and encode them. Checks the machine cannot accurately read are imaged and sent over wire to workers who see the picture of the check on their screen and type in the amount, which is in turn sent back to the encoding machine for magnetic check encoding. In this case, the workers are next door in another room, but the technology could enable workers to be off site. Similarly, electronic check presentment, by which banks receiving a check drawn on another bank transmit an image of the check rather than the check itself, could reduce the need for check processing to be in central locations downtown.

In theory, it would be possible to use image technology to support distributed work, even cottage work, through images sent directly to terminals in the worker's home. However, while technically feasible, banks are likely to resist home work because of the security safeguards that sensitive information demands.

With some notable exceptions, such as Citibank's move to Sioux Falls, most U.S. financial firms have located their customer service facilities, data centers, and routine transaction-processing operations (with the exception of check processing) in mid-sized or larger metropolitan areas—places like Charlotte, Tampa, Dallas-Fort Worth, Salt Lake City, and Phoenix (see table 5-3.) The choice of these areas reflects the high priority given to an adequate labor force and, to a lesser extent, good air transportation access. The sites chosen for such facilities, however, are usually in suburban communities within these regions, or on the outskirts of their central cities. Relatively few cities have succeeded in attracting back office operations other than check processing to older downtown areas.

While some retail back office functions have tended to migrate away from central city locations, wholesale back office functions, with a few exceptions, have stayed closer to corporate front offices, in part because they have been slower to automate and routinize functions which still involve the physical transfer of paper and are very time-sensitive. In addition, in some lines of business that are particularly sensitive, or particularly risky, or that require highly specialized knowledge—such as currency trading—those functions may remain closely tied to major financial centers, even as they take on a more routine character.

For example, Shearson and Irving Trust located new processing facilities in Manhattan. Bankers Trust moved its back offices to Jersey City, just across the Hudson from Lower Manhattan financial district, and Paine Webber went to nearby Weehawken, New Jersey. Similarly, First Chicago opened two support facilities during the 1980s—both in its home city. There are of course exceptions. In 1983 J.P. Morgan located a new operations and data processing center in the suburbs of Wilmington, Delaware. However, because of the closer ties between corporate front and back office functions than is the case in retail banking, older cities have so far managed to hold onto much of the back-office activity associated with whole-

sale finance activity and some more sophisticated types of third-party processing. However, new image technologies may make it possible to move some of the wholesale back office functions that have so far been kept close to downtown.

■ New Retail Functions

Historically, retail banking has served as a residential economic function, providing jobs in the local area in direct relation to local demand. However, retail banking is undergoing significant changes. For example, for many routine bank transactions, automatic teller machines have replaced face-to-face encounters with bank employees. Home banking is likely to reduce them even more. Other technologies such as direct deposit, electronic funds transfer, and debit cards all reduce retail branch employment.

In addition, bank branches have become less and less important in the delivery of all kinds of retail banking services. Many products, such as mortgages, are now distributed through centralized service centers, often without face-to-face contact with the customer; loan officers and other customer service personnel answer telephones and access loan processing software and other information electronically.

For example, 15 years ago, the Bank of America provided a wide range of consumer and small-business services at more than a thousand branches. After a series of consultant studies documented the inefficiencies inherent in this approach, the bank began a far-reaching overhaul of its California retail division. By the mid-1980s, 130 branches had been closed. The number of branches that took consumer loan applications was reduced to 150.⁵ Middle-market commercial lending was taken out of the branches, and consolidated in 46 corporate loan offices. Processing of home mortgage applications was also removed

from the branches, and concentrated in 48 home loan centers; and mortgage servicing was centralized in a single facility. This restructuring led to the elimination of 9,000 retail-division jobs. Similarly, Signet Bank has consolidated its loan approval process into two hub offices in Richmond, Virginia, and Columbia, Maryland (an outer suburb of Washington).

A generation ago, small-town banks and neighborhood branches, often designed to suggest a cross between an ancient temple and a medieval fortress, were for most Americans the archetypal brick-and-mortar manifestation of the country's financial system. Today, the structure that would best symbolize their connection to that system would be an unseen, anonymous building in a remote suburban office park, occupied by a credit card processing operation or a mutual fund telephone service center. The shift from local service delivery to distribution of products from regional or even national service centers has tended to favor both lower-cost locations outside older urban areas and suburban locations near mid-size and large metropolitan areas. 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 financial transactions without face-to-face contact. Citibank reports that in 1987, 73 percent of U.S. households surveyed said they preferred to conduct financial business through face-to-face contact; by 1994, those preferring such contact had declined to 52 percent.⁶

■ Corporate Banking

Technologies have helped routinize some production and at the same time remove many front office retail functions from local areas, allowing both to be more locationally flexible. However, for three reasons, technologies appear to have re-

⁵ Richard Vietor, "Bank of America and Deregulation," in Samuel L. Hayes (ed.) *Financial Services: Perspectives and Challenges* (Boston, MA: Harvard Business School Press, 1993), p. 182.

⁶ Catherine Allen, "Smart Cards and Financial Services: Overview and Legal Implications," presentation to the American Bar Association Consumer Financial Services Committee, Park City, Utah, January 1995.

inforced the urban and central city position of corporate banking.

