

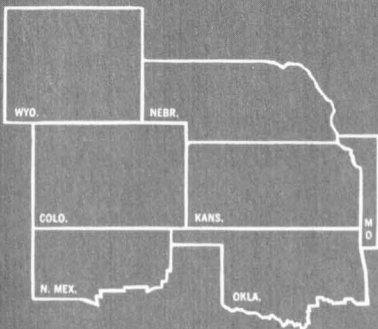


# *monthly review*

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# The Commercial Paper Boom In Perspective

*By Frederick M. Struble*

**B**USINESS indebtedness in the form of commercial paper—short-term, unsecured promissory notes issued by financial, commercial, and industrial firms—has more than doubled since 1965 and now totals more than \$20 billion. Several explanations for this expansion have been advanced in recent discussions of this development. The sharp growth in total indebtedness at business concerns over this period, as internal sources of funds fell well short of requirements, has been mentioned frequently. The greater reliance placed on short-term sources of funds, because of the congestion and the high cost of borrowing in the long-term capital market, has also been mentioned. Finally, frequent reference has been made to the substitution of commercial paper indebtedness for commercial bank indebtedness, a development primarily attributed to the rationing of loans by banks during the extremely tight credit situation of 1966 and to the subsequent reaction of their loan customers to this rationing process.

An assessment of the relative importance of each of these developments is presented in this article. Before considering this question, however, past trend and cyclical developments in this market are reviewed and compared with developments since 1965. The comparisons are made to provide a better basis for making this assessment and to provide insight into the question of whether it appears likely that this sharp rate of expansion can be maintained in the future.

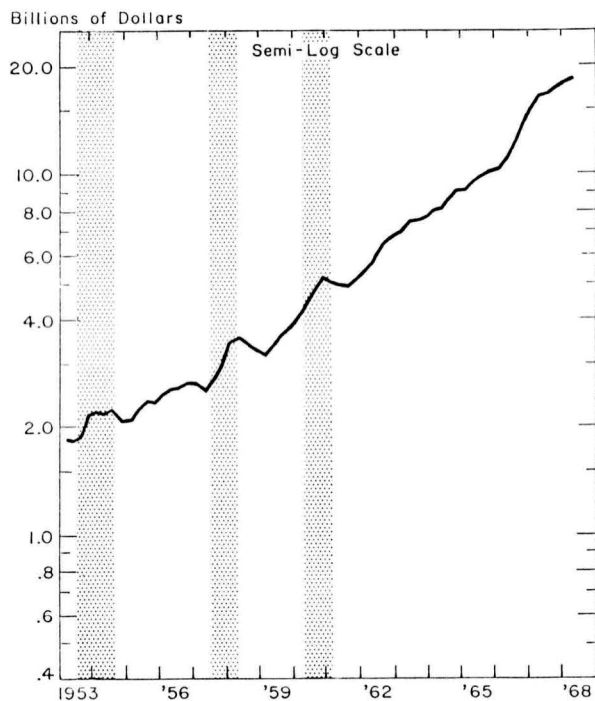
## TREND AND CYCLICAL DEVELOPMENTS IN THE VOLUME OF COMMERCIAL PAPER

The expansion in commercial paper which has occurred since 1965 extends a strong upward trend initially established after World War II. Commercial paper indebtedness increased at an exceptionally strong pace over the early years of this period, as the amount outstanding rose from a war-depressed low of slightly more than \$100 million to nearly \$1.75 billion by the end of 1952. Since then, growth in commercial paper indebtedness has continued to be impressive, as may be seen by examining the top line of Chart 1.

This secular growth in commercial paper was accompanied by considerable cyclical variation. During the 1950's the volume of commercial paper declined during the early stages of an upturn in business activity, increased during the remainder of the business expansion, and continued to increase on into the following period of recession in economic activity. A similar relationship between changes in the volume of commercial paper and the state of economic activity has prevailed during the 1960's. That is, the volume of commercial paper began to decline in the latter part of the 1960-61 recession, fell somewhat further during the early part of the current period of business expansion, and has increased since that time.

Focusing on the period since 1965, it is apparent that commercial paper indebtedness has been increasing at a sharper rate than earlier in

**Chart 1**  
**COMMERCIAL PAPER OUTSTANDING**  
**(Quarterly averages of monthly data,**  
**seasonally adjusted)**



Shaded areas denote recessions as defined by National Bureau of Economic Research.  
 SOURCE: Federal Reserve Bank of New York.

the current expansion. The average quarterly rate of growth during the period was about 8 per cent, compared with a rate of just more than 6 per cent in the years 1961 to 1965. Relative to experience in the 1950's, the recent pace of increase is distinctly higher than that of the 1954-57 business expansion. On the other hand, it is just slightly less than the 8.7 per cent average quarterly gain of the 1958-60 expansion.<sup>1</sup>

<sup>1</sup>The rates of growth for the periods prior to 1966 were measured from that date within the period of business expansion at which commercial paper reached its cyclical trough.

Thus, the recent advance in commercial paper during a period of expanding business activity is generally consistent with its earlier cyclical behavior and the pace of the recent advance is not entirely without precedent. The composition of growth in commercial paper debt during the latest period has differed markedly, however, from what would have been expected on the basis of past trend and cyclical developments.

