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Solid Waste—

Potential for Recycling Still in the Future

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Solid Waste—

Potential for Recycling Still in the Future

By Edward L. McClelland

Modern economies generate huge quantities of solid waste while consuming declining reserves of a number of raw materials. For some cities, the problem of solid waste disposal is fast becoming acute. Potentially the problem can be eased by resource recovery, or recycling, which at the same time could become a significant source of secondary materials. But recycling has not yet proved to be economic on any substantial scale. And before it does, the cost of solid waste disposal by resource recovery will have to become competitive with the cost of conventional waste disposal.

Solid waste is a heterogeneous mixture of materials discarded by households, businesses, and government agencies. Collection and disposal of solid waste constitute an essential service that is provided by municipal governments or, in some cities, is contracted out to private firms. Final disposition of solid waste has always been a question of economics, as cities seek to dispose of their waste by the cheapest means available. Open-land dumping, open-dump burning, and (in some cities) ocean dumping are the cheapest methods of disposal. But with the increasing concern with environmental pollution, these systems of disposal have largely been abandoned. Sanitary landfills and incineration are widely used, but even these now have distinct disadvantages in areas where suitable space is growing scarce and rigid adherence to clean-air standards prevents incineration.

According to the U.S. Environmental Protection Agency (EPA), the volume of solid waste collected in U.S. municipalities in 1974 totaled about 145 million tons, which amounts to a daily rate of nearly four pounds per person. The volume dropped to 136 million tons in 1975, the trough of the recession, but the EPA estimates that by 1980 the annual accumulation of solid waste could total as much as 175 million tons. This projection suggests that many cities will be hard pressed to handle their growing waste problem. A seemingly obvious solution would be the recovery and use of much waste as fuel or secondary material—particularly since many fuels and raw materials are in short supply.

Pilot projects have been undertaken across the country to determine the economic feasibility of various methods of resource recovery, and they have met with varying degrees of success. The systems tested have generally proved to be technically feasible, but many have proved too costly to operate commercially at today's prices for raw materials or have uncovered unforeseen difficulties in processing large quantities of solid waste. Conventional methods of solid waste disposal, then, have remained less expensive than recycling in most cities. But the economics of resource recovery is likely to change rapidly as suitable landfill sites become scarcer, and many cities will probably invest in recycling plants within the next ten years.

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Waste disposal in Texas cities

The potential of resource recovery hinges on the relative costs of conventional means of solid waste disposal. And one of the fastest growing costs is the price of sites for landfills. In most large U.S. cities, particularly in the Northeast, land values are escalating sharply, and suitable landfill sites are no longer available. As current landfilling operations are completed, cities will be forced to find sites farther and farther from the urban centers. This will increase transportation costs and encourage reliance on other means of solid waste disposal.

Progress in resource recovery, however, has been slow. Only about 40 recovery systems are currently operating, and most are designed to recover only ferrous metals. Although there are plans to build and operate about 100 more plants by 1985, this additional capacity will not come close to solving the growing problem of solid waste disposal.

In Texas, vacant land is readily available to cities, unlike many other urban areas in the country. Sani-

tary landfills are the most economical means of waste disposal in the state and are used almost exclusively. In contrast to open dumps—which generate odors and airborne litter and wastepaper and harbor vermin and rodents—sanitary landfills are closely managed operations. Refuse is covered with earth and compacted daily, open burning is prohibited, and site selections are such that surface and ground waters cannot be polluted by water that may leach through the landfill.

The major advantage of a landfill over other methods of solid waste disposal is that little or no capital investment is required for physical plant. Sites are either purchased by the municipalities themselves or leased from private operators. And the only equipment required is a fleet of trucks to collect refuse and some earthmovers to operate the landfill.

Odessa is the only major Texas city that does not dispose of its solid waste by landfilling. Instead, since 1975, it has been experimenting with a "soil enrichment" program. Disposal is achieved by extracting ferrous metals from the waste with an electromagnet, shredding the remainder of the refuse, and disking the shredded materials into the soil of ranchlands that are to be restored. Preliminary results of improved grass yields from the experimental tracts hold the promise that many acres of West Texas land can be enriched to produce higher levels of agricultural output.

Programs to recover reusable materials in Texas are being carried out by a number of private companies. As examples, Alcoa, Reynolds Aluminum Recycling Company, and the Adolph Coors Company are recycling aluminum cans in a large portion of the state and the nation. In 1976, about 5 billion cans, or one out of four of all aluminum cans discarded, were recycled nationwide. Private operators in several Texas cities are also running centers that recycle newspapers and cardboard. The biggest recycler of municipal solid waste in Texas is a Houston firm that purchases almost a fifth of that city's trash for extraction of ferrous metal products. The same firm plans to expand its recovery operations to recycle hand-separated paper and aluminum and to produce fuel. It may also sell combustible materials—for instance, paper, fabric, and plastics—as industrial fuel, such as that used in firing kilns in cement plants.

Potential uses of solid waste

Paper makes up the largest part of solid waste material, accounting for about a third of the total. Yard waste accounts for 19 percent; food, 18 percent; and wood, plastics, rubber, leather, and textile products combined, 11 percent. Glass and metals both comprise around 10 percent—with the discarded metals made up mostly of ferrous metals.

Because about four-fifths of solid waste is combustible, a logical reuse for this portion is fuel. Shredded or pulped, and often separated from the noncombustible materials, much waste (paper, wood, fabrics, rubber, and plastics) has the potential of being used as a supplemental fuel for a coal-fired boiler or industrial furnace. Estimates suggest that municipal refuse has an energy content of about 10 million Btu (British thermal units) per ton, and that is about a third of the average heat content of bituminous coal. If the approximately 116 million tons of combustible materials collected in 1974 had been burned, the heat produced would have been equivalent to that from about 40 million tons of coal or about 207 million barrels of oil.

Another means by which the combustible materials of solid waste can be converted to fuel is pyrolysis. Heating organic materials in the absence of oxygen decomposes them into an oil, and/or gas, and charcoal. Potentially each ton of waste can be converted to 36 gallons of low-sulfur oil having a heat content three-fourths that of No. 6 fuel oil. Pyrolysis systems also have the potential of producing as much as 12,000 cubic feet of gas having a heat content of about 300 Btu.

Despite the large heat potential of solid waste materials, there are disadvantages to burning waste as a fuel. First, unlike that of many fuels, the heat content of solid waste varies widely because of variations in the composition of the combustible mixtures. Therefore, the rate of waste inputs has to be monitored more closely to obtain a given level of heat output. Second, a large amount of waste has to be shredded, pulped, or separated to stoke a furnace. Third, the use of combustibles as fuel would require siting new plants close to urban areas to minimize transportation costs. And this has proved to be difficult in some cities because the citizens oppose having such facilities near residential neighborhoods and because current clean-air standards prohibit additional effluents in many areas.

Much of the noncombustible and paper component of solid waste could be recovered for reuse. For instance, with current technology, recycling of solid waste could provide 7 percent of the iron, 8 percent of the aluminum, 14 percent of the paper, and 20 percent of the tin consumed in the United States each year. In addition, it takes less energy to recycle the waste than to process virgin materials.

Recycling of some noncombustible materials has already proved economical on a specialized basis. For

example, collection centers have been established to receive waste aluminum cans, with collectors paid 17 cents for every pound—about 23 cans— of recyclable (100 percent) aluminum. And citywide pickups of old newspapers and paperboard have also been instituted. It is worthwhile to establish such specialized collection operations because the cost savings from recycling these materials are relatively large.

Aluminum can be reprocessed again and again with virtually no loss in product and with huge savings in energy costs. To convert a given amount of scrap requires only about 5 percent of the energy required to reduce bauxite for an equal amount of finished aluminum.