First, advances in communications and computer technology have allowed financial services firms to gain access to more, better, and more timely information. These advances have greatly reduced the cost and increased the speed of international financial transactions, and have made possible the development of new techniques for managing the risks involved in lending, borrowing and investing across national borders. Opportunities for globalization that new technologies offer have reinforced the important role that major cities play as centers of financial innovation. For example, foreign banking activity in the United States still remains highly concentrated in a few large cities. America's major financial centers—most notably New York—have also been able to maintain their preeminent position in international finance, despite rapid technology-driven growth in global financial services. While New York thus remains unrivaled among U.S. cities as a world financial center, other cities are also participating in the growth of global finance. Los Angeles, Chicago, Miami, and San Francisco all have significant concentrations of foreign banking activity, with Los Angeles in particular benefiting from the growth of trade with Asia, and Miami from its role as a gateway to Latin America.⁷

Second, technology has facilitated the creation of a whole new range of financial products. Beginning in the late 1970s, U.S. financial institutions began to use computer technology to support the creation of new products and services—a process that continues to this day. Early examples of new products made possible by computer technology include adjustable-rate mortgages, money market accounts, and cash management accounts. As the process of technological innovation accelerated, so did the introduction of new products. Between 1977 and 1982, for example, the Bank of Ameri-

ca's retail division introduced five new products for depositors; between 1982 and 1983, it introduced 18.

In contrast to routine processing functions, most financial institutions keep the development and launching of new products and services closely tied to headquarters. And just as innovation has become more important to the competitive position of individual firms, so the role of leading cities as centers of innovation (such as New York, Charlotte, Chicago, and San Francisco) has become more important to their role in the financial services sector. Firms located in established centers usually have easier access to the specialized skills, detailed market knowledge, and supportive services needed for the development and introduction of new products and services. Established financial centers may also provide the best location from which to access potential customers for new services.

New product development often requires highly specialized skills—such as the ability to model how a new type of security will perform under a variety of conditions—that may not be readily available outside the leading financial centers. Moreover, those who develop and launch new products often require the assistance of other specialists—experts in banking and securities law, market research or risk management, for example. Such expertise is usually found most readily in areas where the financial services industries are already concentrated. So are the formal and informal sources of information—from meetings of trade and professional associations to conversations at the gym or local watering hole—that help to foster continuous innovation. For all of these reasons, much of the activity related to innovation in finance is likely to remain concentrated in just a few major cities.

Third, most corporate banking functions remain in the central business district (CBD) because agglomeration economies are more

⁷ In 1993, 87 percent of the 965 foreign bank branches and offices in the U.S. were located in nine cities. These are in order of size, New York, Los Angeles, Chicago, Miami, San Francisco, Houston, Atlanta, Washington, DC, Seattle, and Boston. *American Banker*, Apr. 12, 1994, pp. 12-37.

important to these wholesale and more non-routine functions. They require a concentration of highly specialized knowledge, and ready access to up-to-the-minute information. They need an infrastructure of supporting facilities and services both within individual firms or institutions and in the community at large—international legal and accounting expertise, access to satellite connections, major international airports. Moreover, firms often seek to syndicate bank loans or new securities issues, or otherwise bring partners into their deals. This process works most efficiently when the principal players are concentrated in one location downtown.

INSURANCE⁸

With good reason, Morton Keller's 1963 history of life insurance companies observed: "Few artifacts of this corporate age are more impressive than the buildings of large life insurance companies. Their local offices stand in a thousand communities. Regional headquarters share the skylines of a dozen American cities; Hartford, Boston, and Philadelphia house major firms." These buildings were monuments, intended to be as lasting as the companies themselves. In 1995, however, though home offices of many of the long-established giants remain, many of their employees are elsewhere. Once considered a stable employer, the insurance industry is now undergoing continual re-engineering. Technology is one of a number of factors contributing to dramatic changes in the organization and location of insurance work. As a result, the presence of large insurance offices in American cities can no longer be taken for granted. As company managements search for more efficient combinations, they will locate facilities in new places and hire new employees.

The insurance industry employs almost 2.2 million people: 536,000 by property-casualty insurance companies, 833,000 by life and health in-

surance companies, and nearly 665,000 by insurance agencies, brokers, and service organizations. This employment can be roughly divided into three functions: 1) routine back office (e.g., underwriting and claims processing); 2) front office retail (e.g., insurance agents, claims adjusters, customer service); and 3) more complex back office (e.g., marketing, administration, and investment). Technology is affecting all three functions, but, like financial services, its locational impacts are being felt most strongly in back office retail functions.

■ Routine Back Office Functions

As the insurance industry grew in the 1950s and companies serving the entire country began to develop, many companies established decentralized organizational structures to be close to the customer. For example, during the 1950s Prudential pioneered the decentralization of home office operations. Part of their reason for decentralizing into a regional management system was that "the very distances which mail, notices, inquiries, and premiums had to travel would be appreciably cut down," and regional centers could provide swifter service within its territory. Moreover, insurance records were kept in paper form, requiring relatively close proximity between the records and personnel such as underwriters and agents. In the late 1950s, the president of Connecticut General insurance stated, "Our processes resemble light manufacturing, but rather than assembling metal, wood, or plastic objects, we assemble pieces of paper." Thus, minimizing distance and time that both mail and insurance personnel had to travel was a key in the decentralization of the industry.

During the 1980s, insurers introduced database management systems to collect interrelated data, minimize data redundancy, allow updates regardless of the data's physical storage location, and enhance recoverability and security. The typical insurer is now midway in conversion to a relation-

⁸ This section is based in part on a report prepared for the Office of Technology Assessment. Robert Gibbons, *The Changing Location of the U.S. Insurance Industry: The Role of Technological Change*, May 1995.

al database will allow access to complete customer information regardless of line of business.

