



# Review

**FEDERAL RESERVE BANK OF DALLAS**

**May 1977**

**Offshore Oil Rigs—  
Oversupply Despite World Energy Shortage**

**Bank Structure and Performance—  
Survey of Empirical Findings  
On the Cost of Checking Accounts**



# Oversupply Despite World Energy Shortage

By Stephen L. Gardner

Offshore drilling rigs are in surplus. Because of the oversupply, day rates for drilling paid some rig owners fell as much as 50 percent in 1975 and, at the same time, the large backlog of rigs on order at shipyards began to run off. By the end of this year, back orders are expected to have been largely eliminated.

Paradoxically, the need to drill seems great. Energy prices are at all-time highs, and many parts of the country experienced severe energy shortages last winter. Nor is there a lack of offshore oil to be found. Known offshore fields contain about a fifth of the world's discovered reserves of some 700 billion barrels of oil. And offshore exploration has not gone on for as long or been carried out in most areas as intensively as onshore exploration.

The current glut in offshore oil rigs is similar in some respects to earlier cyclical downturns. But new factors have made the current surplus of rigs much

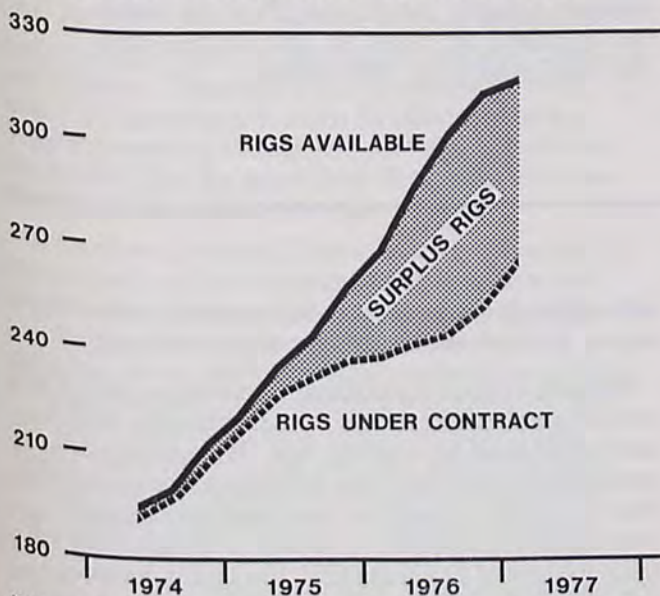
worse than ever before. Because of the great size of the current oversupply, it will probably take longer than in past cycles for price and supply conditions to return to normal.

## Nature of the industry

Offshore drilling originated along the Gulf Coast of the United States in the late 1940's and has continued to be primarily an American business. Most of the world's fleet of offshore rigs was produced in U.S. yards near the Gulf Coast, and it is mainly owned by U.S. contractors. But foreign builders have become increasingly active, resulting in a decline in the share of U.S. production from about half of the total five years ago to about a third today.

The nature of the offshore rig industry makes it subject to large cyclical fluctuations in production. Because of the difficulty of anticipating future needs, current profitability and the immediate outlook for prices and drilling strongly influence plans to order new rigs. But while drilling contractors are unable to anticipate firmly industry needs beyond a year or two, the custom designing and building of an offshore rig may take several years. In addition, when demand is strong, construction back orders may not be filled for several years. Once built, however, a rig may be in service for over 15 years.

Even though demand slackened in 1975, world supply of offshore rigs kept growing because of building lags and order backlogs



NOTE: Excludes rigs owned by government-operated firms.  
SOURCE: Offshore Rig Data Services.

*Because increasing the supply of rigs takes time, those ordering new rigs usually do not adequately foresee the effect on total supply of the rigs then being built. The result is often a period of oversupply like the current one, accompanied by extremely low day rates for drilling.*

A short supply of rigs—or of a particular type of rig—relative to industry exploration needs brings contractors a high rate of return. These high rates tempt drilling contractors to order more rigs. But because increasing the supply of rigs takes time, those ordering new rigs usually do not adequately foresee the effect on total supply of the rigs then being built. The result is often a period of oversupply



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## Types of offshore rigs

The first mobile U.S. offshore drilling rig was built in 1949, as the industry sought to find and tap new reserves of hydrocarbons off the Gulf Coast. Since then, a progression of innovations has enabled oil companies to extend their search to geologic structures at greater and greater ocean depths.

The first true offshore rig, capable of working relatively shallow water in the mild U.S. coastal environment, was a submersible type. This type can be floated to location and then ballasted in place to rest on the ocean bottom for support while its deck rises above the water. But submersible rigs are limited to operating in ocean depths of less than about 100 feet, and none have been built since the early 1960's. Though many of these rigs are still in use, their numbers have been dwindling as units are retired or lost through accident.

To extend the search for oil to greater water depths, the industry had to develop other types of offshore rigs. One was the jackup rig, which first came into use in 1953. Decks on these rigs are supported above the ocean by long, spindly legs. When the long legs are jacked up and the deck is used as a hull, a rig can be towed to a new site. But they are more awkward and expensive to move long distances than are other types. And although recent varieties stand as tall as 35 stories, some areas of exploration are in depths beyond their capability. Fully equipped, these are the least expensive of the modern rigs to build—costing \$22 million to \$25 million.

The drill ship also was first launched in 1953. It resembles a conventional ship but has a drilling rig positioned in its center. This type of offshore rig has the greatest mobility. Most have a complicated anchoring system to ensure stable drilling. The early 1970's added dynamic positioning to the ship's design, through which computer-directed propellers placed along the bottom of the vessel hold the rig on site. Mobility and stability come at a cost, however. Ordinary drill ships cost \$35 million to \$45 million, and dynamic positioning doubles the expense.

In 1963, a decade after the first jackups and drill ships appeared, the first true semisubmersible offshore rig was launched. The deck of this type of rig is held above pontoons by open support work. Modern varieties are quite large—some with decks as large as football fields—and often have displacement equal to a large freighter. Most are towed to site, but some models now being built are self-propelled. When they are ready to drill, they are partly submerged so that waves fall through the open support work instead of crashing against their pontoons. These rigs are also held in place with complicated anchoring systems. Semisubmersible rigs are particularly suitable for exploration in deep water and under difficult climatic conditions. They are about as expensive to build as drill ships—costing \$35 million to \$50 million.

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like the current one, accompanied by extremely low day rates for drilling. In the current cycle, rates for a particular type of semisubmersible offshore rig in the North Sea fell from \$40,000 a day at the beginning of 1975 to little more than half that a year later.