While the savings from recycling newspapers and paperboard are not as great, they are significant nonetheless. Each ton of recycled paper represents 17 trees saved. If two-thirds of all wastepaper were recycled in the United States, as many as 430 million trees could be saved each year. And from an energy-saving standpoint, recycling wastepaper requires less than a third of the energy it takes to make paper from wood pulp.

Economies of recycling solid waste

Although potential benefits of resource recovery are clear, several factors currently impede full-scale implementation of most methods of recycling. The first barrier is the high cost of building and operating recovery operations relative to conventional methods of waste disposal. A second is that tax and regulatory policies generally favor processing virgin materials rather than recycling solid waste.

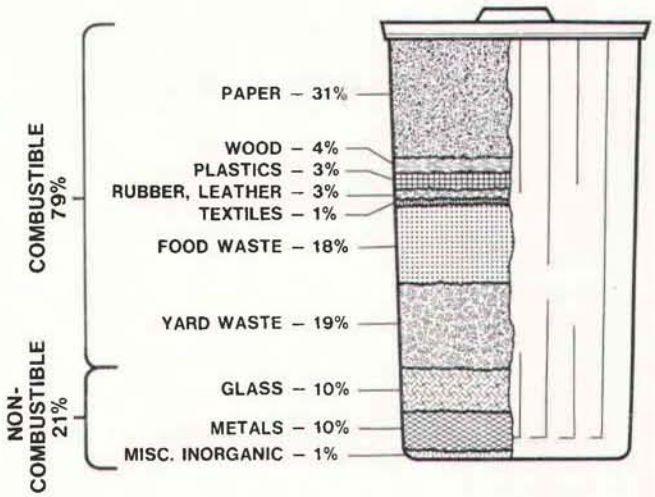
The costs associated with solid waste management fall into two categories—collection costs and disposal costs. Collection costs are incurred in the residential and commercial pickup of solid waste and are largely the capital and operating costs of a fleet of trucks and the accompanying wage bill for drivers and helpers. Disposal costs are incurred in the processing and final disposition of waste materials.

Collection costs run four to five times as much as the costs of disposing of solid waste in a landfill or by incineration. Moreover, collection costs vary widely from city to city and can run as high as $40 per ton. An informal survey of Texas cities indicates that collection costs range from about $2 per ton to about $22.

Since solid waste is generated continuously, cities cannot avoid collection costs regardless of whether the material is destined for disposal or for resource recovery. Therefore, it is disposal costs, relative to recovery costs and the market price of the recovered product, that determine the economic feasibility of resource recovery.[1] Because disposal costs are relatively low in most U.S. cities—averaging less than $10 per ton—conventional methods of waste disposal have a decided economic advantage over resource recovery. In Western Europe, however, resource recovery has proved to be economical in many cities because conventional disposal costs run much higher, ranging from $20 per ton to $30.

But disposal costs in the United States appear to be on the verge of escalating sharply. In many areas, current landfills are almost exhausted, and other suitable land is growing scarcer. The EPA estimates that the average landfill currently in operation will be completed in less than five years. It is

Composition of Solid Waste



SOURCE: U.S. Environmental Protection Agency.

1. Resource recovery is economical whenever the cost of disposal is greater than or equal to the difference between the cost of recovery and the market price of the recovered product. In symbols:
$D \geq R - P$,
where D = disposal cost per unit of product, R = recovery cost per unit of product, and P = market price of recovered product. This is equivalent to comparing the price of the recovered product with its net cost of production, for by rearranging terms one obtains:
$P \geq R - D$.
In areas where disposal costs are high, large investments in resource recovery systems are practical because the net cost of production can be held below the market price of the recovered product.

estimated, for example, that Connecticut will run out of landfill space by 1980 for better than half the refuse it produces annually, now totaling 2.5 million tons. And New York City's 3,000-acre landfill on Staten Island will be exhausted by 1985. Resource recovery systems, therefore, seem to be the logical alternative to conventional disposal in those areas. In fact, a recycling plant is due to begin operation in Bridgeport, Connecticut, next year, and plants valued at $400 million are planned to be built in New York State by 1985.

Compared to landfilling, all resource recovery systems require one or more additional stages of handling waste and large investments in plant and equipment. The additional handling—drying, shredding, or separating—prepares the heterogeneous waste for reuse. And minimum investments call for conveyor systems, shredders, and separators.

The aluminum and paper recycling programs that are operating successfully keep handling costs to a minimum. Aluminum cans and newspapers received at the recycling centers have been sorted and bundled by the consumer. Thus, the collector receives at little cost a homogeneous product that needs only to be shipped to a recyclng plant.

But municipalities collect tons of solid waste that at some stage of resource recovery has to be separated by product. And many products are so contaminated or mixed so thoroughly that they cannot be easily separated. The extent to which waste products are contaminated limits their use as a recycled product and is a barrier to the recovery of solid waste.

Ferrous metals are the easiest and most economical products to separate from the mass of collected waste. Separation is done simply and inexpensively with an electromagnet. However, this scrap metal is contaminated for some uses. Magnetic separation does not discriminate scrap steel with respect to alloy content, and recycling for some metallurgical uses is prohibitive without further, and very costly, sorting. Therefore, most ferrous scrap is recycled for use where alloy content is not a critical factor in the manufacture of the final product, such as in construction steel products.

For other solid waste products, separation can be accomplished by several means. Separation of noncombustibles from combustibles can be done after the waste is burned as fuel. Materials separation can also be accomplished, on the basis of differences in material density and specific gravity, by flotation, vibrators, screens, airstreams, and centrifuges, for example. But all such operations require substantial investments in plant and equipment. Such investment is justifiable when economic markets are available for the materials recovered.

Before resource recovery systems can effectively begin to deal with the growing nationwide problem of solid waste disposal, technological barriers will have to be overcome. The recycling projects undertaken thus far have tested relatively new technologies. On reduced scales of operation, these projects generally achieved their objectives. In full-scale operation, however, unforeseen problems have cropped up and set back recycling programs in some cities. Typical of the problems was equipment that did not meet initial performance standards, and EPA standards could not be met without system modifications.

While natural economic barriers are not "bad" in themselves since they are consistent with an efficient allocation and use of resources, a number of artificial barriers have created economic distortions and deterred fuller implementation of resource recovery systems.

Ironing out the bugs in any new, unproved system often requires additional investment in equipment to overcome the problems encountered. These higher costs, in turn, can lead to short-run delays in the implementation of similar systems planned elsewhere. Over time, however, economic systems will likely be developed.

The economics of secondary materials competing with virgin materials in many cities will also delay implementation of many recycling programs. Cities with low disposal costs, as in Texas, find resource recovery systems an expensive means of solid waste disposal. But as costs of conventional means of disposal continue to rise—as they undoubtedly will in many areas—to, say , more than $10 per ton, the economics of recycling is likely to change rapidly in favor of resource recovery. That change will also be speeded up if prices of virgin materials rise enough to make costs of recycled materials more competitive.

While natural economic barriers are not "bad" in themselves since they are consistent with an efficient allocation and use of resources, a number of artificial barriers have created economic distortions and deterred fuller implementation of resource recovery systems. Producers of virgin materials have tax benefits that are not available to the recycling industry. Virgin materials industries are given depletion

allowances on the usage of natural resources and are often eligible for more favorable capital gains treatment. In many cases, they also receive foreign tax allowances when materials are produced overseas. If users of virgin materials had to pay the full tax burden, there would be more of an incentive to use recycled materials.

The structure of freight rates also discriminates against shipments of some recycled materials *vis-a-vis* their virgin counterparts. Since secondary and virgin materials have different transportation requirements in terms of load size and length of haul, the rates should be different and be based on cost of service. But high rates on shipments of scrap iron and glass cullet by rail and wastepaper by ocean are commonly cited as discriminatory when compared with significantly lower rates for the respective virgin materials. Moreover, because those scrap materials have relatively low values, high freight rates add substantially to their delivered costs and give a competitive advantage to virgin materials.