Expansion in dealer paper, that is, paper sold through commercial paper dealers, made a strong contribution to the recent advance in total commercial paper. Chart 1 shows that, during the 1950's, dealer paper rose sharply only during periods of business recession and, in contrast, declined steadily throughout most, if not all, of the periods of expansion in business activity. This relationship between changes in the volume of dealer paper and economic activity was broken to some extent during the initial stages of the current period of expansion, as dealer-issued paper continued to grow. However, the volume outstanding stabilized by the end of 1962 and then tended to shade downward through 1965, so that in the period immediately preceding 1966, dealer paper showed definite signs of again conforming to its cyclical pattern of the 1950's. Thus, the strong growth in the volume of dealer-issued paper since 1965, occurring as it did well after the start of the current business expansion, quite clearly represents a sharp departure from its earlier cyclical pattern.

The recent growth in directly issued paper—notes sold directly to investors by borrowing firms—appears to be much more consistent with earlier trend and cyclical developments in this sector of the market. The volume of directly issued paper declined during the early stages of the current business expansion period and has been increasing steadily since that time. As shown in Chart 1, these developments conform generally to the preceding strong uptrend and patterns of cyclical fluctuation in this sec-

tor of the market. However, as will be discussed later, the advance since 1965 has been generated by a different set of factors than those responsible for the growth in directly placed commercial paper in earlier periods of business expansion.

#### FIRMS ISSUING COMMERCIAL PAPER

Insight into the factors responsible for changes in the volume of commercial paper can be gained by viewing them within the context of corresponding changes in the level and structure of liabilities at firms issuing this paper. Ideally, the data reflecting liability positions at paper issuers should be classified according to the method used by firms in marketing their paper indebtedness, since dealer-issued paper has displayed a decidedly different cyclical pattern than directly issued paper. Unfortunately, data are not available in this form. However, flow of funds data reflecting liability developments at two major groups of business firms, finance companies and nonfinancial corporations, are available. Although they do not meet the ideal requirement, these data do provide a workable approximation.

About 30 per cent of the firms presently issuing commercial paper are finance companies—firms which finance consumer installment purchases, make cash loans to consumers, and provide funds to business for financing accounts receivable and the purchase of capital equipment on an installment basis. The remaining commercial paper borrowers are nonfinancial corporations engaged in a wide variety of business activities, such as manufacturing, wholesale and retail trade, and the operation of public utilities. Although finance companies constitute a comparatively small proportion of total commercial paper borrowers, they are extremely important in terms of the volume of total commercial paper debt. All directly placed paper is finance company paper. In addition, a considerable proportion of the paper placed through dealers is supplied by finance com-

panies. Each of these generalizations apply for the entire period under consideration.

The number of finance firms placing their paper directly is but a small proportion of the total number of finance companies borrowing in the commercial paper market. However, these direct issuers are quite large relative to other finance companies and, as a result, their commercial paper indebtedness and their total indebtedness substantially exceeds that of all other finance companies. For example, at the end of 1967, directly placed finance company paper was equal to slightly more than 85 per cent of total commercial paper indebtedness of all finance companies, just slightly below the ratio at the end of 1952. Direct issuers have a higher ratio of paper indebtedness to total indebtedness, however, so their total indebtedness is a somewhat smaller proportion of total finance company indebtedness.

In addition to differing in size, the cyclical pattern of changes in commercial paper issued by smaller finance companies has been different than the pattern at larger finance companies. The ratio of dealer finance company paper to total finance paper has generally declined in periods of business expansion and increased in periods of recession, as the volume of dealer placed finance company paper either varied inversely with directly placed paper or changed at a slower rate. The cyclical pattern of change in dealer finance paper was similar to the cyclical pattern of commercial paper issued by industrial firms. However, the ratio of dealer finance paper to total dealer paper generally declined during periods of recession and increased during periods of expansion, because the commercial paper indebtedness of nonfinancial corporations fluctuated more sharply over the cycle.

Since finance companies issuing their paper directly are relatively large, their liability positions generally dominate the data for all finance companies. Accordingly, the finance company data can be interpreted as providing

a fairly good approximation of the changes in liability positions which coincided with fluctuations in directly issued paper. The relationship between dealer-issued paper and liability developments at nonfinancial corporations is quite obviously much less precise because a major proportion of this paper is issued by finance companies. Despite these problems, the association is close enough so that it is possible to gain a general impression of the relationship between fluctuations in dealer-issued commercial paper and associated developments in other liability accounts.

#### FACTORS AFFECTING THE VOLUME OF COMMERCIAL PAPER

Changes in the volume of commercial paper occur as issuing firms either alter their total indebtedness while holding the proportion of commercial paper unchanged or change the relative position of commercial paper in their liability structures. Fluctuations in the relative importance of commercial paper that are reflected in aggregate data also arise in part because of the entrance and exit of firms from the commercial paper market.

