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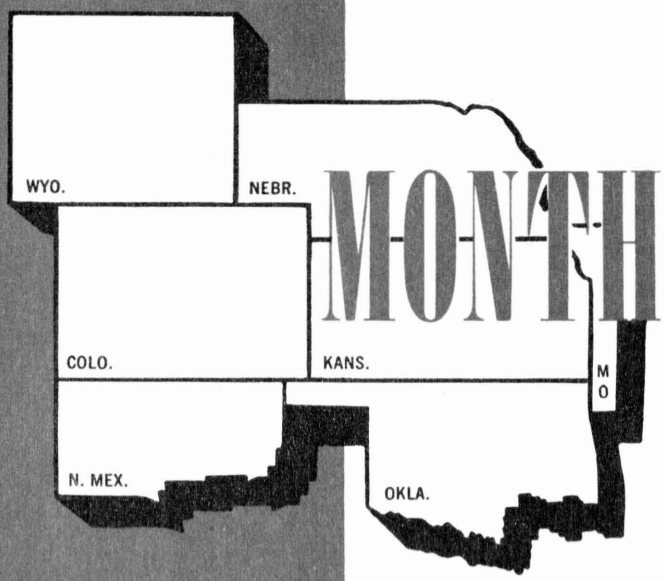

MONTHLY REVIEW

In This Issue

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Is the Cattle Cycle Changing?

SUCCESS IN THE CATTLE business requires long-range planning. In making such plans, some expectations regarding cattle inventories and prices must be formulated. Accurate prediction of cattle numbers is never easy, and it has been especially difficult in recent years. The most recent contraction phase of the cattle cycle—1955 to 1958—was shorter in length and smaller in amount than that of any previous cycle. The current expansion phase of the cycle also has behaved in an unusual manner—numbers increased 1 million last year, as compared with a 6 million increase in the corresponding year of the previous cycle.

Contributing to the uncertainty about cattle numbers is the recent revision in annual estimates for 1955 through 1960, which was made after 1959 census data became available. The large magnitude of the revision—a reduction of 5.2 per cent in total numbers from the original estimates made for 1960—has caused considerable confusion concerning the interpretation of recent livestock forecasts.

Historically, cattle inventories have varied cyclically around a long-run, upward trend. In addition, irregular movements have occurred from time to time, resulting from such diverse factors as droughts, wars, supplies of competitive products, and changes in economic activity. The cyclical and irregular movements have been responsible for much of the instability in the cattle industry. While there is little hope for eliminating all cyclical and irregular movements, it may be possible to minimize them through a better understanding of the nature of changes in cattle numbers. Such a minimization of instability would be beneficial to cattle producers, feeders, suppliers, financial agencies, marketing firms, and consumers.

Trends

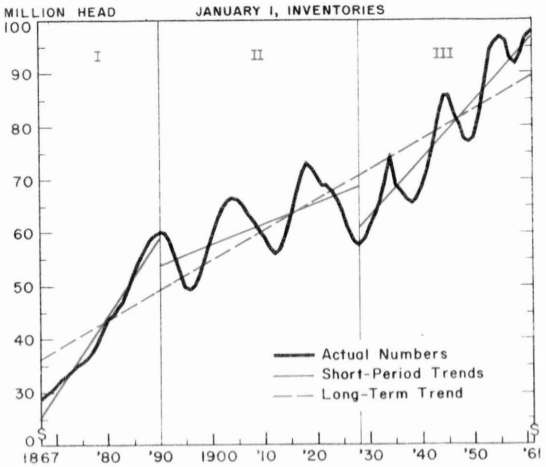
In the 95 years for which annual estimates are available, total cattle numbers have expanded from a low of 28.6 million to a high of 97.1 million, an increase of 240 per cent. The average increase of 729,000 per year tends to be misleading because it includes several types of changes. The long-term trend line in Chart 1 indicates a rate of increase of 560,000 annually for the 1867-1961 period. This probably is a more realistic estimate of the upward trend, since it is not influenced by shorter-run irregular movements to the same extent as the preceding estimate.

Cattle inventories vary in such a way that it is difficult to fit a linear, long-term trend line to the data. Such a trend is influenced by the differential rates of growth for the periods 1867-1890, 1890-1928, and 1928-1961. In the first period, a trend line fitted by visual inspection indicates an average rate of growth of 1,455,000 head per year. A similar trend line for the second period shows an annual increase of only 380,000, while the third period trend shows a growth rate of 1,090,000 head per year. During the first period, the frontier was moving rapidly westward and

Chart 1.

Total Cattle Numbers and Trends

United States



NOTE: The short-period trends were fitted by visual inspection and the long-term trend was fitted mathematically by the least squares method.

SOURCE: U. S. Department of Agriculture.

cattle production was being expanded in the Great Plains area. This was the period following the Civil War when the first transcontinental railroads were built, the Plains Indians were restricted to reservations, and the vast buffalo herds were exterminated. Toward the end of the period, the homestead movement was gaining momentum and the open range was giving way to barbed wire and the plow.

Cattle production expanded faster than demand during the first period, and by 1890, cattle numbers were disproportionately large. During the second period, declining per capita beef consumption was a weakening factor, but it was more than offset by population growth. Consequently, the beef cattle industry was able to continue expanding in this period. During the present period, consumer incomes have risen greatly from the depression lows of the early 1930's and this has contributed to a substantial increase in per capita consumption. In addition, population has increased more rapidly since World War II, further increasing the demand for beef and veal. Strong demand, improvements in productivity, and ample feed supplies in recent years induced the strong growth rate that has prevailed since 1928.