Online access to policy and claim files has weakened the traditional need for proximity in insurance operations. Optical scanning and imaging technology also has great potential to reduce paperwork barriers to distributed work since virtually all information could be online. Scanning is widely used now to process policy applications and premium collections, and as the cost decreases, scanning could be applied to claims processing as well. Finally, more companies are increasingly relying on phone and mail to communicate with policyholders. Branch offices serve less purpose when a telephone call accomplishes the same task, whether it is over 20 miles or 2,000 miles.

For example, Aetna recently put a large share of its policies on databases accessible by PC anywhere in the Aetna system. Because of this, they were able to consolidate a number of operations that had historically been more dispersed. For example, they reduced 55 branch claims offices to 22, and shrank underwriting centers by a similar amount. The result is that there is less need for face-to-face contact between company employees in claims processing. Claims processors can tap into underwriting computer files when they process claims. In addition, agents and field adjusters can communicate electronically with the claims office through fax machines, e-mail, and modems linked to portable computers.

A principal motivation for such consolidation is to achieve economies of scale and save money, particularly on overhead such as buildings, management, and support staff, and to spend a greater share of resources on operations.⁹ For example, CIGNA is consolidating four offices in Florida into one in Tampa. Allstate is undergoing a gradual consolidation of 28 policy processing centers into three centers in Charlotte, Dallas, and Colum-

bus. After considering Orlando and Nashville, CNA decided to centralize policy processing in Reading, Pennsylvania. Reading's advantages included low costs and easy access to population centers of the Northeast, and a well-educated labor force. Similarly, Travelers established two centers processing personal lines of insurance in Knoxville, Tennessee, and Albany, New York. Both are cities where costs are low and where Travelers already had offices (see table 5-4).

In fact, within the space of a few years, seven insurance companies established new operations in Albany, creating about 6,700 new jobs. None of these facilities were located in downtown Albany, however. One was in an essentially suburban area just inside the city limits; and the others were located in outlying communities such as Colonie, North Greenbush and Malta.¹⁰ These suburban areas can more readily provide the large-floorplate, relatively low-cost-space firms want, as well as easier access by auto. While insurance offices are relocating to lower-cost cities, and usually to suburban locations near them, they are also closing many small field offices. Sales offices and claims offices in many small towns everywhere are disappearing.

■ Front Office Functions: Agents, Claims Adjusters, and Customer Service

The insurance business, particularly property-casualty insurance, has three types of front office operation: marketing, claims, and customer service. These are the parts of the industry traditionally located closest to the customer. However, technology and industry reorganization may be changing this, allowing more work to be done in centralized service centers.

Insurance companies use two main systems to reach customers with their products—local agents and direct response (e.g., direct mail, media ad-

⁹ "Trends in Insurance Company Location — and Relocation," Moran, Stahl, and Boyer, New York, 1994.

¹⁰ Kevin O'Connor, "Back Office Operations Located in the Capital Region" (Albany, NY: Center for Economic Growth, 1994), unpublished memo.

TABLE 5-4: Selected Relocations or Movement of Operations of Insurance Companies

Company	Initial location	New location	Date
<i>Intra-Metropolitan</i>			
General Re	New York City	Connecticut suburbs	1970s
NAC Reinsurance	New York City	Connecticut suburbs	1970s
Chubb	New York City	New Jersey suburbs	1970s
Crum & Forster	New York City	New Jersey suburbs	1970s
Fireman's Fund	San Francisco	Suburbs	1982
Colonial Penn Property and Casualty	Philadelphia downtown	Suburbs	1980s
Fidelity Mutual	Philadelphia downtown	Suburbs	1983
Penn Mutual	Philadelphia downtown	Suburbs	1980s
Aetna Claims Center	Philadelphia downtown	Suburbs	1990s
Life of Georgia	Atlanta downtown	Suburbs	1985
TransAmerica P&C	Los Angeles downtown	Woodland Hills, CA	1988
<i>Inter-Metropolitan</i>			
Hanover Insurance	New York City	Worcester, MA	1968
Royal	New York City	Charlotte, NC	1986
Liberty Mutual	Boston	Portsmouth, NH	1980s
TransAmerica Life	Los Angeles	Kansas City, Charlotte, NC	1994
TIG Insurance	Woodland Hills, CA	Dallas, TX	1994

vertising). Local agent distribution systems are expensive and because of increased cost competition in the industry, insurance firms are trying to find ways to reduce agent functions or in some cases bypass them altogether. Technology is playing a key role. For example, just like ATM machines, automated kiosks in places such as shopping centers may prove to be cost-effective distribution channels for routine lines of personal insurance. Similarly, a number of insurers are now experimenting with online marketing. For example, using CompuServe, Continental offers 48-hour quotes for personal auto and homeowners insurance, as well as online claims reporting and policy changes. The introduction of home electronic commerce is a threat to the independent agent system, as customers would have greater ability to communicate directly with regional offices about policies and claims.

Direct response functions are also growing. The largest direct response insurer is USAA, but others include TIAA, GEICO, and Colonial Penn. In addition, many companies are establishing centralized customer service centers. For exam-

ple, many insurance companies, including Aetna and Prudential, have established a toll-free number for direct loss reporting. When a caller calls a nationwide number, the telephone switch identifies the area code of caller and automatically routes it to a regional office that services the claim. The centralized customer service and processing centers that are emerging in personal lines can operate efficiently from any location with the necessary telecommunications infrastructure and a suitable labor pool. As a result, front office insurance employment is likely to be less evenly distributed according to population, and instead be concentrated in centers in metropolitan areas.

