

**SELECTED U.S. FARM MACHINERY RELATED TRENDS
AND THEIR IMPLICATIONS FOR THE U.S. FARM MACHINERY INDUSTRY**

by

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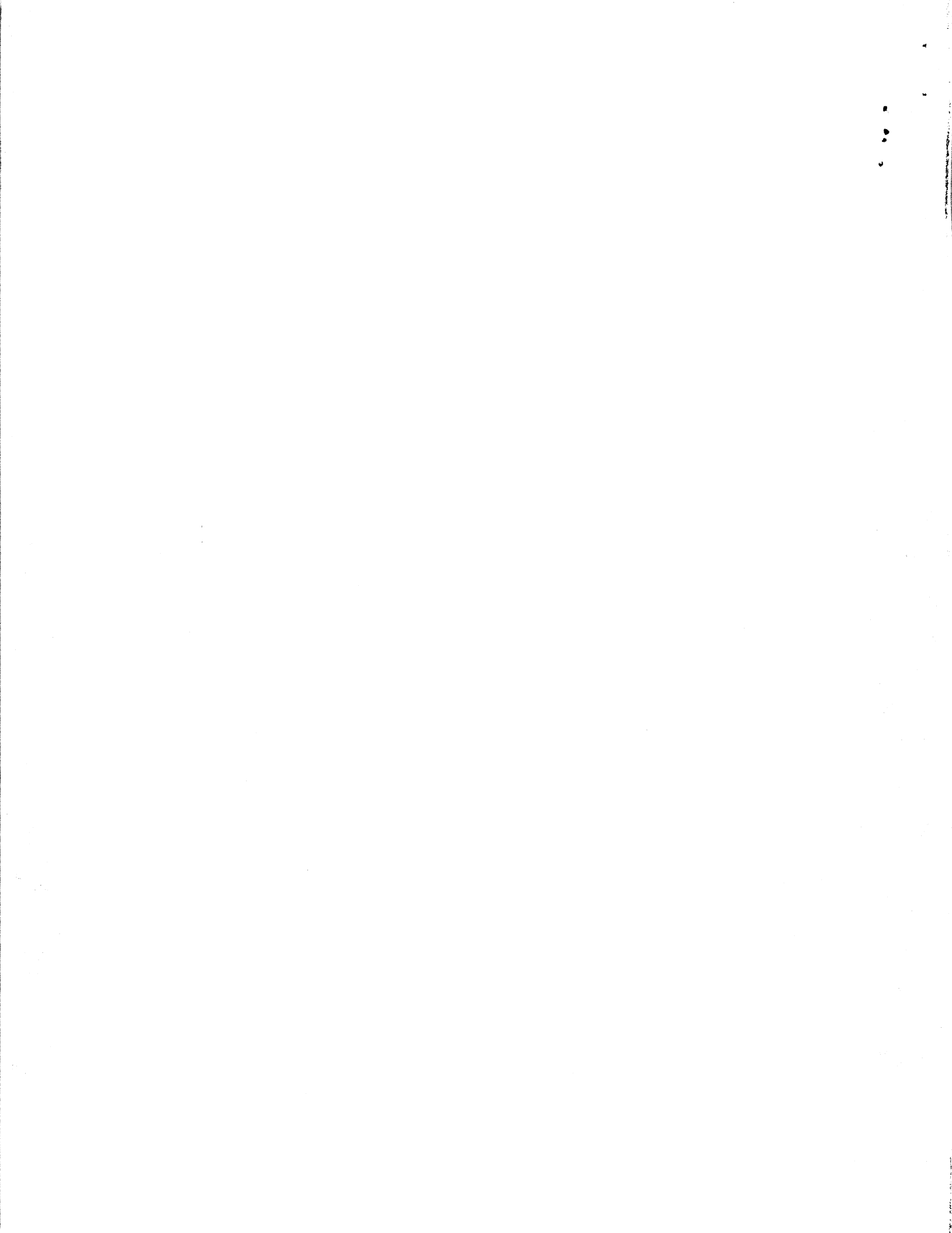
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Selected U.S. Farm Machinery Related Trends and Their Implications for the U.S. Farm Machinery Industry

Early in 1988, the U.S. farm machinery industry was experiencing a recovery from its severe depression of the early and mid-1980s (Holusha, May 4, 1988; U.S. Department of Agriculture (USDA), January 1988). However, the U.S. drought of 1988 appears to have cut short the recovery (Holusha, July 6, 1988). This turn of events illustrates that, even though farm machinery exports are important to the U.S. farm machinery industry, the domestic market is critical to the industry's near-term future. Numerically, the value of U.S. farm machinery exports equalled only 34 percent of farm machinery expenditures by U.S. farmers in 1986 after adjusting for the value of farm machinery imports (USDA, p. 35 and 37, January 1988).