Cyclical Movements

Since 1867, there have been seven periods of increasing cattle numbers and six periods of decreasing numbers. These movements have been largely cyclical, with the length of the cycle being closely related to the time required to build up and liquidate a cattle herd. High or increasing cattle prices apparently stimulate producers to build up breeding herds and to hold feeders to heavier weights. This restricts current marketings, which stimulates further price increases. The cycle reinforces itself until enough time has elapsed for the withholding of animals to be translated into increasing supplies of beef and veal. The resulting increase in supplies tends to depress prices and to reverse the cycle. Since there is no restraint on the rate of liquidation comparable to the restraint on the rate of inventory buildup imposed by the time required for gestation, growth, and fattening, the downward movement can transpire more rapidly than the upward movement.

The comparative amplitudes and lengths of the cyclical movements are shown in Table 1. Since the first period was not characterized by a complete cyclical movement, it serves primarily as a base for the following movements. The first "low" (in 1876) was determined statistically by removing the trend influence as shown in Chart 2. In terms of absolute numbers, there has been little change in the upward amplitude of the cycles since 1890 but, in percentage terms, the average increase in the current period has been smaller than it was in the second. The downward changes have been considerably smaller than the upward changes and they have become increasingly smaller during the current pe-

Table 1.

Characteristics of Cyclical Movements in Total Cattle Inventories

United States

Period	Year	Cycle Position	Inventory Numbers (Million)	Absolute Change (Million)		Relative Change* (Per Cent)		Length of Cycle (Years)			
				Low to high	High to low	Low to high	High to low	Low to high	High to low	Low to low	High to high
Fast growth	1876	Low†	36.1								
				+23.9		+49.6		14			
	1890	High	60.0							20	
					−10.8		−19.8		6		14
	1896	Low	49.2								
				+17.2		+29.8		8			
	1904	High	66.4							16	
II					−10.7		−17.6		8		
Slow growth	1912	Low	55.7								14
				+17.3		+27.0		6			
	1918	High	73.0							16	
					−15.7		−24.1		10		
	1928	Low	57.3								16
				+17.1		+25.9		6			
	1934	High	74.4							10	
					−9.2		−13.1		4		
	1938	Low	65.2								11
				+20.4		+27.0		7			
III	1945	High	85.6							11	
Fast growth					−8.8		−10.8		4		
	1949	Low	76.8								10
				+19.8		+22.8		6			
	1955	High	96.6							9	
					−5.4		−5.8		3		
	1958	Low	91.2								

* Each relative change was calculated by dividing the difference between the high and low by the average of the two in order to eliminate the upward bias inherent in percentage change expressions.
† The low in 1876 was determined statistically by removing trend (see Chart 2).
SOURCE: U. S. Department of Agriculture.

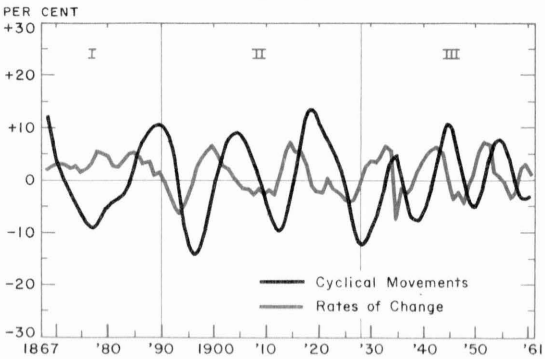
riod. The average number of years of the upswings apparently changed very little between the second and third periods, while that of the downswings changed considerably. During the second period, the downward movements increased in length from 6 years to 10 years, while in the third period, they have decreased to 3 years in length. As a result, the over-all cycles have decreased from an average of about 15 years in the second period to about 10 years in the third.

The purely cyclical movements in total cattle numbers, after the trend and irregular movements were removed statistically, are shown in Chart 2. The cycles have been contracting both in length and amplitude. The upward deviation from the trend line declined from a maximum of 14 per cent in the 1918 peak to 8 per cent in the 1954 peak. Only the depression peak of 1934 rose above the trend by a smaller amount than the most recent high point of the cycle and, since it began from a much lower level, its total rise was greater. The downward amplitudes have contracted even more than the upward amplitudes – from 14 per cent in the 1896 trough to 4 per cent in that of 1959. The over-all amplitudes from low to high and high to low declined by about one half from the second to the third period.

Chart 2.

Cyclical Movements and Rates of Change In Total Cattle Numbers

United States



NOTE: The cyclical movements were computed as percentage deviations of inventory numbers from a trend curve fitted mathematically by the least squares method. The irregular movements were removed by means of a moving average. The rates of change were computed as percentage changes in inventory numbers from year to year.

The rate of change in cattle numbers from year to year reveals a great deal about the nature of the cattle inventory cycles. The rates of change depicted in Chart 2 were calculated from the original data and, consequently, reflect trend and irregular movements as well as cyclical variations. The turning points in rates of change have usually preceded the turning points in inventory numbers by about 2 years, indicating that the buildups and liquidations usually begin to lose momentum some time before the turning points of the inventory cycles. The amplitude of the rate-of-change cycle seems to have changed very little, except for the drastic liquidation period in the early 1890's and the Government liquidation program in 1934. Since the rate-of-change amplitude has remained constant, the contraction of the inventory amplitude must be explained by the shorter lengths of the cycles.