Approximately 425 to 450 firms currently are borrowing in the commercial paper market, only slightly more than the 418 firms issuing paper in 1952. Thus, the long-run growth in the volume of total commercial paper outstanding has not been due in any significant way to this factor. However, some shifting has occurred in the composition of commercial paper borrowers and this did influence the growth of commercial paper debt at finance companies and nonfinancial corporations. More specifically, the number of finance companies issuing commercial paper increased from 95 to 130 over this period and those selling directly to investors increased from 4 to 20. In short, this shift in the composition of borrowing firms tended to stimulate growth in finance company paper and to restrain the growth in the volume of paper issued by nonfinancial corporations.

**Table 1**  
LIABILITY POSITIONS OF FINANCIAL COMPANIES ON SELECTED DATES

	Total Liabilities	Com- mercial Paper	Bank Loans	Ratio		
				Com- mercial Paper To Total Liabilities	Com- mercial Paper Plus Bank Loans To Total Liabilities	Com- mercial Paper To Bank Loans
	(In billions of dollars)			(Per Cent)		
1952	7.6	1.4	3.6	18.4	65.8	38.9
1955	13.0	1.7	5.7	13.1	56.9	29.8
1965	36.2	8.3	11.6	22.9	55.0	71.6
1967	40.8	14.1	9.1	34.6	56.9	154.9

SOURCE: Flow of Funds Accounts, 1945-1967, Board of Governors of the Federal Reserve System, February 1968.

Some alteration also occurred within the composition of nonfinancial corporations, as a number of earlier borrowers left the market and were replaced by new borrowers.

In general, the number of firms issuing commercial paper has increased during recessions and declined during business expansions. Changes in the number of nonfinancial corporations accounted for most of this cyclical fluctuation with one important exception. The total number of firms issuing commercial paper continued to rise during the early part of the current business expansion and then dropped off. By the end of 1965, the number of firms had fallen to 335. Since that time, many borrowers, most of them nonfinancial corporations, have returned to the market or have begun to issue commercial paper for the first time. Thus, the recent growth in commercial paper placed through dealers is attributable in part to an increase in the number of nonfinancial corporations issuing commercial paper.

The total indebtedness of finance companies increased from \$7.6 billion in 1952 to \$40.8 billion in 1967 as indicated in Table 1. If commercial paper had merely maintained the relative position it had in the liability structure of these firms in 1952, the volume of these notes would have risen to slightly more than twice the level outstanding in 1952. However,

commercial paper increased at a stronger rate and the ratio of commercial paper to total liabilities rose substantially over this period. Data for 1955 have been included in this table in order to show the temporary decline which occurred in the ratio of commercial paper to total liabilities between 1952 and 1955, and, more importantly, to emphasize the extent of the almost steady upward trend in this ratio since then. As can be seen, however, the advance in this ratio between the end of 1965 and the end of 1967 was much stronger than would have been expected on the basis of the trend established from the end of 1955 through 1965.

A general indication of the substitution process responsible for the increase in relative importance of commercial paper in the liability positions of finance companies is provided in the last two columns in Table 1. After declining sharply between 1952 and the end of 1955, the ratio of short-term liabilities to total liabilities declined slightly further during the following ten-year period, while the ratio of commercial paper to bank loans trended upward. The advance from 1955 to 1965 in the ratio of commercial paper to total liabilities then was due to the marked substitution of commercial paper indebtedness for commercial bank indebtedness.

The increase in the ratio of paper indebtedness to bank indebtedness which occurred between 1965 and 1967, an increase much stronger than would have been expected on the basis of the 1955-65 trend, stands out dramatically in this table. Moreover, it should also be noted that the latest advance in this ratio was due not only to a comparatively sharp growth in total paper but also to an absolute decline in bank indebtedness. In contrast, during the preceding ten-year period, the change in the ratio was due to the relatively stronger expansion of commercial paper indebtedness.

Changes in level and structure of liabilities at nonfinancial corporations which occurred between 1952 and 1967 are presented in Table

**Table 2**  
LIABILITY POSITIONS OF NONFINANCIAL  
CORPORATIONS ON SELECTED DATES

	Total Liabilities	Com- mercial Paper	Bank Loans	Ratio		
				Com- mercial Paper To Total Liabilities	Com- mercial Paper Plus Bank Loans To Total Liabilities	Com- mercial Paper To Bank Loans
	(In billions of dollars)			(Per Cent)		
1952	113.2	.4	19.5	.3	17.6	2.1
1955	135.7	.3	21.4	.2	16.0	1.4
1965	256.3	.8	48.4	.3	19.2	1.7
1967	310.6	3.0	59.1	1.0	20.0	5.1

SOURCE: Flow of Funds Accounts 1945-1967, Board of Governors of the Federal Reserve System, February 1968.

2. It will be noticed that the ratio of commercial paper to total liabilities declined moderately between 1952 and 1955. This process of substitution was reversed after 1955, however, and commercial paper indebtedness increased at a somewhat faster rate than total indebtedness at these firms through the end of 1965. This growth in the volume of commercial paper indebtedness relative to total indebtedness between 1955 and 1965 was mainly due to a substitution of short-term indebtedness for long-term indebtedness, rather than the substitution of paper indebtedness for bank indebtedness. This contrasts with the substitution process observed at finance companies over this period.

