U.S. Banks and International Telecommunications

October 1992

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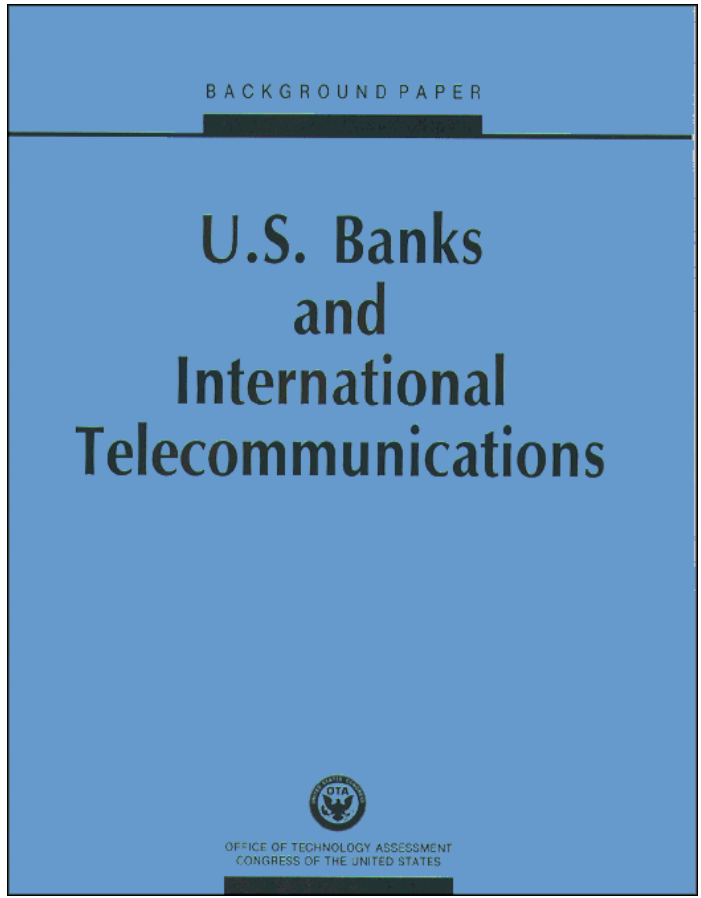

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Foreword

U.S. banks competing in the European market for financial services are among the largest users of international telecommunications networks. Their ability to create innovative financial services and deliver them through public, private, and shared networks provides a competitive edge and allows financial services to contribute strongly to our positive trade-in-services balance. At the same time, however, reliance on electronic systems means increased risk to our national payment system, probably the most serious of the public policy issues related to U.S. banks and international telecommunications.

This background paper on U.S. banks is one of several case studies prepared as part of a larger assessment of *International Telecommunications Networks and U.S.-European Trade in Services. The* assessment, requested by the Senate Committee on Finance and the House Committee on Foreign Affairs, will be completed in the spring of 1993. The case studies focus on exporters of trade in services as users of global networks. This background paper is being released separately from the larger assessment to make it more readily available to those congressional committees whose primary interest is in financial services rather than in telecommunications or foreign trade.

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NOTE: OTA appreciates and is grateful for the valuable assistance and thoughtful critiques provided by the advisory panel members. The panel does not, however, necessarily approve, disapprove, or endorse this background paper. OTA assumes full responsibility for this background paper and the accuracy of its contents.

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Financial Services and Global Markets

Overview

A global marketplace for financial services has developed. It was made possible by international telecommunications networks and liberalization or deregulation of banking and financial markets. It was made necessary by the burgeoning of world trade. Until the late 1980s, U.S. banks, enjoying the advantages of superior information technology, were eager to compete in the new global market. Now some U.S. banks are withdrawing from overseas activities, closing many or all of their overseas branches and subsidiaries. Some of this withdrawal may be temporary, and some results from rationalizing activities or accommodating changes in European laws, regulations, or business conditions (i.e., by consolidating facilities).[1] In other cases, under the pressure of strong competition from European and Japanese ''universal banks,' American banks are controlling costs and safeguarding their returns by concentrating on domestic markets. There has long been a widespread belief that international banks suffer a disadvantage in domestic markets compared with local firms that are closely identified with a single community.[2] In addition, the full internationalization of financial services is still inhibited by domestic and foreign government regulations, the high cost of international operations, and differences in business culture among nations. Technological advantages may not be sufficient to offset the caution instilled by current economic and management problems.

A few of the largest U.S. banks, however, continue to vigorously pursue European (as well as Asian and Latin American) market opportunities.[3] (See table l-l.) These banks are confident that technology gives them a competitive edge in overseas markets. A widening market may also be necessary to justify the expense of the global networks to which they are now committed. These financial institutions are currently reassessing the comparative advantages of private vs. public communications networks in light of new telecommunications technologies and services. The results are often hybrid systems, with a mix of services, providers, and managers. U.S. banks increasingly see the need for close cooperation with telecommunications providers to support their overseas activities. Cooperation is, however, complicated by increasing competition between the two industries.

Table l-l—The Ten Largest U.S. Banks
(Year-End 1991)

Bank	Total assets ($ billions)
Citibank, NA.	$216.9
Chemical Banking	138.9[a]
Bank of America, NT&SA	115.5b
Nationsbank.	110.3C
Morgan Guaranty Trust Co..	103.5
Chase Manhattan Bank, NA..	98.2
Security Pacific National Bank.	76.4
Bankers Trust Co.	64.0
Wells Fargo Bank	55.5
First Chicago Bank	49.0

[a]Combined with Manufacturers Hanover Trust Company, previously the fifth largest bank, in 1991.
[b]subsequently merged with Security Pacific National Bank, which will make it the second largest bank, with total assets of $191.9 billion.
[c]A 1991 merger of North Carolina National Bank and C&S/Sovran banks.

SOURCE: Rivka Nachoma, researcher, in the *Financial Times,* Section III, May 20, 1992. Based on company reports.

New Markets Bring New Issues

It appears that the U.S. telecommunications industry and information services industry have been generally successful in meeting the needs of financial institutions in this country. The technological and related regulatory problems on the overseas ends of networks are more troublesome, but are gradually being reduced. While U.S. banks may be at some disadvantage because of regulatory restrictions on size, geographical range, or diversity of activities, these have not been shown to be major

1 For example, Bankers Trust is closing down a large &~ processing center in Frankfort, but only because European Community directives rendered obsolete a German law requiring such data processing be done within Germany, thus making it possible to consolidate the bank's processing operations in London.

2 John Langdale, *Internationalization of Australia's Service Industries* (Canberra: Australian Department of Industry, Technology, and Commerce, April 1991),

3 This background paper was prepared as part of an assessment of ''International Telecommunications Networks and U.S.-European Trade in Services." It therefore focuses on U.S. banking activities in Europe.

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The most serious problem related to international banking is the increased payment risk on telecommunications networks used for electronic funds transfer.

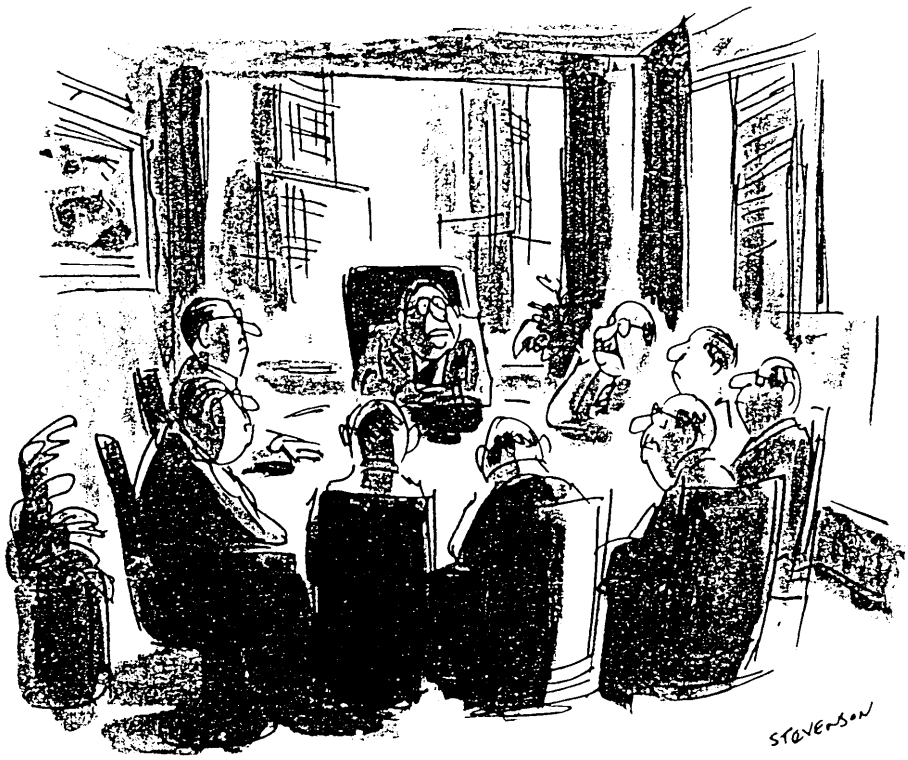
factors in overseas performance. The few large American banks that maintain a strong presence in Europe operate global private communications networks. They have benefited by their ability to create and supply innovative value-added services. Middle-sized and smaller banks participate less directly, generally meeting their domestic customers overseas needs through correspondent banks, through the use of shared communications networks such as SWIFT (an international electronic message system owned and operated by European and North American banks) and CHIPS (operated by the New York Clearing House). Several new or emerging technologies and services hold promise for U.S. banks deciding to compete in world markets. These include virtual private networks, integrated services digital network (ISDN), fast packet-switching technology, electronic imaging, and most important, electronic data interchange (EDI). EDI will change the way banks interact with their domestic and international customers. As described in chapter 4, in the long term EDI could threaten some of banking's core functions, but may, on the other hand, offer opportunities for banks to expand their services to multinational corporate clients. Several issues arise from expanded use of international telecommunications networks by U.S. banks:

- Increased payment risks resulting from reliance on international electronic payment and netting systems;
- Overlapping and confused regulatory jurisdictions resulting from competition between banks and telecommunications companies in delivering financial services;
- Unresolved trade issues with the European Community or other European countries;
- National laws or possible European Community Directives dealing with privacy of financial data;
- Location in countries with less regulation or taxation in order to avoid national control and obligations, or to perpetrate illegal and unethical activities;
- Increased scale and seriousness of violations of data security, systems failure, and human error resulting from the globalization and interconnection of networks; and
- The likelihood that the immense monetary value on communications networks, the speed with which it moves around the globe, and the possibly diminished role of banks may make implementing national monetary policy more difficult.

The most serious problem related to international banking is the increased payment risk on telecommunications networks used for electronic funds transfer. In shared networks, whether operated by central banks or consortia of banks, and in a growing number of offshore payments netting systems, the failure of one or more participants to settle end-of-day deficits resulting from "daylight overdrafts" could result in unacceptable demands on central banks as lenders of last resort, or in a cascade of settlement failures that would precipitate national or even international financial crises.

The technology that makes it possible for regulated U.S. banks to compete overseas is also creating direct competition with telecommunications companies that offer unregulated financial services under newly liberalized rules of market entry. (Other nonfinancial institutions also compete with banks in offering financial services; examples are retail organizations such as Sears, and manufacturers, such as General Motors, who have setup credit and financing subsidiaries.) Financial institutions, in turn, participate in a more limited way in providing telecommunications services. In the United States, some financial services may escape consumer protection and antitrust laws and other traditional oversight (i.e., financial products trading systems and shared networks); in other countries banks may be subjected to dual regulation. Policies may be needed to either: a) further deregulate the banking industry to put competitors on an even basis, or b) adopt functional regulation (i.e., regulate specific business activities instead of regulating institutions).

U.S. international banks hope that several trade issues will be resolved by a strong GATT (General Agreement on Tariffs and Trade) treaty or, if necessary through bilateral negotiations. These include: 1) cost-based tariffs and leasing rates, 2)



"Here's the story, gentlemen. Sometime last night, an eleven-year-old kid in Akron, Ohio, got into our computer and transferred all our assets to a bank in Zurich."

Photo credit: Drawing by Stevenson;@ 1983. The New Yorker Magazine, Inc.

interconnection of private networks with public networks, 3) shared use of private networks and the right to offer value-added services, 4) connection of preferred terminal and network equipment, and 5) intellectual property rights over proprietary software.

Some European data privacy laws have limited the transmission of financial data across national lines. An EC Directive proposed in 1990 would have prevented the electronic delivery of some services and forced financial institutions to maintain dispersed data processing centers rather than concentrating them, but it now appears likely that a revised proposal will not include this provision. Both American business interests and European policymakers sometimes allege that disputes over data privacy conceal struggles over other economic and sovereignty interests.

International telecommunications progressively opened world markets for financial institutions, but have also had a more immediate and darker effect on world banking, encouraging many banks to locate offices or branches "offshore" in countries where there are few or no regulations or taxes. Some of these banks allegedly engage in "money laundering" and other kinds of illicit or unethical behavior. Information technology also makes possible new types of crime that victimize banks, and subjects them to possible data loss, systems failure, and other vulnerabilities.[4]

The general movement toward deregulation of both telecommunications and financial services is

[4] A number of three were reported during the summer of 1992 in the course of investigations of the activities of BCCI. For example, a manager of a Sri Lankan branch of BCCI was said to have stolen a computer chip from a telex machine in the bank's branch in Omaand used it to transfer $10 million from three banks in the United States and Japan to his own account in Switzerland.(Sonia Purnel, "Workers Were Tbo Scared To Tell About Mafia Links," *The Daily Telegraph,* Aug. 3, 1991, p. 2.)

A new relationship between economic policy and telecommunications policy has emerged as a side effect of the reliance of international banking on global networks.

running into a growing realization that global networks move some long-recognized risks beyond the reach of traditional oversight and enforcement mechanisms. International cooperation is needed to address many of these issues. This cooperation in some cases may be handled by industries themselves, to find solutions to shared problems such as standards development, systems failure, or security risks. On the other hand, payment risk reduction, trade negotiations, and control of criminal behavior require involvement of national governments as well.

Control of money supply by national banks is a critical lever for implementing monetary policy, which in turn affects the flow of capital across national borders, currency exchange rates, trade balances, and general economic conditions. The links between the volume of bank balances, the volume of transactions supported by these balances, and the amount of money in circulation have been changed or confused by the rapidly increasing use of electronic netting and payments systems.[5] Some experts believe that the ability to develop effective monetary policy has been compromised. A new relationship between economic policy and telecommunications policy has emerged as a side effect of the reliance of international banking on global networks.

Technology and Competitiveness

International telecommunications networks provide the essential infrastructure for doing business in world markets, allowing a faster flow of funds and making possible the integration of transactions, payment, verification, settlement, recordmaking, and other functions. For banks, communications are not just a business support system but an integral part of a growing array of modem products and services. Telecommunications make it attractive to do net payment or net settlement,[6] thus reducing the high level of uncertainty about markets and about counterpart risk (i.e., the risk that the other party to a transaction will fail to pay or to deliver goods). It is widely assumed that in financial services such as securities and currency trading, international business will gravitate to the market with the most flexible and efficient information systems.[7] Payment capabilities are thus increasingly important in competition within the banking industry in the same way that reservations systems are in the airline industry. U.S. banks have based a large part of their product strategies on the capabilities of their networks. Yet it is not necessarily true that superior telecommunications systems can guarantee competitiveness in world markets. About 10 or 15 years ago, a global communications network conferred a strong competitive edge; now it is an essential. Says Robert Heller of the Federal Reserve Board of Governors:

> . . . IO]ver time, the competitive advantage of the new technology will be eroded as new techniques are generalized and applied to the mass market. Eventually the wizardry of yesterday will become the plain vanilla standardized product of tomorrow.[8]

About 5 percent of U.S. services exports are financial services, primarily commercial and investment banking.[9] The International Monetary Fund ranked the United States third among major exporting nations in total value of foreign assets held by

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5 Netting systems are set up to allow each participant to make or receive one payment at the end of a specified period (usually the business day) to cover the differences between deposits and outflows during that period.