Owners do not find it profitable to take rigs out of service, even with low day rates, because they are given little relief from operating costs. When not used, rigs must still have constant maintenance attention to prevent deterioration, so savings on crew costs are not great. And most other costs have already been sunk in the heavy capital expenditures required to build and equip a rig. Therefore, any

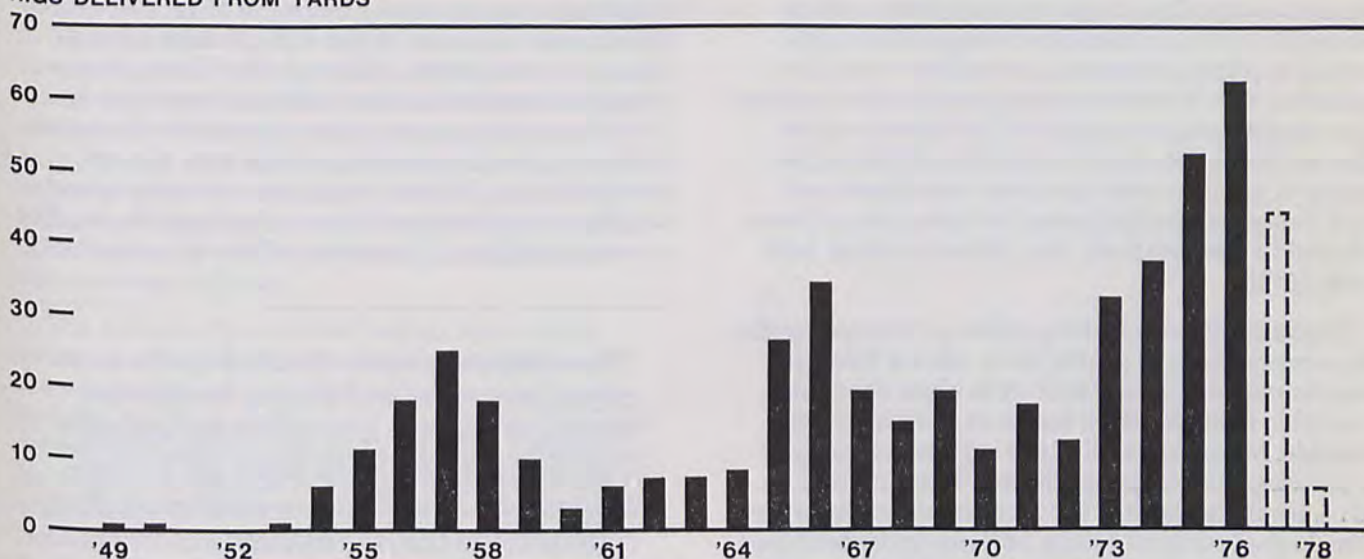
return that helps to meet even a portion of the debt service justifies continued operation of the rig.

Because of their specialized character, a period of oversupply in offshore rigs would ordinarily tend to last longer than for onshore rigs. Offshore rigs are used almost exclusively for drilling exploration wells. Once an offshore field has been found and enough wells drilled and tested to satisfy oil companies and their sources of financing that the find is commercial, the mobile offshore rigs are moved away to new exploration sites. Production wells are then drilled and serviced from permanent platforms. Thus, an excess supply of offshore rigs cannot be absorbed in



## Production of offshore rigs characterized by large cyclical fluctuations

RIGS DELIVERED FROM YARDS



NOTE: 1977 and 1978 based on current backlog of orders.

SOURCE: Offshore Rig Data Services.

the drilling of production wells as new discoveries are made, as would be the case with an oversupply of onshore rigs.

### Sources of current oversupply

The 1973-75 boom in offshore rigs was larger and lasted longer than the two earlier booms in the industry's history. The order backlog peaked in 1975, with 157 rigs valued at some \$4 billion on order. That represented enough offshore rigs to increase the world's fleet by more than 50 percent and foreshadowed the oversupply soon to follow.

A number of unusual factors were responsible for the intensity of the boom-and-bust in orders and construction. First, and perhaps most important, the building period was preceded and sustained by great optimism about the outlook for exploration drilling. To a large extent, this optimism was based on the increase in the world price of oil exacted by the OPEC cartel in 1973. Oil company executives and government officials reasoned higher prices would open drilling opportunities by making previously marginal areas attractive for exploration, as well as making it economically possible to extend exploration to new areas.

A second unusual factor was that many contractors ordered offshore rigs on pure speculation.

Usually, drillers have a contract for a rig's use in hand when they order it, assuring at least its initial employment. If such precautions are widely taken, much overbuilding can be prevented. But with great optimism prevailing, many contractors and their backers were willing to order rigs without contract. Governments encouraged them by guaranteeing financing and offering generous tax incentives for rig construction. In the United States, for example, a change in the Merchant Marine Act in the early 1970's opened the way for Government-guaranteed financing, resulting in a significant easing in the terms on bank loans for construction. Of the rigs on order at the beginning of 1976, over 60 percent were without contract. Many of these may not find profitable employment anytime soon.

Foreign owners, particularly Norwegians, took the lead in placing orders. Even with ownership of less than 5 percent of the world fleet in 1975, Norwegians accounted for nearly a third of the new rig orders. Norwegian tanker owners had made large profits in the early 1970's that they reinvested to avoid high domestic taxes. Because tankers were coming into surplus, oil rigs appeared to be a better investment. And because semisubmersible offshore rigs were operating in the North Sea, Norwegians had a definite preference for them.



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Even on the basis of the soberest of calculations, however, the demand for offshore rigs has not materialized as expected. High world oil prices, which seemed so certain a stimulus to exploration, also helped to plunge economies around the world into recession. Governments were concerned that policies encouraging greater energy self-sufficiency might slow economic recovery. In the United States, for example, gas decontrol measures were frustrated. And though controlled prices for new crude oil were allowed to rise, relatively low prices on old oil held back profits.

Exploration, with its huge risks, is financed by the oil companies out of profits. Only after a field has been found and estimates of oil in place are made is outside financing from banks and other lenders possible. More than half of the exploration budgets of oil companies is spent offshore. From 1970 to 1974, partly because of the increase in profits arising from higher world oil prices, offshore budgets of the companies about doubled to around \$10 billion. But higher taxes imposed by oil-producing countries, as well as relatively low U.S. prices, helped to cause profits to drop 20 to 25 percent in 1975. Exploration budgets increased only 8 percent that year, diminishing hopes for a sustained exploration boom.

Finally, Federal leasing of offshore oil acreage has not been as extensive as generally anticipated, largely because of the impact of environmental concerns. After the Santa Barbara oil spill in 1969, the Federal Government drastically cut back its leasing.

This resulted in a sharp drop in oil wells drilled in U.S. waters. Offshore drilling picked up somewhat following a resumption of leasing in 1972. But altogether, only 3 percent of the U.S. offshore acreage has so far been leased. Although the Nixon administration promised to boost offshore lease sales to 10 million acres a year—about as much as the cumulative total to date—leasing at this pace was not practical. Also, Federal courts have recently raised doubts, on environmental grounds, about the legality of over \$1 billion of lease sales off the Atlantic Coast.

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#### **Effect on the industry**

The companies most affected by the scarcity of contracts and decline in contract terms are the new arrivals in the industry. Companies established since 1972—particularly by Norwegians—hold more than 70 percent of the rigs without contracts for use. Established drilling contractors have advantages



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over newer rivals. Experience means a lot in the complicated and dangerous business of offshore drilling, and oil companies are willing to pay a premium for it. This explains why the larger American contractors have few offshore rigs—mostly drill ships—without contracts. Then too, these contractors operate relatively more of the older rigs whose capital costs have already been paid and, consequently, are in a better position to maintain profitable operations even at reduced day rates. But a number of smaller U.S. companies are less fortunate, and some are encountering difficulty.

The demand for so-called jackup rigs is fairly active, and the backlog of these rigs should be absorbed within a year or two. But because overbuilding has been particularly concentrated in semisubmersible offshore rigs and drill ships, problems for these deep-drilling rigs might extend into the next decade. Much will depend on growth of exploration and on the size and location of discoveries. Another discovery in a difficult-to-drill area on the scale of the North Sea could quickly absorb many of the idle semisubmersible rigs.

Despite the current surplus, however, the long-term outlook for the use of offshore rigs is relatively bright. The offshore potential is huge, as continental margins cover some 30 million square miles—exceeding the total of all known sedimentary basins on land. Furthermore, in contrast to land basins, little of this vast offshore area can be dismissed as a highly improbable source of oil or gas.