Liability developments since 1965, on the other hand, have been similar to those recorded at finance companies. More specifically, commercial paper has increased in relative importance both as a source of total external finance and as a source of short-term funds vis-a-vis bank loans. However, in contrast to what occurred at finance companies, the rise in the ratio of commercial paper to bank loans did not reduce the relative importance of commercial bank loans in the total liability position of these firms. To the contrary, the ratio of commercial bank loans to total liabilities was at a record high for the 16-year period at the

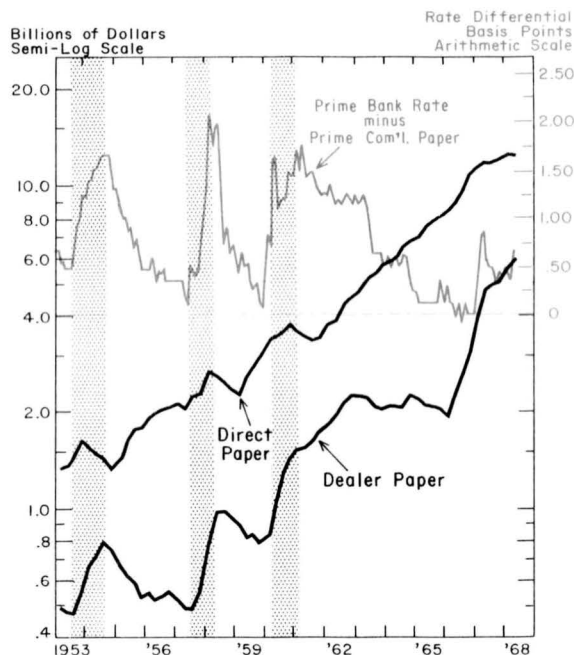
end of 1967 as a result of a strong expansion in these loans in 1965, 1966, and 1967.

The recent sharp increase in the ratio of commercial paper indebtedness to commercial bank indebtedness recorded at both groups of borrowers contrasts not only with past trends in this ratio but also with the fluctuation in these ratios during preceding periods of business expansion. This was particularly the case for nonfinancial corporations, as the ratio of commercial paper indebtedness to commercial bank indebtedness displayed a generally consistent pattern of decline during both the 1954-57 and 1958-60 periods of expansion in business activity. A drop in this ratio also was recorded from the beginning of the current business expansion to the end of 1965. These developments were due to a combination of a reduction in commercial paper indebtedness and an increase in commercial bank indebtedness.

Changes which occurred in this ratio at finance companies during the periods of business expansion of the 1950's were quite similar to those recorded at nonfinancial companies. This ratio declined during the 1954-57 period of expansion. During the 1958-60 period of expansion, the relative size of paper indebtedness and bank indebtedness remained unchanged, which must be interpreted as a cyclical decline if the upward trend in this ratio is considered. On the other hand, commercial paper indebtedness increased at a faster rate than bank indebtedness during the early years of the current expansion. The rate of advance in this ratio was much more modest than that recorded since 1965, however.

One factor which would ordinarily be expected to have a major influence on decisions to borrow in the commercial paper market as opposed to borrowing at banks is the relative cost of each form of indebtedness. A general indication of the relationship between the interest costs for each type of debt is provided by the top line in Chart 2, which shows changes

**Chart 2**  
**COMMERCIAL PAPER OUTSTANDING AND DIFFERENTIAL, BANK PRIME RATE AND PRIME COMMERCIAL PAPER RATE**  
**1st Quarter 1953 to 2nd Quarter 1968**



SOURCE: Federal Reserve Bank of New York; Board of Governors, Federal Reserve System.

which have occurred in the differential between the interest rate charged by banks on loans to their prime customers and the interest rate established in the dealer market on prime commercial paper notes with four to six months to maturity.

Two characteristics about the cost of commercial paper borrowing relative to bank borrowing stand out most dramatically in this chart. First, throughout most of the period since 1952, it was less expensive to borrow in the market than at commercial banks. Second, the relative cost of borrowing in the commercial paper market generally increased during periods of business expansion and declined during



periods of business recession. These secular and cyclical relationships between borrowing costs provide a major explanation for the secular and cyclical changes in the ratio of commercial paper indebtedness to commercial bank indebtedness over the period through 1965.

Since fluctuations in this ratio will also be reflected by changes in the volume of commercial paper debt if other conditions remain the same, the influence of the relative cost of paper indebtedness on changes in the volume of commercial paper would also be expected to be quite strong. This relationship is quite apparent in regard to the volume of dealer-issued paper, the data for which has been replotted on Chart 2. A fairly close direct relationship through 1965 between the cyclical patterns of change in dealer-issued paper and the cyclical patterns of change in the size of this differential can be noted. However, the same close relationship between relative cost and changes in directly issued paper quite obviously did not exist. As previously indicated, this should not be interpreted as indicating any lack of cost sensitivity by borrowers issuing direct paper, for the behavior of the ratio of commercial paper indebtedness to bank indebtedness at finance companies generally declined during periods in which the cost of commercial paper borrowing was relatively high, at least until the current period of expansion. Instead, the growth in directly placed paper during periods of tight money and the decline in periods of easy money occurred despite the effects of the change in relative cost. It may also be said that the variations in external financing requirements during these periods were so strong that they more than offset the influence of changes in relative cost on the volume of directly issued paper.

