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Seasonal Behavior of Some U.S. Farm Prices

Loraine West*

IN THIS ISSUE

Many factors affect prices that farmers receive over the years. Some product prices respond to calendar seasons while others fluctuate in cycles. These patterns are plotted by the author for five categories of commodities: feed grains and hay, meat animals, dairy products, poultry and eggs, and potatoes.

Introduction

The series of prices farmers receive result from trends, cycles, plus seasonal and irregular components. The trend is the long term behavior of the price series and may reflect general inflation, increases in the population, increases in per capita income, and advances in technology.

Cycles are essentially price patterns that regularly repeat for periods of more than a year. In livestock products, a cycle is closely related to the time required to change supply, which is determined by biological processes. Not all agricultural price series have cycles. Crops, such as corn and wheat, planted and harvested annually, do not exhibit price series cycles.

The irregular component of a price series captures the short term price variation resulting from temporary changes in supply and demand and irregular price fluctuations caused by unanticipated events such as drought, strikes, and war.

The seasonal component is the regular yearly movement of the price series. It is the pattern of prices throughout the year caused by annual changes in the climate, the biological processes, and social traditions. The seasonal pattern repeats itself year after year. Not all agricultural price series have a seasonal component. The price series for cotton and feed, for example, show no significant seasonality.

Most seasonal variation in farm product prices is a result of the concentration of production, marketing, or both, at particular times of the year. Social traditions, such as holidays, cause seasonality in the demand for some agriculture products. For example, the demand for turkeys increases around the November and December holidays.

Seasonality in livestock and livestock product prices may arise from the seasonal climatic conditions, the seasonality of feed supplies, and the biological nature of the production process. Seasonality in crop prices arises from the biological growth process and the climate, resulting in annual harvests.

Seasonal price patterns differ for each commodity. For decades, farmers have been concerned with how to adjust marketings to take advantage of higher prices. This adjustment requires storage from harvest to a later date for nonperishable crops and requires changes in production plans for perishable products, such as livestock and livestock products. A knowledge of a prices series and its seasonal component are helpful in making this adjustment decision. Awareness of the seasonal tendency, even if it does not occur exactly the same way each year, is useful.

Just as important as the seasonal pattern is knowing how that pattern is changing over time. In 1980, the author measured the seasonality and changes in seasonality of the official USDA series of monthly index prices U.S. farmers received for several agriculture commodities. The November 1974 *Minnesota Agricultural Economist* presented seasonal behavior of some Minnesota farm prices and this issue lists aggregated U.S. price patterns.

Statistically, seasonality is isolated by the removal of trends, cycles, if present, and the irregular component from a time series. The basic seasonal

Loraine West

*Loraine West is a graduate research assistant in the Department of Agricultural and Applied Economics, University of Minnesota. Helpful comments from University colleagues James Houck and Margaret Dalton are gratefully acknowledged.

Table 1. Average seasonal indexes for 1965-78

Category	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Feed grains and hay	100.9	101.0	100.1	99.5	101.5	102.2	101.1	101.3	100.1	97.2	95.6	99.5
Meat animals	97.6	101.1	100.7	101.0	103.3	102.9	104.0	104.0	100.3	97.3	93.2	94.5
Dairy products	103.3	101.7	99.9	97.6	95.3	93.4	95.0	97.8	102.1	104.4	105.4	104.3
Poultry and eggs	103.7	103.2	102.2	97.1	93.9	94.7	99.5	101.6	103.5	97.5	99.9	103.2
Potatoes	94.8	97.6	100.2	104.8	112.3	116.5	123.2	104.0	85.8	83.2	87.1	90.4

pattern of the monthly index prices (1967 = 100) received by farmers for 1965-1978 was calculated using MON-PRI, a seasonal analysis computer program.

To see if the seasonal pattern was changing for individual months or changing overall, a longer span was examined (1960-1978) using X-11, a more sophisticated seasonal analysis program developed by the Census Bureau and widely used in Commerce Department reports.