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### **New member bank**

University National Bank, San Antonio, Texas, a newly organized institution located in the territory served by the San Antonio Branch of the Federal Reserve Bank of Dallas, opened for business April 28, 1977, as a member of the Federal Reserve System. The new member bank opened with capital of \$600,000, surplus of \$600,000, and undivided profits of \$300,000. The officers are: Porter Loring, Jr., Chairman of the Board; Ralph Langley, Vice Chairman of the Board; Harold R. Beckwith, President; J. G. Henderson, Executive Vice President; and Larry G. Meek, Vice President and Cashier.

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# Survey of Empirical Findings On the Cost of Checking Accounts

By D. K. Osborne\*

Public policy toward competition in banking has assumed a new dimension since 1963, when the Supreme Court ruled that a merger between the Philadelphia National Bank and the Girard Trust Corn Exchange Bank violated Section 7 of the Clayton Antitrust Act. This section prohibits all mergers whose effect "may be substantially to lessen competition or tend to create a monopoly" in any "line of commerce" in any area of the country. Its application to bank mergers, which began with this ruling, extended the scope of public policy beyond the traditional concerns with solvency and liquidity of banks and the "convenience and needs of the community" to competitive aspects. Moreover, later rulings of the Supreme Court applied to banking not just Section 7 of the Clayton Act but the entire body of antitrust law.

This change in banking policy soon stimulated empirical research into banking competition, and the past dozen years have yielded a substantial flow of research findings. The studies mainly follow the Structure-Conduct-Performance Approach developed by economists working in the field of industrial organization: the structure of a market determines the conduct of the participants, which in turn determines how well the market performs.<sup>1</sup> To use this approach one must identify a banking market, measure its structure, and try to find a relation between this measure and some aspect of performance, say the interest rate on real estate loans or the cost to the consumer of checking account services. But markets and market structures are theoretical constructs, the observable counterparts of which are not always obvious. This presents the researcher with a number of difficult problems.

First, what is the relevant market? Elementary economic theory seems to suggest an answer: as the

rational behavior of buyers and sellers will tend to keep the price of a given product everywhere equal in a given market, it follows that where prices are different the markets are different. But this proposition ignores the cost of searching for the best offer, and in banking markets this cost might well exceed the payoff. Furthermore, it is a proposition about equilibrium, not actual prices. Hence, no matter how good the approximation of a theoretical banking market, prices will probably differ from bank to bank within it. Consequently, equality of prices cannot be a criterion of actual markets.

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In fact there is no simple economically defensible criterion for delineating banking markets, and in its absence the practice has developed of separating them by political boundaries. Most investigators assume that towns, cities, counties, and standard metropolitan statistical areas (SMSA's) constitute banking markets. Such an assumption is understandable, for it sidesteps a vexing conceptual problem, but obviously it begs what is usually the main question in public policy proceedings. In the *Philadelphia National Bank* case, for example, the question was whether the relevant market included New York City and much of the northeastern United States, as argued by the defense and held by the lower court, or only a four-county area contiguous to Philadelphia, as argued by the Justice Department and concluded by the Supreme Court. Clearly, it sheds no light on such issues to assume that banking markets coincide with local political units.

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\* The author is grateful to Adrian W. Throop for pointing out a conceptual error in a previous draft.

1. Actually, the "conduct" member of this trio—which describes, for example, how firms set their prices and change them—is usually neglected, as most researchers take it for granted that a competitive structure is necessary and sufficient for satisfactory performance.



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A second problem is measuring the structure of the banking market. By *market structure* we mean those characteristics that are thought to affect the forms and strength of competition. One such characteristic is the number of sellers: generally it is believed that the more numerous the sellers, the stronger the competition between them. Other obvious structural characteristics are the number of buyers, the amount of heterogeneity in the products, the cost and availability of information, and the conditions of entry for new firms. Clearly, market structures differ in a number of dimensions. But the common practice in banking studies is to represent structure unidimensionally, usually by the so-called concentration ratio that measures the percentage of sales supplied by the largest sellers.<sup>2</sup>

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The measurement of prices can present yet a third problem. Not only do prices differ within markets, but often within firms as well according to the amount purchased. It is remarkable how many familiar goods and services are priced in part according to the quantity purchased—electricity and other public utility services, most grocery items with their “large economy sizes,” transportation, and, in particular, checking account services. But the Structure-Conduct-Performance Approach does not lend itself well to analyzing arrays of prices, so researchers have tended to resort to the use of one-dimensional proxies of bank price schedules.

So with respect to markets, structure, and prices, empirical studies of banking competition are a series of compromises between theory and tractability, and their findings constitute persuasive evidence only so far as the compromises are acceptable. In this article we survey the published studies of the relation between market structure and the cost to consumers of checking account services. These studies, with one exception, describe banking markets in terms of political or statistical units, and all of them

represent market structure one-dimensionally. But even accepting these compromises, the price proxies are so demonstrably far from actual prices that the findings cannot be accepted as good evidence.

### Price schedules for checking accounts

The depositor's monthly cost for a checking account, or in other words its price, consists of an explicit service charge and an implicit opportunity cost. The explicit charge usually varies with the minimum (or in some cases the average) monthly balance in the account and the monthly number of checks written on it. The implicit cost is equal to the interest that would have been earned had the minimum balance been invested in interest-earning assets. For the typical “regular” checking account, the explicit part of the price is zero if the minimum balance is sufficiently large but varies with the number of checks (and in some cases contains a fixed service charge) if the balance is smaller. The required minimum balance and the charge per check vary greatly from bank to bank.

For example, a bank in the Washington, D.C., area—call it Bank A—offers a regular checking account without explicit service charge to those whose balances do not fall below \$300. The bank levies a service charge of 15 cents per check on accounts in which balances are below \$300. Those who maintain a \$300 minimum balance do not, of course, get free checking, for they bear an implicit monthly cost of \$300 times the monthly interest rate on funds as liquid as demand deposits. If, for ease of computation, we assume that this interest rate is a relatively high 0.5 percent per month, then the implicit cost of the \$300 minimum balance is \$1.50 per month. Those who write fewer than ten checks per month minimize their costs by keeping no minimum balance and paying the service charge of 15 cents per check. Those who write more than ten checks per month minimize costs by keeping a \$300 minimum balance and “paying” the implicit cost of \$1.50. Hence Bank A's price is 15 cents per check for ten or fewer checks per month and \$1.50 per month for more than ten checks.

While Bank A has a single price for a given number of checks, it does not have a single price for a checking account. The bank is quite typical in this respect but not necessarily in respect to the precise manner in which its price varies with the number of checks. Another Washington bank—Bank B—provides six “free” checks for accounts with a minimum balance of \$200 and three additional “free” checks for each additional \$100 minimum balance; it charges 5 cents for each check beyond those numbers and \$1.50 per month if the balance falls below \$200.

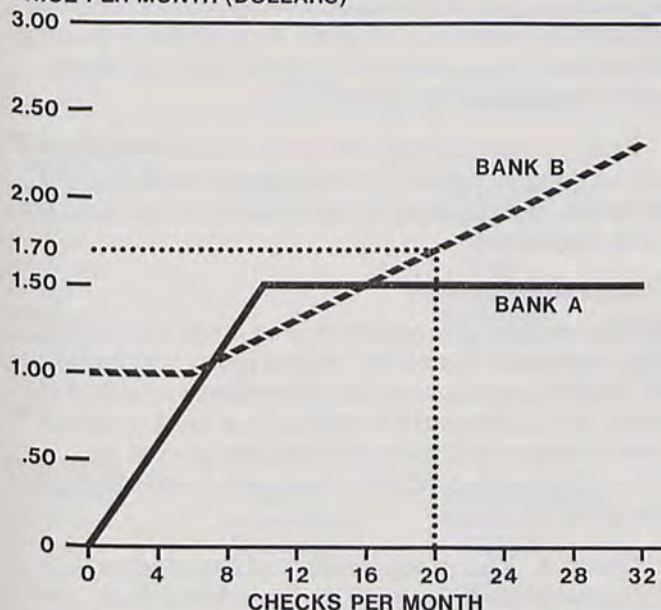
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2. This and other commonly used structural measures are defined in the accompanying appendix.