Conclusion

Although resource recovery holds out hope of partially solving the problem of a growing volume of solid waste, widespread implementation has so far been slow in coming. For most cities, the cost of solid waste disposal by conventional means is still much cheaper than the net cost incurred in recycling. Therefore, for resource recovery to be economically attractive, the costs of conventional waste disposal will have to rise substantially or the price of virgin materials will have to rise enough to make the cost of recycling materials competitive. In cities where there is no acceptable alternative to recycling, implementation should be forthcoming fairly quickly. For others, disposal costs will have to rise from the current average of less than $10 per ton to near $15, or prices of virgin materials will have to increase by somewhat smaller proportions, before recycling becomes economic under current technology. The shift to recycling could be speeded, however, by the lifting of artificial barriers to the use of recycled materials.

For Texas cities, solid waste disposal in sanitary landfills is an optimal solution to the problem for the foreseeable future. The cost of waste disposal by landfilling is minimal, and environmental restrictions are met fairly easily. Moreover, suitable land is available in much of the state for future disposal sites.

Such landfills may even play a key role in future resource recovery. Solid waste is tightly packed when buried. And because groundwater and bacteria cannot easily penetrate the landfill, the solid waste deteriorates very slowly. For example, newspapers buried 15 years have been found to be still readable. Moreover, with each new generation of larger earth-moving equipment, the density of packed waste materials increases, and the rate of decomposition slows further. These landfills are therefore depositories of large volumes of recyclable materials. If resource scarcities force substantial increases in the prices of raw materials, the day may come when cities could find it worthwhile to mine their landfills.

New par bank

San Pedro State Bank, San Antonio, Texas, a newly organized insured nonmember bank located in the territory served by the San Antonio Branch of the Federal Reserve Bank of Dallas, opened for business June 27, 1977, remitting at par. The officers are: James G. Law, Jr., President, and Lindsey Graham, Vice President and Cashier.

The Payments Mechanism—

Electronic Funds Transfer And Monetary Policy

By Charles J. Smaistrla

This is the third of a series of articles on electronic funds transfer. The first, "The Payments Mechanism—A Primer on Electronic Funds Transfer," is in the Business Review *for September 1976. The second article, "The Payments Mechanism—Current Issues in Electronic Funds Transfer," is in the* Review *for February 1977.*

The development of electronic funds transfer (EFT) systems will bring about changes in our financial system that will have implications for monetary policy. EFT systems enable financial institutions to provide their customers a wider variety of services and greater flexibility in managing funds. These innovations will have implications not only for the way our financial institutions operate but also for the way individuals and businesses manage their money. Since monetary policy operates through changes in the stock of money in the economy, the changes in people's behavior toward money that are induced by EFT will affect the formulation and implementation of monetary policy.

In February 1977, the National Commission on Electronic Fund Transfers issued an interim report analyzing the key issues associated with the development of EFT. Among the issues discussed in the report are the implications of EFT for monetary policy. The Commission found "no reason to believe that EFT will, by itself, be a major factor compromising the effectiveness of monetary policy."[1] However, the Commission reported that EFT may complicate existing monetary policy problems, such as the appropriate definition of money for monetary policy purposes, the variability of the demand for money, and the appropriate intermediate target for monetary policy. Furthermore, the analysis supporting the Commission's findings indicates that the extent to which EFT affects the implementation of monetary policy will depend largely on the regulatory structure within which EFT develops.

1. *EFT and the Public Interest: A Report of the National Commission on Electronic Fund Transfers* (Washington, D.C.), p. 84.

This article examines some changes that will accompany EFT and analyzes their implications for monetary policy under current regulations. In addition, it explains how some of the complications EFT may pose for monetary policy could be moderated by changing several of the regulations affecting the financial system, particularly those restricting interest rates on deposits in banks and thrift institutions.

Nature of EFT

EFT systems replace the paper and metal of the conventional payments system with electronic impulses. Although they may employ radically different methods to carry out transactions, EFT systems must accomplish the same task performed in any payments system—the transfer of value. The principal EFT systems in operation today are automated teller machines, point-of-sale terminals, automated clearinghouses, and facilities for paying bills by telephone. The technology for providing all these systems is available now.

Automated teller machines (ATM's) are customer-activated terminals that are usually available 24 hours a day, seven days a week. They provide most of the services available at a teller window, such as cash deposits or withdrawals from checking or savings accounts, transfers of funds between accounts, advances drawn against a line of credit, and responses to balance inquiries. ATM's are activated by inserting a plastic card and entering a personal identification number. They can be installed in a bank office to relieve peak loads on human tellers or can be located in heavy traffic areas, such as airports and shopping centers. As of December 31, 1976, over 5,300 ATM's and cash dispensers, a simpler version of ATM's, had been installed.

Point-of-sale (POS) terminals, located in retail stores, provide check verification and guarantee, credit authorization, and transfers of funds. Different machines are designed for operation by either the merchant's employee or the customer, but all involve the use of a magnetically encoded plastic card and a personal identification number. The services offered by POS terminals vary greatly from one system to another, depending on the design of the particular

system and legal restrictions on the functions performed. Federally chartered savings and loan associations, operating with the approval of the Federal Home Loan Bank Board (FHLBB), took the lead in deploying the terminal systems. As of December 31, 1976, the FHLBB had approved 31 POS projects involving 269 savings and loan associations and 29 commercial banks in 24 states.

Automated clearinghouses (ACH's) are functionally analogous to clearinghouses that process paper checks: both organizations clear funds transfers between banks. But with an ACH, funds transfers take the form of electronic impulses on magnetic computer tapes. Payments such as payroll deposits, preauthorized billings, and point-of-sale transactions can be settled through an ACH. Economies are particularly evident in the case of repetitious transfers—for instance, payroll deposits, mortgage payments, insurance premiums, and utility bills.

An emerging type of EFT is the paying of bills by telephone. These most commonly involve an interest-bearing savings account from which a depositor can pay bills by telephoning the bank. System designs vary, but usually a customer can transmit instructions directly to the bank computer by using a Touch-Tone telephone or talk to a bank teller from any phone. Funds are then withdrawn from the customer's account and credited to the merchant's account to pay the bill.

In the future, improvements in equipment and a trend toward relaxation of legal restrictions may lead to a wider range of consumer services and the development of large-scale switching and processing centers to communicate transactions messages from many merchants to many different financial institutions. Customers would then be able to transfer funds at low cost from one account to another not only within the same institution but also between different institutions. And if POS systems are interconnected, EFT services could become available to customers outside their home state.

Effect on payments mechanism

Any potential impact of these innovations on monetary policy and its implementation stems primarily from their effect on the ways in which the public manages its money. Money can be defined as anything that functions as a medium of exchange. In the United States, coins, currency, demand deposits, and (in some areas) NOW accounts would be included. Other assets—such as time and savings accounts, savings and loan shares, U.S. Treaury securities, and even the cash value of life insurance policies—are considered close substitutes for money, depending on their liquidity, the ease with which they can be converted to money.

Individuals hold money because it reduces the transactions cost associated with buying goods and services. But by holding money, individuals generally incur costs in the form of interest income forgone. How much money a person wants to hold will depend, first of all, on the number of transactions he has planned. Generally speaking, the greater a person's income the greater the number and value of transactions undertaken, so that money balances rise as a person's income rises. Thus, for the economy as a whole, money holdings vary in the same direction as national income.

Since currency, coin, and checking accounts earn no interest, the amount of money people want to hold tends to fall as interest rates rise. If there were no cost to transferring funds from interest-earning money substitutes—such as time deposits or savings and loan shares—to money accounts, individuals would hold all their funds in a form that earns interest and withdraw the funds only as needed in the form of money to carry out transactions. But as long as transfer costs exist, individuals will choose to hold some of their funds in the form of money balances.