Given the severity of the farm machinery depression of the 1980s, examination of historical trends in the use of and expenditures on farm machinery by U.S. farmers may be more useful in obtaining a perspective on the future of U.S. farm machinery market and the U.S. industry than examining the recent past of the 1980s. This article will examine these historical trends and compare them with the experiences of the 1980s. In addition, trends in farm machinery prices relative to prices for selected other farm inputs and relative to net cash farm income are explored. Implications for the domestic farm machinery market and industry are drawn.

Input Use

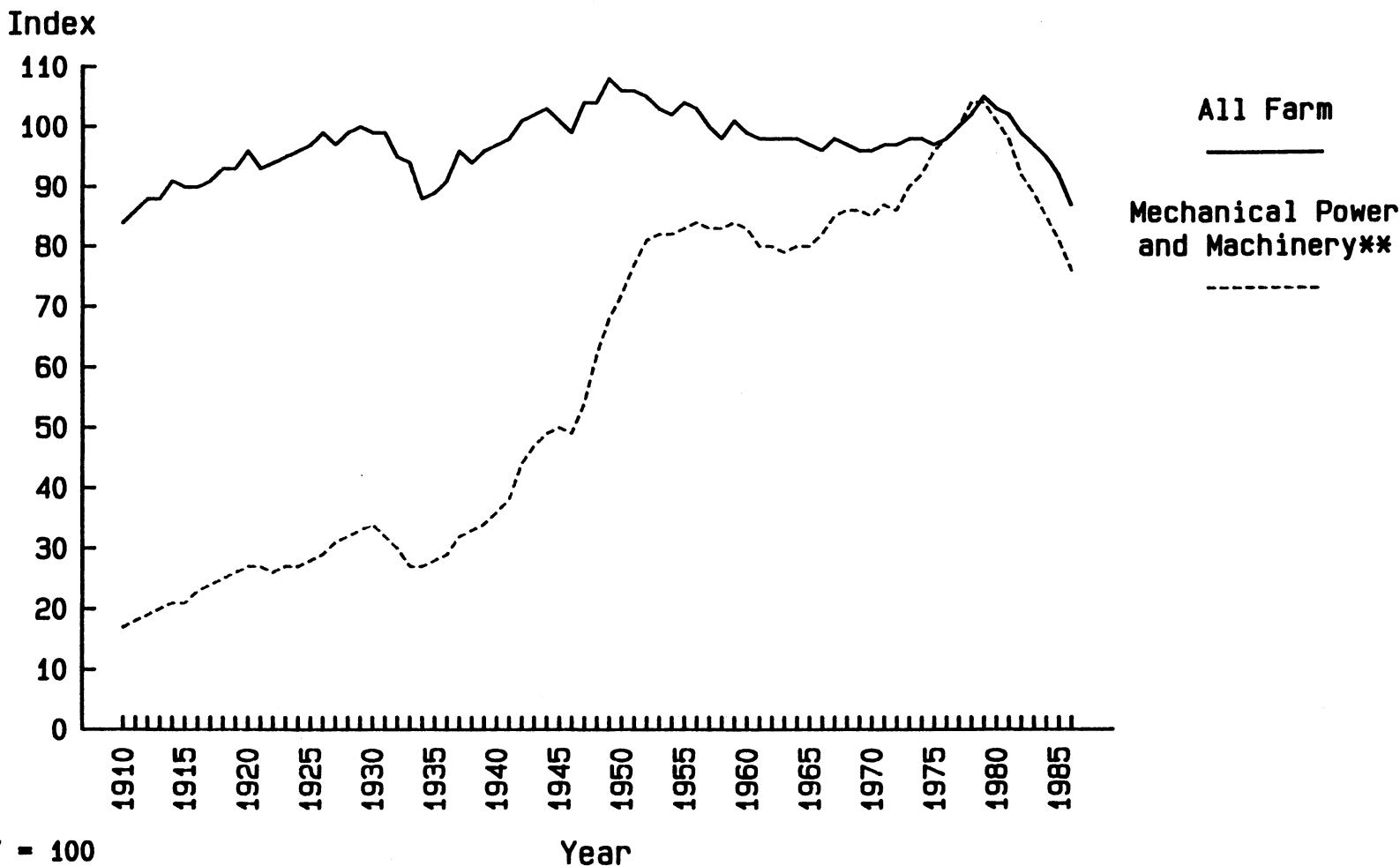
The annual use of all farm inputs has essentially exhibited no trend since 1910 (Figure 1). In contrast, annual use of farm machinery inputs doubled between 1910 and 1940, then doubled again by 1950. However, beginning in 1952, use of farm machinery inputs changed little until 1972. Use began to increase again as the farm economy prospered, reaching a peak in 1978-1979. Since then, annual farm machinery input use has declined 30 percent, reflecting the farm financial crisis and an increase in acreage set aside in government programs from essentially zero in 1980 to 45 million acres in 1986 (USDA, November 1981, p. 5-8; USDA, September 1987, pp. 11).