In contrast, much commercial insurance business still requires periodic personal interaction among policyholders, agents, underwriters, managers, and reinsurers. They may communicate more frequently by fax or telephone, but they still expect occasional personal encounters, and still need locations close to their customers. Serious property and liability claims often require on-site inspection, while life and health insurance claims can be handled from a central location.

■ Complex Back Office Functions

There are a number of more complex insurance functions that have tended to locate in head or regional offices. These include marketing management, some underwriting, claims management, accounting and statistical, legal, actuarial, top management, investments, and computers and software support. However, unlike some industries, such as banking, where the need for face-to-face functions is more important, localization economies in these complex insurance functions appear to be less important. Insurance companies have less need for face-to-face interactions with other companies, either their competitors to cooperate on deals, or their suppliers. In large part, this is because much of the industry involves processing information, as opposed to crafting deals.

The biggest factor explaining home office locations in the industry is inertia. The home offices of most insurance companies are still near where the company began. Companies have expanded into new buildings and larger quarters, but only a small minority have moved across state lines. Regulatory implications add to the costs of moving to another state, but local connections and established facilities usually sufficed to keep companies where they were.

However, as cities became more crowded, insurance companies began to reconsider the cost of big downtown offices. These cost pressures were especially apparent in the most costly cities (e.g., New York, San Francisco, and Boston). Rising costs prompted insurers to relocate not only thousands of routine back office jobs out of these cities, but to also consider moving managerial and professional jobs out as well (see table 5-3).

There have been several major moves. Royal Insurance, a fixture in Manhattan for years, relocated its home office to Charlotte, North Carolina, in 1986 to cut its operating expenses. It paid generous relocation benefits plus the acquisition costs of the new facility in Charlotte, plus all the other expenses related to the relocation, from the proceeds of the sale of its building in Manhattan.

With the move, its annual property taxes declined from \$2.3 million to \$1.2 million, and utility costs from \$2 million to \$600,000. Similarly, when Transamerica Property & Casualty was acquired by TIG to become TIG Insurance, management moved from the Los Angeles suburbs to the Las Colinas area of Dallas, reducing its rent from \$30 per square foot to \$16.

SECURITIES TRADING AND INVESTING

The securities trading and investment industry has undergone shifts similar to other information-based service industries. Selling functions were distributed around the country close to customers, while back office and trading and investment functions were concentrated in the downtowns of the largest cities, particularly New York. Both these patterns have changed, in part due to the introduction of information and communications technology.

■ Retail Functions

New communications technologies have given rise to new modes of delivering financial products and services. In recent years, innovations such as digital call distribution systems, telephone keypads and screen phones have enabled banks, brokerage firms and mutual funds to broaden the range of services that clients can access by phone.

The mutual fund industry has revolutionized the way financial products are distributed. In the late 1970s, companies such as Fidelity, Vanguard and Dreyfus began to recognize the possibility of adopting direct marketing techniques to the sale of mutual funds, allowing them to escape their dependence on retail stock brokers. Mass-media advertising, direct mail, and telephone sales have become the industry's principal means of distribution. Dreyfus, for example, still has 20 retail outlets of its own in major cities around the country, but makes by far the greatest share of its sales through direct marketing. Products are distributed nationwide from just two centers, and ongoing

contact with investors is maintained through a single, nationwide telephone service center in Uniondale, Long Island. Fidelity similarly serves customers nationwide from a facility near Dallas, and Vanguard from suburban Philadelphia. Moreover, online brokerage accounts are rapidly growing, allowing investors to place “buy” and “sell” orders from a PC at home.¹¹

■ Back Office Functions

In contrast to banks and insurance companies, the securities industry has tended to keep its automated back office operations closely tied to headquarters. For example, in New York, the largest firms all developed processing facilities in Manhattan—although usually not at the same site as their headquarters. Some firms have moved, however, to suburban locations. For example, the Securities Industry Automation Corporation used to provide its computerized clearing and reporting services from a facility in lower Manhattan, but now is located in Metrotech, an office complex in downtown Brooklyn. Paine Webber moved its operations from Manhattan to nearby Weehawken, NJ. However, relative to banks, automation was for many securities firms a new phenomenon.

Nevertheless, some data centers have migrated. Dean Witter located its principal data center in Dallas, and Charles Schwab located its major data center in Phoenix. In addition, a few companies have moved other back office functions. In 1988 Salomon chose Tampa as the location for its principal back office facility.¹²

■ Trading and Investment Functions

Historically, securities trading and investment has been a face-to-face enterprise, largely concen-

trated in urban downtowns. Technological change is reinforcing this, but also potentially threatening it. First, information technology has facilitated the creation of such new products as stock index futures, derivatives, and synthetic securities. Moreover, one of the most important financial market trends of the past decade—securitization, or the conversion of all kinds of assets from home mortgages and credit card receivables to commercial real estate into securities that can be bought and sold—would not have been possible without the use of sophisticated computer programs. In the mutual fund industry, intense competition for the individual investor’s dollar has fueled a continuing spiral of new product introduction; between 1985 and 1990, the 20 leading mutual fund companies in the U.S. introduced more than 500 new funds.¹³ As in banking, these innovative activities tend to be located in the downtowns of central cities of major metropolitan areas.

However, advances in information and communication technology as well as the standardization of real-time market information and research available online have the potential to change this.¹⁴ For example, SEC electronic filing requirements for companies have meant that researchers and stock analysts don’t have to be in the core to gain the information. Moreover, the advent of computer and high-speed telecommunications technology made possible the creation of an ever-widening range of options for investors to buy and sell securities without going through the established exchanges. The National Association of Securities Dealers Automated Quotation System (NASDAQ), launched in 1971, triggered the rapid growth of the “over-the-counter” market.