The reduction in costs of making payments that results from EFT would change the way firms and individuals manage money balances; it would allow them to lower their holdings of non-interest-earning money balances and manage them more closely.

But individuals attempt to hold some minimum amount of money that balances the reduction in transfer costs against the interest income lost. For the economy as a whole, EFT reduces this minimum in several ways. First, since money balances clear faster through the financial system in an EFT environment, a given stock of money can suport a somewhat greater number of transactions. Consequently, a somewhat smaller stock of money is demanded for any level of national income.

Second, since EFT reduces transfer costs of shifting from interest-earning assets to money, individuals can more easily substitute these assets for money. As a result, they want to hold a smaller amount of money. In addition, the reduced transfer cost implies

that desired money balances are more sensitive to the interest rates on alternative assets and accounts.

Thus, the development of EFT systems would affect the payments mechanism primarily by reducing transfer costs. Using electronic terminals, households and firms could shift funds more conveniently from one type of account to another in one or more depository institutions. The reduction in transfer costs would change the way firms and individuals manage money balances; it would allow them to lower their holdings of non-interest-earning money balances and manage them more closely.

Because of the ease with which funds can be transferred, competition between different types of financial institutions will probably intensify. Terminal systems will likely provide equal access to different types of accounts, whether they are located in a commercial bank, a savings and loan association, or a credit union. EFT will thus make the nonbank depository institutions fuller participants in the payments system by increasing the "moneyness" of savings accounts. With different types of institutions sharing the same system, funds would be easily transferred from one institution to another and depositors would become more sensitive to interest rates paid on different deposits.

The deployment of EFT systems will also make financial information more readily available, having an effect equivalent to a further reduction in transfer costs. In an EFT system, transaction information is entered, recorded, and stored in a form that allows easy and low-cost retrieval. When combined with the new funds transfer capability, these balance-reporting facilities become cash management systems that can dramatically reduce working cash balances, especially for large corporations. A corporate treasurer subscribing to such a system can receive detailed information on the firm's demand deposit balances, regardless of their location, in any of the banks that participate in the system. Once the treasurer knows the amount of excess funds available, he can move the funds by wire transfer and invest them in interest-bearing assets, such as U.S. Treasury bills or commercial paper. The firm earns a return on formerly idle funds while lowering its demand deposit holdings.

This increased mobility of funds, especially in combination with some of our current financial regulations, has important implications for the financial system. A number of financial regulations were initially aimed at preventing the shifting of funds between depository institutions. For example, one of the reasons Regulation Q ceilings on interest rates were established was to keep banks from bidding funds away from each other. This was also one of the purposes for the prohibition of interest rates on demand deposits in banks. In a similar way, limitations on the third-party transfer powers of thrift institutions restricted transfers of funds deposited with these institutions.

To a large extent, EFT has developed as a way of circumventing these restrictions. Because of the reduction in transfer costs that it brings about and its ability to circumvent many restrictions, EFT can pervert the impact of these regulations so that instead of inhibiting transfers, they provide an incentive for transfers.

For example, current regulations allow savings and loan associations to pay one-quarter percent more interest on deposits than banks may pay. The differential enables S&L's to attract and retain funds in competition with banks. But as EFT erodes the differences between accounts at banks and S&L's, the differential may give enough extra advantage to the S&L's so that funds are shifted to them.

Similarly, the prohibition on the payment of interest on demand deposits provides the incentive for corporate treasurers to shift funds from these accounts to interest-bearing accounts and other financial assets. With the introduction of the electronic cash management systems, deposits are more likely to be shifted away from regional banks to banks in the major money market centers—the exact opposite of the effect originally intended by the regulation.

Implications under present regulatory structure

The ultimate objective of Federal Reserve policy is to influence total spending in the economy to help achieve satisfactory levels of employment, output, and prices. But since the Federal Reserve cannot affect spending directly, it must implement its policy through some intermediate instrument. The question of which instrument is best is a controversial one, but the major debate has been between those who advocate some measure of money and those who favor some measure of interest rates.

Several measures of money have been considered as policy instruments. The narrowest measure, M_1, based on a concept of money as a medium of exchange, includes only currency and demand deposits other than those held by commercial banks and the U.S. Government. A broader measure, M_2, includes M_1 plus time and savings deposits at commercial banks other than the large negotiable certificates of deposit. A still broader measure, M_3, adds in deposits at thrift institutions.

M_1 has been the traditional measure of money because of its role as a medium of exchange. Of all the measures of money, it most closely corresponds to the theoretical concept of money as a transaction balance, as discussed earlier. It is currently one of the money variables used by the Federal Reserve in setting its monetary policy targets. Thus, EFT, through its effect on the public's demand for M_1, may affect the formulation of monetary policy.

Because of the reduced cost of making payments that can be brought about by EFT, households and businesses will spend more per dollar of money balances than they did before. In other words, a given stock of money balances will support a larger value of expenditures and output. This has important implications for setting targeted growth rates for M_1.

For example, the ratio of GNP to M_1, commonly referred to as the income velocity of money, has increased in the post-World War II period at an average of about 3 to 3½ percent per year. This trend must be taken into account when the Federal Reserve sets its targeted rate of growth for M_1. And the widespread introduction of EFT would likely accelerate the increase in the income velocity of money, requiring downward adjustment in the targeted rate of growth of M_1 if inflationary effects are to be avoided.

The widespread introduction of EFT would likely accelerate the increase in the income velocity of money, requiring downward adjustment in the targeted rate of growth of M_1 if inflationary effects are to be avoided.

Moreover, the reduction in transfer costs made possible by EFT would tend to increase the sensitivity of desired money balances to changes in interest rates. The increased sensitivity stems from the greater ease with which money holders could shift their funds between money and near-money forms. This in turn would increase the variability in the relationship between money and GNP, so that changes in the velocity of money would be more frequent and possibly more difficult to predict. This instability could make monetary aggregates, especially a narrowly defined one such as M_1, less reliable policy instruments for the Federal Reserve.

The extent of the uncertainty with regard to velocity that is introduced by EFT will depend largely on how quickly the systems are deployed. The problem will be more serious if changes in payments technology occur so quickly or erratically that it is more difficult for the Federal Reserve to take them into account.

One way to adapt to the change brought by EFT would be to redefine "money" for purposes of monetary policy. Monetary policy was discussed above in terms of M_1, the narrowest definition of money. By stating its target growth rates in terms of a more broadly defined aggregate, M_2 or M_3, the Federal Reserve could overcome some of the problems caused by funds shifting from one type of account to another.

This respecification would be reasonable on a theoretical basis. Many of the distinctions between M_1, M_2, and M_3 are disappearing anyway because funds in bank time deposits and thrift institution accounts are increasingly being treated as transactions balances. To the extent that commercial bank time deposits are used as a substitute for demand deposits the demand for M_2 will not be affected as much as that for M_1. If money holders turn to deposits in thrift institutions, then M_3 will be least affected Thus, the broader aggregates may maintain a more stable relationship to GNP and may be more useful as monetary policy control variables.

Other problems could still remain, nevertheless. A good monetary control variable not only must have a predictable relation to GNP, it also must be under the control of the Federal Reserve. The Federal Reserve does not control any of the money measures directly; it brings about changes in them by varying the amount of reserves supplied to the banking system. Ideally, the relation between reserves and money would be fairly constant, so that an increase in reserves would produce a predictable increase in money.

However, transfers of funds between the different components of the money measures can make the relation between reserves and the measures of money vary. For M_1, for example, if demand deposits shift from the smallest banks, which typically have the lowest reserve requirement ratios, to the largest banks, which face the highest reserve requirements, a greater amount of reserves is needed to support a given level of M_1. The relationship between M_2 and reserves is affected by transfers between demand deposits and time deposits in commercial banks.