6 In financial services, there is a uniquely high volume of information flow between competitors because one transaction Often involves two Or more banks.

7 Robert R. Bruce, Jeffrey P. Cunard, and Mark D. Director, *The Telecom Mosaic: Assembling the New International Structure* (London: Butterworths, 1988), chapter It, Telecommunications and Transaction Services.

8 H. Robert Heller (Member, Board of Governors of the Federal Reserve System), "Future Directions in the Financial Services Industry—International Markets," *World of Banking,* vol. 6, May-June 1987, p. 19.

9 The United States has a positive trade balance in services. Net exports of services have risen from $8.6 billion in 1986 to $42.8 billion in 1991; however, the rate of increase is declining. The U.S. overall trade balance-all goods and services—is negative, $17.6 billion in 1991. *Economic Report of the President* transmitted to Congress February 1992, table B19, p. 319.

commercial banks in 1989.[10] The *Financial Times* reported in mid-1992 that the United States holds 66.3 percent of the world market for financial services based on fees earned by commercial and merchant banks.[11] U.S. banks may well be more successful in European markets than is generally acknowledged; the benchmarks that are used to measure success are probably inaccurate and misleading.

At the end of 1990, 126 U.S. banks (members of the Federal Reserve system) were operating overseas, through 819 branches.[12] U.S. banks control $230 billion in assets in Europe, while European banks have about $184 billion in the United States.[13] These figures may however understate the presence of U.S. banks overseas, since many governments do not permit foreign 'branches' but do permit subsidiaries, representative offices, affiliates, etc.[14] It is generally assumed that financial services are best delivered through direct interaction between provider and consumer, and that therefore international activity requires a bank to establish a physical presence in foreign countries (direct investment). This is probably less true of wholesale services—i.e., cash management, electronic data interchange, foreign exchange and currency trading-than it is of retail services. However, foreign establishment is still generally the rule. Sales that a financial institution makes through a foreign affiliate do not constitute international trade, although revenue returned to the parent firm will show up in national accounts, and will certainly affect the strength and competitiveness of the parent bank. This is another factor making it difficult to talk with precision about competitiveness in international trade in financial services.

U.S. banks have excellent technology for overseas competition, but suffer some nontechnological handicaps.

Financial institutions are among the heaviest users of international communications networks, both to deliver overseas services directly and to communicate with subsidiaries. United States banks have excellent technology for overseas competition, but suffer some nontechnological handicaps. They tend, for example, to be smaller and less diversified than foreign competitors. The largest 10 U.S. banks in terms of assets rank from number 26 to 119 in a list of the world's largest banks.[15] U.S. banks have been kept relatively small by laws restricting interstate banking and preventing banks from engaging in activities such as insurance and securities brokerage. These and other regulations were aimed at preventing monopolistic aggregation of financial capital and power.

According to a member of the Federal Reserve Board of Governors:

> The United States is perhaps the only nation in the world that does not have an integrated national

10 This is in fact a poor measure of trade because it uses the value of outstanding loans as a proxy for the value of services provided to foreign borrowers, neglecting revenues from fees and commissions for other services provided overseas. It merely gives some rough indication of market share. It is notoriously difficult to define or measure trade in financial services. Financial institutions are intermediaries. For purposes of figuring gross domestic product, gross national product, and current national accounts, services produced by financial institutions for businesses (which includes most services offered in international markets) are considered to be embedded in the value of other goods and services rather than being treated separately. For this and other reasons, national account statistics probably give a distorted and understated picture of financial services exports and imports.

11 "U.K. Financial Service Hold 17 percent of Market," *Financial Times*, Aug. 25, 1992, p. 6. According to the article, Japanese firms are third with 5.1 percent, followed by France (4.2 percent), Canada (3.2 percent), and Switzerland (2.1 percent).

12 *Industrial Outlook*, 1992. This was a decline from 916 branches in 1985. The other side of this picture is the operation of foreign banks within the United States. This country has one of the most open and competitive markets for financial services. There were 727 foreign bank offices in the United States (at the beginning of 1991). Their assets have risen from $198 billion in 1980 to $787 billion in 1991 (constant dollars). Foreign banks (most of them from Japan, Canada, France, and the United Kingdom) hold nearly 23 percent of total bank assets in this country and make nearly a third of all commercial and industrial loans made by banks.

13 The story is different with Japan. While U.S. banks hold only 1 percent of total bank assets in Japan (and all foreign banks together only 3 percent), Japanese banks control 15 percent of bank assets in the United States and this is projected to rise to 25 percent by the end of the decade. Senator Donald W. Riegle, Jr., chairman of the Senate Committee on Banking fears that this may give the Japanese some control over which U.S. industries get credit and are able to grow. See "Fair Trade in Financial Services Act," Hearing before the Subcommittee on Trade of the House Committee on Ways and Means, House of Representatives, 102 Cong., 1st Sess., July 29, 1991, Serial 102-60.

14 For example, Citicorp alone has over 2,000 overseas offices, consisting of 303 branches, 8 representative offices, 643 banking subsidiaries, 116 banking affiliates, 837 other financial subsidiaries, and 146 other financial affiliates. (Information supplied by Citicorp/Citibank Director of International Government Relations to OTA, July 31, 1991.)

15 List compiled by *American Banker*, Sept. 12, 1991. Of the 25 largest banks, 16 were Japanese, 5 French, 2 British, 1 German, and 1 Swiss.

banking system. Clearly, this has a major impact on the ability of American banks to compete abroad and on their capacity to serve domestic customers active in international trade and finance.[16]

The Edge Act (1929) allows national banks to conduct foreign lending operations only through Federal or State chartered subsidiaries. These Edge Act corporations, unlike domestic banks, can own banks in foreign countries. Only very large banks tend to have Edge Act subsidiaries that can provide international services. This factor should not be overstated, however. While a bank must be fairly large to sustain overseas activities, it is not clear that greater size and diversity would guarantee successful international operations.

Traditionally, banks moved to the international arena primarily to follow their big customers overseas[17]—i.e., to serve American companies that have become multinational corporations-although they may then compete with foreign banks in their own markets. U.S. international banks lack the close corporate ties enjoyed by Japanese and German banks. By contrast, U.S. corporations are increasingly bypassing banks, raising their own capital through commercial paper.[18]

U.S. banks have also been hurt in recent years by the weakening economy, the large trade deficit, the low savings rate, losses on developing countries' debt and on commercial real estate, and a migration of retail deposits to nonbank competitors such as mutual funds. The Federal Deposit Insurance Corporation Improvement Act of 1991 (Public Law 102-242) may further inhibit international banking because it requires U.S. banks to increase capital reserves and foreign banks to undergo more stringent supervision. In the long run, however, with higher levels of capital U.S. banks maybe better able to compete in the global economy .19

There are now probably no more than a dozen American banks with ''abroadly-ba.sed, truly global presence,' according to the American Bankers Association. The number of U.S. banks with foreign branches has fallen in the last 5 years, and the U.S. share of international markets has fallen. In spite of superior information technology that should be a strong advantage in international banking, Chemical Bank, the Bank of America, and Chase Manhattan Bank, among others, have shrunk their overseas activities.

In some cases this withdrawal may be reversed when economic conditions imp-rove and the current restructuring of the banking industry through mergers and bank failures is over.[20] For example, Chemical Bank reduced its substantial overseas holdings to three European and three Japanese locations in order to buy banks in Texas and New Jersey. Then in 1991 it took over Manufacturers Hanover Trust Company, the fifth largest bank in the United States in 1991. Manufacturers Hanover Trust was operating in 30 countries, and chemical Bank reportedly intends to continue most of those activities. Officers say it has the capital strength to again emphasize international as well as domestic services. The ***Industrial Outlook*** of the U.S. Department of Commerce projects stable and sustainable economic growth in overseas banking in 1992.[21]

16 Heller, op. cit., footnote *8*, p. 21.

17 Walter W. Eubanks et al., *U.S. Banks in the Global Economy: Effects of Capital, Tax, and Regulatory* ***Requirements,*** Congressional Research ***Service*** Report for Congress, 90-293 E, June 12, 1990; see also John Langdale, op. cit., footnote 2.

18 U.S. banks are suffering from changing interest rate structures and competition from nonfinancial institutions that operate money market funds or make 10ans—such as automobile manufacturers that set up credit operations. For some years there has been a strong trend to disintermediation-i.e., direct transactions between lenders and borrowers, with banks becoming less the intermediary and more often the broker, advisor, or guarantor of direct transactions.

19 Walter W. Eubanks, ''Banking Reform and International Banking,'' Congressional Research Service Report for Congress 91-197 E, Feb. 20, 1992.

20 It is expected by many experts that the number of U.S. banks (12,800 individual banks, or 9,500 independent banks and bank holding companies) will drop by about 25 percent by 2000, as a result of mergers, acquisitions, and bank failures. There may be, by 2000,7 to 10 very large banks with $100 billion or more in assets. These projections are from a survey conducted by the Bank Administration Institute aiAndersen Consulting Co., reported in Keith Stock, "The Banking Industry of the Future, "*The Planning Forum Network,* May 1992, vol. 5, No. 5.

21 *Industrial Outlook,* '92, chapter 46, pp. 3-4.

Chapter 2
Networks for Financial Services

Until recently, a state-owned postal, telegraph, and telephone agency (PTT) operated the public telecommunications network in each European country. Some of these have recently been privatized.[1] In the United States, the telecommunications network was developed by privately owned corporations and came to be dominated by the American Telephone& Telegraph Company (AT&T). AT&T functioned as a heavily regulated monopoly until it was broken up in 1984 into a long-distance carrier (AT&T) and seven regional Bell operating companies (RBOCS), each of which has a monopoly over local telephone service in its region. AT&T now must compete with MCI and Sprint in long distance and international services.

International transmission lines are generally provided by the joint investment of telephone companies or PTTs in two or more countries using the facility, with switching remaining in national hands at either end of the transmission line.[2]

Public networks by definition afford universal access to highly standardized services at regulated rates or tariffs. Private networks, which may be operated by a corporation, group of corporations, association, or services vendor, offer dedicated or discriminatory access to select and usually tailored services, at rates set by contractual agreement with the users.

U.S. banks active in overseas markets primarily serve large corporations rather than individuals. They offer "wholesale" services such as cash management,[3] financial market data, and currency and securities trading. (Citibank is an exception to this rule; it emphasizes retail as well as wholesale services overseas.) These banks have two needs for international communications:

- As intra-corporate business support: voice, voice mail, fax, E-mail, and data transmission, and
- As a means to create and deliver financial products and services: electronic funds transfer, cross-border electronic letters of credit, customer account information and cash management, financial information.

Manufacturers Hanover Trust, which merged with Chemical Bank in January 1992, was fairly typical. The bank's 'Global Wholesale Bank' used international telecommunications primarily for internal bank business, while its operating services group (GEOSERVE) delivered electronic banking products and services to corporate customers around the world. GEOSERVE customers using the network could access the bank's computers to check their account balances and to initiate funds transfers and letters of credit.

Private Networks

In the 1980s, many large U.S. commercial banks and investment banks or securities houses created private networks made up of facilities leased from public telecommunications companies. These leased facilities might include cable circuits and satellite capacity, interconnected to the public network, with some network and terminal equipment owned by the financial institution. The bank exercises full financial and managerial responsibility over network operations. While only very large financial institutions have elaborate international private data networks, many financial institutions have a few point-to-point leased circuits to tie their dispersed locations into larger operating centers. (See box 2-A.)

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1 In some cases, regulatory authority and operating responsibility have been separated, with the latter being lodged in a quasi-governmental corporation for greater independence. In some cases, partial private ownership of the operating corporation has been allowed or is contemplated for the future.

2 The transoceanic cable systems have Consortium ownership that traditionally reflected the degree of national use of the cable. Satellite transmission facilities are collectively owned and operated by the world's governments through Intelsat with shares proportional to national use of the system. A series of intergovernmental agreements effectively divided up transmission between satellites and cables. The Federal Communications Commission (FCC) has now authorized competitive international satellite systems. In May 1985, the FCC authorized the construction of a private undersea fiber-optic communications link between the United States and the United Kingdom, with no obligation to offer service to the public.

3 Cash management is a set of services that allows company treasurers to collect and manage revenues, schedule payments, and place the corporations' temporarily idle funds so as to obtain the best yield from them while maintaining necessary liquidity.

Box 2-A—The Largest U.S. Banks and Their Private Networks

Citibank, NA, of New York, is the largest U.S. bank and one of the few that offers a full range of retail and wholesale financial services around the world. During the 1980s, Citicorp developed 100 separate private **networks, covering** *92 countries. Each* Citicorp business unit independently bought, developed, or **contracted** for networks. Beginning in January 1992, these are being combined into one global information network, or GIN. The goals are seamless technology integration, with common architecture and protocols, services across national borders, and reduced costs. The GIN will include voice, video, and data capabilities, will connect local-area networks (LANs) and wide-area wideworks (WANs), and will support value-added services such as electronic data interchange (EDI). The consolidation is expected to save $100 million per year within 3 years, by bulk purchases and leases and by eliminating some of the 1,500 network professionals. GIN was made feasible, Citicorp officials say, because of the evolution of ISDN (integrated services digital networks) and advances in flame-relay technology. In time, Citicorp may turn part of GIN over to a systems integrator or may have an outside entity manage or operate its systems ("outsourcing"). This is not, however, an explicit goal.

The Bank of America, the third-largest bank in the United States, has a packet-switched network to support its World Banking Division. The network is used to transmit data on loans and letters of credit, to supply financial information to officers and customers, to support on-line accounting, to send and receive international **payments,** and to receive customer instructions for business transactions.

Chase Manhattan, among the largest 10 banks in the United States, uses a private packet-switched network provided by Tymnet, which is owned by British Telecom.

Manufacturers Hanover Trust had a T1 (high-speed) backbone network providing transport among its U.S. locations, and a global X.25 packet-switching network based on Telenet (now Sprint hardware and software) connecting 52 cities in 27 foreign countries.

Bankers Trust offers no retail services but is a "merchant bank," i.e., a combination of investment bank and commercial (wholesale) bank. The bank's private network, created in 1982, is primarily a data network but carries some voice traffic on heavily used segments, such as between London and New York There are also some 24-hour trading circuits for direct trading between countries where the business day overlaps (these differ from regular voice circuits because traders have an open microphone on their desk that is activated by a distant trader using a 4-digit code). Satellite links are used for backup; Bankers Trust prefers terrestrial links to satellite links to avoid the several seconds delay which is disorienting for traders and may affect their ability to trade in volatile moments.

SOURCE: OTA, from interviews and materials provided by bank offices.