Inventory Changes by Classes

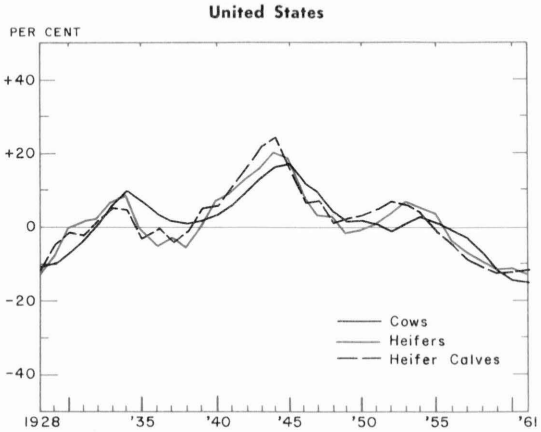
While movements in total cattle numbers are of considerable interest, they tend to obscure many important divergencies in movements among the different classes of cattle. An especially significant difference has occurred between cattle and calves kept for milk and those not kept for milk. The proportion of the cows 2 years old and over which were kept for milk declined from 71 per cent in 1928 to 43 per cent in 1961. Similarly, the proportions of heifers 1-2 years old kept for milk dropped from 62 to 42 per cent and calves from 37 to 21 per cent. This should not be interpreted as a shift from dairy breeds to beef breeds because much of the change has been the result of a shift from dual-purpose animals to specialized animals. Prior to World War II, many beef cattle raisers milked their cows during the flush season and sold cream. Both dairy and beef production have become more highly specialized in recent years and, while fewer beef and dual-purpose cows are milked, dairy herds still provide a substantial amount of beef and veal.

The growth of specialization in dairy production has been accompanied by a considerable increase in average milk output per cow. Since this increase has occurred during

Chart 3.

Cyclical Changes In Dairy Cattle Numbers By Classes

United States

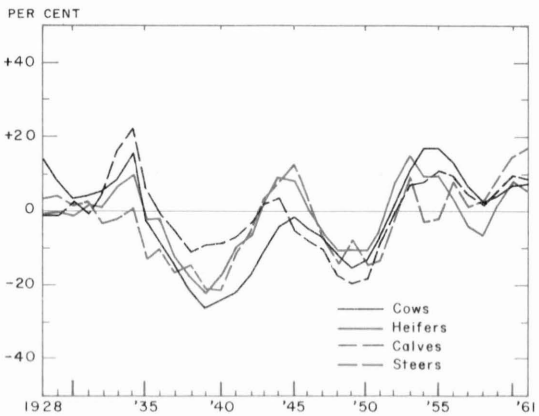


NOTE: The cyclical movements for each class were computed as percentage deviations of inventory numbers from a trend line fitted mathematically by the least squares method.

Chart 4.

Cyclical Changes In Beef Cattle Numbers, By Classes

United States



NOTE: The cyclical movements for each class were computed as percentage deviations of inventory numbers from a trend line fitted mathematically by the least squares method.

a period of slow growth in the demand for milk, fewer and fewer milk cows have been needed. Dairy cattle numbers, which trended upward from 1921 to 1944, have followed a downward trend since then, particularly for milk cows 2 years and older. Chart 3 shows that cycles exist in dairy cattle numbers, but comparison with Chart 4 shows that they differ considerably from the cycles in beef cattle numbers. The amplitude of the dairy cattle cycle has been smaller and the turning points have tended to precede those of beef cattle. It is usually assumed that the culling of dairy herds is influenced by slaughter cattle prices and that this causes some similarity in the cyclical patterns.

Chart 4 shows that the cyclical movements among the different classes of beef cattle have tended to coincide in timing and direction but not in amplitude. Steer numbers have been the most irregular, often moving opposite to the others. This probably is a reflection of the single purpose and more ready marketability of steers. Cow numbers have been the least irregular, reflecting the influence of longer-run production plans. In addition, there has been considerable variation between trends for the different classes, with cows having the strongest upward trend and calves being second. Steers and heifers 1-2 years old have increased the least of the group, although both increased more than any class of dairy cattle.

The trend line for all beef cattle indicated an increase of 1,108,950 per year based on a linear regression equation fitted to the 1925-61 data. A similarly calculated trend for dairy cattle indicated an increase of only 7,440 per year. Since World War II, beef cattle numbers have moved upward even more strongly, while dairy cattle numbers have declined.

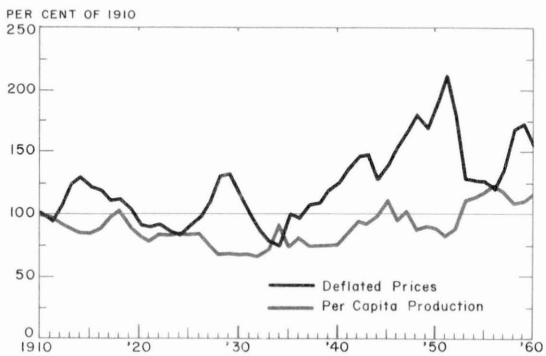
Meat Production and Slaughter Prices

Beef and veal production are used to measure production responses because they reflect the influence of variations in slaughter weights as well as slaughter numbers. Cattle and calf prices tend to respond immediately to changes in beef and veal production—as-

Chart 5.

Deflated Beef Cattle Prices and Per Capita Beef Production

United States



NOTE: Deflated prices were computed by dividing average prices received by farmers for beef cattle by the index of prices paid by farmers for commodities used in production. Per capita production was computed by dividing total beef production by civilian population.