Although recognition of the influence of external financing needs reasonably explains why directly issued paper expanded sharply rather than declining in earlier periods in which the cost of commercial paper indebtedness was high

relative to bank indebtedness, it clearly does not do so for the growth in both directly issued and dealer placed paper which has occurred since 1965. As previously indicated, the advances in the volume of paper indebtedness were attributable in part to growth in total liabilities, particularly at nonfinancial companies. A shift toward greater reliance on short-term sources of funds also played a part. However, the main source of growth was the sharp substitution of commercial paper debt for bank debt which occurred at both groups of borrowers, a development which contrasts sharply with what occurred during earlier periods in which similar cost conditions prevailed.

This evidence provides strong support for the explanation that the growth in commercial paper since 1965 was stimulated primarily by the inability of commercial banks to meet the strong credit demands over the final three quarters of 1966 and, as a result, found it necessary to encourage many of their customers to seek funds elsewhere. Moreover, the effects of this process of rationing appear to have lasted long past the period in which banks were experiencing stringent conditions, for the strong expansion in paper continued on through 1967 and the first half of 1968, even though banks were generally well supplied with funds. This suggests that many borrowers decided to continue to rely on the commercial paper market even though conditions at commercial banks changed and banks became more willing and able to supply short-term funds. In addition, other borrowers apparently decided to begin issuing commercial paper to establish an alternate source of external funds.

#### IMPLICATIONS FOR THE FUTURE

Because of the relatively high ratio of commercial paper indebtedness to bank indebtedness and to total indebtedness at finance companies, and because of the sharp increase in this ratio since 1965, there is some reason to believe that finance companies will not con-

tinue to substitute commercial paper for bank loans at a pace similar to that of the past two and a half years. Moreover, some shift from short-term indebtedness to long-term indebtedness may occur if the relative cost of long-term indebtedness declines. These observations taken together suggest that the rate of growth in directly issued paper in the next few years will be determined primarily by the rate of growth in total indebtedness at finance companies rather than by the substitution of commercial paper for other forms of indebtedness. As a result, it appears likely that the rate of growth of directly issued commercial paper will at best conform to past growth trends and may in fact expand at below this trend.

The outlook for growth in commercial paper sold through dealers, on the other hand, appears to be much more favorable. The ratio of

commercial paper to total indebtedness at non-financial corporations remains quite low, even though it has increased since 1965. Thus, the possibility of substantial substitution of commercial paper for other forms of indebtedness appears quite strong, particularly in view of the strong growth which has occurred under what formerly would have been considered highly unfavorable conditions. The recent increase in the number of firms selling paper in this market, particularly the increase in the number of public utility firms, provides additional support for this judgment.

The implications of this latter projection are obvious. The commercial paper market already has cut substantially into the loan business of commercial banks with finance companies. The potential for similar inroads at nonfinancial corporations is clearly present.

# Machinery and Other Equipment— Agriculture's Largest Input

By Raymond J. Doll

FARMERS USE more machinery and other equipment inputs today than any other major resource. Compared with agricultural inputs in 1950, less than half as many labor, slightly fewer real estate, and moderately more farm equipment inputs are being used. Fertilizer and lime, feed and seed, and other chemical and biological inputs have more than doubled during the period but, because of their lesser importance in 1950, continue to lag behind farm equipment in relative importance.

The changing mix of resources used in farming can be attributed largely to changing relative prices and the impact of changing technology on the use of specific resources. The influence of changing prices on the mix of resources used is verified by the fact that, from 1950 to 1967, real estate prices increased 157 per cent, farm labor 95 per cent, farm machinery 66 per cent, and fertilizer 6 per cent. It can be illustrated that technology also had an impact by pointing out that efficient use of modern day techniques for soil preparation, application of chemicals, and harvesting methods frequently require sophisticated machinery and equipment.

The dynamic resource utilization that prevails in agriculture has a sharp impact on farm investment, production expenses, output of farm products, and all related areas. The two input groupings with the greatest impact on both farm investment and production expenses

are real estate and farm equipment. The investment in real estate is substantially larger than that in farm equipment, but current inputs as computed by the U. S. Department of Agriculture are larger for farm equipment. The increasing relative importance of farm equipment in agricultural investment and production expenses makes an evaluation of this resource appropriate.

## IN RETROSPECT

Rapid increases in technology and mechanization have been occurring in U.S. agriculture for approximately a century. The rate of increase has accelerated in recent decades, with the result that management, investment, and techniques used on today's modern farms are foreign to those used on farms as recently as a decade or two ago. Even though aggregate figures will be used as illustrations, changes on the more sophisticated commercial farms have occurred more rapidly than on all farms.