## Price Schedules for Checks at Two Banks

PRICE PER MONTH (DOLLARS)



Still assuming that the opportunity cost is 0.5 percent, the implicit cost on a \$200 minimum balance is \$1.00 per month, which is less than the \$1.50 monthly charge for a smaller balance. So all customers of Bank B should keep the \$200 minimum balance. Each additional \$100 in the balance implicitly costs 50 cents per month while saving only the 15 cents corresponding to the three additional "free" checks, which would have cost 5 cents each; therefore, no customer should keep a minimum balance larger than \$200. Hence Bank B's price is \$1 per month plus 5 cents for every check in excess of six per month. The accompanying diagram gives the price schedule of Bank B and of Bank A as well, illustrating the difference in the way the price varies with the number of checks at these two banks.

Now suppose that every bank in a certain town, Town 1, has the same price schedule as Bank A and that every bank in Town 2 has the same schedule as Bank B.<sup>3</sup> In which town is the price higher? Clearly, there is no single answer. For 7 to 16 checks per month, the price is higher in Town 1; for other numbers it is higher in Town 2. Suppose further that Town 1 has fewer banks or a greater concentration of accounts in its banks. Do our findings confirm the hypothesis that fewer banks or more concentrated

deposits mean a higher price, or do they contradict it? The answer is by no means clear. So the price schedules present a problem, and the value of research findings on the relationship between market structure and performance depends, among other things, on how this problem is handled. A number of approaches are possible.

The best approach would be to take several different numbers of checks—say 10, 20, 40, and 80 per month—and use each of the corresponding prices in a separate analysis. Thus, we would try to uncover the relation between market structure and the price of 10 checks per month, the price of 20 checks per month, and so on. The relation might vary according to the number of checks; indeed it might be strong for some numbers and absent for others.

The next best approach would be to select the average number of checks written by depositors and look for a relation between the corresponding price (paid by the average depositor) and market structure. Thus, if the average depositor writes 30 checks per month, we would look for the relation between market structure and the price of 30 checks. This, like any approach that substitutes a single price for the entire price schedule, will waste information, so it is inferior to the first approach.

The preceding approaches will be explored in a future article examining the observed relationship between market structure and actual price schedules for checking accounts. Either one would appear to be greatly superior to the three approaches actually taken in past studies. These completely neglect the implicit part of the price, and proxy the price schedule by a number based on explicit service charges only. They differ merely in the proxies chosen.

## Summary evaluation of earlier findings

One approach taken in past studies is to proxy price by the explicit monthly service charge for a hypothetical account on which 20 checks are written and which contains a \$100 minimum balance and \$200 average balance. The two studies following this approach uncovered no statistically significant relation between the market structure and the chosen price proxy.

The problem with this approach is not only that it is arbitrary—why 20 checks rather than 10 or 40?—but also that it specifies a minimum balance (\$100) that may not minimize the cost of writing 20 checks, with the result that the chosen price proxy is off the actual price schedule. In Banks A and B, for example, depositors writing 20 checks on accounts with a \$100 minimum balance would pay not the

3. In fact, of course, price schedules vary greatly within towns.



required amounts of \$1.50 and \$1.70, respectively, as shown in the diagram, but \$3.00 and \$2.50. This proxy actually reverses the true ranking of these particular banks with respect to their prices. It may not perform quite so badly in every case, but its large error loads the dice against the discovery of any relation between price and market structure.

The second approach taken in these studies is to proxy price by the ratio of the bank's total service charge revenue to its total or average deposits. This ratio is a poor proxy, even for the explicit service charge. Not only does it vary with the number of accounts and their activity, as well as with the service charge per account, but it also varies with the mix of personal and business accounts. As is well known, businesses keep substantially larger minimum balances than individuals do, partly to compensate their banks for various services performed for no explicit charge.<sup>4</sup> Two banks with the same price schedule but different proportions of business accounts will have different ratios of service charge revenue to deposits, thus appearing to have different prices. Clearly, this approach ends up off the true price schedule and, like the preceding one, has a poor chance of finding whatever relation there may be between price and market structure. It therefore means little that most of the studies taking this approach found no such relation or that the relation found by one study, while statistically significant, was practically negligible.

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*From the studies here reviewed we have findings but no good evidence. The relation between market structure and the price of checking accounts remains to be discovered.*

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The third and final approach is to estimate for various banking markets average explicit service charges per account, adjusted for activity and average balance. This estimate assumes that the explicit charge varies with account characteristics in the same way at all banks in the sample. As Banks A and B illustrate, this is not necessarily so. But even if these estimates of average explicit charges are roughly correct, they bear no ascertainable relation

to the average of the actual price schedules in any market. Though the one study taking this approach found that market structure greatly affects the price of checking services, it inspires no confidence because of the poor price proxy and several other problems with its methodology as well.

From the studies here reviewed we have findings but no good evidence. The relation between market structure and the price of checking accounts remains to be discovered.

### Details of the studies

All the studies here reviewed used cross-section multiple regression equations, with a proxy for the price of checking accounts as the dependent variable. In every study, the proxy is related to a bank's explicit service charge but not to the implicit part of its price. The studies fall into three groups according to the proxy.

**Group 1.** This group consists of two studies (Heggstad and Mingo 1976; Stolz 1976) that proxied price by the explicit service charge for a personal checking account with an average balance of \$200, a minimum balance of \$100, and monthly activity of 20 checks and two deposits. Even if this proxy were on the price schedule for 20 checks per month, its use would uncover only a part of the relation between price and market structure. But in fact it is off the price schedule of every bank at which \$100 is not the optimal minimum balance for the writing of 20 checks, so it proxies those banks' prices with an error. If this error is random (and, of course, it may not be), it does not bias the estimated coefficients, but it does reduce the calculated *t* statistics and thus the statistical significance of the coefficients. With this proxy it is difficult to uncover any part of the relation between price and market structure.

Unexplained variation in prices is further increased by the omission of a measure of cost from the regression equations. To the extent that the cost of providing checking accounts differs among markets, its omission reduces the statistical significance of the estimated coefficients.

Table 1 summarizes the nature and results of these studies; it shows the low  $R^2$ 's (less than 20 percent) that we expect from poorly measured dependent variables. Indeed, the only coefficients significantly different from zero at the 5-percent level are those relating to the banks' total deposits and the market's income growth (in the Heggstad-Mingo study) and the presence and entry of a multibank holding company (in the Stolz study).

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4. The relation between the bank and its business customers is the foundation of Hodgman's (1963) theory of bank behavior. This theory, especially as extended by Wood (1975), is by now well established.