The chief reasons that banks developed private networks during the 1980s were:

- Their special requirements for highly reliable, secure transmission,
- The fact that many enhanced data services were not available on public networks, and
- Lower unit costs in terms of volume of use. (Circuits are leased at flat rates, i.e., not volume-sensitive rates.)

The decision whether to carry voice communications on a private network or on the public network is largely cost driven, because voice accounts for about 80 percent of all traffic and voice messaging is a largely undifferentiated product. Banks also are especially sensitive to costs when communications are "products" (e.g., in electronic funds transfer), because of the narrow profit margins on many such products.

Financial firms often use private networks with packet switches, multiplexer, and multiprotocol bridges/routers to interconnect local area networks (LANs) serving their far-flung facilities. (See box 2-B.) It is difficult for telephone operating companies to provide these connections with standard equipment because of frequent incompatibilities between computer architectures and communications architectures.[4] Alternatively, banks may find it cheaper and easier to use a third-party services provider that can interconnect LANS, perhaps with TCP/lP,[5] X.25, frame-relay, or other advanced

[4] Robert Crandall, the Brookings Institution, interview, Nov. 30, 1991.

[5] TCP/IP (Transmission Control Protocol/Internet Protocol) is a Department of Defense protocol developed to link computers across networks.

Box 2-B—Private Networks in Other Financial Industries

Not only banks but other kinds of financial institutions developed international private networks during the 1980s:

- One of the largest securities houses, Shearson Lehman, has private T1 networks between New York and London and between New York and Tokyo. These are primarily for data but some of the leased circuits are dedicated to voice. Data circuits go through three international hubs (New York London, Tokyo) that have multiplexer concentrators to route messages to about 30 other locations. In London, there is a connection to SWIFT for funds transfer.
- American Express operates a network of 37 nodes linking 10,000 automated teller machines in 16 countries and 1.6 million Point-of-sale terminals in 25 countries. Transaction authorization at these terminals is on-line and immediate.[1]
- A global money brokering firm[2] uses only point-to-point lines-i.e., dedicated open lines between the firm and its customers. For domestic communications, across state lines, it leases circuits on fiber-optic cables, provided by services vendors who house the firms' multiplexer% on the vendors' premises. These communications are voice, referred to by the firm as "shouting down the pipe." For international service, the firm leases low bit-rate voice circuits; for example, it has 49 point-to-point lines to London. Other kinds of service are deemed not necessary and too expensive. A high bit-rate circuit might cost $2,500, compared with $700 for the voice circuits. The firm used satellites in the past, but the several seconds delay was disruptive for voice trading and it now uses cable.
- Reuters Ltd., a worldwide vendor of general news and financial data services delivers information services, predominantly financial market data, to customers around the world over leased lines and satellites. It has its own earth stations on Long Island, having been granted a license by the Federal Communications Commission. (In the United Kingdom, its home country, Reuters had to buy a company that already had a license in order to operate an earth station. In most of the rest of Europe, only post telephone and telegraph agencies can operate earth stations).

SOURCE: OTA, from interviews and materials provided by corporate offices.

[1]National Telecommunication and Information Administration, *Telecom 2000,* NTIA *Special* Publication 88-21, October 1988, p. 447.

[2]A brokering firm is an intermediary, bringing buyers and sellers together; in this case, the money brokering firm handles trades Of foreign *currency,* overnight Federal funds, Eurodollars, etc. Its customers are dealers located in banks or other large financial institutions. An official of the firm provided OTA with information in extended discussions but asked that the firm not be identified.

packet-switching technologies. In Europe, most of these services providers are U.S. firms.

Public Networks

Having global private networks does not preclude the use of the public switched network. It is most often used for voice, but it is also necessary to deliver products and services (account balance reporting, initiation of funds transfers and letters of credit) directly to customers' terminals and personal computers. Public switched networks may be used more for data transmission as switched multi-megabit data service (SMDS) becomes more widely deployed in the future.

Large investment banks and brokerage houses usually have arrangements with AT&T, MCI, and/or Sprint for discounted pricing for high-volume international carriage. AT&T's bulk sale contract, for example, is known as Tariff 12. The discount can be as much as 40 percent off regular business rates for large users willing to sign a long-term contract (usually 5 years) at a pre-stipulated volume of traffic. Competitive prices usually determine the allocation of traffic among the three major international carriers, but there are also considerations of redundancy and back-up capacity.

Data transmission is increasingly important for financial institutions. Public data networks, where available, are said to have a poor record of support of vendor-specific protocols. European PTTs want to force all vendors to use X.25. This is an international three-level standard protocol for interfacing terminals or computers to public packet-

switching networks,[6] but X.25 services are not always available and there is no standard interface. The inability to get needed services across national borders drove the development of private networks in the 1980s.

These conditions changed significantly in 1990, when carriers began offering "virtual private networks" (VPNs). Normally, specific leased circuits are reserved for the customer, irrespective of the volume of traffic on those dedicated lines. To make more efficient use of the total network facilities, virtual networks allocate lines dynamically upon need and there will not necessarily be the same links every time (a "virtual" network). This capability results from the development of sophisticated ''intelligent" software in the network switches. Many financial institutions worried at frost that there might be less quality control and predictability with virtual private networks than with leased line networks, because they could not monitor the lines. In fact, VPNs are now said to have added reliability compared with leased circuits since they are dynamically switched if line failures occur. All major U.S. carriers now offer virtual private network service internationally, generally through arrangements with in-country carriers and PTTs. These arrangements are not always easy to make, but in general the experience with virtual networks appears to be satisfactory for major users.

Shared and Value-Added Networks

In addition to their own private networks, most banks use a number of shared and third-party private networks such as SWIFT, MasterCard International, VISA International, and ATM networks. These are ''value-added' networks because they do more than transmit data; they also gather, select, format, or process data, perform other operations, or facilitate the sending and receiving of various kinds of messages. These networks are used, for example, for credit authorization and validation and for payments and settlements. The most widely used is SWIFT' (the Society for Worldwide Interbank Financial Telecommunications), which by 1990 had 1,812 member banks and linked 3,049 financial institutions in 84 countries.[7]

SWIFT is technically a message system and not an electronic funds transfer (EFT) system. SWIFT messages instruct a bank to make payment, and the bank then transfers funds from one account to another on its books. (The ability of banks to make "final payment' sets them apart from other financial institutions.) However, for many purposes SWIFT is considered an EFT system because its messages are accepted by banks as authentic and authoritative.[8]

In 1990 a replacement network, SWIFT II, was introduced, and will be fully completed by the end of 1992. It will eventually offer an electronic data interchange (EDI) service for network users, a netting service for banks trading in ECUs (the uniform European currency unit), and the automatic matching of foreign exchange and money market transactions.

Very large financial institutions, with their own international networks, still depend on SWIFT for communications to regions that their private networks do not reach. Many financial institutions other than banks want access to SWIFT'. SWIFT has in recent years allowed new categories of institutions to participate, e.g., securities exchanges and brokers and dealers. Broader access has become a highly charged issue.[9] SWIFT would be a benefit, for example, to a mutual fund whose payment orders must now go through a broker to a bank to another bank to another broker to a customer, with additional costs and counterpart risks at each step. But some members have objected that access to SWIFT

6 It was developed by the Consultative Committee for International Telephone and Telegraphy (CCITT) with the participation of the United States, Canada, Great Britain, France, and Japan, among other countries.

7 Small and mid-sized banks usually funnel their international traffic through the SWIFT facilities of larger, correspondent banks. Although SWIFT is used by banks of all sizes, only about 100 of the approximately 12,000 U.S. banks are actually members of SWIFT and only about 60 of these routinely generate more than 200 messages a day. Information supplied by the American Bankers Association.

8 Another U.S. system, CHIPS (Clearinghouse Interbank Payments System) is owned and operated by major New York banks and links 140 financial institutions. CHIPS messages do create legal obligations to deliver money, and according to the Federal Reserve System Board of Governors, CHIPS can be considered an electronic funds transfer system. Final payment-i. e., legal transfer of funds from one bank to another and one account to another-is done by FEDWIRE, operated by the U.S. Federal Reserve System.

9 Discussion with Charles Taylor, Executive Director of the Group of Thirty, Washington, DC, Nov. 18, 1991. The Group Of Thirty is an association of 30 internationally respected financial experts from Central Banks, investment houses, and academia, who meet to discuss and seek cooperative solutions to global financial issues.

Box 2-C—Example of the Use of International Telecommunications Networks by Foreign hanks

Banca d'Italia uses public networks for two-way data transfer services from personal computers through the public network outside databases such as the Organization for Economic Cooperation and Development, and for message switching to access CEBAMAIL. The public ITAPAC packet-switching network has been found to provide a good quality service at relatively low cost, with pricing based on volume, The public telex system is used for incoming wire service dispatches. There are private lines for message switching and file transfer services, using protocols not offered by the public facility. SWIFT is used for the exchange of payment orders and other financial operations. IBM's International Network links computer terminals in the bank with the Bank for International Settlements (in Basle) and with IBM's DIAL service. The European Academic Research Network is used to exchange messages and texts among the international scientific community. The Bank also gets information services from Reuters and Telerate.

Danmarks ***Nationalbank*** uses CEBAMAIL to communicate with European correspondent banks, and SWIFT for international transfer of payment orders. These two shared networks are used to **exchange information** foreign exchange markets and to discuss common decisions. The bank uses a number of value-added networks including Dow Jones, Telerate, and Bloomberg for international news.

Bank of Israel uses SWIFT for currency transfer and related purposes, and relies on Reuters and Bloomberg for financial market data and news. It subscribes to a number of information services, including BITNET, EARN, LEXIS, and DIALOGUE. The public network serves for other international communications.

Bank of Tokyo, ***Ltd.,*** completed linking its worldwide offices in the late 1970s; a combination of private networks and the public network provides message switching, data transmission, voice communications, fax and E-mail. Key considerations were cost, quality, and security. There are four major nodes: Tokyo, Hong Kong, London, New York The bank uses CHIPS, FEDWIRE, SWIFT, and other shared and value-added networks.

The Industrial Bank *of Japan, Ltd.* has two primary private telecommunications networks. IBJ Net was implemented in 1989 for reasons of security, privacy, and cost-reduction. It originally carried voice and facsimile communications between the bank's international offices, and now transmits data by packet-switching, using AT&T leased circuits, with Tokyo, New York and London as the primary hubs. IBJ Net also transmits data between LANS in IBJ international offices. The International Banking On-line System (IB0S) is the bank's proprietary computer system, used in the offices outside of Japan, to support loans, foreign exchange, and treasury and accounting operations. Data resident in **host** computers at each office are transmitted using the GE Mark III telecommunications system, but managed by the IBJ's proprietary software. The bank also participates in CHIPS, SWIFT, and other international shared networks.

SOURCES: Information provided by the Telecommunications Department of Banca d'Italia courtesy of Tommaso Padoa-Schioppa Vice Director General communication of Jan. 27, 1992; Ejner Petersen Head of Foreign Exchange, Danmarks Nationalbank, in a letter of Jan. 6, 1992; Abraham Jacoby, Director, Computer Services Department, Bank of Israel, letter of Jan. 5, 1992; Toyoo Gyohten Advisor to the Board of Directors, Bank of Tokyo, Ltd., letter of Dec. 26, 1991; and Masatoshi Tamaru, Senior Vice President (New York), Industrial Bank of Japan Ltd., letter of Jan. 2,1992.

encourages nonbanks to compete with banks and undermines the payment settlement role of banks.

CEBAMAIL is another shared network, established by European Community central banks and later expanded to serve other banks (the Federal Reserve Bank of New York is a member). It began as a voice network but later became a data network, and is used to exchange information on foreign exchange markets and to discuss common decisions.[10] (See box 2-C.)

Shared financial networks entail some serious payment risks, to be discussed later.

While SWIFT and CEBAMAIL are shared networks owned by banks, most banks also use third-party networks. For example, Chemical Bank has a private international network for intrabank messages, but outsources all telecommunications related to its customer cash management services to the General Electric Information System (GEIS). Many European banks use IBM's International Network and DIAL service to communicate with

[10] Letter to OTA from Danmarks National Bank, Jan. 6, 1992.

Box 2-D-Citicorp Moves Into Electronic Services

Citibank is unusual among U.S. banks in emphasizing retail services overseas-i.e., services to individuals and households. Citibank has a retail presence in 11 countries in Europe, with 700 branches and 11,300 people; it serves 3 percent of all European households.

In the 1960s electronic communications allowed nonbanks to create financial instruments, such as money-market mutual funds invested in short-term government securities, that paid higher interest rates than banks could offer under existing regulations. Money flowed out of bank into these new kinds of investments. Corporations began to sell commercial paper directly to investors or to borrow from industry-owned finance companies. Banks were less often the intermediary between borrowers and lenders ("disintermediation").

Citicorp decided to shift its assets away from prime wholesale lending to computer based services. Citicorp created a time-sharing computer subsidiary, "Citishare," which developed the first comprehensive automated teller machine network in New York and later extended it across the country. It issued 20 million credit cards and purehased two other credit card companies. In the late 1970s Citicorp worked toward becoming a global, diversified company offering retail banking, commercial banking, investment, insurance, and information services. It entered joint ventures with NYNEX, RCA, and McGraw Hill to offer electronic services to the home and to develop 24-hour trading systems. In 1985 Citicorp passed Bank of America to become the largest U.S. bank in terms of domestic deposits. The next year it bought a controlling interest in Quotron, an information services vendor specializing in financial market data.

SOURCES: David Lascelles, "Networking Without Frontiers," ***Financial Times, special*** **section on international banking, May** ***9,1990,*** p. ***6;*** ***Citibank World,*** vol. 1, No. ***2,*** April 1992; and interviews.

each other and with the Bank of International Settlements in Basel, Switzerland.

Although value-added networks rely on the basic telecommunications infrastructure, they are not subject to regulation as is the primary basic service supplier. Value-added networks maybe operated by:

- Telecommunications companies that manage connections between users' computers and terminals (e.g., AT&T[11]),
- Hardware suppliers that tend to specialize in interconnection of their own computers (e.g.,IBM), and
- Services providers with no particular allegiance to a telecommunications provider or to computer hardware (GEIS, Reuters).

Many value-added processing services such as treasury management, dealing and trading, settlement services, and transaction or credit authorization, were developed to meet the needs of financial institutions. (See box 2-D.) There is now a strong movement of financial institutions to become suppliers, as well as users, of such value-added services. The ability to develop value-added services is a valuable competitive advantage of U.S. banks. In France, following deregulation of financial markets, there has been rapid development of such services by banks in alliances with information suppliers. The French Government is backing the development of a nationwide payments and credit card authorization network.

The Changing Balance

Financial institutions appear to be going back to reliance on the public switched network. The comparative costs of public and private networks are changing, and technology is allowing public networks to provide better control and reliability and to offer value-added services if they choose to do so. As private networks become less effective as product differentiators, costs and reliability become the primary selection criteria. One bank official says that the importance of the price of services "cannot be overestimated.' '[12] When volume discounts such as Tariff 12 made the public switched network cheaper for basic voice services, there was an immediate and almost total migration back to the public network.

11 Under the Modified Final Judgement, AT&T at first had to provide value-added services and networks through fully separate subsidiaries. The FCC removed the separate-subsidiary requirement and since August 1991, AT&T has been free to offer network-based value-added services directly.