In general, the effect of a transfer of funds from one type of account to another increases with the difference between reserve requirements on the accounts. Thus, the broader measures, which include components with the greatest difference between

reserve requirements, are affected more. For example, the relationship between reserves and M_3 can be especially sensitive to shifts in funds between the banking system and thrift institutions, which are not required to hold reserve balances. Such variation in the relationship between reserves and the monetary aggregates can make it difficult to use the reserve base as an operating target for monetary policy, especially for controlling the broader aggregates.

A way around this problem is to control the money aggregates indirectly through the use of interest rates, rather than reserves, as an operating variable. In fact, the Federal Reserve generally follows such a procedure currently. Historical relationships between M_1 and the Federal funds rate are used to determine the level of the funds rate that will achieve the desired rate of growth of M_1. The Federal Reserve then supplies or withdraws reserves from the banking system to achieve a funds rate near the indicated level.

Using such a Federal funds rate approach, the Federal Reserve has generally been able to achieve its annual growth targets for M_1 and M_2. However, the usefulness of an interest rate as an operating target to attain a desired rate of growth in a monetary aggregate depends on the stability in the relationship between the interest rate and the aggregate. Because of the sizable "savings" element in the broader aggregates, demand for them depends not just on the level of interest rates but also on relative interest rates on different financial assets. As a result, controlling the broader aggregates through the use of only one interest rate, such as the Federal funds rate, might be more difficult. Therefore, the advantage of an interest rate target over a reserve target to control money becomes less clear-cut.

A more basic question is whether EFT will introduce so much instability into the relationship between GNP and monetary aggregates that even the broader measures will become less useful as a control variable for monetary policy than some measure of interest rates would be. Some have suggested that in such an EFT environment, interest rates be used instead of monetary aggregates as the control variable for monetary policy. In general, whether monetary aggregates or interest rates are preferable depends on whether the predominant source of uncertainty in the economy is related to consumption and investment or to money and the financial system.[2]

As already discussed, EFT will probably have a much more direct effect on money and financial markets than on propensities to spend. With EFT, the relationship between money and income can be expected to change. But even if EFT makes the demand for money less stable, its variance might still be less than that of spending propensities. Thus, money, appropriately defined, could remain better linked to GNP than interest rates would. If, for example, the speed with which new payments technology is introduced over the next 20 years is no faster than it was over the past 20, the short-run impact on the demand for money could be minimal.

Effect under regulatory change

So far, we have assumed that the regulatory structure under which our financial system operates remains unchanged. However, it is quite likely that EFT will exert strong pressures for change in the regulation of financial institutions. With appropriate regulatory change, any disruptions induced by EFT could be minimized and the complications for monetary policy would be lessened. Several regulations are prime candidates for reform.

The Banking Act of 1933 forbids banks to pay *explicit* interest on demand deposits. Repealing the prohibition has been advocated on at least two grounds. First, the prohibition leads to inefficiencies. The *implicit* payments made to bank customers are most often payments "in kind," such as free checking privileges, that are an ironic intrusion of inefficient barter exchange into our payments mechanism. That depositors hold a significant amount of funds in the form of demand deposits is attributable only to the implicit payments made by banks and to the costs involved in transferring funds from time and savings accounts.

But second, and more important for monetary policy, the prohibition against paying interest results in needless shifting of funds between demand deposits and other assets as yields on the interest-earning assets change. As EFT lowers the costs of transferring funds, it will make depositors still more sensitive to changes in yields on such assets, increasing the variability of the income velocity of money, as dis-

2. An example of uncertainty in the financial system would be unpredictable shifts in the demand for money, such as those produced by EFT. If the Federal Reserve maintained a constant, targeted rate of growth in money under these conditions, then the money market would tighten or loosen as the demand for money rose or fell in relation to the relatively constant supply. Such a policy would perpetuate the instability rather than dampen it. So, it would make more sense for the Federal Reserve to set interest rates at some desired level, supplying more or less money as demand for it fluctuated. The effect of the fluctuating demand for money would not then be transmitted to money markets and the rest of the economy.

cussed previously. Allowing explicit interest payments on checking accounts would reduce the shifting of funds and the problems it produces for monetary policy.

Removal of Regulation Q restrictions on the rates banks pay on time and savings deposits has also been advocated for essentially the same reasons as in the case of demand deposits. The main purpose of the restrictions, in the 1930's, was to protect banks from competition among themselves. Later, in the 1960's, similar restrictions were placed on thrift institutions to control competition for funds between the thrifts and commercial banks.

Whatever success the restrictions have had in achieving their initial goals is mainly due to lack of information or to transactions costs, which prevent depositors from investing in alternative instruments. EFT, by lowering these costs, will facilitate movements of funds in response to interest rates. In particular, the problem of disintermediation that occurs when yields on accounts at one set of institutions or another get out of line with market rates will be aggravated.

If banks and thrifts were allowed to compete freely, there would be a continuum of net yields on deposits, depending on maturity, withdrawal provisions, and costs of servicing the accounts. There could be a tendency for the institutions to pay explicit interest on all accounts and to levy explicit charges for servicing the accounts. Such a system would encourage customers to use financial services more efficiently and enable them to acquire a broader range of deposits, varying in yield and liquidity.

Furthermore, if the rates paid on demand deposits are allowed to move more closely with the rates on other assets, there would be less incentive for customers to shift back and forth between demand deposits and other financial assets, lending more stability to the income velocity of money, narrowly defined. There would also be less shifting of funds between deposits and market instruments, since depository institutions would be free to bid for funds, if necessary, to prevent a runoff of deposits as money markets tighten. So, the stability of the income velocity of the broader monetary aggregates would be enhanced as well.

The development of EFT systems will also strengthen the arguments for establishment of uniform reserve requirements on similar deposits at different financial institutions. As the deposits become more similar and as competition between the institutions becomes more intense, differential reserve requirements will become less defensible.

Various groups have advocated establishment of uniform reserve requirements, in one form or another, for commercial banks and thrift institutions since the midthirties. The Federal Reserve has continually sought the extension of its reserve requirements to state-chartered nonmember commercial banks on the basis of ensuring equitable treatment of member and nonmember banks and for the purpose of improving the implementation of monetary policy. Membership in the Federal Reserve System and uniform reserve requirements for all state-chartered commercial banks and all thrift institutions offering third-party payment services were recommended in 1971 by the President's Commission on Financial Structure and Regulation.

EFT is likely to make revisions in several financial regulations all the more necessary, both for the equitable treatment of depository institutions and for facilitating monetary control.

Uniform reserve requirements could aid the implementation of monetary policy. As pointed out earlier, differential reserve requirements particularly loosen the relationship between a reserve base and the broader measures of money. EFT will tend to increase the importance of the broader measures as monetary policy control variables since they will take on the characteristics of transactions balances to a greater extent.

As the broader measures of money become more important, the Federal Reserve may need to change its operating strategy for monetary policy. Although the Federal Reserve has been able to achieve its growth targets for the narrower monetary aggregates through the use of interest rates in the past, control over the broader aggregates might be more easily achieved through reserves since demand for them depends more on the relationship of interest rates on different assets than on the level of interest rates. In this case, uniform reserve requirements, by tightening the relationship between reserves and money, would help to improve monetary control.

Conclusion

The widespread introduction of EFT will likely accentuate a number of existing problems of monetary policy, but it is unlikely to raise many new ones. Because individuals and firms will treat money and near-money balances as closer substitutes when EFT

lowers the costs of transferring funds between different accounts, some of the traditional definitions of the monetary aggregates will probably need to be updated. And the broader monetary aggregates are likely to increase in importance relative to the narrower ones. At the same time, however, it might become more difficult to control the broader aggregates through a Federal funds rate strategy because of the increased complexity of the demands for them.