SOURCE: U. S. Departments of Agriculture and Commerce.

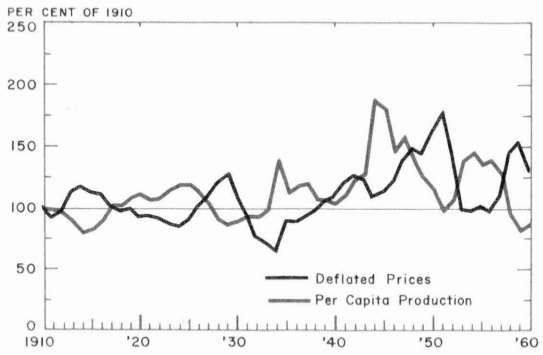
suming that demand conditions and supplies of substitutes remain the same. Production, for reasons discussed earlier, responds more slowly to the influence of price incentives, although responses tend to be more rapid for veal than for beef production. Chart 5 shows the movements in cattle prices and beef production from 1910 to 1960. The prices were deflated by the index of prices paid by farmers, and per capita production was derived by dividing total beef production by civilian population. Use of this procedure gives a truer picture of the cyclical movements in the beef market. Cyclical movements in beef cattle prices were largely obscured by a generally rising price level from 1934 to 1951, but a strong cyclical movement seems to have developed since then. Per capita production of beef has shown a moderate although fairly regular cycle.

Calf prices and veal production display a comparatively regular cyclical movement, as shown in Chart 6. This apparently reflects the greater responsiveness in veal production. The amplitudes of the cyclical movements in veal production and calf prices are similar, whereas those of beef production are considerably smaller than those of cattle prices. Veal and beef production are not, of course, unrelated. The responsiveness of veal production prevents greater variations in beef production by absorbing much of the shock of abrupt changes in demand or supply conditions and, in the case of increased calf slaughter, by decreasing the potential supply of beef. The ratio of calf slaughter to the calf crop offers some advance indication of changes in cattle numbers. This ratio usually reaches a low and begins to rise about 2 years before total cattle inventories reach a peak and begin to decline. Further, the ratio usually reaches its high and begins to decrease about 4 years before inventories reach a low and begin to rise.

Chart 6.

Deflated Calf Prices and Per Capita Veal Production

United States



NOTE: Deflated prices were computed by dividing average prices received by farmers for calves by the index of prices paid by farmers for commodities used in production. Per capita production was computed by dividing total veal production by civilian population.

SOURCE: U. S. Departments of Agriculture and Commerce.

Concluding Remarks

Livestock numbers display some regularities of movement but sufficient irregularity exists to make forecasting difficult. Year-to-year predictions often miss by a wide margin and longer-term predictions are especially hazardous. Nevertheless, changes in cattle production require such a long time that producers and capital suppliers must formulate some sort of expectations for as much as 5 to 10 years in advance. In view of this necessity and the sharp fluctuations which occur in livestock prices and feed costs, livestock production and financing are hazardous occupations from an economic standpoint.

A statistical projection of the trend curve and cyclical pattern in total cattle numbers is shown in Table 2. The figures are not a prediction of future cattle numbers but simply a first and second approximation based on an extension of past conditions into the future. The trend shows a figure of 95.3 million for 1958 with a continuous rise to 120.5 million

Table 2.

Statistical Projection of Total Cattle Numbers

United States

Year	Trend Values* (Million)	Cyclical Deviations** (Per Cent)	Statistical Estimates† (Million)	Inventory Numbers (Million)
1958	95.3	—5.3	90.2	91.2
1959	97.2	—5.0	92.3	93.3
1960	99.1	—1.9	97.2	96.2
1961	101.2	+3.0	104.2	97.1
1962	103.3	+6.9	110.4	
1963	105.5	+7.9	113.8	
1964	107.8	+6.7	115.0	
1965	110.1	+4.0	114.5	
1966	112.6	—0.3	112.3	
1967	115.1	—3.3	111.3	
1968	117.8	—3.8	113.3	
1969	120.5	—3.4	116.4	

* Based on a trend curve fitted mathematically by the least squares method.

** Based on smoothed percentage relationship between inventory numbers and trend values in last full cycle.

† Based on trend values adjusted for cyclical deviations.

in 1969. Superimposing the most recent cycle pattern (from 1949 to 1957) on these figures indicates 90.2 million for 1958, rising to 115.0 million in 1964, declining to 111.3 million in 1967, and climbing to 116.4 million in 1969. That the pattern of the current cycle differs from that of the previous cycle is shown by comparing the inventory numbers with the statistical estimates for 1958 through 1961. The inventory numbers differed from the statistical estimates by only 1 million in each of the first 3 years, but they were 7 million less than the estimate in 1961. This may presage a shorter buildup in this cycle than in the last.

The turning point of the present cycle seems highly uncertain. If the pattern of the most recent cycles were repeated, the peak would occur in 1964. However, there is some indication that it may occur sooner. The rate of increase dropped off in 1960 and, since this has usually preceded a peak in numbers by about 2 years, it indicates a possible peak in 1962 or 1963. Such a brief buildup would be the shortest on record and there is little in the previous history of cattle cycles to support such an expectation except that the last liquidation was also the shortest on record. In any event, the amplitude of the cycles has declined in recent years, and if it continues to decline, the cattle cycle may eventually assume negligible proportions.