During 1985 and 1986, farm machinery input use was below the 1952-72 level. Thus, the increases of the mid-1970s have more than been reversed. While acreage in production and, therefore, machinery use will increase as federal farm program land set-asides are reduced, the 1970s appear to have been an aberration in the post-1950 trend of little change in farm machinery use. This lack of a trend in machinery use is indicative of a replacement, not growth, market.

Expenditures

After bottoming at \$59 million in 1933, the nominal value of annual purchases of all farm machinery by farm operators increased until 1979 (Figure 2). Since reaching this peak of

FIGURE 1. INDEXES OF ALL FARM INPUTS AND MECHANICAL POWER AND MACHINERY INPUTS*, U.S., 1910-1986.



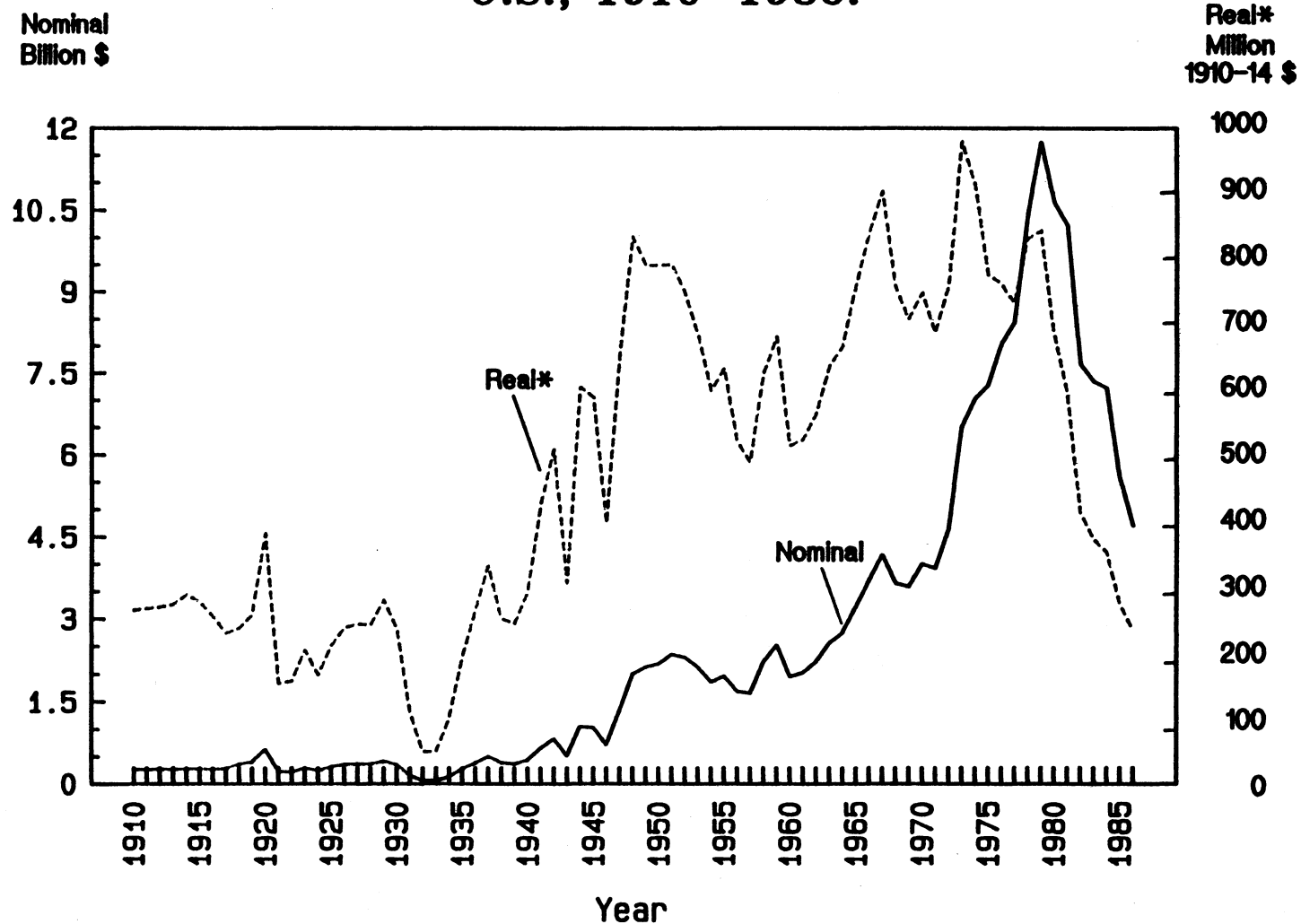
* 1977 = 100

** Includes fuel

SOURCE:

Economic Indicators of the Farm Sector: Production and Efficiency Statistics, 1981 and 1986.

**FIGURE 2. EXPENDITURES FOR ALL FARM MACHINERY,
U.S., 1910-1986.**



* Nominal expenditures deflated by prices paid for all farm machinery.

SOURCES:

Agricultural Prices: Annual Summary 1980 and 1986

Economic Indicators of the Farm Sector: National Financial Summary 1986

Hanthorn and Sisco

Lucier, Chesley, and Ahearn

\$11.7 billion, nominal value of purchases has dropped 60 percent. Part of this decline can be attributed to a general decline in farm expenditures of 10 percent between 1979 and 1986 (USDA, December 1987). More important, the share of all farm expenditures devoted to purchasing farm machinery declined from 9.4 percent in 1979 to 4.2 percent in 1986 (Figure 3).¹ In fact, the 1985 and 1986 farm machinery expenditure shares of 4.5 and 4.2 percent, respectively, were the lowest back-to-back years since the 1.6 and 3.2 percent share for 1933 and 1934. These shares contrast with average farm machinery expenditure shares of 7.2 percent from 1910 through 