EFT is likely to make revisions in several financial regulations all the more necessary, both for the equitable treatment of depository institutions and for facilitating monetary control. If restrictions on interest rates on time deposits and the prohibition of interest on demand deposits remain in force, the complications posed for monetary policy will increase as EFT systems are deployed. The variability of the income velocity of money, narrowly defined, will increase. So also will the variability of the income velocities of the broader monetary aggregates and the relationships between them. In addition, to the extent that reserves are used as an operating variable to control any of the monetary aggregates, the variability in the ratios of the aggregates to the reserve base due to the lack of uniform reserve requirements will have more serious effects.

On the other hand, if the prohibition of explicit interest on demand deposits and the Regulation Q restrictions on the rates banks pay on time and savings deposits were removed so that banks and thrifts were allowed to compete freely, problems posed for monetary policy by the development of EFT systems would become more manageable. If the rates paid on demand, time, and savings deposits were allowed to move more closely with those on other types of earning assets, the stability of the income velocity of money, both narrowly and broadly defined, would be improved. And establishing uniform reserve requirements for similar deposits would facilitate the use of reserves as an operating target for controlling the monetary aggregates.

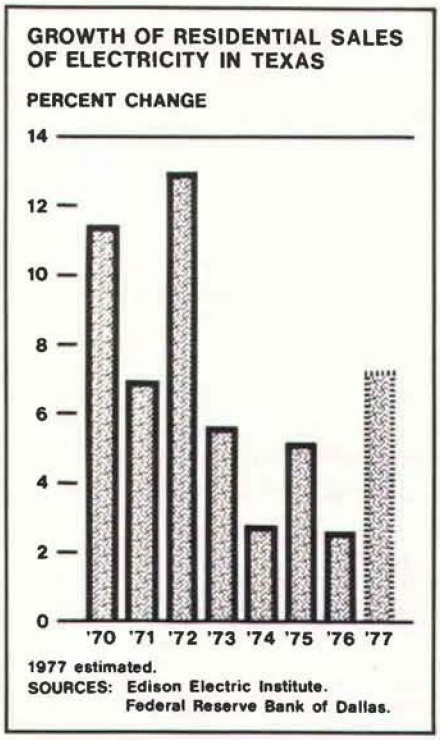
Federal Reserve Bank of Dallas
August 1977

Eleventh District Business Highlights

SUMMER HEATS DEMAND FOR ELECTRICITY IN TEXAS

Hotter than normal temperatures this summer have led to a sharp rise in the annual peak load for electric utilities in Texas. Peak load is the biggest demand for electricity—the maximum amount of power that electric utilities are called on to supply. The annual peak load in Texas usually occurs in July or August, when summer air-conditioning use is highest.

Some electric utilities in the state experienced record peak loads this July when temperatures climbed to record-breaking levels. According to the Edison Electric Institute, consumption of electricity in the four-state region of Texas, Oklahoma, Louisiana, and Arkansas in the week ended July 23 rose nearly 17 percent above the comparable week in 1976. While much of the rise reflected greater use of electricity per household, some was due to the larger number of residential customers.



In 1976, Texas experienced an exceptionally cool summer, following three years of below-average summer temperatures. For example, the number of cooling degree-days (a measure of summertime temperatures) in the Dallas-Fort Worth area last year was down 14 percent from 1975 and down 21 persent from 1972—the last average summer. But this summer has been hotter than normal and may have an estimated 30 percent more cooling degree-days than a year ago.

Last year, total residential sales of electricity in Texas rose 3 percent to 41 billion kilowatt-hours and reflected growth in the number of residential customers. The number of residential customers increased 3.7 percent in 1976, compared with 2.8 percent in 1975. However, average household use of electricity in the state last year fell 0.8 percent. Cooler weather reduced the demand for air conditioning, and an average increase of 13 percent in electricity rates encouraged residential customers generally to hold down consumption and conserve energy.

Electricity costs have continued to rise. In Dallas, for example, the bill for a household using 1,000 kilowatt-hours of electricity last April rose 32.2 percent over a year earlier. Comparable bills in Houston and San Antonio rose 10.1 percent and 9.5 percent, respectively.

Higher air-conditioning use has raised the peak load for electric utilities in Texas to a record level, and the hot temperatures have created a difficult choice for many residential customers. Faced with both a greater need for air conditioning and higher rates for electricity, the customer has to strike a new balance between comfort and economy and between consumption of electricity and all other goods and services.

PRICES ADVANCE SHARPLY IN DALLAS AND HOUSTON

Consumer prices in Houston and Dallas rose 7.6 percent and 6.0 percent, respectively, in 1976, while prices increased 5.8 percent in the nation as a whole. And this year, the rise in consumer price indexes for the two cities has continued to outpace the national average.

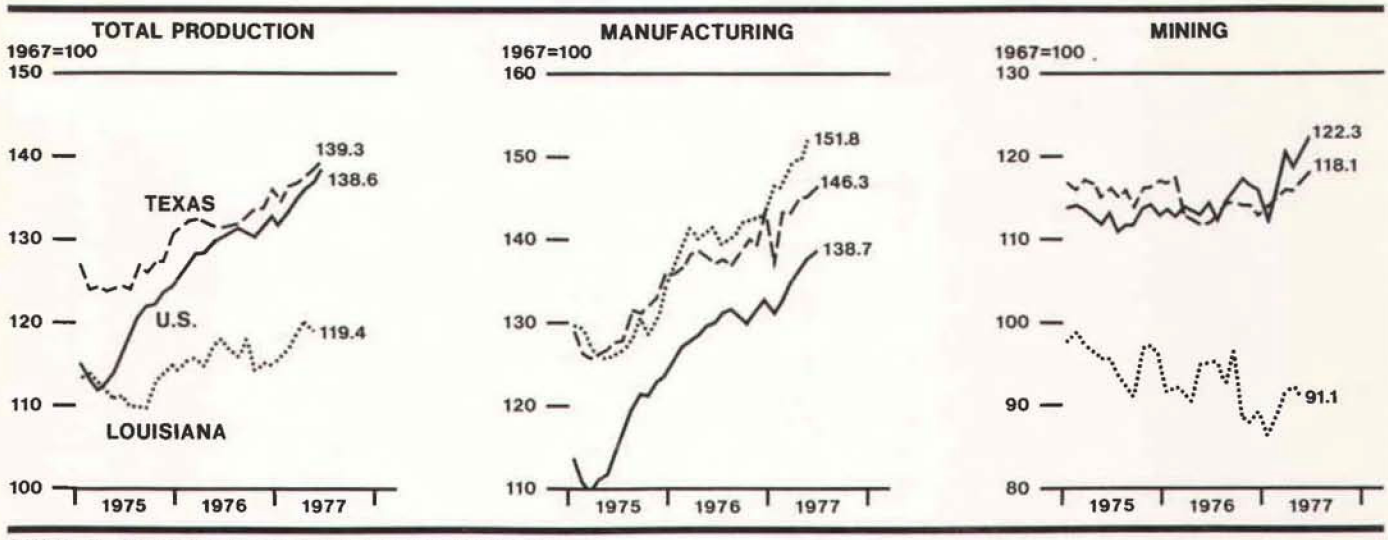
The Houston index rose 2.8 percent in the three-month period from January to April, while the index for the nation increased 2.4 percent. And between February and May, the Dallas index rose 2.4 percent, which was substantially faster than the 1.9-percent increase for the nation. The U.S. Bureau of Labor Statistics (BLS) publishes the consumer price index for Houston in the first month of each quarter and the index for Dallas in the second month of each quarter.