The five monthly index of prices received commodity categories are presented here and include feed grains and hay, meat animals, dairy products, poultry and eggs, and potatoes. Table 1 contains the average seasonal indexes of these five categories for 1965-1978.

Feed Grains and Hay

Figure 1 plots the monthly seasonal pattern for feed grains and hay prices. The solid center line is the average of the seasonal indexes for each month of the year and represents the typical seasonal price pattern for feed grains and hay. The vertical distance between this line and the index base of 100 represents the percentage that monthly prices typically vary from the average annual price, regardless of the actual price level. For feed grains and hay, the seasonal pattern does not fluctuate greatly. The seasonal high is only 102.2 in June and the seasonal low is 95.6 in November. Also plotted above and below the seasonal indexes is the "zone of irregularity." This is one standard deviation above and below the average seasonal indexes and about two-thirds of all the monthly observations fall within this shaded area. This is also called the variability range. A tighter, narrower band means greater conformity to the pattern and a stronger seasonal pattern. The "zone of irregularity" for feed grains and hay is quite wide and the seasonal price fluctuation is narrow, therefore, the seasonal pattern is weak. Since the seasonal pattern is so weak, it was not examined further for changing seasonality.

Figure 1. Seasonal behavior of feed grains and hay

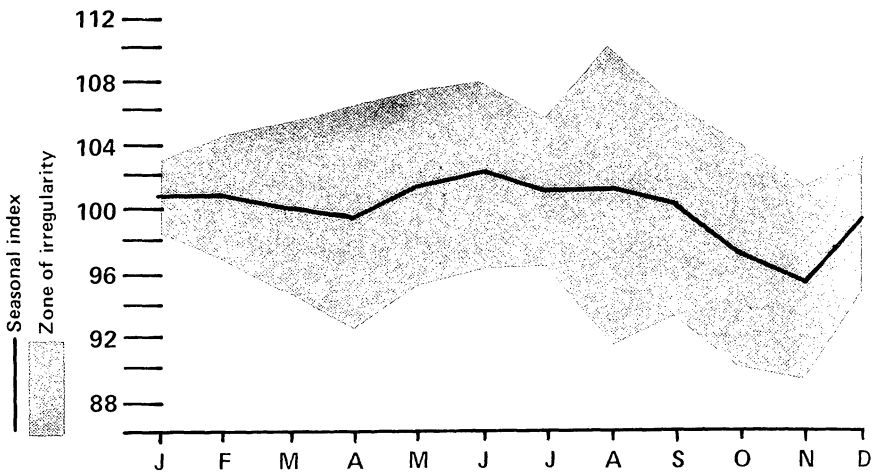
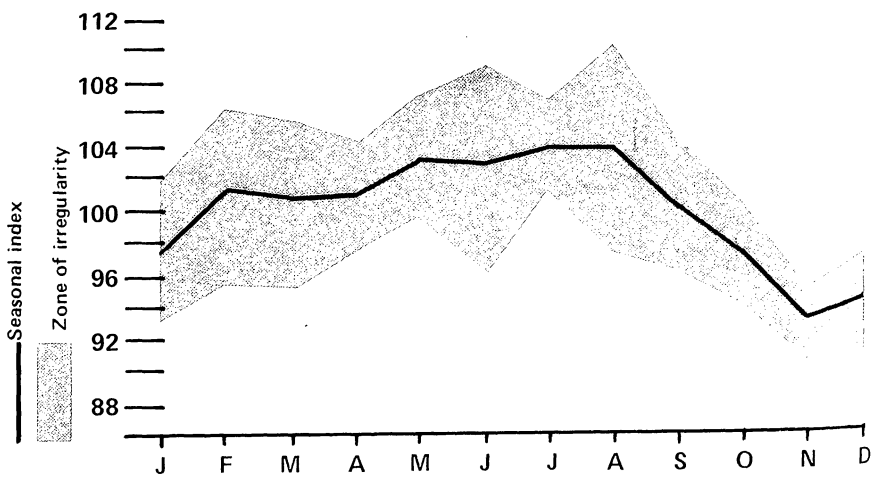