1986 and of 9.4 percent from 1970 through 1979. The share of expenditure ratios for 1933-34 and 1985-86 illustrate the ability of farmers to postpone machinery purchases relative to other input expenditures during periods of poor income. This ability contributes to the annual variability in sales.

When purchases are deflated by the prices paid by farmers for all farm machinery², three, instead of two, distinct periods emerge after 1933: a period of rapid growth from 1933 to 1948, a period of no growth with widely fluctuating annual purchases from 1948 to 1979, and a period of declining purchases since 1979. These periods correspond with those discussed in the input use section, except that the mid-to-late 1970s appear to be a

FIGURE 3. PROPORTION OF TOTAL FARM CASH EXPENDITURES SPENT ON PURCHASING MACHINERY, U.S., 1910-1986*



* Calculated as (machinery capital purchases/ cash production expenses plus total capital purchases) .

SOURCES:

Economic Indicators of the Farm Sector: National Financial Summary, 1986
Lucier, Chesley, and Ahearn

continuation of the replacement market rather than a period of increase.

Over the second period of 1948 to 1979, real expenditures averaged \$720 million. However, they ranged from a low of \$511 million in 1960 to a high of \$980 million in 1973, with a standard deviation of \$120 million. The 67 percent statistical confidence level for annual purchases over this period ranged from \$597 to \$837 million. The high annual variation suggests the need to carry large inventories to meet surges in demand. Consequently, the current desire among farm machinery manufacturers to make farmers order ahead instead of making purchases on the spot from existing inventory (Holusha, May 4, 1988) could face serious obstacles and lead to fewer sales unless the manufacturers work closely with farmers to reduce the annual variation in farm machinery purchases.