Numerous data on investment, numbers of specific kinds of equipment, and expenses are available showing past trends in the use of machinery and equipment. Many problems are involved in attempting to evaluate these data. For example, as agricultural technology develops, it becomes increasingly difficult to distinguish between equipment and real estate inputs. What part of an irrigation system is equipment and what part real estate? In large

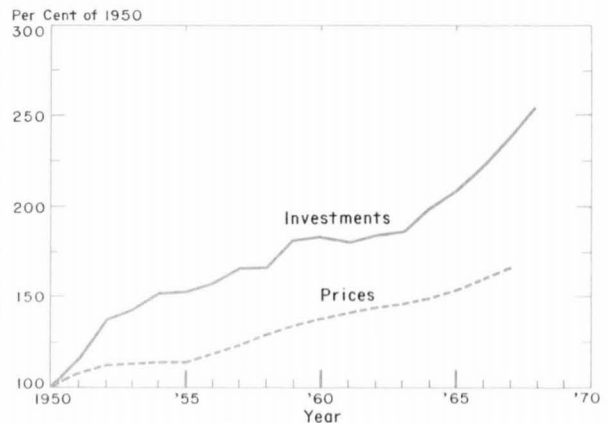
commercial feed lots, are feed-mixing mills equipment, real estate, or a combination of such inputs? Some inputs now classified as real estate probably are equipment. Arbitrary distinctions as to whether the input is equipment or real estate may not be significant, but, to the extent that misclassification results, the importance of real estate will be overstated and that of equipment understated. Despite these and other classification difficulties, a review of past trends should aid in effective planning for future developments. Consequently, a number of different, but related, series will be reviewed to provide information that should help evaluate the outlook for use of farm equipment.

#### Investment in Machinery and Motor Vehicles

The U. S. Department of Agriculture prepares a comparative *Balance Sheet of Agriculture* each year which provides dollar estimates for the major groups of assets used in agriculture. In 1968, the value of all farm real estate was listed as \$193.7 billion—up from \$75.3 billion in 1950. The value of farm machinery and motor vehicles in 1968 was estimated at \$31 billion—up from \$12.2 billion in 1950. The dollar values of both categories increased at rather consistent rates and were more than 2 1/2 times as large in 1968 as in 1950. Growth in dollar investment in machinery and motor vehicles kept pace with that for real estate, despite the fact that real estate prices increased almost 2 1/2 times more rapidly than machinery prices during this period.

Chart 1 indicates the trends in dollar investment and prices for farm machinery and motor vehicles. Both investment and prices increased during the period, with prices increasing consistently, and investment rapidly from 1950 to 1952, more slowly from 1953 to 1963, and accelerating again from 1964 to 1968. Investment increased about twice as rapidly as prices for the whole period.

**Chart 1**  
FARM MACHINERY AND MOTOR VEHICLE  
INVESTMENT AND PRICES



SOURCE: U. S. Department of Agriculture.

It also should be noted that trends in prices are extremely difficult to measure. The chart shows machinery prices as having increased 66 per cent during the period. However, since machinery has changed quite rapidly, prices of unlike machines are being compared. The investment figure, however, does reflect the trend in current dollar value of machinery and motor vehicle investment.

From an individual farm manager's viewpoint, this trend in investment is particularly significant since the number of farms since 1950 has declined approximately a half, with all of the decline being accounted for by fewer small size farms. In recent years, only Economic Class I and II farms (those producing over \$40,000 and from \$20,000-\$39,999 worth of farm products annually) have increased in number. Today, about one seventh of all farms are Class I and II farms, and this seventh of all farmers produces approximately two thirds of all farm products. About half as many farmers today have more than 2 1/2 times as much invested in machinery

and equipment as compared with 1950, and one seventh of them account for more than half of the equipment investment and inputs used in agriculture. It is common for the average Class I or II farm to have an investment in machinery and other equipment alone of more than \$50,000.

### Number of Major Equipment Items on Farms

*The Balance Sheet of Agriculture*, 1968, provides data on the major equipment items found on farms. These data verify the increasing investment in farm equipment in recent years. Several interesting facts are revealed by close perusal of Table 1. Despite a decline of about 50 per cent in the number of farms from 1950 to 1968, the number of major items of farm equipment increased. Although the table does not reflect size and quality changes, almost without exception the machines on farms in 1968, on an average, were larger, higher-powered, and otherwise more sophisticated than those on farms in 1950. Thus, dollar investment in these machines increased much more rapidly than numbers reveal. Available data indicate that the average value per unit for a tractor shipped for domestic use increased by more than three times and that of a combine by more than four times from 1950 to 1966.

**Table 1**

#### MAJOR ITEMS OF EQUIPMENT ON FARMS United States

Year	Tractors (other than garden)	Grain Com- bines	Corn Pickers and Picker- Shellers	Pickup Balers	Motor- trucks
	(In Thousands)				
1950	3,394	714	456	196	2,207
1955	4,345	980	688	448	2,675
1960	4,685	1,042	792	680	2,825
1965	4,783	910	690	751	3,023
1967	4,815	880	655	775	3,100
1968	4,820	870	640	790	3,125

SOURCE: *The Balance Sheet of Agriculture*, 1968.