12 Edward J. Regan, Vice President, Chemical Bank, New York, interviewed by OTA in March 1992.

This could also happen with data services. A few years ago, data traffic came from large computer terminals and tended to be steady, predictable, and consistent. With LAN-to-LAN communications and more diverse applications, traffic has become "bursty." Financial institutions, in particular, tend to sporadically transmit large numbers of short messages with little traffic between bursts. Some leased circuits are "empty" much of the time. If there is a great deal of excess capacity on a bank's leased lines, much of their cost advantage disappears, particularly as public network international tariffs are reduced. Banks are also increasingly eager to reduce the high costs of managers for private networks.[13]

Banks and brokerage houses spend about 4.5 percent of their revenues on information systems—more than utilities, heavy industry, or retailers.[14] A survey by Ernst & Young for ***The American Banker*** found that the U.S. banking industry spent over $11 billion on information technology in 1990, and expected this to rise modestly from 1991 through 1993.15

Most of this goes for computer hardware, software, and services; financial institutions have been a major impetus for development of advanced computer applications. Nevertheless, one source estimates that financial institutions worldwide spent $243 billion in 1990 to operate communications networks (domestic and international), including staff, line charges, equipment leases, and depreciation; possibly about $40 billion of this went to private networks.[16] The magnitude of these expenditures clearly makes the tradeoffs between public and private international networks important to financial institutions.[17]

Photo credit: Citibank

A Citibank telecommunications operation center for its global network.

New technologies are reducing the cost of private networks. European PTTs are cutting the price of international leased lines, although their costs are still much higher than those from the United States to Europe.[18] In some counties, the costs of leased lines have decreased 50 percent since 1987. Compression technologies, which allow more information to be squeezed into a given capacity, could reduce prices even further.

But while private networks are becoming cheaper, public switched facilities are beginning to offer low-cost virtual network services. *Network World* developed a model that shows that the amount of switched traffic necessary to cost-justify a transatlantic private line dropped from 18,765 minutes per

13 Financial services institutions have the highest percentage of total employees categorized as information systems employees, 7.6 percent of all employees for nonbanks and 6.2 percent for banks, compared with 6.1 percent for telecommunications companies, 3.4 percent in high-tech manufacturing, 0.9 percent in retail industries, and 3.4 percent for all industries, according to a survey of 500 largest American users of information technology reported by *Information Week*, Sept. 16, 1991.

14 National Telecommunication and Information Agency (NTIA), *Telecom 2000*, NTIA Special Publication 88-21, October 1988.

15 "Technology Spending Evades Cost Cutting," *American Banker*, Aug. 21, 1991, p. 1.

16 Alan Cane, "~ormation Technology in Finance,' *Financial Times*, Nov. 7, 1990, p. III-1.

17 Manufacturers Hanover probably invested $55 million for its proprietary telecommunications network. Marjorie Greene reports this estimate from a study by a competitive analysis group at First Chicago in 1985, based on interviews. ("Public Policy and International Telecommunications Technology in Financial Markets-An Overview," OTA contractor report, February 1992). It is possible that the true costs were higher even at that time. Citicorp says it spends from $1 to $2 billion per year on information technology, including telecommunications equipment and services (Discussion with Michael Nugent, Association General Counsel of Citibank, N.A., New York City, Dec. 4, 1991.) *The Financial Times* estimates Citicorp expenditures at $1.5 billion yearly (Alan Cane, "Information Technology in Finance," *Financial Times*, Nov. 7, 1990, p. III-l). A large securities firm estimated, in OTA discussions with officials who asked that the firm not be identified, that it spends about about $50 million for international telecommunications, and about $10 million of this is for leased circuits.

18 The monthly rental for half circuit at 64 kbps to the United States ranges from $3,863 (UK Mercury) and $4,115 (France Telecom) to $7,124 (Austria). From the United States to Europe, the average price is about $3,400.

month (mpm) in 1987 to 11,493 mpm in 1989, but rose again to 15,352 mpm in 1991, because the cost of AT&T's best international business services dropped by 32 percent from 1989 to 1991.

A migration of financial institutions back to public networks may also be greatly encouraged because there is a growing need for financial institutions to be linked electronically directly with customers' computers. The scope of internetworking among corporations is growing, and banks may have to participate in electronic payments and electronic data interchange in order to retain their traditional customer relationships and avoid being bypassed. Private networks cannot always provide direct connections to customers as can public networks.

Paul Glaser, formerly head of Citicorp's Corporate Technology Committee (now retired), says that "...except for higher bandwidth on the dedicated circuits, it is best to go public" for domestic communications.[19] The evidence suggests the likelihood of a decline in the use of private networks by financial institutions, or at least that banks will increasingly handle traffic growth by routing it over public networks. Edward Regan, of Chemical Bank, concurs: "The concept of dedicated corporate networks must be re-examined as public carriers build more intelligence, flexibility and reliability into their networks. The trade-offs . . will change."[20] For international communications, however, this will require that PTTs become more customer-oriented and innovative.

[19] Correspondence with OTA staff, May 24, 1992.

[20] Edward J. Regan, then Vice President, Manufacturers Hanover Trust, in a talk given at Communications Networks'91, Washington DC, Jan. 29, 1991.

Chapter 3
Implications of New Technologies and Services

It is now difficult to distinguish clearly between telecommunications services and telecommunications infrastructure, networks, or equipment. Software-related functions embodied in networks often support both message transport and data processing and protocol conversion. Equipment and services issues are linked by the possibility of cross-subsidy; profits from services can be used by telecommunications companies to develop new technology, and vice versa. Both equipment and services increasingly require standards.

Most studies of the ways in which telecommunications markets are changing have focused on equipment markets. But Robin Mansell points out that as we shift from technology based on cheap inputs of energy to technology based on cheap inputs of information, there is often a mismatch between the established social and institutional framework and the new paradigm.[1] Thus new services, based on new kinds of equipment that nearly always require new kinds of software, often confound established regulatory categories and trade agreements.

With large central telephone switching systems, new technology must achieve a global market share of about 15 percent to recover research and development (R&D) costs plus profit.[2] Most American telecommunications manufacturers have done poorly in European markets; but U.S. computer systems and services have done well, and much of the U.S. dominance in that market cart be linked to the spread of financial/processing services for banks. NCR (now owned by AT&T) is the leading supplier of automated teller machines (ATM) systems to financial institutions in the United Kingdom, with 62 percent of the market share in 1990.[3] Barclays Banks, Britain's largest clearing bank, has approximately 2,600 ATMs in service, all manufactured by NCR. If European postal telephone and telegraph (PTTs) increasingly offer value-added services for banks, this could indirectly reduce the market for data processing equipment sold to banks by U.S. manufacturers.

The European Community (EC) now requires competitive, nondiscriminatory procurement of equipment by all companies that have special rights (e.g. state monopolies or private firms that are regulated monopolies). In General Agreement on Tariffs and Trade (GATT) negotiations, the EC says it is prepared to allow foreign firms to compete under these same conditions, so long as there is reciprocity. The United States holds that it cannot guarantee reciprocity because our telecommunications companies are private and the government cannot regulate their procurement. In 1988, however, the Federal Communications Commission (FCC) ordered telecommunications companies to report their purchases of switching equipment from foreign sources who shut U.S. firms out of their markets.

There are still some U.S. restrictions on the transfer of telecommunications technology in the interests of national security (" Cocoon" restrictions), but these are now under review and likely to be further reduced. For some banks this was a real problem in the past because specific applications of the restrictions often appeared unreasonable. For example, Citicorp wanted to put encrypted videoconferencing equipment in its own facilities in Central and Eastern Europe for use by its own officials, but it ran into so many CoCom problems that it gave up the plan.

Integrated Services Digital Networks

The concept of an ISDN, first publicized in the CCITT Orange Book of 1980,[4] calls for an end-to-end digital network that can carry data, voice, video, and graphics. This would in effect combine telephone and computer networks and allow public

1 Robin -en, "Rethinking the Telecommunications Infrastructure: The New 'Black Box,'" *Research Policy 19,* 1990, pp. 501-515.

2 Kenneth Lindhorst (AT&T), "New Telecommunications Trends and International Relations," Hamid Mowlana and Nanette S. Levinson (eds.), *Telecommunications and International Relations: An East-West Perspective,* International Communications Program, School of International Service, American University, Washington DC.

3 Guy Daniels, "Case Study: Networking Bank ATMs," *Telecommunications,* January 1992, pp. 27-29.

4 Margrit Sessions, "ISDN Tariffs in Europe," *Telecommunications,* January 1992, pp. 57-59. The concept of ISDN was first publicized in the Consultative Committee for International Telephone and Telegraphy (CCITT) Orange Book of 1980.

networks to provide specialized services now available only on specialized private networks.[5]

In April 1989, European telecommunications organizations signed a Memorandum of Understanding on the implementation of European ISDN service by 1992. It is generally assumed that ISDN should begin with digital telephony and progressively incorporate additional functions and network features, including those of other dedicated networks.

Some ISDN services are available in the United Kingdom, France, and Germany, and the claim is made that by 1997 commercial ISDN services should be available throughout Europe.[6] The French and German PTTs, unlike U.S. carriers, decided to consider ISDN "amass medium" intended for both large and small customers;[7] these countries are committed to rapid deployment and ISDN is priced about level with regular phone service. British Telecom, however, is targeting large corporate users such as financial institutions, and U.K. tariffs are much higher than in France and Germany.

Until recently, deployment of ISDN in the United States has been slow. But it is projected to increase significantly in the next 2 years. The plans announced by the seven regional Bell operating companies would result in a total of over 61 million access lines with ISDN capability by 1994. The percentages of access lines capable of ISDN would vary considerably among the Regional Bell Operating Companies (RBOCs), from 27 to 90 percent, with an average of about half of the access lines capable of ISDN.[8]

Final standards for ISDN have not yet been accepted, and there is little interconnection between such ISDN services as exist. It is not yet available for residential and retail business ends and not yet transferable to most consumer applications such as ATM and electronic funds transfer.[9] At 64 kbps, ISDN is too slow for many of the needs of large corporations. In some countries the introduction of ISDN may deliberately be slowed, to allow economic resources to be used to extend telephone service to underserved areas, or to extend existing public packet-switched network nodes. Thus, the Organization for Economic Cooperation and Development (OECD) concludes, "There maybe reasons to encourage large business users to [continue to develop] leased circuit networks to meet their needs. 10 In some cases, leased circuits can offer a cheaper method for meeting the needs of a small number of large users; therefore, some people argue that it should not be necessary to incur the costs of upgrading public networks to the level of sophistication required by these users.

For financial institutions the approach of ISDN holds both promise and concerns. There is concern about ISDN tariffs. ISDN promoters and regulators may assume that all users will want an entire 64 kbps data channel between two locations. However, many financial institutions need to move large numbers of messages consisting of small chunks of data (e.g., credit authorizations). If the smallest unit of data transmission for which tariffs are set is larger than these chunks, financial institutions could end up paying more than they do now to move data and, in their view, a disproportionate share of the estimated cost of transition to all digital networks.[11]

Other New Developments

Beginning with Bellcore's IN/l concept in 1985, software design aimed at giving operating companies highly computerized switching nodes to create

5 CCITT standards call for multiples of a digital voice-grade channel (64 kps). The Basic Rate Interface, or 2B+D format, provides a total channel capacity of 144 kps. The Primary Rate Interface, or 23B+D format, provides a total capacity of 1,544 reps. Broadband ISDDN will provide dynamically configurable channels, or packets, at rates up to 150 reps.

6 Organization for Economic Cooperation and Development (OECD): *Telecommunication Network-Based Services: Policy Implications*. Information Computer Communications Policy 19, chapter V, p. 86.

7 Sessions, op. cit., footnote 4.

8 U.S. Department of Commerce, National Telecommunications and Information Administration, *Telecommunications in the Age of Information (Washington DC: 1991)*.

9 OTA *discussion* with Michael Nugent, Vice President and Associate General Counsel, Citibank, NA, April 1992.

10 Organization for Economic Cooperation and Development (OECD): *Telecommunication Network-Based Services: Policy Implications*. Information Computer Communications Policy 19., chap. V, p. 86.

11 Marjorie Greene, "Public Policy and International Telecommunications Technology in Financial Markets-An Overview," OTA contractor report, February 1992.

virtual private networks and wide area centrex,[12] with standard network interfaces to provide a flexible platform for many services. This concept was intended to help public networks hold on to big users like financial institutions, but services could also be offered to small business or residential users if end-to-end digital interconnectivity existed.[13]

Frame relay technology and switched multimegabit data services (SMDS) are for high-speed data transfer. Frame relay lets financial institutions send bulk data in irregular bursts, by providing bandwidth on demand. It is an efficient form of packet-switching that can boost performance up to 35 percent. This allows firms to squeeze more out of their existing networks, or public switched networks can provide this "dial-up" bandwidth. SMDS is a 1.5 to 45 million bits per second high-speed switched technology now being offered by some public networks services providers.

Bankers' interest in high-bandwidth public services may be stimulated by electronic document imaging. This service provides computer-digitized "photorealistic images" of documents or paper records. For example, UNISYS has a system for processing checks at up to 1,800 front-and-back images every minute. IBM and Wang also have new image processing systems based on digital scanners and optical disks of the "worm" (write once, read many) variety. Banks need to transmit or exchange current documents, but imaging will also be valuable to them for computerizing and using old paper records.[14] However, some legal ambiguities may have to be resolved to clarify the standing of documents preserved by imaging because of the possibility of electronic altering of the documents.

Questions of Standards Development

Both technology standards and data standards are increasingly important with the spread of intercorporate sharing of information. Powerful forces are involved in standards-development struggles.[15] The development of ISDN is an example. Some kinds of international standards could cause major computer companies and data processing firms to lose market share to telecommunications companies; other kinds of international standards could benefit those firm but work against younger firms developing innovative, rapidly changing technologies by preempting the future in regard to too many key design elements.[16]

The U.S. standards community reached a consensus on January 6, 1992, on steps to improve international standards development and information sharing between the United States and the European Community.[17] The EC has assured the U.S. Secretary of Commerce that its new testing and certification program will not restrict U.S. exporters. But the financial services industry remains skeptical.

Financial institutions are principally concerned that they, as major users, should be included in the standards development process. Yet in many banks, senior managers with little understanding of technology are reluctant to approve costly participation in standards development activities. Financial institutions that have developed global private telecommunications systems have sometimes resisted switching from proprietary to standards-based systems. But there now appears to be a strong consensus in favor of international standards. The development of standards for mass-market data communications will allow Europe-wide use of ATMs, point-of-sale terminals, and electronic trading, which should bean advantage for U.S. institutions that excel in automating financial services. This should also make the balance of competitive forces within the financial services industry better for smaller firms that have limited network reach.

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12 Centrex is a service that allows business users to directly dial outside numbers from extensions within their facilitiesand to directly dial company extensions from outside the facilities. The switching system, based on a stored-program digital computer, can be located on customer premises but is nearly always located in the telephone company's centraloffice.

13 Mansell, op. cit., footnote 1.

14 Ellis Bookers, "Migration to Public Nets Accelerates," *Computerworld*, Jan. 13,1992, p. 5. Technology Futures, Inc., a futures and market research company, projects that by 2000, 60 to 80 percent of professionals will use document-based applications.

15 U.S. Congress, off& of Technology Assessment, *Global Standards: Building Blocks for the Future*, OTA-TCT-512 (Washington, DC: U.S. Government Printing Office, March 1992).