Table 1

## STUDIES PROXYING PRICE BY THE EXPLICIT SERVICE CHARGE ON A HYPOTHETICAL ACCOUNT

Study and sample	Market definition	Market structure		Additional explanatory variables	R <sup>2</sup>
		Measure	Effect on service charge <sup>1</sup>		
<b>Heggestad and Mingo (1976)</b> 236 banks in 69 SMSA's in states permitting little or no branching; some data from 1970, others from 1972	SMSA	Two measures: Herfindahl index of total deposits Reciprocal of index	None  (Reciprocal significant at 10-percent level)	Total deposits of bank* Ratio of market personal income in 1970 to that in 1967* Per capita personal income Ratio of demand to total deposits Ratio of demand deposits in accounts smaller than \$1,000 to total deposits Market share of bank in terms of total deposits	.11
<b>Stolz (1976)</b> 333 banking offices in 75 rural markets in Iowa, Minnesota, Wisconsin; 1975	"Area of convenience" (See text.)	Three measures: Herfindahl index of total deposits Reciprocal of index Cubic function of index	None	Dummies for: Presence of a multibank holding company in market* Entry of such during 1970-74* Affiliation of bank with such Market share of bank in terms of total deposits Total deposits of bank Population in market and percent change of such from 1960 to 1970 Weighted per capita income in major towns in market Dummies for presence of: Thrift institution in market or Production credit association in market	.17

1. If significantly different from zero at 5-percent level.

\* Coefficient significantly different from zero at 5-percent level.

Stolz's study introduces a new approach to banking markets. Eschewing the ready-made political or statistical unit (city, county, SMSA) used by most students of banking competition, Stolz identifies a local banking market with a geographic "area of convenience" within which local residents and businesses transact most of their business. He delineates such areas according to shopping and commuting patterns and various other economic and demographic data and finds that they do not correspond very well to the ready-made units. This approach to market determination is not, of course, without error, but it appears to deserve both emulation and further refinement.

Both studies measure market structure by the Herfindahl index or a function of it. Neither obtains statistically significant coefficients, though Heggestad and Mingo find the reciprocal of the index to be significant at the 10-percent level. But as argued

above, these results only show that market structure has no significant effect on a particular price proxy; they are silent about the effect of market structure on actual prices.

**Group 2.** This group consists of studies that proxy the banks' price schedule by the ratio of total service charge revenue to total or average demand deposits. This ratio varies with the number of accounts and their activity, as well as with the explicit service charge. It would be a reasonable proxy for the explicit service charge—though not for the price, which has an implicit part—if the number and activity of accounts were held constant or, alternatively, placed in the regression equation as regressors. Neither is done in these studies.

Furthermore, variations in the mix of personal and business accounts must be controlled if this ratio is to be a good proxy for the explicit service



Table 2

## STUDIES PROXYING PRICE BY THE RATIO OF TOTAL SERVICE CHARGE REVENUE TO TOTAL OR AVERAGE DEPOSITS

Study and sample	Market definition	Market structure		Cost measure
		Measure	Effect on service charge <sup>1</sup>	
<b>Fraser and Rose (1971)</b> All banks in 78 Texas cities or SMSA's, each with less than 250,000 population; 1966 and 1967	City or SMSA	1-bank CR (concentration ratio, total deposits)	None	Ratio of yearly wages and salaries to average assets during year
<b>Fraser and Rose (1972)</b> All banks in 72 relatively isolated towns in Eleventh Federal Reserve District; 1965 and 1966	Town	Dummy variable: 0 if town had 1 bank 1 if town had 2 or 3 banks	None	None
<b>Ware (1972)</b> All banks in 57 non-SMSA counties in Ohio; 1969 and 1970	County	2-bank CR	None	Ratio of total operating expenses to total assets*
<b>Rose and Fraser (1976)</b> 704 banks in 90 Texas counties (68 counties belonged to no SMSA, and 78 had fewer than 100,000 residents); 1970	County	Nine measures: (1) number of banks (2) 1-bank CR (3) 2-bank CR (4) 3-bank CR (5) entropy (6) Herfindahl index (7) Hall-Tideman index (8) relative entropy (9) Gini coefficient (plus three measures of market structure changes)	(2), (5), (6), (7): increase of 1,000 basis points in structure measure increases service charge by 3 basis points.  All others: none	Ratio of wages and salaries to total assets

1. If significantly different from zero at 5-percent level.

\* Coefficient significantly different from zero at 5-percent level.



Additional explanatory variables	$R^2$
Bank debits per capita and yearly percent change in same	.30 (1966) .26 (1967)
Dummy for presence of S&L (savings and loan association)	
Average deposit size of banks in market	
Ratios to total loans of:	
Commercial and industrial loans	
Real estate loans	
Consumer loans	
Agricultural loans	
Dummy for presence of S&L	.30 (1965)
Road distance to nearest Reserve city	.32 (1966)
Population in 1960*	
Percent change in population, 1950-60*	
Percent change in total deposits, 1960-65 or 1960-66*	
Percent change in county population, 1960-70, and per capita personal income, 1959-69	Not reported
Percent of covered employment in manufacturing	
Number of S&L's	
Ratio of consumer loans to gross loans	
Average deposit size of banks in market*	
Ratios to total loans of:	.35 to .50
Real estate loans	
Farm loans	
Consumer loans	
Business loans	
Average asset size of bank	
Ratio of demand to total deposits*	
Urban percentage of population*	
Retail sales per capita*	

charge. Banks with the same price schedule but different proportions of business accounts will have different ratios of service charge revenue to deposits. One way of controlling these differing proportions is to include regressors that are likely to be correlated with them. But the lack of statistical significance of all such regressors that were tried (such as the ratio of various loan categories to total loans) indicates that the control is inadequate.

As Table 2 shows, these studies are weak in a number of other respects. It is not clear, for example, how the ratio of wages and salaries to assets corresponds to the cost of servicing demand deposits. But to criticize the other weaknesses would be analogous to charging a convicted murderer with disturbing the peace. The gross imprecision of the price proxy—even as a measure of only the explicit part of the price schedule—is enough to destroy our confidence in the results, whether they indicate a 0.003-percent increase in the price for a 1-percent increase in some measures of the market structure, as in the Rose and Fraser study of 1976, or no relationship, as measured in other studies.

**Group 3.** This consists of a single study, which developed a price proxy for the explicit service charge through regression analysis. Bell and Murphy (1969) began with the regression equation:

$$\log R_i = \alpha_0 + \alpha_1 A_i + \alpha_2 S_i + \alpha_3 N_i + \alpha_4 W_i,$$

where for bank  $i$  ( $i$  ranging over the entire sample):

$R_i$  = service charge revenue per account

$A_i$  = log of check-writing activity per account

$S_i$  = log of average balance per account

$N_i$  = log of number of accounts

$W_i$  = log of a wage index.<sup>5</sup>

They estimated the  $\alpha$ 's and then, holding activity per account and balance per account constant at their mean values  $A$  and  $S$ , respectively, they replaced bank  $i$ 's observed  $R_i$  by the calculated value  $R'_i$ , where:

(1)  $\log R'_i = a_0 + a_1 A + a_2 S + a_3 N_i + a_4 W_i$   
and the  $a$ 's are the ordinary least squares estimates of the  $\alpha$ 's.

$R'_i$  is what bank  $i$ 's service charge revenue per account would have been had it varied with the regressors in the same way the typical bank's did and had its accounts shown the same average balance and activity as the typical sample bank's. It is a price proxy from which all market structure effects have been removed. One bank's  $R'$  can differ from another's if (and only if) it has a different number

5. The equation also contained five branching dummies, which we neglect for simplicity.



of accounts or faces a different wage index. These are cost factors, not market structure factors. Conceptually,  $R'$  is more akin to a bank's cost than to its price.