¹¹ According to one estimate there are almost 625,000 online brokerage accounts and this is expected to reach 1.3 million by 1998. Vanessa R. O’Connell, “Brokerage Firms are Moving Into Cyberspace,” *Wall Street Journal*, July 6, 1995, p. C-1.

¹² Columbia Business School, “Salomon Brothers,” unpublished case, 1994.

¹³ Erik R. Sirri and Peter Tufano, “Competition and Change in the Mutual Fund Industry,” in Samuel L. Hayes (ed.), *Financial Services: Perspectives and Challenges* (Boston, MA: Harvard Business School Press, 1993).

¹⁴ John E. Bodenman, “Dispersal of the Institutional Investment Advisory Industry in the United States, 1983-1993,” paper presented at the American Association of Geographers Annual Meeting, Chicago, Illinois, Mar. 17, 1995.

Automation of trading systems has the potential to both reduce trading employment and allow it to relocate. For example, Bernard L. Madoff Investment Securities handles about 5 percent of the daily trading volume of stocks listed on the New York Stock Exchange. But rather than going to the floor of the Exchange, the trades are routed through Madoff's own proprietary trading system. An even more revolutionary system was launched in 1991 by the Arizona Stock Exchange, which handles only a fraction of one percent of the volume of shares traded each day on the New York Stock Exchange, but does so in a completely automated way. At a prescribed hour, participating firms and institutions can post bid and asked prices for blocks of a specific stock. The system then arrays bids and offers into textbook-style demand and supply curves; the price at which the curves intersect is the price at which trades are executed. Systems like Instinet allow large institutional investors to trade directly with one another, without using an exchange, broker, or dealer at all.¹⁵ According to an earlier OTA study, "electronic trading systems may be the stock exchanges of the future."¹⁶ If so, these systems will come into direct competition with today's face-to-face markets.

Finally, as in other information-based industries, technology is facilitating consolidation. In securities, institutional investment management firms account for an increasing share of investment transactions, rising from 20 percent in the

1960s to approximately 80 percent today.¹⁷ Traditionally, New York has been home to most of these firms, but in the last decade, firms in San Francisco, Los Angeles, and Boston have gained share.¹⁸ Because of increased access to information electronically, these firms are able to more widely disperse. But this dispersion out of New York has not been scattershot in nature; rather, it could be described as concentrated dispersal, where the industry is dispersing to a larger number of sites, but these are generally in central cities of a moderate number of major metro areas.¹⁹

TELECOMMUNICATIONS

The telecommunications industry is in the middle of a transformation from a set of regulated utilities to that of a more competitive and high-tech market, and in this transformation the large telephone companies are reorganizing and looking to cut costs and increase labor and capital productivity in every part of their businesses. These companies are therefore cutting and relocating workers in the face of increasing competition, enabled by new technologies that allow more centralization and control of activities.²⁰ Because of these parallel trends and the lack of data, it is not always clear which areas have fared better or worse through this transformation. Rural areas, however, have clearly lost telecom employment due to this transformation.

Part of what is driving this downsizing is the geographic rationalization of the industry. Fol-

¹⁵ United States Congress, Office of Technology Assessment, *Electronic Bulls and Bears: U.S. Securities Markets and Information Technology*, OTA-CIT-469 (Washington, DC: U.S. Government Printing Office, September 1990), p. 46; Securities and Exchange Commission, Division of Market Regulation, *Market 2000: An Examination of Current Equity Market Developments* (Washington, DC, January 1994), pp. II:11-13.

¹⁶ U.S. Congress, Office of Technology Assessment, *U.S. Banks and International Telecommunications*, OTA-BP-TCT-100 (Washington, DC: U.S. Government Printing Office, October 1992), p. 25.

¹⁷ Bodenman, op. cit., footnote 14.

¹⁸ Ibid.

¹⁹ Ibid.

²⁰ For example, since August 1993, Bell Atlantic announced cuts of 5,600 jobs; AT&T announced cuts of up to 15,000 jobs over two years; US WEST announced it would cut 9,000 jobs over three years. Since 1990, employment in Telephone Communications has dropped from 913,000 to 858,000 in 1994. (U.S. Bureau of Labor Statistics, *Employment and Earnings*, March issues, and *Supplement to Employment and Earnings*, August 1989 and August 1992.)

lowing divestiture, the Regional Bell Operating Companies (RBOCs) varied nationwide in their technical and managerial operations. State regulations also varied: some states (for example, in the Northeast) required separate operating companies in each state, while others (such as in the South and West) were more tolerant toward multistate operations. The different RBOCs acted as different companies with their own organizational structures. Many RBOCs are therefore only now reorganizing to consolidate their sub-regional operations left over from pre-divestiture days. For example, while Bell Atlantic Pennsylvania now operates as one business in the state, before deregulation it operated as three companies in three regions in the state.

Employment in the telecommunications industry can be divided into three areas: 1) routine front and back office (e.g., operators, billing and repair inquiries, customer service); 2) non-routine front office (e.g., repair, maintenance, and marketing); and 3) complex back office.

■ Routine Front and Back Office

Call completion and directory assistance may be considered routine tasks, as well as customer-service personnel functions such as billing or changes in service. Similar tasks aimed at particularly important business customers or involving advanced services, however, may require considerable technical expertise and problem-solving. Nevertheless, many of these activities such as marketing can be standardized in ways that make them more routine than other activities.