Input Price Ratios

Changes in the ratio of input prices can provide an insight into future changes in input use (Binswanger). Changes in relative prices will encourage input users to substitute the less expensive for the more expensive input, assuming the relative price changes are not due to relative changes in input quality.

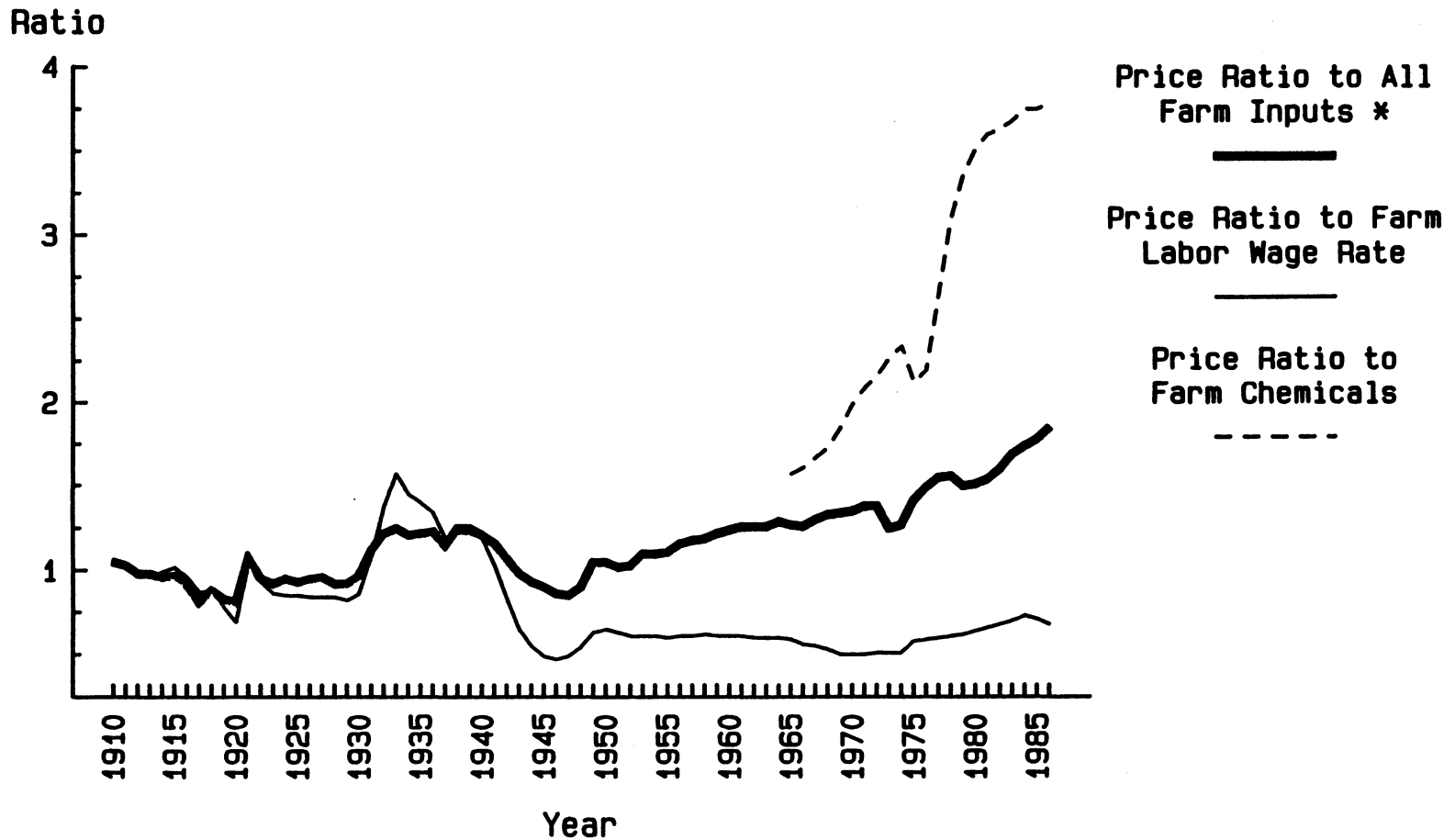
During the period 1910 to 1950, the ratio of farm machinery prices to all farm inputs fluctuated around one, indicating that

machinery prices changed at about the same rate as the prices for all farm inputs (Figure 4). However, since 1950 the ratio has steadily increased, including a 22 percent increase during the 1980s despite the sharp downturn in machinery sales. While this input price ratio has not been adjusted for changes in input quality, the trend suggests that economic forces may cause farmers to substitute other inputs for farm machinery.