16 As argued b, Jonathan David Aronson and Peter F. Cohey, in *When Countries Talk: International Trade* in *Telecommunications Services* (Cambridge, MA: Ballinger Publishing Co., 1988).

17 U.S. Department of Commerce, International Trade Administration, *Europe Now: A Report*, winter 1991-92, p. 1.

Chapter 4
The Disappearing Boundary: Financial Services and Telecommunications Services

Banks operate communications systems; telecommunications firms offer financial services. But the market encroachment is one-sided. Telecommunications companies are increasingly including financial services among information services they intend to offer, and are also creating subsidiaries for leasing, financing, and investing. (Other nonfinancial fins, such as Sears and General Motors, also offer such financial services.) Banks are more limited in the range of activities that they may conduct.

Banks and Resale of Network Capacity

Financial institutions operate corporate communications networks and share with other financial institutions the ownership and management of value-added networks. They may also make it possible for their customers to access their networks, and they may offer enhanced data communications services. To a limited extent, they are thus competing in the telecommunications services market.

Estimates are that the average use of private networks by financial institutions varies between 10 and 30 percent of capacity.[1] This overcapacity came about because in the booming 1980s financial institutions overestimated their future traffic to allow for growth, and also regarded some overcapacity as insurance in case of circuit failures. Their bursty traffic also results in excess capacity, particularly during certain off-periods of the day. This raises the possibility of financial institutions reselling the excess capacity on their private networks.

Already some postal telephone and telegraph administration (PTTs) regard large financial institutions as ''carriers in disguise, '' when they give customers access to the bank's computers through the private network, as they may do in accordance with Consultative Committee for International Telephone and Telegraph (CCITT) regulations. Most such uses involve small amounts of data per transaction (2,000 to 4,000 characters for account balance reports); third-party use is a small part of the total capacity, estimated to be under 25 percent, shared by many customers.

In the United States, for national banks and federally regulated banks, both banking law and communications law govern resale of telecommunications capacity. Under banking regulations, a bank may operate a network only for financial data. Under communications law, resale requires a "214 certificate" issued by the Federal Communications Commission (FCC) (under section 214 of the 1934 Communications Act) that would subject the bank to common carrier regulation.[2] Banks can make some excess capacity available to other institutions or customers for limited purposes but only if the excess is "genuine, not manufactured excess. " They may not routinely resell capacity.[3]

New Kinds of Competition

Although U.S. banks are prohibited from operating telecommunications systems except for financial services use, telecommunications companies are offering financial services and becoming competitors to banks. Banks have traditionally served as intermediaries and escrow agents between lenders and borrowers by holding deposits and dispersing loans, or linking buyers and sellers and handling currency transactions for them. Now telecommunications companies are moving into this market. AT&T launched its Universal Card on March 26, 1990; this is a general credit card as well as a calling

1 *Marjorie* Greene, "Public Policy and International Telecommunication/Technology in Financial Markets-An Overview," OTA contractor report, February 1992.

2 In December 1991, the FCC proposed to permit resale between the United States and any other countries with equivalent Opportunities. This incentive, which is still pending, could in theory open up the U.S. international telecommunications market to more competition bringing in foreign competitors.

3 In 1982 Citicorp applied to the FCC for permission to provide a common-carrier service focusing on banking, financial, and economic data. The FCC refused on the grounds that under the Bank Holding Company Act, the approval of the Federal Reserve Bank would be required for Citicorp to engage in common-carrier communications. (Citibank does not resell capacity, and says that it now has no interest in being a common carrier.)

card.[4] Ameritech followed suit with a Complete Card, also a combined credit card-calling card, in October 1991.[5] There are also joint business arrangements in which telecommunications companies and financial institutions are allied for more limited purposes.[6]

Telecommunications companies can perform cash management functions, and are also developing transaction or trading systems for securities companies. Prodigy, a U.S. videotext service, and MINITEL, the videotext service provided by France Telecom in France (and now in other countries, including the United States) carry banking services. Other telecom companies are expected to offer such services through 800 and 900 numbers.

AT&T Capital Corporation, originally set up to finance the sale or leasing of AT&T products, now also leases transportation equipment and data processing equipment, provides project financing for energy production companies, makes loans to small businesses, and provides financing for equipment firms in Canada and Europe.[7] The NYNEX Capital Funding Co. provides funding for NYNEX subsidiaries (other than the New England Telephone Co. and the New York Telephone Co.) through issuance of debt securities in the United States, Europe, and other international markets.[8]

American Bankers Association officials acknowledge that AT&T and the Regional Bell Operating Company (RBOCs) are becoming "near banks" because they can do nearly everything a bank does[9] except debit/credit deposit accounts. With electronic data interchange (discussed below), even this distinction may become blurred. As one bank official

Photo credit: Citibank

A Citibank advertisement for its home banking telephone.

said, "AT&T is becoming a payment system for inter-corporate and consumer-to-corporation payments. 10 It seems possible that in the future, the banking system will no longer provide a unique infrastructure for the payments mechanism.

The telecommunications companies' large customer base and well-developed billing systems make their competition in financial services particularly threatening to the banking industry. For example, the new credit/calling cards could yield valuable

[4] The Universal Card is issued by the Universal Bank in partnership with an ~&T subsidiary, AT&T Universal Card Services Corporation, which handles the validation billing, and collection for the card. AT&T's subsidiary markets the card, which has either a Visa or a Mastercard number and an AT&T Calling Card number. (AT&T's name and logo are on the credicard billing statements, and telephone calls charged to the card appear on these statements and not on bills from thdocal telephone exchange.) The Universal Bank was setup by Synovus Financial Corporation at the request of AT&T and is not a general service bank. AT&T is or was until 199the bank's sole depositor and sole lender. Information provided by AT&T; see also Complainantts Brief, *In the matter of Bankamerica Corporation, The Chase Manhattan Corporation, Citicorp, and MBNA America Bank NA v. AT&T, AT&T Universal Card Services Corporation, and UniversalBank,* Files Nos. E-90-21 1, E-90 -212, and E-90-213, Common Carrier Bureau, FCC. The brief cites Universal Bank's Application for a bank charter and for Federal Deposit Insurance (June 29, 1990).

[5] The Complete Card is a MasterCard offered in a five-state region by Ameritech, one of the RBOCS, in conjunction with Household International. *Amen-tech Annual Report,* 1991.

[6] For example, in May 1992, British Telecom and Visa International announced that VISA cards could soon be usedto pay for telephone calls to the United Kingdom from overseas, and visitors to the United Kingdom with Visa cards will not need a U.K. telephonaccount, but can bill calls to their Visa card in their home currency. Telecom Highlights International, May 20, 1992, p. 5.

[7] See AT&~ *Annual Report,* 1991.

[8] NYNEX, *Annual Report,* 1991.

[9] A commercial bank is an institution that both accepts deposits and makes loans. (" Nonbank banks" either accept deposits, as do moneymarket accounts, or make loans, as do credit companies.)

[10] Michael Nugent, of Citicorp, in statements made at OTA'S May 10, 1991 workshop.

Box 4-A—Reuters, Ltd: A Global Information Services Vendor

Paul Julius Reuter began delivering financial market data across Europe in 1850, using carrier pigeons to fly stock market quotations between Brussels and Aachen, where telegraph lines had not yet been strung. The next year Reuters used the first underwater telegraph cable, connecting Dover and Calais, to transmit market data and financial news firm London to the continent. Today, Reuters Holdings PLC is one of five companies that dominate the market for money, securities, and futures market data.[1]

Until the late 1960s, 70 percent of Reuters business was general news (press communications). Now 60 percent is information services related to money markets.[2] The turning point was Reuter's 1960s venture with Ultronics to produce and use "Stockmaster" for real-time dissemination of market data to brokers' desks. (Ultronics was later bought by Sylvania and still later by ADP.) The Western Union Cable from Miami to Caracas, on which Reuters leases capacity, was another important step. Then Reuters moved into transactions services with the Monitor service for dealers. Now as much as 40 percent of all foreign exchange transactions may go through Reuters. Telerate is the chief competitor, and Quotron is just beginning a dealer/transactions service. In the future, Reuters' officials say, their chief competitors may be Japanese. (KDD has built computer service facilities to serve Japanese traders and companies in New York and the United Kingdom, and British Telecom owns a 2 percent share of this venture.)

Reuters is headquartered in London, but its long-term strategy is to have equal nodes in London, New York and Tokyo. Reuters was owned by the press associations of Great Britain, Australia, and New Zealand until it went public in 1984. Forty percent of the general public shares are U.S.-owned. A panel of Trustees has the power to prevent a controlling interest in Reuters being sold to a "non-appropriate" owner-i.e., one that might threaten the fair and equal dissemination of news and data, especially financial data.

Deregulation or liberalization in Europe and Asia has given Reuters more freedom to use leased lines for new services. Before deregulation, it usually took 3 years to get permission to offer dealing services. On June 25, 1992, Reuters began operating a global trading system for financial futures contracts, in cooperation with the Chicago Merchantile Exchange and the Chicago Board of Trade. With this GLOBEX system, the futures exchanges will have the liability for completing transactions; in its own foreign exchange dealing service, Reuters bears that liability. In the future, Reuters' officials say, Reuters may find a larger role in telecommunications services within multinational corporations.

SOURCE: OTA interview with Peter Smith, International Communications Manager for Reuters Ltd., in London, Apr. 18, 1991; OTA interviews with Michael Reilly, Senior Vice President for External Relations, Reuters America Inc.; Reuters Holdings PLC Annual Report, 1990, "Products and Technology," Reuters Holdings PLC, 1990

[1] For further description of the market and vendors purveying financial markets quotations and other data, see U.S. Congress, Office Of Technology Assessment, *Trading Around the Clock: Global Securities Markets and Information Technology-Background Paper,* OTA-BP-CIT-66 (Washington DC: U.S. Government Printing (Mice, July 1990).

[2] Reuters still carries general news but media traffic has dwindled because newsmen now carry laptops and modems. In Eastern Europe, until recently Renters sent news to government newspapers that then selectively disseminated that news to other recipients. Now Reuters ean deliver general news directly to many newspapers and broadcasters in Central and Eastern Europe through satellite services.

custorner-specific transaction data for the targeting of other financial services.

Organized securities markets are also at risk. Stock exchanges and other securities market institutions (e.g., futures and options exchanges) could build telecommunications systems to support round-the-globe, round-the-clock trading through the exchange; but thev are slow in picking up this challenge.[11] Information services providers, such as Reuters, are offering off-exchange electronic trading and transactions services such as Dealing 2000, Instinct, and GLOBEX (the latter developed jointly with Chicago futures exchanges). (See box 4-A.) The traditional markets could find themselves bypassed. Brokers/dealers who want to do arbitrage and 24-hour trading will presumably use any services provider, and information companies are seeking to develop value-added services.

[11] For a thorough discussion of this challenge, see U.S. Congress, office of Technology Assessment, *Trading Around the Clock: Global Securities Markets and Information Technology—Background Paper*, OTA-BP-CIT-66 (Washington DC: U.S. Government Printing Office, July 1990).

Electronic Data Interchange

In the long run, the greatest competitive threat to banks as a result of information technology may come through electronic data interchange (EDI). EDI is a specialized application of electronic mail, allowing business to transact the transfer of customized business forms such as invoices, purchase orders, and shipping notices. EDI systems can also verify authorization on orders, connect orders with invoices, and send payment instructions to banks.

This definition conceals the fact that at its ultimate extension, EDI approaches electronic funds transfer (EFT), the process through which banks move funds from one account to another or from one bank or banking location to another. The generation of electronic invoices has been actively developed faster than generation of payment orders (one reason being the desire not to lose float) .12 But like EFT, EDI allows a buyer to authorize its bank to transfer funds to a seller; both use the bank as a clearinghouse. The payment remittance transaction can act as both authorization and remittance history; it is passed through the bank which strips the information needed to effect the money transfer and forwards the rest of the information to the trading partner. Corporations with EDI networks could continually net transactions between themselves and their suppliers and customers who connect to the network, and only at the end of the day authorize one final net funds transfer through the banking system to settle the day's business. This would greatly reduce the role of banks. (The question of payment risk would have to be resolved.)

While the net payment must go through the bank, all intermediate payment remittances could go directly from buyer to seller, or if there is a third-party service provider, from customer to vendor. In this case the bank would be providing little or no value-added service, and might be able to charge only 'commodity prices' for passing money through its system.[13]

The use of EDI for financial applications is growing rapidly as the number of EDI trading partners grows. State government policies encouraging such applications as electronic State tax payments and child support payments account for part of this growth. However, corporate exchanges are increasing more rapidly .14

This clearly poses a competitive challenge to banks. Some banks are positioning themselves to become EDI "hubs" or suppliers. In the United States, they already offer customers ways to pay their suppliers electronically, such as automatic debit agreements. Banks have the strong advantage of being able to finalize payments. They have built cash management services on their ability to transfer funds and their computerized processing capability; they could market general EDI products tied to the cash management services. Citibank, for example, already offers EDI as part of cash management services.

EDI systems can, in other words, be operated by banks, public telecommunications operating companies, suppliers of third-party value-added services, corporations (connecting to suppliers, vendors, and banks), or various combinations of these. AT&T Istel, Sprint, and Bell Atlantic offer EDI services. Several European PTTs are planning to develop them. In the United Kingdom, Barclays Bank, Lloyds, Midland, and National Westminster offeror plan to offer EDI systems.[15] Value-added networks are also already providing payment-related EDI services (i.e., IBM's International Network, GEIS, and British Telecom's Tymnet). In both the United States and the United Kingdom, corporate EDI systems are proliferating; about 3,000 United Kingdom companies now electronically issue order forms or invoices.[16]

EDI networks in both countries are still rudimentary. For EDI to work effectively, it must incorporate "business semantics" as well as data standards; that is, it must capture the steps and sequence in, for example, a transaction process. At the international

12 Phyllis K. Sokol, *EDI: The Competitive Edge* (New York, NY: McGraw-Hill Book CO. Intertext Publications, 1989), p. 172.

13 Ibid., pp. 172-175.

14 The number of corporate partners tripled from the final quarter of 1990 to the final quarter of 1991. Stephen M. Lewis, "Banks Increase Role in Financial EDI," *EDI World,* July 1992, pp. 34-38.

15 Della Bradshaw, "Corporate Cheque-Writing Draws to an End," *Financial Times, Nov. 7,* 1990, special section, "Information Technology in Finance," p. vii. Bradshaw reports that each payment would cost about L.2 (approximately U.S. $3.60), plus a small network charge; the estimated cost of corporate payment by check in the United Kingdom is estimated at L.5 to 30 (U.S. $9 to $54).

16 Ibid.

level, this is a particularly severe problem because U.S. banks have operating procedures very different from those in Europe.[17]

Today, a full EDI system usually requires special protocol conversions and a prearranged business agreement between partners as to the protocols to be used. Various communities of users use different subsets of X12. (the standard under development by the American National Standards Institute Committee X12) that are still not compatible. Thus each pair of partners must negotiate an agreement before they can interchange data. This is very different from a general electronic mail system, where each user has a mailbox that can accept unstructured mail from others on the system. But at present, EDI networks offered by most vendors do not have direct connections between suppliers, vendors, banks, or other participants. They provide mailboxes reached through 800 numbers. EDI messages sit in an electronic mailbox until they are retrieved by the addressee.