The more rapid price gains in the two cities resulted largely from faster-rising costs of housing, which cover outlays for shelter, fuel and utilities, and household furnishings and operation. Price increases for medical and personal care and for transportation were also higher in Dallas and Houston than in the nation, but price increases for food were slightly lower.

Reflecting the higher level of economic activity in Texas and the considerable in-migration of businesses and people, the demand for housing has been strong in Houston and in Dallas. Shelter costs in

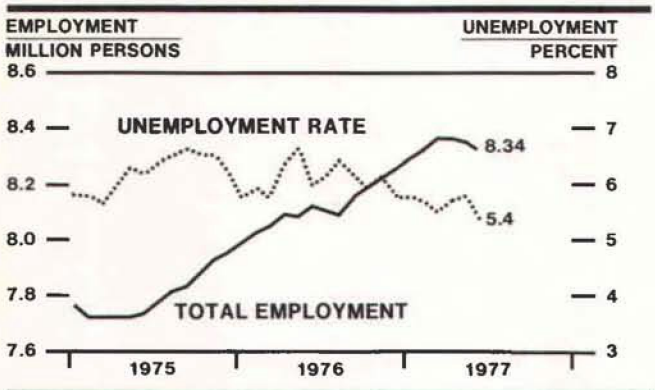
(Continued on back page)

INDUSTRIAL PRODUCTION
(SEASONALLY ADJUSTED)



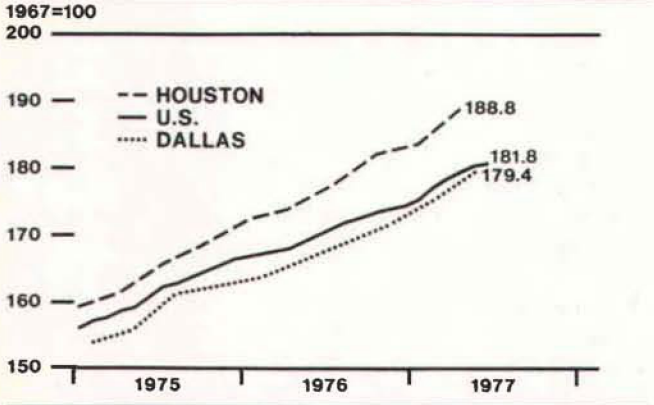
SOURCES: Board of Governors, Federal Reserve System.
Federal Reserve Bank of Dallas.

EMPLOYMENT AND UNEMPLOYMENT
FOUR SOUTHWESTERN STATES[1]
(SEASONALLY ADJUSTED, BY FRB)



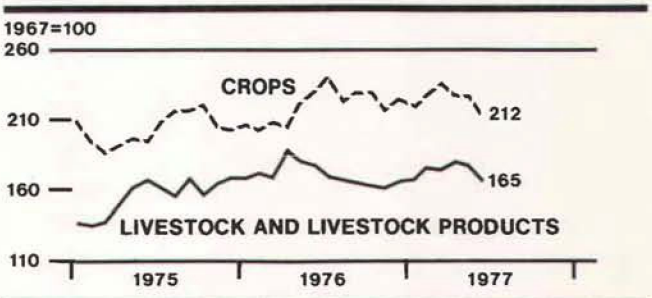
1. Louisiana, New Mexico, Oklahoma, and Texas.
SOURCE: State employment agencies.

CONSUMER PRICES



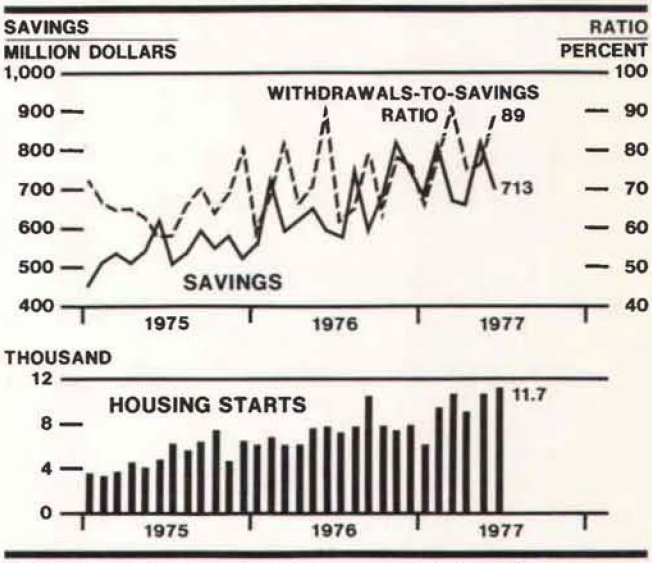
SOURCE: U.S. Bureau of Labor Statistics.

PRICES RECEIVED BY TEXAS FARMERS



SOURCE: U.S. Department of Agriculture.

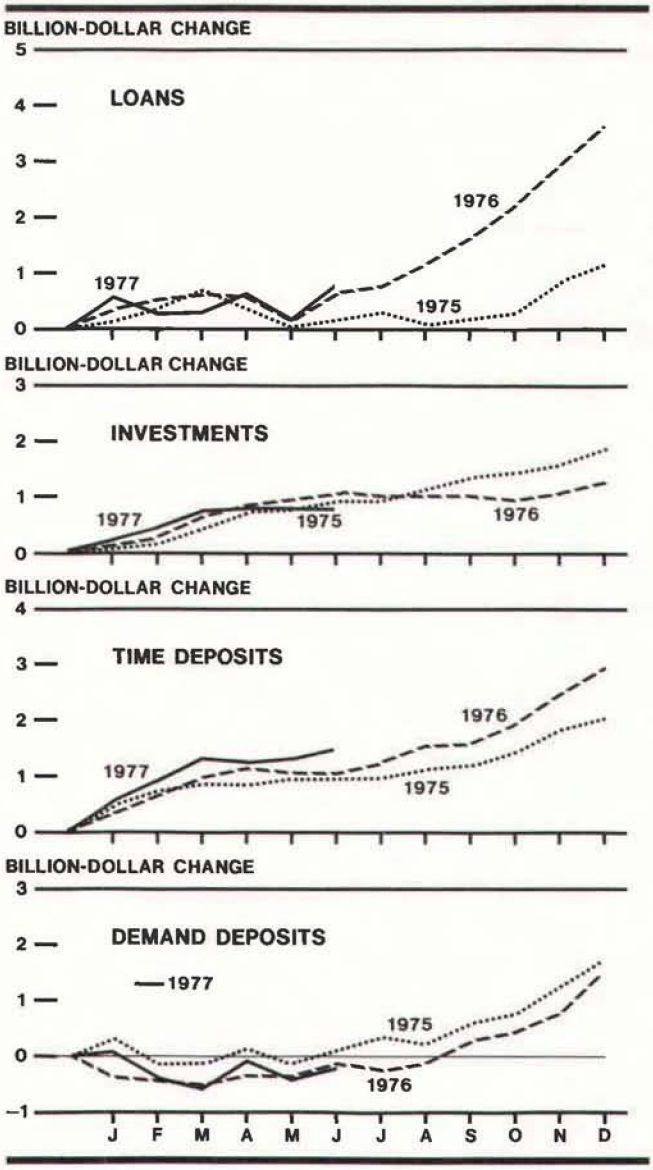
SAVINGS AND LOAN ASSOCIATION ACTIVITY AND HOME BUILDING IN TEXAS
(SEASONALLY ADJUSTED, BY FRB)



SOURCES: Bureau of Business Research, University of Texas.
Federal Home Loan Bank of Little Rock.