The telephone companies have automated many customer service and other functions by using new call processing equipment, and transferring inquiries to large megacenters via the industry's own telecom infrastructure. Automated call management (ACM), voice mail, and interactive voice response (IVR) equipment allow telephone companies to play recordings to callers, accept touch-tone or voice inputs, and triage calls in complex ways. Calls can be transferred to the next available assistant and even across time zones as the need requires. These applications are

linked to other technologies. For example, centralized billing allows customer service representatives to call up information on the customer's account and process it in real time. In most telecom companies 10 years ago, customer service representatives had to access paper records; now any service representative in the company can gain online access to any customer record. Much of the call-completion, directory assistance, and customer service functions are automated and computer-assisted, so that workers in those positions do not have to be located near the customer and are not limited by a local paper-based record keeping system. Most companies are moving to computerize all records.

The technology as well as the reorganization of the industry has led most companies to create larger, centralized customer service centers. These centers are usually specialized in five activities: call completion operators, directory assistance, network management, customer service representatives (for ordering, billing, and queries), and accounting and billing. Companies are centralizing into megacenters in order to gain economies of scale—trimming employees and other costs. In addition, a smaller number of managers can more easily manage consolidated functions. As companies downsize management, remaining managers have increased spans of control, making management of dispersed offices more difficult.

Consolidations of consumer and small business centers are more common, since these activities are more routine and less sensitive than those for large customers. For example, NYNEX reorganized more than 133 offices for their customers into seven regional centers. Ameritech is consolidating 83 consumer and small business sales and service centers to 21 locations. US WEST announced plans in 1993 to consolidate its customer service workers from 563 sites into 26 centers, including Denver, Phoenix, Minneapolis, Seattle, Salt Lake City, Boise, Omaha, and Portland. GTE has operations widely dispersed across the U.S., but has consolidated its operator megacenters to only five locations: Erie, Pennsylvania; Lexington, Kentucky; Winsfield, Missouri (located out-

side of St. Louis); California; and Hawaii. Bell South has three network management centers in suburban sites in Atlanta, Nashville, and Charlotte. These were consolidated from previous operations distributed throughout its nine-state region. Bell South's consumer customer service centers are more distributed, however, including 14 in Georgia alone.

Long distance providers have also consolidated operations. AT&T has six megacenters for its residential customer service line, several more for small businesses, network management, and call-completion operations. Relatively new competitors such as Sprint and MCI built megacenters into their networks from the beginning, locating them in lower-cost regions of the country. Sprint, for example, has centers located at Jacksonville, Florida; Dallas, Texas; Kansas City, Missouri; Phoenix, Arizona; and Winona, a small city in Minnesota.

As companies consolidate operations, the general trend, as in other industries, is to expand larger operations, usually located in mid-size and larger metropolitan areas, and close smaller ones, usually located in smaller towns. As a result, between the cuts in employment and the relocation to megacenters, rural areas have lost workers to urban areas.

Before central electromechanical switches, many operators for the former Bell system worked out of their homes with mechanical patchboards. Today, after a series of centralizations, the telecom industry could once again return to home work, completing the cycle of centralization and decentralization. Interestingly, such a decentralization would be enabled by the same technology that enabled the current centralization. That is, calls and information could be transferred to virtually anywhere, whether to a central megacenter or to dispersed homes or telework centers. In contrast, the original decentralized homeworkers were limited to the neighborhoods they were serving by the

technology of the time. Since many of the activities are already monitored by computer, oversight of employees in a common location may not be necessary and many tasks could therefore be performed at home or in telework centers. Telework is particularly attractive for filling off-shift positions as companies turn more toward 24-hour service, as well as for ordinary routine and non-routine workers. Such a pattern of decentralization would allow companies to gain the benefits of centralization (e.g., economies of scale of operations, centralized customer access) with the benefits of decentralization (lower space utilization costs and lower wages).

■ Non-Routine Front Office

The telecom industry must locate many workers where its plant is located and where it can market and support high-profile customers. Marketing includes customer sales, especially business marketing. Plant operations include installing and maintaining the local telecommunications infrastructure, engineering, network administration, testing, and other tasks associated with the switches and the main trunk lines. Roughly one-third of the jobs in telecommunications are plant-related jobs involved in the production, construction, and maintenance of equipment and lines.

New technologies are altering the number and location of plant operation jobs, and are likely to reduce the number of jobs in this area. A Department of Labor 1990 forecast note that the greatest relative decline in employment for the industry will be for installers and repairers as a result of such technological improvements as fiberoptics, digital switches, modular equipment, quick-connect features on cables, and the off-loading of many tasks to the customer.²¹

In addition, technology allows many of these functions to be performed remotely. In the past, installers wired buildings and homes, and had to

²¹ U.S. Department of Labor, Bureau of Labor Statistics, *Outlook for Technology and Labor in Telephone Communications*, Bulletin 2357 (Washington, DC: U.S. Government Printing Office, 1990).

go into the field for most of the diagnostics and repair. Today, installers perform many functions remotely at the central office. Much of the network management, including troubleshooting and adding new features, can be supervised and performed in remote locations.

There are a number of technologies that enable this. The most striking is the digitization of internal telephone operations, which allows providers enormous flexibility in the management of their systems. Digitization means that voice communications are converted from analog signals coming into the switching office to binary ("on/off") signals, which usually are converted back to analog before they reach the other user. Yet another development in digitization and switching leads to the centralization of the operating system software. This development, called "advanced intelligent network" (AIN), eliminates the need to replace the software in all the (standardized) switching equipment—itsself a costly process. Instead, the carrier can change the software in only certain central "nodes" within a region. The effect of the developments in digitization is a net decrease in installation and maintenance using analog switching equipment.²² Remote switches, for example, can be controlled through larger switches at central facilities, removing the need for on-site personnel.