The need for negotiated protocols between each EDI user-pairs will eventually be overcome. There are increasing pressures on multinational corporations and financial institutions to adopt message text standards for EDI. The International Standards Organization (IS0)[18] committees are working to develop an international standard called EDIFACT. SWIFT is moving to EDIFACT, and EC directives also call for moving to EDIFACT. U.S. banks will have to decide whether to go along. If they do not, they will be at a competitive disadvantage in European operations. If they do go along, they will have to support EDIFACT, plus X12. for domestic applications,plus ACH (Automated Clearing House) standards. This triple support will be costly.

There are still unresolved legal issues related to EDI. In Europe, some laws require that various kinds of documents be on paper to convey title or to demonstrate the existence of a contract. A European Model EDI Agreement is being developed to serve as a standard contractual framework for parties in EDI trade relationships.[19] In the United States, computer documents are generally admissible as evidence if they can be shown to be part of a ledger constructed and kept in accord with ''normal business practices. '' There is, however, still some uncertainty or unsettled legal questions in this area.

Traditionally, corporations (in making payments, lending and borrowing, investing, and other financial transactions) usually interacted with each other through the intermediation of a bank-or, more often through a series of interbank transactions. When these exchanges became electronic, each corporate network became in effect an extension of a bank-operated network.Third-party service providers with value-added networks (VANS) can expedite the transmission of financial data between partners, but only a bank can provide final settlement of the payment obligations. Banks and VANS are now forming business alliances in which the VANS transmit the payment information and the bank provides settlement. But the VANS are interposed between banks and their customers, allowing corporations to deal directly with each other while only the VAN itself connects to the bank network.

It is likely, therefore, that EDI services will change the way banks operate and the way they relate to each other and to customers. To avoid being cut out of the loop, banks will need closer communications through direct electronic connections with their customers, such as were possible in the past only with correspondent banks and a few large corporations. Chase Manhattan Bank, for example, offers a full range of services, handling transmission of electronic invoices and purchase orders as well as final payment, with no third-party VAN involved.[20]

Only the largest U.S. banks are active in delivering financial services to overseas customers, due to the high costs of maintaining private international networks to support enhanced services. Mid-sized and smaller banks usually serve overseas corporate customers through foreign correspondent banks. Smaller banks have begun to use international VANS to handle networking and information processing; they also may use them for EDI services. By making it easier for smaller financial institutions to operate in other countries, EDI systems compete

17 This section draws on discussions with Judith Fincher, EDI marketing manager for HFSI, Inc.

18 The ISO is a multinational organization that promotes and coordinates international standardization.

19 Andre Bertrand, ''EDI: the Final Draft of the European Interchange Agreement,'' *International Computer Law Advisor*, vol. 5, No. 12, September 1991.

20 Lewis, op. cit., footnote 14, p. 38.

with SWIFT. In response, SWIFT 2, now under development, will have EDI capabilities.

EDI makes it difficult to distinguish between the competitive networks of value-added suppliers and the cooperative bank-owned networks for interbank funds transfers (e.g., SWIFT, CHIPS). This creates a situation where a nonfederally regulated entity offers payment services. The question of oversight of international banking will be much more difficult.

Traditional clearing arrangements for cross-border payments could be bypassed as new financial service products are developed. Because EDI will change the way financial institutions interact, there may be new kinds of payment risk, and new approaches to control risk will be needed. The distinction made by the National Commission on Electronic Funds Transfer in 1976, between a) transfer of data related to financial transactions, and b) transfer of funds into or out of a depository account, is beginning to break down in the face of technological innovations.

Electronic Trading Networks

Supplying financial market data (such as "last sale" prices, bids, offers, and quotations) has become a "commodity market." Stock and futures exchanges make data available to any reseller or distributor in digitized form. Information services suppliers are moving to compete by offering value--added services, including some that enable buyers and sellers to complete a trade or transaction (except for final payment). Dealers and institutional investors trade directly with each other through the electronic network, rather than through brokers or organized markets such as stock exchanges.[21] Reuters in 1981 began the Monitor Dealing Service to allow foreign exchange dealers to negotiate transactions over Reuters' network and dedicated terminals. About 40 percent of the interbank foreign exchange trading now takes place on Monitor. Dialing and automated central matching was added in 1992.

In 1987 Reuters bought an electronic securities trading system, Instinct (developed a decade earlier by a broker/dealer). Instinct now executes trades of about 13 million shares a day. In cooperation with two U.S. futures exchanges, Reuters has also developed a network for global futures trading (GLOBEX) that will allow electronic trading of futures and options of the Chicago Board of Trade and the Chicago Mercantile Exchange. GLOBEX opened on June 25, 1992.

In the meantime, Telerate started, then abandoned, a joint venture with AT&T to develop a competing trading service. Quotron is now developing an electronic execution network for foreign exchange. Another currency trading system, Electronic Brokerage System (EBS) is being developed by a consortium of banks. The only electronic trading system in a U.S. exchange[22] is in the New York Cotton Exchange (in its index futures division known as Finex). It accommodates nearly 24-hour trading. Its average daily turnover immediately increased about 62 percent when it installed the system—about 30 percent of the trading is done overnight.[23]

Global trading systems require international standards. They may ultimately be a key driving force for development of integrated services digital network (ISDN) technology. Many serious technical problems are yet to be solved. Multicast dissemination of market data is essential for an automated trading system. But market data disseminated from a central point take longer to reach some market participants in various parts of the world than they do to reach others. Even a few seconds delay can give participants an advantage over others who receive the information later. ISDN specifications for public networks do not yet allow the market information to be received simultaneously worldwide.[24]

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21 U.S. Congress, Office of Technology Assessment, *Trading Around the Clock: Global Securities Markets and Information Technology*, OTA-BP-CIT-66 (Washington, DC: U.S. Government Printing Office, July 1990).

22 "The Arizona Stock Exchange," formerly known as Wunsch Auction Systems, Inc., is an electronic system operating a single price auction daily, in over 3,000 equities. It was granted exemption by the Securities and Exchange Commission (SEC) from registering as a stock exchange for purposes of regulation, and it is not a self-regulatory organization as are registered U.S. stock exchanges. It is approved by the Arizona Corporation Commission and the Arizona Commerce and Economic Development Commission. For discussion of single price stock auctions and the beginnings of Wunsch Auction Systems, Inc., see U.S. Congress, Office of Technology Assessment *Electronic Bulls & Bears: U.S. Securities Markets & Information Technology*, OTA-CIT-469 (Washington DC: U.S. Government Printing Office, September 1990).

23 Anite Raghavan, "Tiny Finex Takes Big Step in Round-the-Clock Trading," *The Wall Street Journal*, Apr. 8, 1992.

24 Both DEC and IBM have said that they will have simultaneity in their proprietary network software (DEC as part of their Trading Platform, IBM as part of their DataTrade offering) but this has not yet been demonstrated.

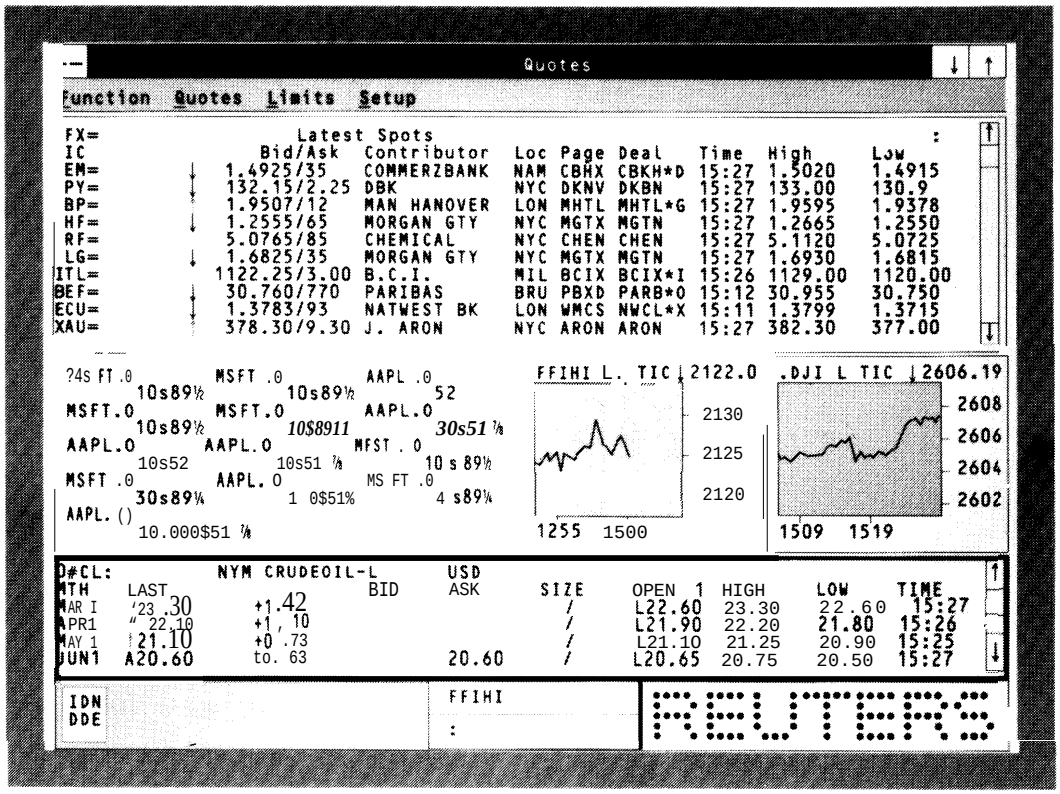

Photo credit: Reuters

International financial data and news on a Reuters terminal.

If multicasting of market information is implemerited, it is still not assured that all subscribers will receive the transmission. If some subscribers do not receive the information, they will be using incorrect or dated information. There is no foolproof system to verify the receipt of the information by each subscriber.[25] If there are line failures, market participants may be unable to place or cancel orders, or trades may take place even though a cancellation was entered. Reuters had similar problems with its trading systems but asserts that the problems have been overcome.

As these problems are solved, however, electronic trading systems will come into direct competition with today's face-to-face markets (e.g., the New York Stock Exchange) and with telephone-based dealer markets such as the government bond market and the over-the-counter stock market. Brokerage houses interviewed by OTA said that electronic trading systems will, at least, change the way they do business, and may ultimately put them out of business.

OTA, in an earlier study, concluded that such electronic trading systems may be the "stock exchanges of the future. "[26] These trading systems are evolving without much regulatory oversight (the Securities and Exchange Commission has so far refrained from regulating them as exchanges). Regulatory problems will emerge as global systems are implemented.

[25] Letter t. OTA from Garth Eaglesfield of E. Consulting Services, Feb. 25, 1991.

[26] *U.S.* Congress, Office of Technology Assessment *Electronic Bulls & Bears: U.S. Securities Markets & Information Technology,* OTA-CIT-469 *(Washington* DC: U.S. Government Printing Office, September 1990).

Chapter 5
International Issues

Dual Regulation

In most countries, banking and telecommunications have both been highly regulated, and institutions that engage in both have borne a double burden. Banking regulation controls the financial services that can be offered and the activities that banks may engage in. Communications regulation controls the technology by which services are delivered and, with respect to many local and long-distance network services, the rates that may be charged. Both affect the classes of customers to whom financial services are offered.

In the United States, the Federal Communications Commission (FCC) generally regulates only communications common carriers, and not the private lines operated or shared by banks. The Federal Reserve Board does not allow bank holding companies to own telecommunications businesses other than one transmitting primarily or only financial or banking data. Telecommunications companies are still regulated at both State and Federal levels, but this regulation generally does not extend to those new activities in which they have begun to participate, and they are not regulated by bank authorities or the Securities and Exchange Commission (SEC). There is relatively little domestic dual regulation.[1] Instead, in the United States, new entities are being created that are not covered by regulations applying to older parallel institutions-for example, it is not clear whether new electronic trading and transactions systems such as Instinct and Globex should be treated as telecommunications systems, securities exchanges, or neither.[2]

In some countries, However, electronic fund transfer (EFT), credit card authorization, and switching for automated teller machines (ATM) are considered telecommunications services, with varying degrees of regulation. The D-Series Recommendations of the Consultative Committee for International Telephone and Telegraphy (CCITT) in the past severely restricted the offering of telecommunications services, although these restrictions were subject to national interpretation. CCITT Study Group 3 has now approved new, liberal recommendations on the use of leased circuits.

Banks often operate cash netting services for multinational corporations. These services enable the corporations to make funds transfers and settlements among subsidiaries around the world, from a personal computer that ties into the banks' networks. Most such systems accommodate some message transmission in the form of instructions or explanations. However, some foreign regulators and postal telephone and telegraphy administrations (PIT's) consider this to be an unlawful messaging activity by the banks, or resale of communications capacity. Some countries discourage shared ATM networks.

In a number of countries, cross-sector regulatory issues are becoming more confusing as both financial institutions and telecommunications systems are deregulated, but at different rates. It may not be clear, for example, whether an on-line transaction is a regulated banking service, a telecommunications service that is regulated in some, but not all, jurisdictions, or an unregulated data processing service. For example, Citicorp allows citizens of the United States to use Citibank ATMs in Japan to withdraw money on deposit in the United States.[3] This raised the issue of whether this is a use of intercorporate leased lines, resale of capacity to a third party (which in Japan requires a license), or provision of a value-added service.

Antitrust regulations or policies that support competition are a problem in several countries, chiefly as they apply to networks operated by groups

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1 The American Bankers Association notes that some States in the United States have "shown an interest in" regulating credit card authorization and ATMs through State public utility commissions

2 Robert R. Bruce, Jeffrey P. Cunard, and Mark D. Director, *The Telecom Mosaic: Assembling the New International structure* (London: Butterworths, 1988), chapter III, Telecommunications & Transaction Services. The Securities and Exchange Commission has so far declined to regulate them as exchanges but has left open the possibility of doing so in the future

3 Citibank offers an International Citicard that lets travelers overseas use Citibank ATMs to withdraw cash from accounts in the United States (in foreign currency, but with the debited exchange rate shown on screen), and also check their U.S. bank balance or transfer money between accounts. As of now, Japanese customers of Citibank can use their International Citicard in the United States or other countries, but not in Japan, where bank-issued cards carry a magnetic strip that uses local rather than international standards. (Citibank Japan is now redesigning its ATMs.)

of banks. Shared networks may be perceived to reduce competition among banks, or conversely, nonbank suppliers of networks may be viewed as competitors of banks. National authorities may promote legislation with respect to what can or must be shared. On the other hand, if payment systems are seen as part of the larger telecommunications market, where their competitive effects are relatively small, rules designed to assure competition are unlikely to be applied.[4] The Commission of the European Community is now studying institutional and legal aspects of new payments technology.

Although bank networks were studied by the Antitrust Division of the U.S. Department of Justice in the early 1980s, no action was taken and telecommunications regulation has remained limited to common carriers. In the late 1980s, consolidation eliminated nearly half of the ATM networks. The increasing concentration of ATM transactions in a few large networks has again raised the issue of anticompetitive behavior, and both State and Federal antitrust authorities are monitoring the practices of ATM networks.[5]

If payment systems are viewed as telecommunications networks rather than as banking networks, any third party can provide switches to route money transfers from one location to another across national boundaries, although ultimately transfers must show up on the books of depository institutions. In the United States banks now have to compete with money market funds for deposits and nonbank institutions may process and switch monetary debits and credits. Regulators are increasingly less able to monitor, measure, and, perhaps, control money supply. Most importantly, the management of payment risk may become much more difficult.