The authors then regress, not each bank's  $R'$  on measured market structure and variables specific to the bank, but the average  $R'$  in each market on the measured structure and the average of the market banks' estimated marginal costs.<sup>6</sup> With  $p_j$  being the average value of  $R'$  in market  $j$ ,  $c_j$  being the average value of marginal costs there, and  $r_j$  being the three-bank concentration ratio there, the regression equation was

$$(2) \quad \log p_j = \beta_1 \log c_j + \beta_2 \log r_j.^7$$

This method eliminates all of the within-market differences in price-cost ratios, helping to raise the statistical significance of any estimated effect of market structure on price without, however, biasing the estimate. But since all market structure effects were removed from the measure of explicit price in the first place, the calculated market averages bear no ascertainable relation to average explicit service charges, and, of course, even less to average price schedules, in the various markets. Though the estimated value of  $\beta_2$  in equation (2) is .21, indicating that a 1-percent increase in the concentration ratio would raise the price of a checking account by 0.21 percent—by far the largest such effect ever found—the method that produced it inspires so little confidence that we cannot regard it as evidence.

6. There were 14 markets, all in New England, 13 of them SMSA's and the 14th Suffolk County. The sample was taken in 1966.

7. The authors actually estimated eight sets of  $\beta$ 's, one for each of eight different three-bank concentration ratios defined with respect to various classes of checking accounts. The results differed hardly at all.

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## Appendix

### Some measures of market structure

Let there be  $n$  sellers in a market. Let  $s_i$  be the market share of seller  $i$ . Number the sellers from 1 to  $n$  according to their market shares, with  $s_1 \geq s_2 \geq \dots \geq s_n$ . Evidently,  $s_1 + \dots + s_n = 1$ . Most of the commonly employed market structure measures can be expressed in terms of these  $s$ 's.

#### 1. The $k$ -bank concentration ratio, $R_k$ :

$$R_k = s_1 + \dots + s_k \quad (k \leq n).$$

The minimum value of  $R_k$  is  $k/n$ , attained when all market shares are equal; the maximum value is 1. This measure is usually assumed to vary inversely with the strength of competition.

#### 2. The Herfindahl index, $H$ :

$$H = s_1^2 + \dots + s_n^2.$$

The minimum value of  $H$  is  $1/n$ , attained when all market shares are equal, and the maximum value is 1, attained when there is only one seller. This measure, like the concentration ratio, is assumed to vary inversely with the strength of competition.

#### 3. Hall-Tideman index, $T$ :

$$T = \frac{1}{2 \sum_{i=1}^n i s_i - 1}.$$

The minimum value of  $T$  is  $1/n$ , attained when all market shares are equal, and the maximum value is 1.<sup>1</sup>  $T$  is assumed to vary inversely with the strength of competition.

1. The formula for  $T$  is incorrectly printed in Hall and Tideman (1967) and incorrectly printed (and incorrectly calculated?) where used in the studies reviewed here.

#### 4. Entropy, $E$ :

$$E = -[s_1 \log_2(s_1) + \dots + s_n \log_2(s_n)].$$

The minimum value of  $E$  is 0, attained when the market has only one seller; the maximum value is  $\log_2(n)$ , attained when all sellers have the same market share. This measure, unlike the preceding three, is assumed to vary directly with the strength of competition.

#### 5. Relative entropy, $E_r$ :

$$E_r = \frac{E}{\log_2(n)}.$$

This measure, which can range from 0 to 1, is also thought to vary directly with the strength of competition.

#### 6. The Gini coefficient, $G$ :

Put  $q_1 = s_n$

$$q_2 = s_{n-1}$$

.

.

.

$$q_n = s_1;$$

$$\text{then } G = \frac{2(q_1 + 2q_2 + \dots + nq_n) - n - 1}{n}.$$

This measure ranges from 0 to  $(n-1)/n$ , inversely, it is assumed, to the strength of competition.

A useful discussion of the strengths and weaknesses of these things, as measures of market structure, may be found in Stigler (1968).





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Federal Reserve Bank of Dallas

May 1977

## Eleventh District Business Highlights

### DRILLING RECOVERY PICKS UP

Drilling activity has been increasing, and active rigs in the Eleventh District in late April numbered 37 percent more than a year earlier. The number of rigs in Texas and Oklahoma were at 17-year highs. Louisiana had a 12-year high, and New Mexico a one-year high.

There is usually a seasonal decline in drilling activity in the first quarter of a year. However, such a decline did not occur in the Eleventh District this year.

A slump in drilling in early 1976—largely due to bad weather and price and tax uncertainties surrounding the oil and gas industry—led to a modest buildup of idle rigs and a slowing in new orders for oil field equipment. However, drilling began to pick up last July, when the Federal Power Commission announced that the price of newly

discovered interstate natural gas would be boosted to \$1.43 from \$0.52 per 1,000 cubic feet.

This action, along with greater crude oil price incentives, accounts for most of the rebound in drilling activity. During the last half of 1976, the number of active rigs in Texas, for example—the top-ranking state in U.S. drilling—rose 22 percent above the first half. Growing demand for drilling rigs reduced the number of idle rigs to low levels. This led drilling contractors to begin ordering new oil field equipment by year-end.

With an increase in new bookings, production of oil field equipment is strengthening as drilling backlogs continue to build up. But equipment shortages are not expected to hamper drilling operations. Moreover, oil field equipment producers have ample capacity to

meet any expected surge in demand for rigs. The continued recovery in onshore drilling should lead to steadily improving sales for rig manufacturers this year.

Along with the increase in the number of active rigs, the number of wells and footage drilled last year in the Eleventh District rose 4.8 percent and 4.4 percent, respectively, above 1975. Oklahoma experienced the largest percentage gains in both, while New Mexico showed the only declines.

Despite the pickup in drilling operations, production of crude oil and natural gas has continued to decline since 1972 and 1973, respectively. Oil production in the District in 1976 fell 3.3 percent from the previous year, and gas production fell 1 percent. All four states posted setbacks in crude oil output, but Texas was the only District state to register a drop in natural gas output.

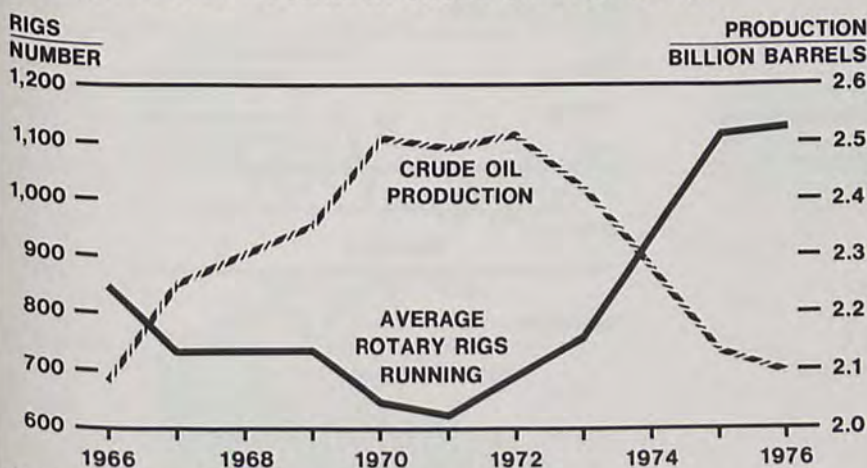
Proved reserves of crude oil and natural gas in the District slumped 8.4 percent and 6.8 percent, respectively, from 1975 to 1976. However, New Mexico had a slim gain in natural gas reserves. The drop in District reserves was much greater than the decline in output.