Automation of system troubleshooting allows computers to diagnose problems so that humans do not have to intervene. If there is a break in a fiberoptic transmission line, for example, a computer in the command center can detect the interruption, re-route all following transmissions through new paths, and narrow down the possible failure modes. In many cases, a failure in a switching facility can be identified, and a technician is sent only to replace or repair the part. In the past, local technicians were on call to identify and repair such problems. For example, Pacific Bell has successfully tested a circuit box technology that can determine if trouble in phone lines is in the customer's

home or on the outside line for which the company is responsible, significantly reducing the number of repair visits.

One result is the growth of network management centers. These centers monitor local switching and switching between company facilities, manage emergency routing, monitor weather and disaster information, diagnose network problems, and so forth. Since metropolitan areas contain the bulk of telecom customers, the decrease in plant-related workers may indicate a net decrease in these occupations in metro areas. However, rural areas may be even harder hit, because the big providers may perceive that such workers are better placed in metro areas where they can gain efficiencies by responding to a wider region. For example, US WEST and GTE are both selling and swapping many rural territories to create contiguous or more densely populated territories.

■ Complex Back Office

Corporate operations include planning, accounting and finance, procurement, information management, legal services, and so forth. These operations are almost always located in major metropolitan areas, and often in downtown locations. The headquarters of the RBOCs and major long-distance providers are all located in large metropolitan areas, and most are in central business districts. For example, Bell Atlantic (Philadelphia), Bell South (Atlanta), US WEST (Denver), Pacific Telesis (San Francisco) and AT&T (New York) are all located in the central business districts of these cities. Some others, such as MCI (Arlington, Virginia) and Southwestern Bell (Irving, Texas), are in edge cities of large metropolitan areas.

PROFESSIONAL SERVICES

In the last two decades, professional services (e.g., legal, accounting, engineering, computers) have grown significantly, particularly in metropolitan

²² Anthony Ramirez, "GTE Says It Will Cut 17,000 Jobs," *New York Times*, Jan. 14, 1994, p. D1.

areas and central cities. Some sectors, such as legal services, appear to have been important components of central business district revitalization. Other sectors, such as computer services, appear to have contributed to the increase in suburban office growth.

Much of the work in services such as law, architecture, accounting and consulting involves individualized, non-routine craft work. Many employees are “front office” professionals—lawyers preparing individual cases, accountants auditing accounts to produce financial statements, consultants producing reports. These functions are impossible to automate, but technology, such as the personal computer, can increase efficiency. For example, in 1986, 7 percent of attorneys had computers on their desk, while 76 percent had them in 1993.²³ Back office support includes clerical and para-professionals jobs.

Because of the non-routine and complex nature of these functions, professional services are still overwhelmingly located in metropolitan areas. In 1985, producer services, (including professional services) accounted for 20 percent of employment in metropolitan areas, but only 9 percent in non-metropolitan areas.²⁴ Law firms, especially large firms, are predominately located in central cities of large metropolitan areas. For example, in 1989, 59 percent of employment in the largest 492 law firms was in nine central cities of the largest U.S. metropolitan areas.²⁵ Seventy-four percent of software industry employment is in the top 25 metropolitan areas.²⁶

There are several reasons for this concentration in metropolitan areas. First, firms want to be near

clients. One survey of legal, architectural and engineering, and management consulting firms found that face-to-face conversations with clients or in-person delivery of documents was a principal way of delivering services to clients.²⁷ For example, the accounting firm of Ernst and Young has offices in almost 200 U.S. cities because of the need to be close to their clients—largely businesses. Accountants must visit clients and in some cases spend considerable time on their premises going through financial records for auditing and tax work.

Second, a high percentage of firms (legal, 83 percent; accounting, 76 percent; and engineering, 77 percent) collaborate with other service firms and institutions in producing their services.²⁸ The importance of collaborative work within law firms, and also interactions with clients, courts, and other law firms, has led law firms to concentrate in metropolitan areas. Moreover, legal work involving litigation must maintain close linkages with district and federal courts, while legal work related to financial transactions maintains linkages with banks, both of which are located principally in central cities of metropolitan areas.

In addition, unlike banking and insurance sectors, professional service firms are less likely to move support and back office functions to separate locations outside the CBD. For example, lawyers want support staff nearby since the staff directly support legal work, unlike back office work in insurance and banking, which processes transactions. However, some accounting firms have moved some back office functions such as computing facilities to suburban locations.

²³ Larry Hirschhorn and Bob Gutman, “The Future of Law Firms,” report prepared for the Office of Technology Assessment, 1994.

²⁴ William Beyers, “Trends in the Producer Services in the USA,” in *Services and Metropolitan Development* ed. P.W. Daniels (New York: Routledge, 1991).

²⁵ Barney Warf and Chand Wije, “The Spatial Structure of Large U.S. Law Firms,” *Growth and Change*, Fall 1991.

²⁶ Edmund A. Egan, “Spatial Concentration and Networking in the U.S. Computer Software Industry,” paper presented at the 1994 Association of Collegiate Schools of Planning Conference, Tempe, AZ, Nov. 4, 1994.

²⁷ 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.

²⁸ *Ibid.*, p. 40.