Shared networks provided by common carriers are subject to telecommunications policies that may not always serve the interests of the financial industry as a whole. For example, SWIFT, cooperatively owned by banks through agreements reached with PTTs around the world, is subject to rate increases for leased lines. Yet SWIFT will be under pressure to remain price competitive as new value-added networks offering electronic data interchange (EDI) make it possible to bypass SWIFT. At the same time, large banks fear that if SWIFT expands into electronic banking services for corporate customers, it will compete with them.

The blurring of traditional industry boundaries is a recurring effect of advances in information technology because it allows organizations to offer new products or perform functions in entirely new ways. These new activities often do not fit older legal or regulatory proscriptions and requirements. New regulatory approaches have been suggested, such as framing regulations and agency jurisdictions around functional activities rather than around industies, institutions, or products-e. g., regulating the activity of lending rather than regulating "banks" or bank credit cards. As noted above, such potential changes should be examined carefully for undesirable effects.

GATT Negotiations

In the early 1980s it often took over a year to get type approval in foreign countries to connect terminal or network equipment to leased circuits. This situation has eased in most countries,[6] but there are still some government restrictions both in industrialized countries and in developing countries that can prevent financial institutions from operating their global networks efficiently. Not all European PTTs are fully committed to providing leased circuits at flat or cost-based rates,[7] a critical factor in offering value-added services and thus in the global competitiveness of U.S. financial institutions.

Large corporations that are heavy users of telecommunications generally argue that a GATT (General Agreement on Tariffs and Trade) treaty must address access to and use of exclusively provided telecommunications services (state-owned systems

4 Marjorie @_teri e, "Public Policy & International Telecommunications Technology in Financial Markets-An Overview," OTA contractor report, February 1992.

5 James J. McAndrews, "The Evolution of Shared ATM Networks," Federal Reserve Bank of Philadelphia, *Business Review*, May-June 1991, p. 3.

6 France, i.e., relaxed restrictions on private networks in its Telecommunications Regulation Law of December 19, 1990. Users may now deploy private facilities to support private networks, although large private networks may still be required to register. Network services were deregulated; restrictions on shared networks such as SWIFT were dropped; and private companies may now sell basic data transport services (e.g., packet switching) to the public.

7 U.S. Department of Commerce, U.S. *Telecommunications in a Global Economy,* report to the Congress and the president of the United States, August 1990, p. 105.

or regulated monopolies) as well as provision of competitive services. An agreement should be flexible enough to accommodate a great variety of regulatory approaches and business needs, and flexible enough to integrate rapid changes in the industry.[8] A U.S. proposed telecommunications annex to GATT would:

- Give users greater freedom to use private line services as they choose,
- Require international private line prices to be based on costs,
- Allow users to interconnect private networks with public networks, and
- Allow users to connect their preferred terminal and network equipment.[9]

These negotiating points generally reflect the needs of U.S. firm-cifi services providers, as expressed in many OTA interviews with bank executives and in a statement by banking representatives to the President of the United States.[10] Financial institutions want their private networks to be interconnected through public switched networks, although treating financial systems as telecommunications systems could raise new issues barely recognized as yet by financial institutions. They want the ability to share use of private circuits, among banks (ATM systems) and between unrelated enterprises (EDI systems), and they want the right to connect leased circuits by whatever equipment is needed. Another key concern is the ability of the customer or supplier to access the financial institution's information systems for data and services, now sometimes prohibited as resale. Financial services providers insist that leased circuits should be priced near costs, so that they are not charged a "tax" to pay for the development of services for the general public. Finally, financial institutions want legal protection for proprietary computer software which they may provide to their customers or suppliers to communicate with the corporation's computer.

Heads of 10 U.S. financial institutions and associations signed a letter to the President of the United States that called for:

> .a strong comprehensive [GATT agreement [that] will increase trade, create jobs in the United States and enhance the international competitiveness of U.S. firms.[11]

Officials of some financial institutions, however, voice reservations about the GATT negotiations; some prefer that the United States rely on bilateral agreements so that they "can work deals [with PTTs] to offer services, sometimes disguised as public services, and this may not be possible under GATT."[12]

The fragmentation of government policymaking in the United States is not a major concern to U.S. financial institutions. "It's an opportunity rather than a problem,' one bank official said cheerfully, because 'we can select the regulator we want to deal with." But it is a problem when the Department of State cannot negotiate bilateral trade agreements because the U.S. Trade Representative considers the issue to be a general trade problem, thus subject to GATT.

Transborder Data Flow Issues

In the view of one banking official, the interplay among financial regulation, telecommunications regulation, and privacy regulation will determine the future of American banking overseas.[13] The possibility of stringent EC privacy restrictions has been a growing concern for U.S. banks, services providers, and large network users because of an EC privacy directive proposed in 1990, which it was feared could disrupt the use of bank-owned global data systems. The directive would have severely limited

8 See "U.S. Industry Proposed Approach for a General Agreement on Trade in Services Applicable to the Telecommunications Services Sector," Submission by the U.S. Council for International Business (to the U.S. Trade Representative), November 1989. This submission was withdrawn for technical reasons but reflects a widely held industry position.

9 U.S. services providers have built enhanced services around proprietary protocols. But some countries, especially Japan, want value-added networks built around CCITT protocols. Marian Barell, Deputy Assistant to the U.S. Trade Representative, in hearings before the Subcommittee on Communications of the Senate Committee on Commerce, Science, and Transportation, U.S. Senate, 100th Congress, 2d Sess. on International Telecommunications Issues, Apr. 19, 1988.

10 Letter coordinated by the Financial Services Group of the Coalition of Service Industries, Inc., Washington, DC, Nov. 25, 1991.

11 Ibid.

12 According to interviews by OTA (non-attribution requested).

13 Michael Nugent, Associate General Counsel, Citicorp, personal communication. Citicorp offers retail financial services; privacy restrictions are a less acute problem for investment and wholesale banking.

the use and transmission of financial and other personal data. The European Parliament, however, raised more than a hundred specific objections to the text of the proposed directive and returned it to the Commission for rewriting. A new version is expected to be released in October 1992, but it is anticipated that the provisions of greatest concern to U.S. banks (and to many European businesses as well) have been greatly modified.[14]

In the mid-1970s transborder data flow issues focused on privacy in the flow of personal data across boundaries. But by early 1980s they had evolved into a broader range of issues including telecommunications policy, economic protectionism, trade barriers, cultural identity, national sovereignty, and security .15

Many American business people believe that what is being called "privacy protection' is a trade issue rather than a privacy issue. They argue that the real goal is the preservation of jobs and the related revenue base for taxation. Governments may use privacy protection to force financial institutions and other large multinational corporations to operate local data centers and keep jobs within host countries. For example, the Canada Banking Act requires that processing of financial data be done within the country; this prevents Citicorp from consolidating its data processing activities in its processing center just across the border in the United States.

However, on the U.S. side, opposition to privacy protection laws may also front for an unstated economic motivation. The laws could tend to promote the deployment of distributed networks in Europe, over the centralized processing approach. Central processing facilities for the most part are equipped with data processing equipment often supplied by U.S. firms such as IBM and DEC.

Legal issues under the privacy umbrella include trade documentation, copyright law, software protection, and the appropriate locus of liability for loss of data. Security and sovereignty issues revolve around possible dependence on foreign suppliers for information and the transfer of high technology to hostile or competitive countries.

Lack of International Monitoring and Oversight

Some banks seek to escape national regulation by locating activities offshore or in countries with different regulatory regimes. International telecommunications networks have unfortunately encouraged this practice. For example, the Cayman Islands (three small islands between Mexico and Cuba) have become a major center of international banking. A British Crown colony, the Cayman Islands were recently reported to hold 548 bank offices.[16] Most of these are 'booking centers" that do all of their work through voice and fax communications and data networks for customers and correspondent banks in other countries. U.S. banks began to use Cayman Island booking centers chiefly to avoid the Federal Reserve System's reserve account requirements.[17] But the banks in offshore havens can also be used for ''laundering' money earned in illegal or unsavory activities.[18] There are said to be over 40 such centers of international banking where modem telecommunications networks allow foreign banks to operate virtually without regulation or oversight.

U.S. banks are subject to laws requiring the reporting of large cash transactions in order to discourage money-laundering.[19] Congress passed legislation that requires the Treasury Department to negotiate bilateral agreements allowing the United States to track cash deposits of U.S. currency in foreign countries for purposes of criminal prosecu-

14 Information provided by the Washington Office of the European Commissions Delegation, Sept. 17, 1992.

15 Edward J. Regan, Vice President, Manufacturers Hanover Tmst Company, in a talk given to the U.S. State Department Bureau of International Communications and Information Policy, at Airlie House, VA, Apr. 8, 1986.

16 Steve Lohr, "Where the Money Washes Up, " *The New York Times Magazine,* March 29, 1992, pp. 27ff. As a British Crown Colony (like Hong Kong), the Islands make their own laws and regulations and the Bank of England has no control over banks there. However, according to the American Bankers Association@ new legislation was enacted in the United Kingdom at the end of 1991 providing for new supervisory responsibilities in the British dependencies.

17 This is not illegal; and Federal Reserve Board of Governors analysts say that because the Board has reduced reserve requirements in the past few years there is now only a minimal incentive to use Cayman Island banking offices to avoid them.

18 According t. Th. *New York Times,* op.cit., footnote 16, Cayman Islands banks were used by Lt. Col. Oliver North to collect money fOr the Iran-Contra arms deal, and by the Bank of Credit and Commerce Internationa(BCCI) to handle its allegedly illegal transactions.

19 This is the practice of moving money from the United States to other countries that do not have such requirements; then, after perhaps moving the money through several "shell" or name-only corporations, wiring it to a U.S. bank account in electronic form not subject to reporting.

tion. Nations that do not cooperate would be subjected to penalties, including loss of the ability to make transfers through Clearing House Interbank Payments System (CHIPS). However, Senator John Kerry (Chairman of the Subcommittee on Terrorism and Narcotics of the Senate Committee on Foreign Relations) has charged that the Treasury Department has failed to negotiate such agreements because the threat of penalties would put U.S. banks at a disadvantage in trade negotiations.[20]

The Basel Committee on Banking Supervision recently adopted stricter minimum standards for supervision of international banking. They recommend:

- Banks opening offices in another country should receive both host and home government approval;
- Regulators in the home country should have the authority to obtain information from foreign bank operations; and
- Bank regulators from countries represented on the Basel Committee (including the United States) should share information.

These recommendations highlight the lack of oversight in the past, but it is far from clear how well they will be implemented or how they can be enforced.

Data Security and Reliability Issues

criminal violations of data security are a serious concern of users of international private networks, although financial institutions are very reluctant to talk about specific instances. Another concern is the possibility of international terrorism. Improved security is one of the reasons often cited by financial institutions for developing private networks. An International Chamber of Commerce Position Paper says:

> In the long-distance network it is difficult to attack specific traffic channels without very expensive apparatus, even if the physical routing of any particular connection is known. . ..whether public switched services or leased lines are used. However, when the traffic reaches the local (or 'serving') exchange office it is concentrated onto discrete routes to the customer's premises. . .[and] is often reasonably physically accessible. . .[and] vulnerable to intercept using relatively inexpensive resources and simple techniques.[21]

On the other hand, some experts now argue that growing security concerns will encourage financial institutions to return to public switched networks. They say that private and shared networks are highly tempting targets for hackers because the financial data is concentrated and readily identifiable, whereas on public networks it is masked by general traffic.[22]

Financial institutions have different approaches to data security on their private networks, including dedicated and well-guarded host computers, recognition procedures, and encryption and authentication technologies.[23] Adequate Security on private networks has become very expensive. Several bank officials interviewed by OTA said that most institutions have woefully inadequate safeguards, both because of the expense and because of general lack of appreciation ''at the Board level" of the risks.

Most financial institutions are much more concerned with data integrity than with confidentiality, and are particularly sensitive to the importance of cost-effectiveness and ease of use in considering security safeguards. Users in some other industries and some parts of government-especially those related to national defense—may have more stringent requirements for confidentiality and may necessarily be more tolerant of higher costs or lessened ease of use. This is the origin of a long-standing dispute over security safeguards and the role of the U.S. Government in developing or mandating them.[24]

The National Security Administration (NSA) was established to unify U.S. signals intelligence operations against foreign communications and to protect

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20 John Kerry, "A Money-Laundering Loophole," *Daily Telegram, Nov.* 4,1991, p. 15.

21 International Chamber of Commerce, "Communications Network Security: An International Business View" (Policy Statements on Telecommunications, Position Paper 13), pp. 15-16.

22 This opinion was expressed by several network managers in talks with OTA. They were understandably reluctant to be identified.

23 Encryption is encoding text with a unique set of characters (the key) through a mathematical process (the algorithm) to produce a sin-bled or unreadable message so that only a person having knowledge of the key can unscramble it. Authentication techniques make use of newly developed mathematical techniques called public-key cryptography and electronic procedures for providing "digital signatures" to verify the identity of the sender of the message.

24 For a detailed discussion of security technology, see U.S. Congress, Office of Technology Assessment, *Defending Secrets, Sharing Data: New Locks and Keys for Electronic Information* (Washington, DC: Government Printing Office, October 1987).

U.S. military, intelligence, and diplomatic communications. A civilian agency, the National Bureau of Standards (NBS), now known as the National Institute for Standards and Technology (NIST), played a central role in setting information security standards for civilian government agencies and certifying commercial encryption products. It spearheaded the development of a national standard for cryptography, the Data Encryption Standard (DES). In the 1980s, changing government policies expanded the Federal role, and especially the role of the Department of Defense, in developing information safeguard technology and in certifying standards for encryption and related technologies. National Security Decision Directive 145, in 1984, shifted responsibility for certifying DES-based products from NBS to NSA. In 1986, NSA announced that it would no longer certify DES-based products for government use and would supply its own cryptographic designs for use by U.S. companies and civilian government agencies.

This immediately raised industry concerns about the costs and availability of information safeguards, and about the appropriateness of such a strong role for a military intelligence agency in corporate information security. This dispute has continued, and may have contributed to the slowness of financial institutions to give adequate attention to safeguard technology, as reported to OTA in several interviews.

Errors, as opposed to malevolent interception, are also a serious concern for banks. Human error can be magnified by the speed at which telecommunications work. According to news reports:

> .a minor error by a bank official resulted in a U.K: clearing bank mistakenly paying out, within 30 minutes, more than $3 billion to U.S. and U.K. customers.