The increasing relative price of farm machinery was especially noticeable for farm chemicals (Figure 4). From 1965 through 1969, the ratio of farm machinery to farm chemical prices was 1.7. From 1983 through 1987, the ratio equalled 3.8, an increase of 122 percent. This trend may partially explain the growing interest in the more chemically dependent low/minimum/no tillage systems. They are viewed as a way to reduce the use of increasingly expensive farm machinery.

The price ratio of machinery relative to farm labor wages was higher during the 1980s than at any time since World War II (Figure 4). From 1943 through 1979, this ratio averaged .57; but from 1980 through 1986, the ratio averaged 0.69. It is not possible to tell if the increase is large enough to slow the historical substitution of machinery for labor, but the trend is in that direction.

**FIGURE 4: RATIO OF ALL FARM MACHINERY PRICES
TO SELECTED OTHER FARM INPUT PRICES,
U.S., 1910-1986.**



* Prices for all farm inputs includes prices paid for production items, interest, taxes, and wage rate.

SOURCES:

Agricultural Prices: Annual Summary, 1980

Agricultural Prices: 1986 Summary

Hanthorn and Sisco

Farm Machinery Purchasing Power

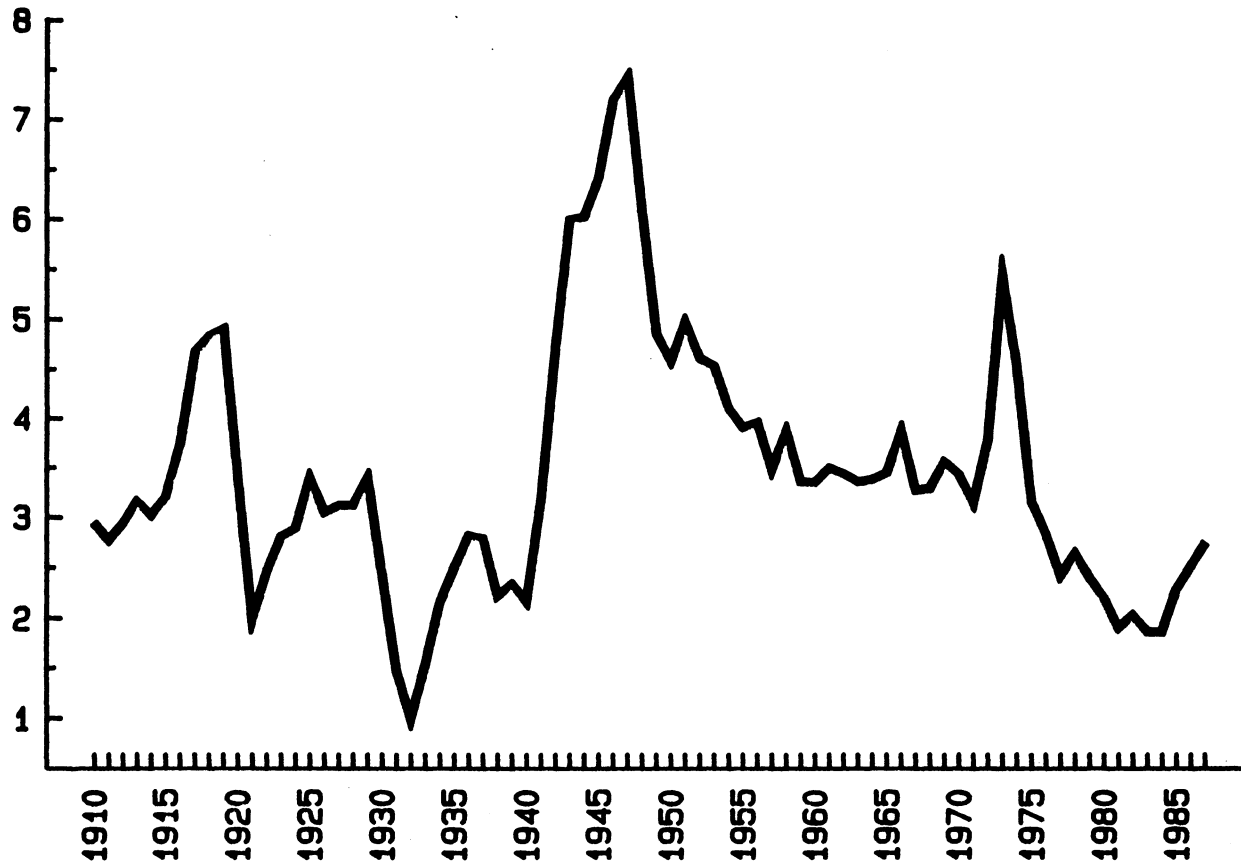
A major contributor to the upturn in farm machinery sales in 1988 was the surge in U.S. farm income that began in 1984. Net cash farm income increased from \$39 billion in 1984 to \$57 billion in 1987 (USDA, Agricultural Outlook, June 1988). The importance of this increase for the farm machinery industry can be ascertained by dividing net cash farm income by the index of prices paid by farmers for farm machinery on a 1910 - 1914 basis and multiplying by 100. This ratio is a measure of the farm machinery purchasing power of net cash farm income.