Finally, it can be noted that the number of grain combines and corn pickers and picker-shellers have been declining in recent years, which probably can be attributed to changing grain harvesting technology. To an increasing extent, grain farmers have been using custom operators for harvesting the major grain crops. Rather than have an investment of thousands of dollars in a grain combine, used only a few days a year, producers hire the custom operators who follow the small-grain harvest from south to north during the summer, and then use the combines for harvesting the fall crops. Since grain combines now are adaptable for use in harvesting small grains, grain sorghum, soybeans, and as picker-shellers for corn, custom operators can use these expensive machines much of the year. Substantially fewer machines are needed, and investment in harvesting equipment is minimized. Better machines, with more comfort devices for the operators, can be justified and overall costs of harvesting reduced. Data from the U. S. Census of Agriculture indicate that large farms increasingly are using custom services. Expenditures for custom and contract work on farms producing more than \$10,000 worth of farm products increased from \$225 million in 1950 to \$628 million in 1964, while on farms with less than \$10,000 worth of products such expenditures declined from \$386 million to \$241 million during the same period. The decline occurred despite the fact that the small farms accounted for two thirds of all farms in 1964.

The use of certain other items of farm equipment is increasing rapidly but comparable data are not available. These items include specialized harvesting machinery for cotton and many of the fruit and vegetable crops, irrigation machinery and equipment, electrical power equipment, fertilizer and chemical applicators, computers, feed-mixing installations such as flaking mills, and others. All such items of machinery and equipment are in-

cluded in the rapidly increasing investment in this component of farm assets.

### Machinery Costs

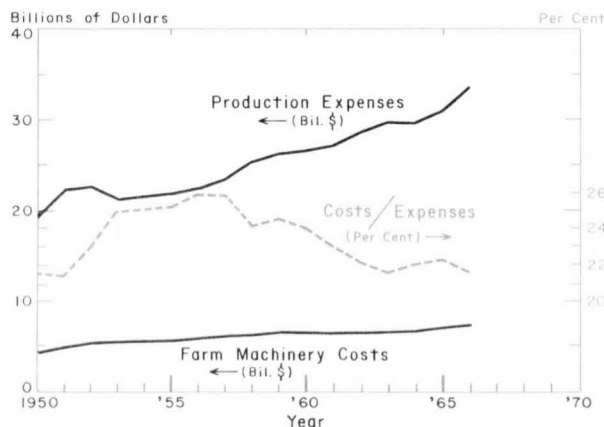
Farm machinery and equipment costs account for almost one fourth of total farm production expenses. They have been increasing sharply in absolute terms as machinery inputs have been substituted for other inputs and as machinery operation costs have increased along with most other costs. Consequently, today's commercial farm manager evaluates his machinery inputs carefully and uses them as efficiently as he can. His interest has not been to reduce machinery inputs absolutely but to use them to produce farm products most efficiently. Chart 2 indicates that both farm machinery costs and total production expenses have been increasing and that machinery costs as a per cent of production expenses increased about 4 percentage points from 1950 to 1956 and declined by about that same amount from 1956 to 1966; thus, being in the same relative position at the end of the period as at the beginning.

Machine hire and custom work also have increased substantially in absolute terms in recent years. Expenditures for machine hire, and custom and contract work, as noted, increased from about \$611 million in 1950 to \$869 million in 1964, with all of the increase occurring on large farms. All of the data—dollar investment in machinery and motor vehicles, numbers of major equipment items on farms, or machinery costs—verify substantial increases in the mechanization of U. S. agriculture. If data were available on items of equipment other than machinery and motor vehicles, much of which is included in real estate investment and cost, available evidence points to increased inputs of these items also.

### A PROJECTION

Projecting trends is hazardous; yet, farmers, financial institutions, and farm equipment

**Chart 2**  
**FARM PRODUCTION EXPENSES, FARM MACHINERY COSTS, AND MACHINERY COSTS AS A PER CENT OF PRODUCTION EXPENSES**  
**1950-66, United States**



SOURCE: U. S. Department of Agriculture.

manufacturers and sales organizations must plan if they are to remain viable. Trends in farm management techniques and technology for the immediate future can be determined rather accurately on the basis of research findings which show potential in practical applications. It has been estimated that farmers who are innovators frequently use new techniques 5 to 10 years before their common acceptance. Furthermore, many of the discoveries made through research have not been perfected, but are well enough determined to provide a fairly accurate evaluation of the types of equipment that are likely to evolve. Trends in farm management techniques also are well enough known to provide good information on their likely impact on future farm equipment investment and costs. Such factors as the basic characteristics of the agricultural industry, changing relative prices of inputs, and the increasing complexity of managerial decisionmaking in agriculture are likely to influence future equipment use in a predictable fashion.

The farming industry continues to be composed of many relatively small firms. These firms, because of spatial requirements, frequently are widely scattered, tend to use labor in an isolated manner, and tend to be isolated from most other sectors of the economy. Since the resource inputs usually need to be distributed over a large area, management and control of input applications frequently require special equipment.

Complicating the problem of input applications is the fact that resources can be substituted widely in producing agricultural products. For example, electricity can be substituted as a source of power for gas, other petroleum products, animal power, or direct manpower. The decision as to which will be used depends upon factors such as how much, how often, and where the power is needed, and the relative cost. The amount and type of equipment needed may vary widely depending on the source of power to be used.