Importance of Size and Other Factors Affecting Bank Costs

ARTICLES IN THE TWO preceding issues of this *Review* dealt with the relationship between size and costs at member banks in the Tenth Federal Reserve District. Measured as a per cent of assets, costs at a sample of about 270 District member banks during the period 1956-59 were found to decline significantly with increasing size. The cost advantages of larger-scale operations were shown to reflect the ability of larger banks to operate with smaller numbers of employees per dollar of assets and with a higher proportion of nonofficial employees to officers. These cost advantages seem to stem partly from opportunities to perform ordinary banking functions in more efficient ways, and partly from the ability of larger banks to carry on transactions for loans and investments in larger dollar amounts.

In the two previous articles, attention was focused on the average relationship between bank size and costs without considering the importance of size in relation to other factors that influence bank cost ratios. Is the size of a bank the dominant characteristic influencing its expenses as a per cent of assets, or are other characteristics of greater significance? The first portion of this article presents a discussion of the relative importance of various factors that influence bank cost ratios, and is based on the same statistical analysis used in the earlier articles.

A second and related topic deals with changes in the relative importance of factors influencing costs during the years 1956 to 1959. This period witnessed striking changes in the volume and composition of assets and liabilities of District member banks. A study of the changing relative importance of various factors associated with bank costs during these 4 years sheds light on the way in which District banks responded to a sharp upswing in their loans and deposits and to the spread through the banking system of higher interest rates on time deposits.

Factors Identified as Cost Determinants

Methods of statistical analysis do not permit isolation of all of the many factors that account for differences in costs among banks. Special circumstances that are unique to an individual bank often account for a significant share of the difference between its costs and those of other banks similar in size and in other respects. Moreover, there are some forces responsible for cost differences among banks that cannot easily be measured or for which the necessary data are unavailable.

The statistical method employed to investigate the relationship between bank size and costs also sought to find an association between bank costs and major characteristics of assets and liabilities for which data are readily available from member bank reports of condition. A brief discussion of the reasons for selecting the characteristics included in the study provides a helpful background for the discussion to follow.

The division of a bank's assets among major classes—loans, securities, and cash—is certain to have a significant effect on its costs. The structure of assets by major classes is represented in the analysis by two factors: (1) the per cent of total assets in the form of loans, and (2) the per cent of total assets held as securities other than U. S. Government issues. Given these two percentage figures, the proportion of bank assets in liquid form (cash and U.S. Government securities) is automatically allowed for, since loans, se-

curities, and cash assets add up to virtually 100 per cent of total assets at almost all banks. Since analysis showed that the distribution of liquid assets between cash and Government securities was not closely related to bank costs, this possible consideration can be safely ignored.

There are four principal categories of loans extended by District banks—loans to businesses, nonguaranteed farm credits, real-estate mortgage loans, and loans to individuals or consumers. The proportion of total loans extended to consumers was found to exercise a strong upward influence on bank cost ratios. On the other hand, no significant association was discovered between costs and the proportion of loans extended to businesses, to farmers, or to the mortgage market. This conclusion, which may seem surprising, might well indicate that the administrative costs of making a loan are determined not so much by the type of borrower as by characteristics of the individual loan transaction, particularly the size of loan. Consumer loans are high cost assets because they are small loans and because the bulk of them are repaid in instalments. The average size of other types of loans depends primarily on the size of bank, and so tends to be reflected in the cost advantages enjoyed by larger banks.

On the liability side of the balance sheet, time deposits involve substantially larger costs than demand balances, since interest payments are forbidden on demand accounts. The amount of expense incurred on time deposits depends both upon the average rate of interest paid on time accounts and on the percentage of deposits in time accounts. These are not, however, unrelated characteristics. Indeed, the association between average rates paid on time deposits and the proportion of deposits in time accounts was so strong that their influence on costs of the sample banks could not be separated statistically. Therefore, the latter characteristic alone was employed to represent both influences on costs.

The statistical analysis also showed that, among larger banks, the percentage of demand deposits in the form of correspondent balances was associated with bank costs. Other things equal, ratios of costs to assets tended to be lower for banks with a high percentage of interbank demand deposits.

Results of an earlier study—published in the July 1960 issue of this *Review*—suggested that banks with high growth rates tended to have higher cost ratios. The present study confirms this association and yields additional information on the relationship between bank growth rates and bank costs.

Direct Influence on Costs

Together with bank size, the characteristics of assets and liabilities mentioned in the preceding section account for 62 per cent of the variation in ratios of total costs to assets among the sample banks over the period 1956-59. Each factor separately, or directly, accounts for part of the variation, while an additional portion is explained by the joint influence of the several factors. The direct influence of each factor provides the best initial guide to its relative importance as a determinant of bank cost ratios, and therefore will be discussed first. Measures of direct influence on cost ratios, as shown in Table 1, can be compared with one another readily, since each measure expresses the percentage of variation in cost ratios among the banks that a particular factor explains.