Production of oil and gas may decline further unless additional reserves are found, particularly if efforts are made to conserve the prospective supply. There were no large new discoveries of crude oil and natural gas last year. Exploration was limited by uncertain policies, especially those that affect prices for energy.

The drilling outlook in the District for the remainder of this year is for a high level of activity. It will be affected, of course, by the direc-

*(Continued on back page)*

RISE IN RIG ACTIVITY IN ELEVENTH DISTRICT STATES  
HAS NOT HALTED DECLINE IN CRUDE OIL PRODUCTION



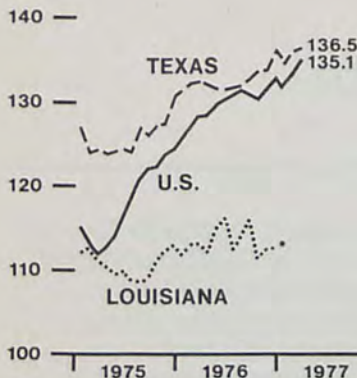
SOURCES: Hughes Tool Company.  
U.S. Bureau of Mines.



# INDUSTRIAL PRODUCTION (SEASONALLY ADJUSTED)

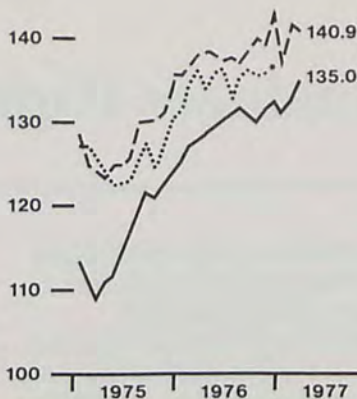
## TOTAL PRODUCTION

1967=100  
150



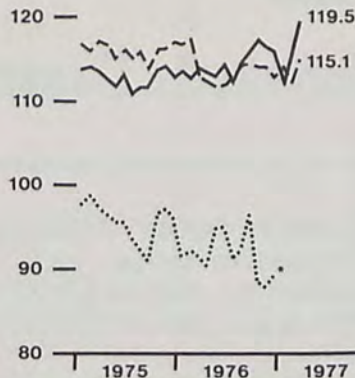
## MANUFACTURING

1967=100  
150



## MINING

1967=100  
130



\*Estimation of Louisiana industrial production index discontinued pending receipt of revised employment data.

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

## EMPLOYMENT AND UNEMPLOYMENT

FOUR SOUTHWESTERN STATES<sup>1</sup>

(SEASONALLY ADJUSTED, BY FRB)

EMPLOYMENT  
MILLION PERSONS

8.6

UNEMPLOYMENT  
PERCENT

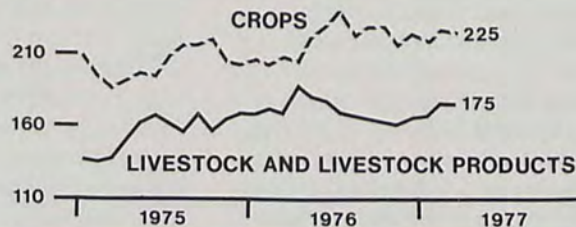
8



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

## PRICES RECEIVED BY TEXAS FARMERS

1967=100  
260



SOURCE: U.S. Department of Agriculture.

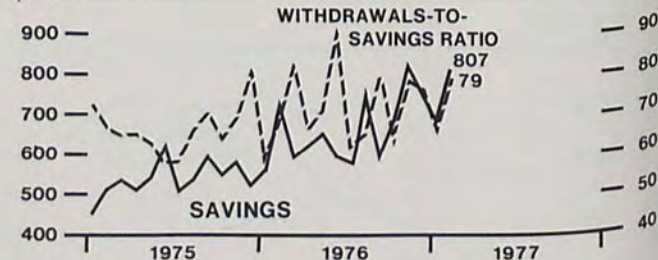
## SAVINGS AND LOAN ASSOCIATION ACTIVITY AND HOME BUILDING IN TEXAS

(SEASONALLY ADJUSTED, BY FRB)

### SAVINGS

MILLION DOLLARS

1,000



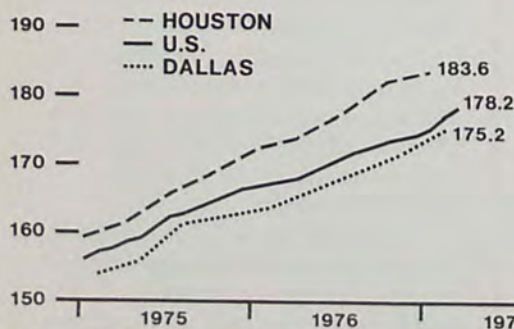
THOUSAND



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

## CONSUMER PRICES

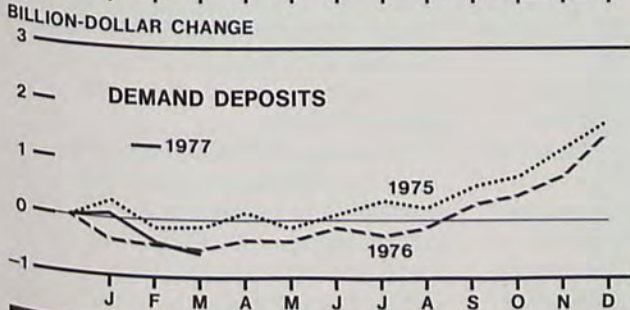
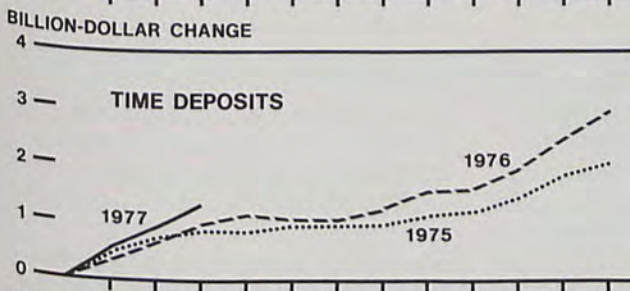
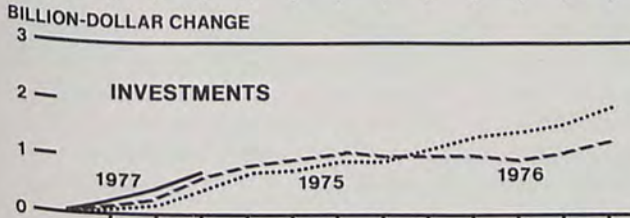
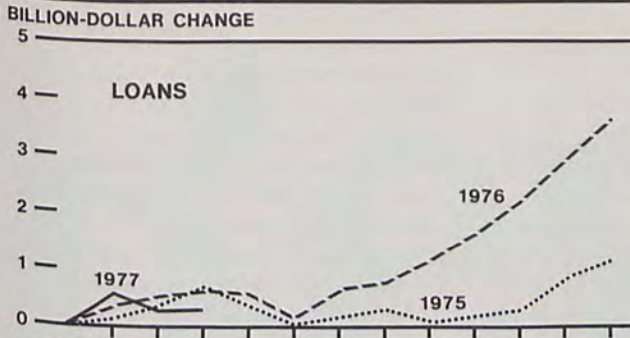
1967=100  
200



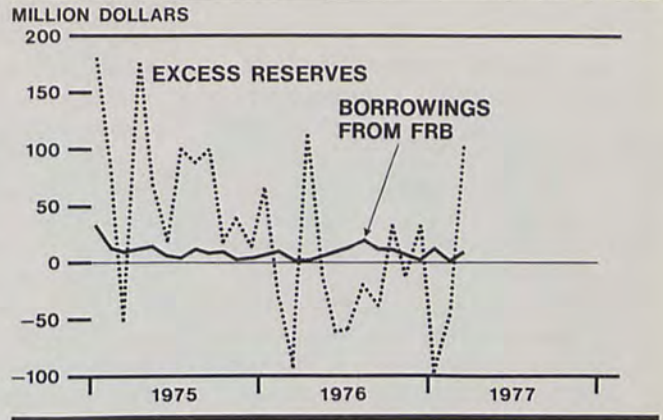
SOURCE: U.S. Bureau of Labor Statistics.