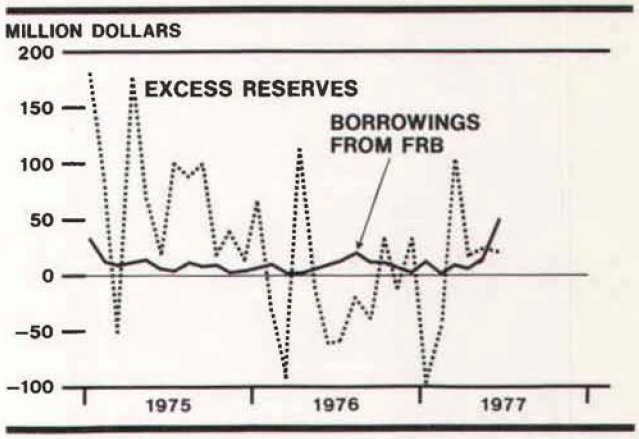
CONDITION STATISTICS OF ALL MEMBER BANKS

ELEVENTH FEDERAL RESERVE DISTRICT
(CUMULATIVE CHANGES)



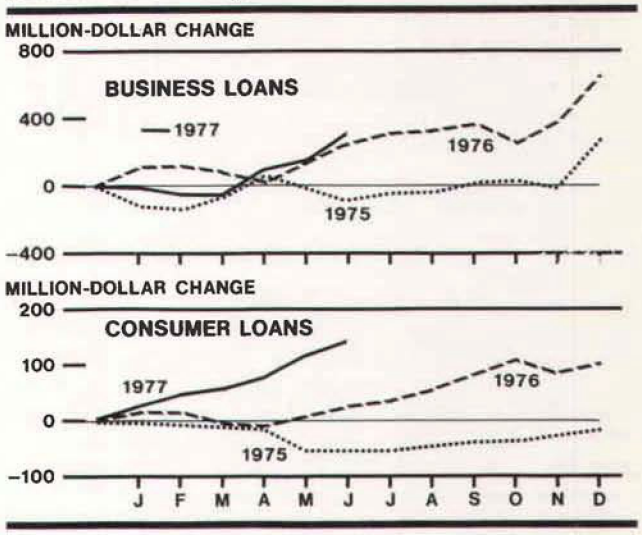
RESERVE POSITION OF MEMBER BANKS

ELEVENTH FEDERAL RESERVE DISTRICT
(MONTHLY AVERAGES OF WEEKLY DATA)



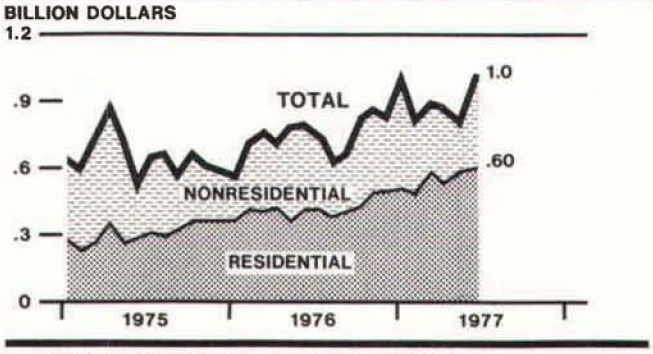
LOANS AT WEEKLY REPORTING BANKS

ELEVENTH FEDERAL RESERVE DISTRICT
(CUMULATIVE CHANGES)



BUILDING CONTRACTS

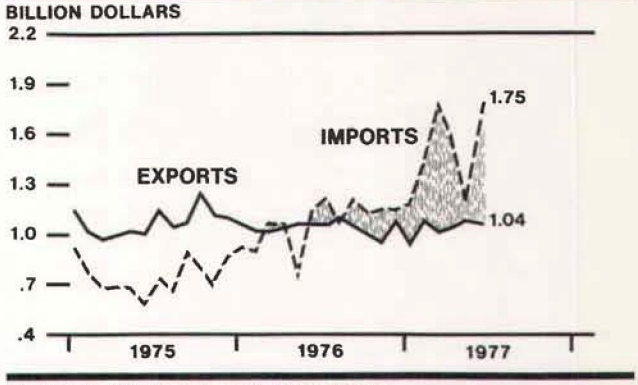
FOUR SOUTHWESTERN STATES[1]
(SEASONALLY ADJUSTED, BY FRB)



1. Louisiana, New Mexico, Oklahoma, and Texas.
SOURCE: F. W. Dodge, McGraw-Hill, Inc.

FOREIGN TRADE

HOUSTON CUSTOMS REGION
(SEASONALLY ADJUSTED, BY FRB)



SOURCE: U.S. Department of Commerce.

Houston rose 3.4 percent in the three-month period ended in April, compared with a gain of 2.0 percent nationally. In Dallas, shelter costs rose 2.6 percent between February and May, compared with a gain of 1.9 percent nationally. For Texans, as well as other Americans, shelter costs have risen more rapidly for homeowners than for renters, mainly because the rise in mortgage interest rates in recent years have outpaced the rise in rents.

However, sharp increases in prices of fuel and utilities also have been a major factor in the more rapid rise in housing costs in the two Texas cities. Prices for fuel and utilities rose 5.6 percent in Dallas and 3.1 percent in Houston in the latest three-month periods for which estimates have been published. In the nation, the same items increased only 2.3 percent between January and April and 1.9 percent between February and May.

The bigger increases in the prices of fuel and utilities in Dallas and Houston largely reflect the fast rise in natural gas prices in the unregulated intrastate market. Higher natural gas prices not only impact heavily on fuel costs but also affect electricity rates because natural gas is the predominant boiler fuel used by electric utilities in Texas.

Costs of medical and personal care have also risen faster in Dallas and Houston than elsewhere in the nation. Medical care costs rose 2.8 percent in Dallas and 4.3 percent in Houston during the latest three-month periods, compared with increases of 2.4 percent and 2.5 percent, respectively, for the nation. Price increases for personal services in the two cities exceeded those in the nation by similar margins.

In addition, transportation costs have advanced considerably more rapidly in Dallas and Houston than in the average U.S. city this year. The higher costs in the Texas cities reflected sharp growth in private transportation expenses, since the increase in public transportation costs was significantly lower than the average increase nationwide.

Although consumer prices have risen sharply in Dallas and Houston, it is still less expensive to live in these cities than in most other major U.S. cities, according to the BLS reports. The BLS estimates that the budget requirement for a middle-income family of four in Dallas and Houston is about 90 percent of that for the average middle-income family in the nation.

The major reason for the lower family budget estimates in the Texas cities is the absence of a state personal income tax. Nevertheless, the rapid price increases in Dallas and Houston are closing the gaps between typical family budgets in the two cities and the average U.S. city.

OTHER HIGHLIGHTS:

- Preliminary figures show the seasonally adjusted Texas industrial production index rose moderately in June, with both manufacturing and mining contributing to the rise. Increased production of both durable and nondurable goods accounted for the overall gain in manufacturing output, while sizable increases in crude oil production and drilling activity accounted for the gain in mining.
- Total employment in the four Eleventh District states declined slightly in June from a month before. The decline centered in the service, construction, and agricultural industries and more than offset moderate increases in all other categories. The unemployment rate dropped to 5.4 percent.
- The value of building contracts in the four southwestern states rebounded in June to the record high achieved last January. Nonresidential building accounted for most of the gain over the previous month, while residential construction rose modestly.

In Texas, housing starts climbed to almost 11,700 units, seasonally adjusted, in June. That is the highest level ever recorded in the state.

- Total credit at member banks in the Eleventh District rose substantially in June, as loan demand picked up sharply. The growth in loans was broadly based. Loans to businesses increased at a record rate for the month, while real estate and consumer loans continued to increase sharply. Although banks expaned their portfolios of tax-exempt municipal securities, total investments declined slightly in June because of a further reduction in holdings of U.S. Government securities.

Eleventh District Business Highlights is published monthly by the Research Department. This issue of *Highlights* was prepared by Jonathan Euseary, Mary Grandstaff, Jean Adeler, and Carolyn Hamilton under the supervision of Edward L. McClelland.