The first four characteristics listed in the table each explain directly from 9 to 14 per cent of the variation in ratios of total costs to total assets among the sample banks. Although each of the four accounts for a slightly different percentage of total cost variation, the differences are not large enough to be assigned any important weight. The appropriate inference is that differences among the

Table 1.
Measures of Direct Influence On Total Cost Ratios
Sample of Tenth District Member Banks, 1956-59

Bank Characteristic	Per Cent of Variance in Total Cost Ratios Explained
1. Asset size	13
2. Relative volume of time deposits	9
3. Percentage of assets in loans	10
4. Percentage of loans extended to consumers	14
5. Growth rate of assets, 1956-59	2
6. Percentage of assets in non-Treasury securities	2

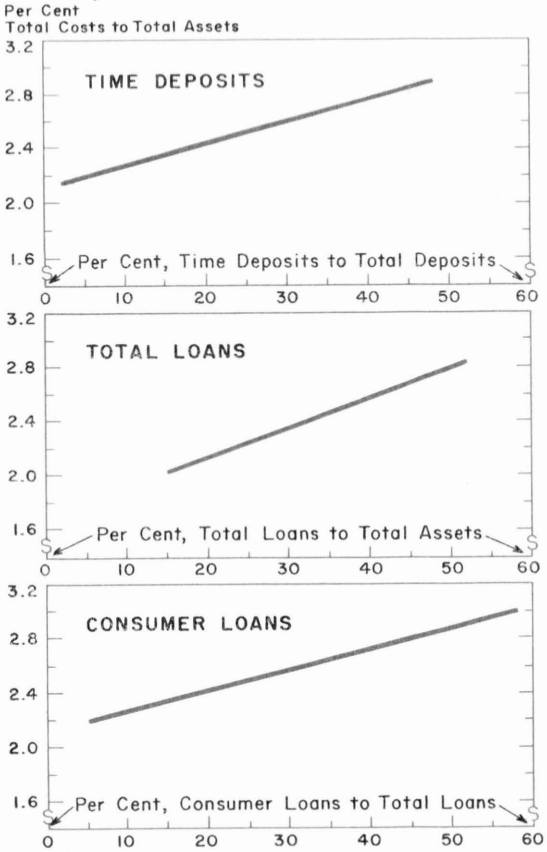
NOTE: The data in the table are based on the function: $X_1 = f(\log X_2, X_3 \ldots X_7)$, where X_1 is the ratio of total costs to total assets, X_2 is asset size in millions, X_3 is the ratio of time to total deposits, X_4 is the ratio of total loans to total assets, X_5 is the ratio of non-Treasury securities to total assets, X_6 is the ratio of consumer to total loans, and X_7 is the percentage increase in assets, 1956-59, with all ratios expressed in percentage terms. The function was fitted to data for individual banks obtained by averaging annual figures for the years 1956-59. The measures shown are squares of the beta (standardized partial regression) coefficients, expressed in percentage terms.

banks in size, in the relative amount of time deposits, in the percentage of assets in the form of loans, and in the percentage of loans made to consumers all were of approximately equal significance in explaining differences in total cost ratios. However, the comparative importance of these four factors in accounting for differences in ratios of wages and salaries to total assets was quite different. Bank size, which explained directly about 28 per cent of the variation in wage and salary ratios, was by far the most important determinant.

Rates of growth in assets and the percentage of assets held as securities other than U.S. Government issues, the last two characteristics shown in the table, exerted a substantially smaller direct influence on total cost ratios than the other four characteristics. The proportion of demand deposits in the form of interbank accounts – a characteristic not shown in the table – was found to account directly for about 2 per cent of the variation in total cost ratios among sample banks with over $25 million in assets. Clearly, then, measures of direct influence point to the first four characteristics in Table 1 as exerting the dominant influence on total cost ratios.

The previous articles in this series discussed in some detail the average relationship between size and costs, and it is of interest to note how cost ratios change, on the average, with changes in the other three principal factors affecting costs. The top panel of the chart shows the way in which ratios of total costs to assets tend to rise with higher ratios of time accounts to total deposits, after removing the influence on costs of all other

Relationship Between Total Cost Ratios and Characteristics of Assets and Liabilities
Sample of Tenth District Member Banks, 1956-59



NOTE: The charts are based on the function described in the note to Table 1. The line in the top panel is obtained by setting variables X_2, X_4 . . . . X_7 at their mean values and then graphically portraying the resulting relation between X_1 and X_3. Lines in the second and third panels are obtained by an analogous procedure. For each characteristic, the lines are drawn to cover the range of variation which is found among the sample banks. For example, few banks have ratios of total loans to total assets of less than 15 per cent, so the line in the second panel is not extended below that figure.

characteristics identified as cost determinants. The cost ratio rises by .16 percentage points, on the average, for each 10 percentage point increase in the ratio of time to total deposits. Similarly, as displayed in the second and third panels, the total cost ratio rises .22 percentage points for each 10 percentage point increase in the ratio of total loans to total assets, and .16 percentage points for each 10 percentage point increase in the proportion of total loans extended to consumers.

Joint Influences on Costs

Additional insight into the relative importance of the various characteristics may be gained by examining their joint influence on cost ratios. To clarify the meaning of joint influence, it may be helpful to use a simple illustration from another field.

Suppose a person earning $10,000 gives 10 per cent of his income, or $1,000, for charitable purposes. When his income increases to $15,000, he gives 15 per cent to charity, or $2,250. Of the $1,250 rise in his contribution, no more than $500 is accounted for *directly* by the growth in his income—$500 being the product of the increase in income times the initial contribution rate of 10 per cent. Similarly, no more than $500 is accounted for *directly* by the increase in contribution rate, since the 5 percentage point rise in contribution rate times the original income of $10,000 is $500. The $250 not accounted for directly by either the increase in income or the increase in contribution rate is properly described as the *joint* influence of both changes. Had the contribution rate dropped to 5 per cent when the income figure rose to $15,000, the direct effects would have been plus $500 for the change in income and minus $500 for the change in contribution rate, while the joint effect of both changes would be minus $250.