The purchasing power ratio has exhibited significant variation over time, reaching its highest level during and just after World War II (Figure 5). As discussed previously, this was a period of rapid mechanization. Further examination suggests that when this ratio drops below 2.4, there is a high probability (over 75 percent historically) that farm machinery sales will decline. An income-price ratio of less than 2.4 has occurred for two extended periods: 1931 to 1934 and 1980 to 1985. Both times, real farm machinery purchases by U.S. farmers declined more than 50 percent.

Beginning in 1986, this ratio exceeded 2.4 for the first time during the 1980s. It increased even more in 1987 to 2.7. Thus, increased farm machinery purchases during early 1988 were not unexpected. The increase in this ratio can be attributed

FIGURE 5. PURCHASING POWER INDEX FOR FARM MACHINERY, U.S., 1910-1987.

Purchasing Power Index *



* Net Cash Farm Income Divided by the Index of All Farm Machinery Prices, 1910-14=100, times 100

SOURCES:

Agricultural Outlook, June 1988

Agricultural Prices: 1986 Summary

Economic Indicators of the Farm Sector: National Financial Summary, 1986

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almost totally to improved net cash farm income because the prices paid by U.S. farmers for farm machinery changed little between 1984 and 1987 (USDA, June 1987, and USDA, Agricultural Outlook, June 1988). Reasons for the increase in net cash farm income included lower farm production expenses, increased government program expenditures, and substantial livestock sector profits. Because additional acreage will be pulled back into production as grain stocks decline, meaning added expenditures for variable inputs; because federal farm income support levels are likely to decline; and because, depending on its severity, the drought of 1988 may have a lingering effect on the farm sector, caution is urged relative to expectations of farm machinery purchases over the next few years. For example, a decline to \$50 billion in net cash farm income for 1988 would push the farm machinery purchasing power index below the historically important value of 2.4.

Summary and Conclusions

The drought of 1988 has illustrated the importance of the domestic U.S. farm machinery market to the U.S. farm machinery industry. Furthermore, historical trends since 1950 suggest the U.S. domestic farm machinery market is a replacement market, not a growth market. Thus, despite the euphoria of the 1970s, a consolidation of the U.S. machinery industry, as happened in the

1980s, was almost a given (see McKee for a discussion of the consolidation).

Despite the consolidation, the cost of machinery production and distribution is likely to remain a major problem. Prices paid by farmers for machinery need to be reduced, both to increase the farm machinery purchasing power of farm income and to discourage the substitution of other inputs for farm machinery. If this price problem is not challenged, the farm machinery industry could become a declining, rather than replacement, industry.

Footnotes

1. All farm expenditures were measured as cash expenses, including farm household expenditures, plus all capital expenditures.

2. The all farm machinery prices index was estimated for 1986 and 1987 from the price index reported for tractors and self-propelled machinery and for other farm machinery. To derive the weighted aggregate index, it was assumed, for lack of better information, that the share of farm machinery expenditures accounted for by both categories was the same in 1986 and 1987 as in 1985.

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