There are four technological developments in professional services that could affect location. First, an increasing share of work and information is in electronic form, making it possible for professionals to do some remote working. In law, online or CD-ROM legal research allows firms to access legal information without having to maintain expensive law libraries. In addition, law firms are also increasingly using image technology to enter legal documents into a computer format, producing significant savings on document search time. Many clients are now transmitting documents to legal firms electronically. Court documents are increasingly being filed electronically.²⁹ Similarly, accounting firms are experimenting with image technologies that would allow documents to be accessed by computer. In theory, as these technologies reduce paper transactions in favor of electronic ones that enable online access to documents and information, these firms should be able to work from more remote locations or to facilitate part time telecommuting by attorneys and accountants. Conversely, these linkages could make it possible for centralized professional service firms to serve clients that are more dispersed. For example, as corporations decentralized to suburban areas, law firms remained generally concentrated in urban cores, in part because they could communicate with clients through phone, overnight mail, and fax.

Second, expert systems can improve productivity in some sectors, particularly in the more routine segments. For example, computers can mechanize and automate relatively simple work such as estates and trust. Expert systems are also emerging that make legal knowledge available to

novice legal practitioners. Whether this will enable lower-skilled legal staff (e.g., legal secretaries) to do more legal work is unclear.³⁰ In addition, it is possible that knowledge-based systems could be used to outsource the production of some legal documents.³¹ These “document houses” are likely to locate in urban areas, although not necessarily in the core, to be near expert legal and computing personnel. This could reduce locally-based legal employment, which tends to do more routine legal work.

Third, information networks and shared work systems are increasingly allowing professionals to cooperate on work in different locations. For example, the accounting firm Price Waterhouse uses Lotus Notes to allow personnel from different offices to work collectively on one project. Similarly, DuPont is developing an information network for its 50 outside legal firms so that outside and in-house counsel throughout the country can draw upon a common database of filings, briefs, research documents, and strategy notes.³² Similarly, scientists and engineers are using such tools to collaborate across distances. “Virtual” experimental communities or “collaboratories” that permit real-time interaction among researchers have also emerged.³³ For example, Xerox has created an internal research group of researchers in Britain, Los Angeles, Rochester, and Palo Alto to cooperate on a particular technical problem that Xerox earlier had not been able to address because the expertise to do so was distributed among these four sites. The researchers communicate via video conferencing and e-mail. Even though most professional services employees are still located in metropolitan areas, they can now cooperate with

²⁹ For example, the State of Maryland has introduced a program to encourage lawyers to file all court documents electronically (*Government Technology*, July 1995).

³⁰ *ABA Journal*, September 1993, p. 88.

³¹ Hirschhorn and Gutman, op. cit., footnote 23.

³² Ibid.

³³ U.S. Congress, Office of Technology Assessment, *International Partnerships in Large Science Projects*, OTA-BP-ETI-150 (Washington, DC: U.S. Government Printing Office, July 1995).

clients and others located in other metropolitan areas.

Similarly, the increased use of electronic mail and fax, and the expected growth in telephone and video conferencing, are making communication between clients and professionals easier. Because such technologies make it easier to communicate, they may allow increased movement of these activities out of high-cost central business districts to suburban sites. However, because these services are unlikely to replace direct contacts with clients when client interaction is required, many functions located in metropolitan areas to serve a regional client base are unlikely to move to new areas.

DATA ENTRY AND PROCESSING

The computer services industry, including data entry and processing, employed 233,000 people in 1994 in routine tasks such as keying of mailing lists and receipts and more complex tasks such as payroll and tax return processing.³⁴ While about 78 percent of the population lived in metropolitan areas in 1987, over 95 percent of data entry and processing employment in the U.S. was in metro areas, most of it providing non-routine processing and entry.³⁵

Although most data entry and processing employment is located in metro areas, routine data entry jobs are more concentrated in exurban and rural areas and developing nations, since they consist of more labor-intensive, low-skill data entry tasks, especially when labor cost is a key factor and contacts with clients are routine. Firms generally are able to communicate with clients largely through mail and courier services to obtain hard copy, which they in turn enter into the computer. Companies then return data either by telephone line (larger companies) or by mailing computer

tape or disks (smaller companies). Generally, firms in urban areas are not competitive in data entry because of the high labor costs. Rural areas in the U.S. are generally competitive in work that requires a quick turnaround, while overseas locations such as Barbados and Jamaica, where wages are about half of rural U.S. wages, compete in work that does not require immediate response. More complex work, which makes up the bulk of data processing work, occurs largely in metropolitan areas, in large part because of the need for close communication with clients.

Technological change is likely to reduce the amount of routine work, while increasing its overseas share, and increase the proportion of work that is complex, and done largely in large and mid-size metropolitan areas. First, improvements and cost reduction in image technologies are eliminating the quick turnaround advantage currently held by rural firms and allow overseas locations to be competitive. Images of documents increasingly will be able to be sent cheaply to offshore locations for data entry. Jamaica, for example, has invested in image transmitters and satellite transmission, and has access to digital switching and fiberoptic circuits to the United States. Second, new technologies are displacing manual data entry tasks. For example, developments in optical character recognition technology (OCR) have the potential to reduce manual data entry. Moreover, point of transaction data entry will reduce subsequent manual data entry. Finally, as routine data entry operations become more automated, data entry firms are offering more specialized services, such as tax preparation and consulting and software development.³⁶ As firms do more of these functions, they choose metropolitan locations, in part to be close to clients, but also to attract more skilled labor.

³⁴ This section is based on Marie Howland, "Technological Change and the Spatial Restructuring of Data Entry and Processing Services," *Technological Forecasting and Social Change*, vol. 43, 1993, pp. 185-196.

³⁵ Ibid.

³⁶ Ibid.