In a similar manner, characteristics of bank assets and liabilities have both direct and joint effects on costs. For example, sample banks with either high ratios of loans to total assets or high ratios of time to total deposits tended to have higher cost ratios, as noted above. These characteristics, however, are not independent—usually, banks with relatively high time deposit ratios have above average loan ratios. Consequently, these banks tend to have above average cost ratios for three reasons: their comparatively high volume of loans, their higher percentage of time deposits, and because both loans and time deposits are relatively high.

As with the direct influence on costs discussed above, the joint influence of any two cost determinants may be expressed in terms of the relative amount of variation in cost ratios among banks that it accounts for. Table 2 shows the joint effect on costs of each pair of characteristics listed in Table 1. A red figure indicates that the joint effect is negative—as in the illustration above when the contribution rate declined.

These measures of joint influence disclose several interesting aspects of bank cost experience. First, the joint influence of bank size and the three other major determinants of costs are all negative. This results from the fact that, among District member banks, ratios of time to total deposits, total loans to total assets, and consumer loans to total loans, all tend generally to increase with larger bank size. Thus, while increasing size is associated with decreasing costs, part of the cost advantage of larger size is offset by changes in the structure of assets and liabilities which make for higher costs.

This should not be taken to imply, however, that ratios of time to total deposits, total loans to assets, and consumer loans to total loans rise continuously with size of bank throughout the full range of bank sizes in the District. For although the very largest banks in the District tend to have the highest ratios of loans to assets, banks with assets in

Table 2.
Measures of Joint Influence on Total Cost Ratios
Sample of Tenth District Member Banks, 1956-59

Per Cent of Variance in Total Cost Ratios Explained

	Asset Size	Time Deposits	Total Loans	Consumer Loans	Growth Rate, 1956-59	Non-Treasury Securities
Asset size	—	2	1	4	1	*
Time deposits		—	6	4	3	*
Total loans			—	*	2	2
Consumer loans				—	2	*
Growth rate, 1956-59					—	*
Non-Treasury securities						—

*Less than 0.5 per cent. A red figure indicates that the joint effect is negative.
NOTE: The data in the table are based on the function described in the note to Table 1. The figures represent twice the cross-product of the relevant beta coefficients times the simple correlation coefficient for each pair of variables, expressed in percentage terms. The algebraic sum of the direct effects shown in Table 1 and the joint effects indicated above is equal to the square of the multiple correlation coefficient in percentage terms (62) except for a difference due to rounding.

the range of $10-$50 million have the highest ratios of time deposits and the largest percentage of their loans extended to consumers. Larger banks than this, which are typically downtown banks in larger cities, usually have relatively smaller amounts of time deposits and consumer loans.

A second notable feature is the substantial amount of cost variation explained by the joint influence of time deposits and two characteristics of asset structure. Banks with high ratios of time accounts to total deposits also tend to have a relatively large portion of their assets in loans and a higher-than-average percentage of their loans extended to consumers. Presumably, this reflects the attempt by banks with relatively large amounts of time deposits to search for assets carrying higher yields as a means of covering interest expenses on their time accounts.

Differences in total cost ratios among the sample banks also were accounted for to a considerable degree by the joint influence of their growth rates with other cost-determining characteristics. In fact, the joint influence of growth rates and other characteristics explains 8 per cent of the variation in total cost ratios among the sample banks, while the direct influence of growth rates on costs explains but 2 per cent. This implies that the relatively high costs found among the more rapidly growing banks resulted primarily from bank characteristics that are associated with rapid growth. Sample banks whose growth rates were high had relatively high ratios of time accounts to total deposits (and paid above average rates of interest on time deposits), high percentages of loans to total assets, and high percentages of consumer loans to total loans.

Banks whose growth rates were higher than average over the years 1956-59 were spread broadly over all District states; the list included some downtown banks as well as suburban banks, and banks in rural communities as well as in urban areas. It thus seems appropriate to view their favorable growth experience as resulting in considerable measure from management policies conducive to growth—including a willingness to pay higher interest rates to attract time deposits, and the adoption of aggressive policies to accommodate loan customers. Interestingly, the characteristics of assets and liabilities associated with more-than-average growth over the years 1956-59 also were associated with more-than-average growth over the longer period from 1947 to 1959.

Changing Relative Importance of Cost Influences

The years from 1956 to 1959 witnessed significant changes in the comparative importance of the four principal characteristics that account for differences in bank cost ratios—that is, among bank size, the percentage of deposits in time accounts, the percentage of assets in loans, and the proportion of loans extended to consumers. These changes are reflected adequately in the measures of their direct influence on total cost ratios for each of the individual years 1956 through 1959, as shown in Table 3.

Table 3.
Measures of Direct Influence on Total Cost Ratios, 1956-59
Sample of Tenth District Member Banks

	Per Cent of Variance in Total Cost Ratios Explained			
	1956	1957	1958	1959
1. Asset size	16	16	13	10
2. Relative volume of time deposits	6	7	11	12
3. Percentage of assets in loans	13	10	8	8
4. Percentage of loans extended to consumers	12	11	15	10

NOTE: The figures in the table are squares of the beta (standardized partial regression) coefficients of the function described in the note to Table 1, fitted to each of the individual years 1956 through 1959.