With many complex decisions facing him, the farm manager of the future will rely increasingly on such devices as computers and electronic control centers, both for making decisions and for applying the highly specialized resources needed most effectively. More sophisticated equipment also will be used for harvesting, sorting and grading, maintaining a high-quality product until it is marketed, and for marketing itself.

The large investment required for much of this equipment, the complexity of operating it, technical obsolescence, and other considerations will encourage use of such techniques as leasing and custom operating. Such developments have led scientists from universities and industry to conclude that the successful farmer of the future will be a highly trained individual with outstanding skills, who will be able to effectively coordinate the activities of the economist, agronomist, chemist, and engineer, and have the equipment that will enable him to do his job most efficiently.

The equipment needs for this kind of agriculture will be huge. Based on projections made by Heady and Mayer of Iowa State University and Brake of Michigan State University and simple, straight-line projection of the trend that has prevailed from 1950 to date, an estimated investment in farm machinery and motor vehicles of around \$60 billion by the year 2000—only 32 years hence—seems reasonable to assume. To the extent that leasing and custom hiring are substituted for individual machinery and equipment ownership, the growth in dollar investment may be retarded somewhat, but leasing and custom hiring expenses would increase. Although this estimate may miss substantially, it appears most reasonable to assume that machinery and other equipment investment and costs will continue to increase sharply. Furthermore, the number of farms is likely to continue to decline for some time, so investment and cost per farm will increase at a substantially more rapid rate than the aggregate figures.

If this evaluation is correct, farmers will be confronted with sharply increasing capital requirements for financing equipment investment and costs. They also will be faced with the necessity of constantly evaluating their equipment investment and cost data to be certain that they are using these inputs most effectively. Equipment manufacturers, sales firms, and servicing firms will be under pressure to provide equipment and service that will enable the farmer to utilize equipment inputs for producing and marketing his products most efficiently. Finally, financial institutions will need personnel who understand the importance of equipment inputs, understand why they are being used, and are willing to finance them for those farmers who are using equipment efficiently in their operations.

#### FINANCING FARM EQUIPMENT

In the past, farmers have financed a large proportion of their equipment investment and

costs with equity capital. If commercial farm managers use a larger proportion of credit for financing in the future and capital requirements for equipment increase, as anticipated, the amount of credit extended for financing equipment investment and inputs is likely to increase sharply. Someone will provide this credit and, if properly extended, it will be a profitable investment. With the increasing importance of such credit, it will be essential that the credit be tailored to requirements. Maturities and methods of repayment on notes used for financing equipment investment will vary widely depending on such factors as type of equipment being financed, rapidity with which the item becomes obsolete or wears out, how the item is used, and the individual whose operation is being financed. Most credit for leasing or custom work probably will be extended with single repayment notes written to mature at the time the farm operator markets his product. However, the kinds of credit used and methods of extension will vary widely for financing both equipment investment items and operating costs.

As of mid-1966, commercial banks held 551,763 farm machinery and equipment loans with an outstanding volume of \$1,713 million. Since considerable borrower and bank data were available on an individual loan basis, an intensive analysis of such loans was possible.

By use of multiple linear regression analysis, farm machinery and equipment loans were adjusted for gross dollar value of sales, net worth, loan size, method of repayment, maturity, size of bank making loan, loan-deposit ratio of bank, and location by Federal Reserve district to determine the net impact of each of these variables on interest rates charged. These factors accounted for 68 per cent of interest rate variability. The average rate charged in the Nation was 7.45 per cent. By far the most important factor explaining rate variability was method of repayment. Eleven per cent of all machinery and equip-

ment notes were instalment loans with add-on, and these loans bore an average interest rate of 10.9 per cent. An additional 5 per cent of all such loans were discounted instalment loans, and bore an average interest rate of 11.6 per cent. Instalment notes frequently were purchased by banks and, to the extent that this happened, banks were not originally responsible for establishing the rate on these notes. Fifty-seven per cent of the loans were single-payment, and the remaining 27 per cent charged interest on outstanding balance. Rates charged on these repayment methods were 6.7 and 6.8 per cent, respectively.

Next in importance in explaining interest rate variability was region, as determined by Federal Reserve district. Rates on such loans, adjusted for all the factors mentioned previously, varied from a high of 8.1 per cent in the Dallas District to a low of 6.7 per cent in the Richmond District. Rates tended to be relatively high in the Boston, Minneapolis, Kansas City, Dallas, and San Francisco Districts, and low in the other districts. Gross dollar value of sales, net worth, loan size, maturity, and bank size and loan-deposit ratio were relatively unimportant in explaining rate variability when the loans were adjusted to hold the impact of the other variables constant.

Although the amount of farm credit used has increased sharply since 1950, the debt-to-asset ratio of 1-to-6 in agriculture remains low relative to most other industries. With the trends discussed previously, it is likely that a relatively larger proportion of farm assets and production expenses will be financed by credit in the future. To the extent that this trend continues and the dollar volume of equipment assets and costs increases, as projected, the amount of credit used for financing these items is likely to increase sharply. Farm equipment loans, properly made, are likely to be an important investment for financial institutions in the future.