This was blamed on a fault in computer software that allowed a payment message to be transferred repeatedly because a date was omitted.[25]

System reliability is a major concern for investment bankers or securities houses; if their systems fail, they will have liability for trades not completed. They will also lose customer confidence, "which is deadly in this business," as a securities house official said. Securities houses are also greatly concerned that data could 'leak' from the network—i.e., be accessed by unauthorized persons to whom it might give unfair advantage in trading. This could subject the firm to SEC penalties for insider trading, as well as result in loss of customers' confidence. Brokers and dealers also must protect their customers' privacy. These concerns are bigger with private or shared networks than public networks because the operator of the network may be held to bear the liability .26

System failure is also a major concern of stock exchanges since the assurance of fair and orderly markets now depends heavily on the proper functioning of their automated systems and telecommunications links. Yet the degree to which stock exchanges and investment banks take steps to reduce risks associated with automated systems varies widely. The attention paid to such risks by national regulatory processes also varies widely .27

Most foreign regulators have given little attention to addressing automation risks and have generally not issued policy guidance on automation control requirements. Both OTA and the GAO have pointed to the need for the SEC and the Commodity Futures Trading Commission to actively encourage the international financial community to address these risks. Five international organizations are now working on the problem: Le Federation Internationale des Bourses de Valeurs, the Group of Thirty, the International Organization for Standardization, the International Organization of Securities Administrators, and the Organization for Economic Cooperation and Development (OECD).[28]

System breakdowns are a more serious problem than crime or hacking for public switched networks. In September 1991 a major telephone system failure in lower Manhattan (Thompson Street) was traced to ''a combination of failures in power equipment and

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25 Alan Cane, ''Bank Error Leads to $2 Billion Pay-Out to Companies," Financial Times, Nov. 19, 1989.

26 The question of liability for data on private networks is not fully settled, Under UCC 4A the operator must meet "reasonable" standards and reasonable customer expectations of security. In private or shared networks the question of liability is often incorporated in a contract.

27 For a definitive analysis of risks in clearing and settlement mechanisms around the world, see *Study of International Clearing and Settlement, a* study administered by Bankers Trust Company under contract to OTA, 1989, vol. 1; available from National Technical Information Service.

28 GAO, ''Global Financial Markets: International Coordination Can Help Address Automation Risks," IMTEC-91-62-ES, September 1991.

alarm systems."[29] There were big differences in vulnerability to the Thomas Street failure.[30] One bank had concentrated its data processing into two remote centers, using three long-distance carriers and intelligent multiplexer for routing traffic between them. This network lost 25 percent of capacity but suffered no disruption. By contrast, a large securities house lost all connection to the Securities Industry Automation Corporation and could not clear and settle the day's trades over the network. (Failure to have settled would cause it not to be allowed to trade when the market opened the following morning. The securities house was reduced to dumping data onto tapes and ferrying them by automobile to the clearinghouse.) The firm had believed it was fully protected by redundant circuits to its local carrier, NYNEX, but discovered to its chagrin that these circuits all went through one AT&T switch, which failed.

Most financial institutions go to great lengths to have complete redundancy in their own networks, but the public networks to which they are connected sometimes make minor engineering changes without checking to see if this routes ''redundant" circuits through a common switch. Several such cases were related to OTA by Wall Street fins.

The liability of communications carriers for lost or compromised data is emerging as a major issue. Financial institutions would like to bind the public carriers by contract (as is done with private carriers) to guarantee security, but the carriers claim to be unable to assume such responsibility under FCC's tariffing rules. The Bush Administration's position, according to some concerned about the issue, is that the market will take care of this.

Payment System Risks in Shared Financial Networks

A payment system is a system that moves messages that are electronic funds transfer instructions and thereby affects settlements among its members.[31] When monetary value is irrevocably transferred from one party to another, this is called "finality of payment" (i.e., payment in cash). A unique capability of banks is their ability to credit and debit accounts on their books (typically referred to as a "book" transfer) without a physical transfer of cash/currency.

FEDWIRE, operated by the Federal Reserve System, is an electronic payment mechanism that provides finality of payment on an individual transaction basis. CHIPS, operated by the New York Clearing House, has incorporated procedures to assure finality of settlement at the end of the day. SWIFT is considered a communications system rather than a payments system as it moves messages among its members including funds transactions that are subject to settlement by other means. However, Federal Reserve Bank analysts say that for many purposes SWIFT may also be considered a payment system because banks accept instructions sent over it as authoritative.

The use of electronic systems, and especially the reliance on international telecommunications systems for funds transfers, brings with it growing concern about payment system risks. Payment system risks arise in both the U.S. Federal Reserve's FEDWIRE and in private (shared) networks, such as CHIPS and SWIFT FEDWIRE each day transfers billions of dollars between banks. When any bank's payments exceed the balance in its account for some period during the day (i.e., a "daylight overdraft") that is in effect a loan from the Federal Reserve system to the bank-a loan that is paid off at the end of the business day.

Unlike FEDWIRE, which maintains an account in which there are actual funds, CHIPS maintains an electronic book entry account for each participant in the system. Debit amounts in such accounts represent the fact that the participant paid out more than they received. The CHIPS system handles approximately $915 billion per day, and the average total daylight overdraft at the peak of the business day is $45 billion.

If at the end of the day, any bank in a deficit position cannot settle, it has either failed, or been hit

29 Alfred C. Sikes, "A Review of FCC Activities, Accomplishments, and Objectives, " in *Telecommunications,* February 1992, p. 19.

30 The following discussion draws on a number of interviews with financial institutions, which were universally reluctant to be identified in any discussion of security risks.

31 This sections relies heavily on the assistance of Sy Rosen, Vice President for Payment Systems of Citibank, N.A. and a member of the Federal Reserve Board of Governors Large-Dollar Payments System Advisory Group. A basic discussion of payment risk can be found in E.J. Stevens, "Payment System Risk Issues," *Economic Commentary,* Federal Reserve Bank of Cleveland, June 15, 1989; however, this work predates 1990 changes in the CHIPS system to reduce payment risk.

by a severe liquidity problem. Either the Federal Reserve or the other participants in CHIPS or other shared networks are left holding the bag. FEDWIRE operates on the principle of ''irrevocable payment, which means that its funds transfers are final. Therefore the Federal Reserve absorbs the risk that a bank will fail at the end of the day. Private shared networks have no "comparable risk-absorber because payments are not irrevocable. "

In the CHIPS system, since CHIPS acquired settlement finality in 1990, a defaulting bank's net debit position would be covered by an allocation of the other banks on the system in accordance with a set formula. Before 1990, there was no mechanism for covering any resulting illiquidity of those banks and no well-defined risk-assignment law or regulation to determine who should bear the loss. Now there is a collateral pool of U.S. Government securities of about $3.4 billion.

SWIFT messages affect billions of dollars a day by facilitating virtually every international trade and many cross-border securities and foreign exchange transactions.[32] SWIFT is often used to send messages from one country to another. Many countries use its message text standards for payments and thus it can be used as an intermediary to convert from one national clearing system to another.[33] Central banks are increasingly concerned about the scope of settlement failures that could occur on SWIFT'.

The increasing use of international payment networks has given rise to the netting of positions within groups of users. This includes offshore netting centers, such as the Tokyo-based U.S. dollar clearing system and the Private ECU Clearing and Settlement System. The offshore netting schemes are an electronic extension of domestic netting schemes made possible by telematic technology. By reducing the number and overall value of payments between banks, netting improves the efficiency of domestic payment systems and reduces the settlement costs of foreign exchanges.[34] But offshore netting arrangements also are subject to payment risk, and this raises further questions of responsibility and about the role of central banks as lenders of last resort.

In the case of a CHIPS settlement failure it is commonly but unjustifiably presumed that the Federal Reserve might intervene (to the extent, perhaps, of making a short-term loan to banks to cover temporary deficits) .35 With international transfers of funds, the risk becomes greater. It is not known whether foreign central banks would assist foreign CHIPS participants that were subsidiaries of their nation's banks, or whether they would backup participants on offshore netting arrangements. Differences in time zones and bank holidays would also complicate settlement readjustments. .

This leads to a growing danger of systemic risk. When one or more participants in a payment system are unable to meet their obligations, thus causing other participants to default on their obligations, the failures can cascade through a national (and in theory, international) payment system. According to bank authorities,

> Of the various kinds of risk to which banks may become exposed through the accelerated use of the new technology, it is this systemic risk that is the greatest cause for concern.[36]

The Federal Reserve System has taken steps to contain such risks in the United States. U.S. banking authorities have proposed various additional approaches. There is a concern that any national regulations that are viewed as burdensome could result in some banks shifting their participation from onshore to offshore networks to avoid the regulations, or the largest banks might work out bilateral netting arrangements and avoid multiparty networks. After the failure of investment bankers, Drexel Burnham Lambert Group, in April 1990, E. Gerald Corrigan, president of the New York Federal Reserve Bank, set up a committee of commercial and investment bankers to study the implications for the payment system, and to "boost communications among private sector institutions and regulators on

32 Analysts at the Federal Reserve System Board of Governors told OTA that the amount of money moved by SWIFT messages in a day is not known; however, they doubted estimates by other experts of "several trillion dollars. '

33 Greene, op. cit., footnote 4.

34 ''New Report on Interbank Netting Schemes From BIS,' *The World of Banking,* vol. 9, No. 6, November/December 1990, pp. 25.

35 Stevens, op. cit., footnote 31.

36 Bank for International Settlements, *Payment Systems in Eleven Developed Countries* (Chicago, IL: Bank Administration Institute, May 1989), p. 3.

payment, clearing, and settlement issues."[37] This advisory group developed three panels or committees (network operations, contingency planning, regulations), and discussions continue.[38]

At the international level, central banks and industrywide study groups are working on ways to minimize systemic risk and its potential impact on payment systems. A Committee on Interbank Netting Schemes set up by the central banks of the Group of Ten Countries has agreed on minimum standards for the design and operation of cross-border and multicurrency netting arrangements.[39]

As very large multinational corporations establish direct links between their own accounting and those of their banks through EDI networks, and make direct transfers to the debit or credit of other customers and other banks through these networks, payment systems are becoming part of larger networks not controlled directly by bank supervisory bodies. New international mechanisms may be necessary to deal with these enlarged risks and new, non-regulated services providers.

Implications of Electronic Funds Transfer for Monetary Policy

World financial flows have "become largely disconnected from trade flows," says James Brian Quinn, citing estimates that 95 percent of the daily volume of foreign exchange markets are not commercial business but trading between foreign exchange dealers in international banks.[40] Annual money flows over CHIPS or SWIFT ''dwarf world merchandise trade, " and FEDWIRE's volume of transactions far exceeds the U.S. gross national product.

Robert E. Keleher of the Board of Governors of the Federal Reserve System says:

> Revolutions in telecommunications and information processing, deregulation of financial firms, as well as the global integration of financial markets have transformed the environment in which both financial institutions and central banks operate. ***These developments have important implications for monetary policy. They*** have (1) changed the form of financial intermediation, (2) significantly altered the transmission mechanism of monetary policy, and(3) significantly affected the behavior of instruments, indicators, and targets of monetary policy.

Some of these effects come about because of the securitization of corporate and mortgage lending, which was strongly encouraged by lower costs of information processing and transmission, which in turn "dramatically lowered the cost of risk assessment. '[41] Some result from the integration of world financial markets, again encouraged by international telecommunications. A major effect (see box 5-A) is that:

> . . .a monetary policy diverging from the policies in place elsewhere elicits rapid capital flows and sharp exchange rate movements [and causes] changes in monetary policy [to] affect economic activity or prices in different ways than when the economy was less open.[42]

Central banks influence national money supply by reaching a desired operating target through the banking system. (Banks "create" money by making loans; central banks try to control this process by setting reserve requirements and interest rates, and through other procedures.) If the link between the volume of bank balances and the volume of transactions supported by these balances is no longer predictable, it raises questions about the reliability of the central banks' operating targets.[43] A stable relationship between money supply and the monetary base may not be maintained. This may eventually motivate nations to seek an international coordinated approach to control of the money supply.

FEDWIRE and CHIPS together now handle most of the very large monetary transfers that occur in the United States, about $1.7 trillion daily. Automated Clearing House direct deposit and various bank systems handle about one-tenth of that amount daily.

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37 Jeanne Iida, "Pa$_{ren}$t M&S Getting Fresh Look,'' *American Banker,* Nov. 18, 1991.

38 In November 1991 these panels were dissolved in favor of a committee to study ways of limiting risks to the payment system.

39 'tNew Report. . .", op. Cit., footnote 34.

40 James Brian Quinn, '"I&h.uolo~ in Services: Past Myths and Future Challenge%' Bruce R. Guile and James Brian Quinn (eds.), Technology *in Services: Policies for Growth, Trade, and Employment* (Washington, DC: National Academy of Engineering, 1988), p. 35.

41 Ibid.

42 Ibid.

43 Greene, op. Cit., footnote 4.

Box 5-A—The Currency Crisis

"Wide Currency Crisis Jolts European Unity,"
-Headline, *Washington Post,* September 17,1992

"World's Economies, Now Interdependent, All Suffer Together,"
-Headline, *The Wall Street Journal,* September 17,1992

"The world's currency markets, it seems, are no longer governed by central bankers in Washingtonand Bonn, but by traders and investors in Tokyo, London, and New York, ., ."

Allen R Myerson, "Turnmoil in the Currency Markets,"
The New York Times, September 17,1992.

The European Monetary System (EMS) was designed as a preliminary step in the movement toward a unitary European currency and central bank, the goal of the Maastricht treaty signed by the 12 members of the European Community less than a year ago. The EMS has an exchange rate mechanism that locks in the relative values of national currencies by obligating governments and central banks to take steps (for example, adjusting interest rates) to keep their currencies stable relative to the German mark In a tumultous two day period, under **extreme pressure** from currency speculators and arbitrageurs, the imposed stability collapsed, several national currencies were effectively devalued, and the British pound was withdrawn, at least temporarily, from the European Monetary System.

The conditions for the European monetary crisis were created over several years of economic and political disruptions, by diverging national interest rates, and by other strains attendent on the effort to move toward a unitary currency. But the flows of money through electronically linked currency markets may have strongly contributed to the scope of the crisis and the speed with which it climaxed, and indicated to many observers that money values may increasingly slip beyond the control of central banks and national governments.

SOURCE: "Wide Currency Crisis Jolts European Unity," ***Washington Post,*** **September** 17, 1992, and Allen R. Myerson 'Turmoil in the Currency Markets," **The New *York Times, September* 17,1992, D1.**

Together this is a daily flow equal to 55 times average bank reserve balances, and over one-third of the annual gross national product.[44] Herbert Schiller, describing financial telecommunications systems such as SWIFT and Citibank's GIS, says:

> At the same time as these informational networks have been established, another phenomenon has grown up in the world economy, what ***Business Week*** calls "stateless money—a vast, integrated global money and capital system, ***almost totally outside of all governmental regulation,*** that can send billions of Euro-Dollars, Euro-marks, and other 'stateless' currencies hurtling around the world 24 hours a day. "[45]

Thus telecommunications policy may have a critical role to play in controlling risks associated with the operation of the worldwide financial system, because telecommunications companies are becoming major players in national monetary and payment systems.

44 Elinor Harris Soloman points out that a great deal of money is nowin the form of prepayment embedded in plasticcards ("smart cards," etc.), lines of credit accessible by credit cards, spendablecredits on electronic networks, or electronic float. In moving from cash and paper checks to electronic transfer, the velocity or rate of use of the underlying conventional money has greatly increased. Prior to final payment at the end of each day, much money exists as credits on telecommunications networks and maybe spent several times before net settlement. This will effectively increase with the spread of EDI. Soloman believes that these conditions make many monetary policy levers ineffective. Soloman, "EFT: The Transformation of Money," an address to the Electronic Funds TransferAssociation, Mar. 24, 1992.

45 Herbert I. Schiller, *Who Knows: Information in the Age of the Fortune* 500, (Norwood, NJ: Ablex Publishing Corp., 1981), P. 104.