The most striking change that took place was the large increase in the relative importance of time deposits as a determinant of total cost ratios. Between 1956 and 1959, average effective rates of interest on time accounts at the sample banks rose from 1.57 per cent to 2.19 per cent, with most of this change taking place after January 1957, when legal maximum rates payable on time deposits were raised from 2½ per cent to 3 per cent. Meanwhile, time accounts increased from 17.3 per cent of total deposits in 1956 to 22.0 per cent in 1959. To be sure, these changes were widespread among District banks, as well as in other sections of the country, but that did not prevent ratios of time to total deposits from becoming a more important factor in explaining cost differences among the banks. A given increase in interest rates on time accounts affects costs most at banks where ratios of time to total deposits are relatively high. Similarly, a given increase in the percentage of time accounts affects total cost ratios most at banks paying higher-than-average rates to their time deposit customers. Thus, the result of these changes was a sharp rise between 1956 and 1959 in the importance of time deposit ratios in accounting for cost differences among District members.

This increasing significance of time deposit ratios itself tends to lower the measures of relative importance for other characteristics of banks that influence their expenses.[1] The declining influence of total loans on costs is, however, too large to be attributed to this influence alone. It results mainly from bank responses to the vigorous upswing in loan volume that took place from 1956 to 1959.

At the group of sample banks included in the study, average loan volume in 1959 was about one-fourth higher than in 1956. The average ratio of loans to total assets among the banks advanced from 32.9 per cent in 1956 to 36.3 per cent in 1959. The largest part of this surge in loan volume took place in the relatively short span of 2 years— from mid-1957 to mid-1959. To handle the increasing volume of loans, it was not necessary for the banks to increase proportionately their staffs of officers and employees; rather, existing staffs were used more intensively, with the result that bank costs became less closely associated with the relative amount of their assets in loans. Consequently, the growth of loans in relation to other assets added to the banks' net earnings rates not only because of the shift to assets with higher gross earnings rates, but also because administrative costs per dollar of loans were held down.

No changes of fundamental significance are evident, however, in the relative importance of bank size or in the proportion of loans extended to consumers as cost influences from 1956 to 1959. The measures for consumer loans shown in Table 3 vary erratically from one year to the next, suggesting only that the weight as a cost determinant is more appropriately judged by data that are averaged for several years. The measure for bank size is lower in 1959 than in earlier years because the year witnessed a relatively larger increase

[1] This is because the effect is to increase the variance of total costs. Thus, if the partial regression coefficient of, say, bank size and the variance of bank size are unchanged, while the variance of total costs is increased, the standardized partial regression coefficient of bank size is reduced.

in miscellaneous expenses at large than at small banks. Part of this increase was due to a rise in borrowings among larger banks during 1959; a second part was due to the comparatively larger advance for large than for small banks in non-income tax payments during both 1958 and 1959. The basic advantages of larger-scale operations in banking, which are found in wage and salary expenses, were just as important in 1959 as they were in 1956.

Concluding Remarks

The foregoing analysis indicates that although bank size is an important factor affecting the ability of a bank to operate with low costs in relation to its assets, it does not overshadow other factors. Meaningful comparisons of cost ratios among banks must give attention not only to the size of bank but also to a variety of other characteristics of their assets and liabilities.

The dominant structural characteristics of assets and liabilities that influence costs are directly within the control of bank management. However, the avoidance of high costs by policies such as the selection of assets on which administrative costs are low, or the maintenance of low rates of interest on time deposits, carries its penalties. It is widely recognized that gross earnings rates are directly influenced by choices among alternative types of assets, but the growth rate of a bank also may be affected significantly by its lending policies and its willingness to attract time deposit customers. From the viewpoint of its influence on expenses, the interest of a bank in growing rapidly is clearly evident in the relationship between size and costs. For while the immediate result of rapid growth appears to increase costs, the longer-run influence is to reduce costs by permitting the bank to enjoy the cost advantages of larger-scale operations.

BANKING IN THE TENTH DISTRICT

District and States	Loans				Deposits			
	Reserve City Member Banks		Country Member Banks		Reserve City Member Banks		Country Member Banks	
	February 1961 Percentage Change From							
	Jan. 1961	Feb. 1960	Jan. 1961	Feb. 1960	Jan. 1961	Feb. 1960	Jan. 1961	Feb. 1960
Tenth F. R. Dist.	+4	+8	+2	+16	−2	+6	†	+8
Colorado	+3	+2	†	+11	+1	+5	†	+6
Kansas	+4	+10	−1	+23	†	+7	−2	+10
Missouri*	+7	+18	†	+7	−2	+8	−4	+4
Nebraska	+2	+3	†	+21	†	+5	−1	+8
New Mexico*	**	**	+8	+14	**	**	+4	+9
Oklahoma*	+1	+8	+6	+18	−5	+6	+2	+11
Wyoming	**	**	+1	+8	**	**	−2	+3

*Tenth District portion only.
†Less than 0.5 per cent.
**No reserve cities in this state.

PRICE INDEXES, UNITED STATES

Index	Feb. 1961	Jan. 1961	Feb. 1960
Consumer Price Index (1947-49=100)	127.5	127.4	125.6
Wholesale Price Index (1947-49=100)	120.0	119.8	119.3
Prices Rec'd by Farmers (1910-14=100)	244	241	233
Prices Paid by Farmers (1910-14=100)	302	301	299

TENTH DISTRICT BUSINESS INDICATORS

District and Principal Metropolitan Areas	Value of Check Payments		Value of Department Store Sales	
	Percentage change—1961 from 1960			
	Feb.	Year to date	Feb.	Year to date
Tenth F. R. District	+2	+8	+5	+5
Denver	+11	+13	+7	+8
Wichita	−10	−3	−7	−7
Kansas City	0	+6	0	+2
Omaha	−2	+5	+22	+28
Oklahoma City	+1	+8	−6	−4
Tulsa	0	+5	+3	0