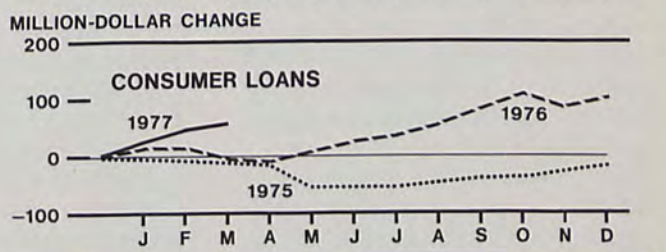
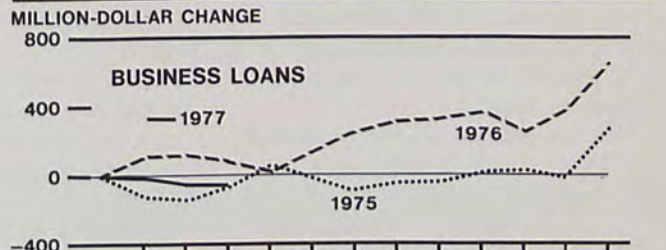
**CONDITION STATISTICS OF ALL MEMBER BANKS**  
ELEVENTH FEDERAL RESERVE DISTRICT  
(CUMULATIVE CHANGES)



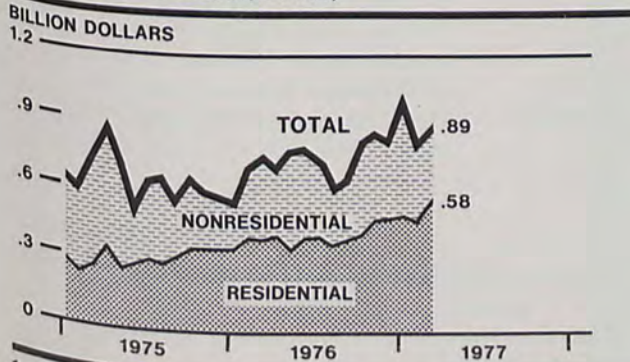
**RESERVE POSITION OF MEMBER BANKS**  
ELEVENTH FEDERAL RESERVE DISTRICT  
(MONTHLY AVERAGES OF WEEKLY DATA)



**LOANS AT WEEKLY REPORTING BANKS**  
ELEVENTH FEDERAL RESERVE DISTRICT  
(CUMULATIVE CHANGES)



**BUILDING CONTRACTS**  
FOUR SOUTHWESTERN STATES<sup>1</sup>  
(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.



tion of impending energy legislation, although the major impact of this will likely come in 1978 and later years.

### **BANK LOANS TO DEVELOPING COUNTRIES WELL DISPERSED**

Commercial banks in the Eleventh District had about \$2.5 billion in loans and other claims to foreigners in *developing* countries at the end of 1976. Over 90 percent of the total was accounted for by the five largest District banks, but a few small banks also held claims on foreigners in less developed countries (LDC's).

District banks had an additional \$2.2 billion in loans and other claims to foreigners in *developed* countries. The total claims on foreigners were about 6.4 percent of total assets—up from 5.6 percent a year earlier but still a fairly small proportion. Insofar as the rise in foreign loans of U.S. banks has become a matter of widespread interest, it has focused largely on the growth of loans to the *developing* countries.

Direct claims by District banks on foreigners in *developing* countries were widely distributed, involving a total of 56 countries. The amounts ranged from a low of about \$1 million in each of five countries to a high of around \$400 million in Mexico. Approximately \$560 million of total claims represented debt from the Bahamas. But a major portion of the claims on the Bahamas was investment funds shifted from District banks to their branches in the Caribbean—funds that probably were subsequently loaned to foreigners in various other countries.

The five largest banks in the District hold three-fourths of the total claims on foreigners in Mexico, with the remainder held mainly by several smaller banks located near the Texas-Mexico border. The Mexican debt held by these border banks—approximately \$100 million—represents well over half of all claims on foreigners in LDC's that are held by smaller District banks.

As in the United States as a whole, District bank claims on foreigners in LDC's are fairly well dispersed. In addition, in countries where District banks have the big-

gest direct commitments—Mexico, Brazil, the Philippines, and Spain—over a fourth of the debt is irrevocably guaranteed by one or more parties outside the LDC in which the borrower is located.

Banks have a good record in terms of loan losses in LDC's. So far, only a few borrowers have found it necessary to reschedule loans because of changing economic conditions in their countries. Moreover, it would appear unlikely that many countries would allow widespread default on foreign borrowings, since such default probably would severely dampen a country's credit rating for some time. Even so, Congressmen, banking authorities, and others have expressed concern that adverse economic conditions in some LDC's might call into question the repayment of a portion of foreign loans.

District banks undoubtedly will continue to make loans to foreigners in LDC's, but it appears that growth in the loans may be slower in the near term. For one thing, the ratio of external debt to exports has risen sharply in many oil-importing LDC's. As a result, additional credit requests from those countries may appear less creditworthy.

For another thing, part of the growth in foreign lending by District banks probably has been attributable to relatively weak loan demand from domestic businesses. A significant pickup in domestic demand for bank funds could moderate the growth in foreign lending by District banks.

Finally, the increasing public attention being directed toward the growth in foreign lending may cause some banks to go slow in extending additional credit in LDC's.

### **OTHER HIGHLIGHTS:**

- Preliminary figures show the Texas industrial production index rose in March at a seasonally

adjusted annual rate of 4.7 percent. The growth centered in the mining sector, as manufacturing output declined slightly.

- Total employment in the four southwestern states increased in March for the sixth consecutive month. The unemployment rate was 5.6 percent of the total labor force—an improvement from 5.8 percent a month earlier.
- Total credit at member banks in the Eleventh District increased moderately in March. Most of the increase reflected further acquisitions of U.S. Government securities.

Total loans rose slightly. But borrowing by businesses declined further, indicating no strong need for credit to finance additional inventories or additions to plants and equipment. Reflecting the strength in District construction activity, however, real estate loans again rose sharply. And consumer loans to finance automobile and credit-card purchases continued to increase, but at a slower pace.

Net acquisitions of U.S. Government securities continued to account for most of the growth in investment portfolios. However, District banks also increased their holdings of municipal securities more than in any other month since June 1976.

- The value of total building contracts in the four southwestern states rose 11 percent in March, as a sharp increase in residential contracts more than offset a small decline in nonresidential contracts.

Housing starts in Texas increased to 10,288 units, seasonally adjusted in March. That is the highest level since last September.

- According to the mid-decade population estimate by the U.S. Bureau of the Census, San Antonio, Texas, is now the tenth largest city in the country. Ranked 14th in the 1970 census, San Antonio joins Houston, ranked 6th, and Dallas, ranked 8th, in the top ten cities.

This issue of the *Highlights*, published monthly by the Research Department under the general supervision of Edward L. McClelland, Senior Economist, was prepared by Jonathan Euseary, Mary G. Grandstaff, and Jean T. Adeler.