Figure 2. Seasonal behavior of meat animals



Meat Animals

Figure 2 plots the seasonal pattern of U.S. monthly index prices received for meat animals. The prices received reach a peak of 104.0 in June and August and are at a seasonal low 93.2 in November. This significant fluctuation

Figure 3. Meat animals: changing seasonality

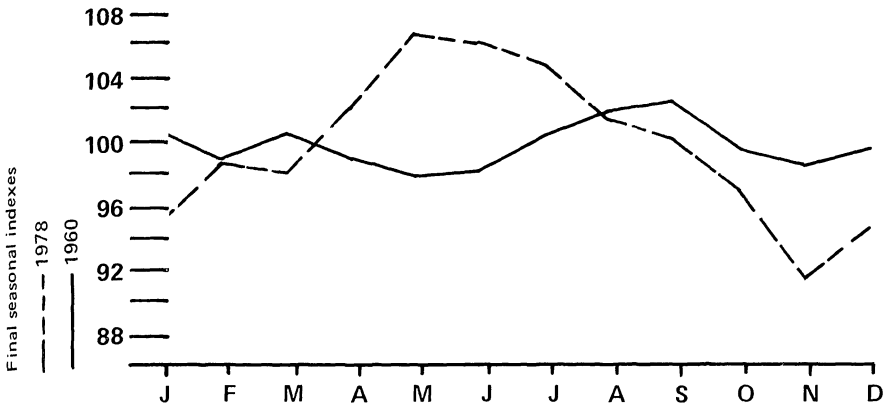


Figure 4. Seasonal behavior of dairy products

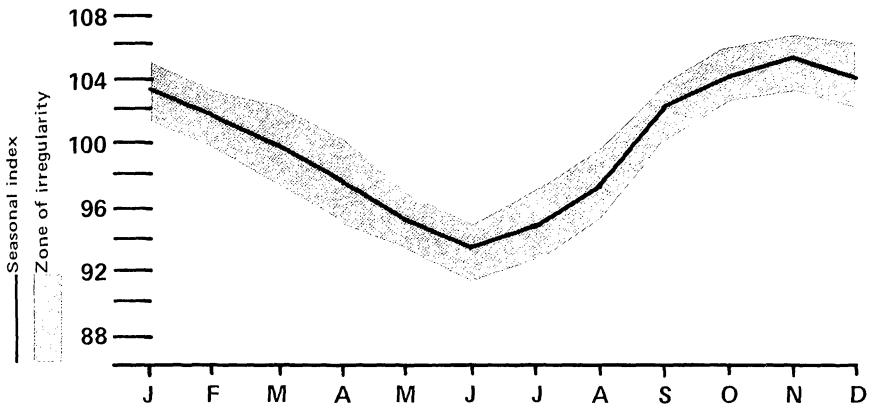


Figure 5. Dairy products: changing seasonality

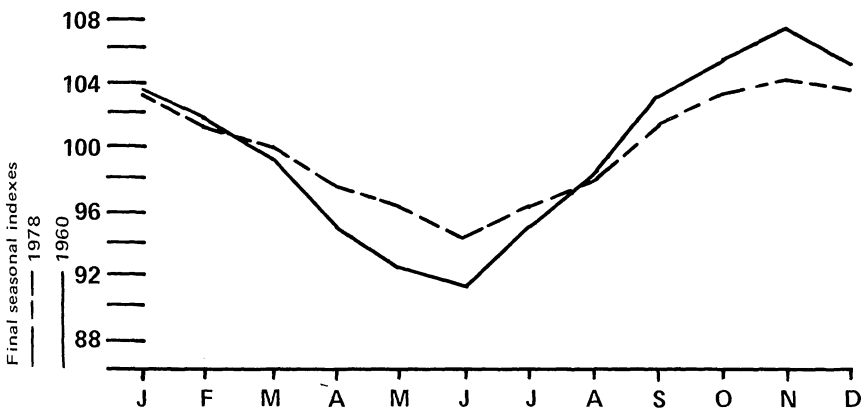
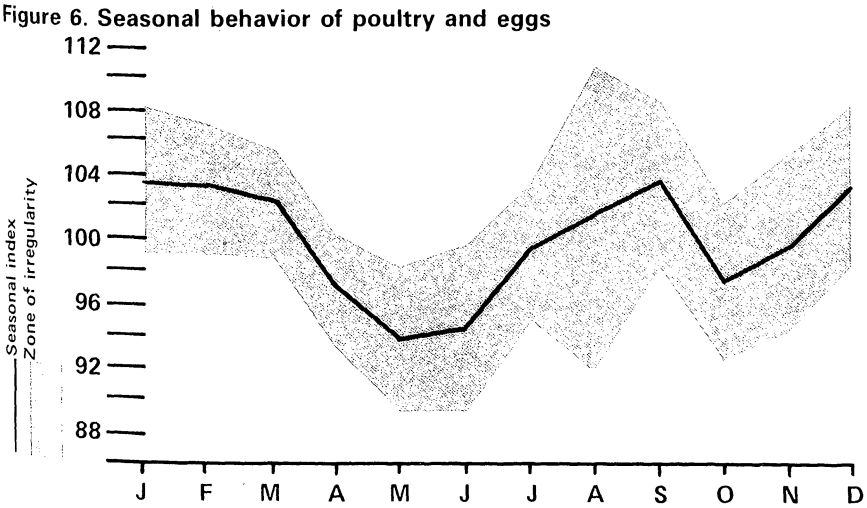


Figure 6. Seasonal behavior of poultry and eggs



in the seasonal prices and a reasonably narrow "zone of irregularity" make for a definite seasonal pattern.

Figure 3 shows the seasonal patterns of meat animals for 1960 and 1978. The patterns appear distinctly different especially for the months of May, June, and November. From an examination of the seasonal indexes for each month over time, it appears the seasonal pattern is changing for the months of January, April, May, June, July, November, and December. The prices now rise in the spring and decline during summer and fall as they have since the late 1960s. Previously the prices fell in spring, rose in summer, and fell again in fall. The magnitude of the seasonal fluctuations has also increased over time. In the 1960s, choice slaughter steers reached peak prices in August. During the 1970s, especially 1973-75, choice slaughter steers have shown a weak, irregular seasonal tendency and highly unstable prices. The continued expansion of feedlots and the strong incentive for year round feeding has leveled out the marketings of choice slaughter steers. For slaughter barrows and gilts there are two annual crops and hence two price peaks, one in August and one in February. In recent years, the summer price peak has occurred as early as June. This forward movement of the peak is probably a reflection of production changes made by hog producers in their attempts to cash in on higher summer prices. These recent developments help explain the seasonal pattern shift of meat animals. The sharper decline in recent years of the seasonal meat animal prices in the fall can be partially explained by the liquidation of herds occurring in the mid-1970s.

Dairy Products

Figure 4 contains the seasonal pattern of prices received for dairy products. The seasonal price pattern is at a low of 93.4 in June, rises to its peak of 105.4 in November, and then declines to the June low. The "zone of irregularity" around the seasonal indexes of dairy products is very narrow, indicating a strong seasonal pattern.

An examination of the seasonal pattern of dairy products in 1960 and 1978 in figure 5 shows that the overall seasonal pattern is the same, but that the seasonal peak in November is not as

high and the seasonal trough in June is not as low in 1978 as it was in 1960. There are seven significant months in which seasonality is changing for dairy products; April, May, June, September, October, November, and December show decreased seasonality. Advances in technology explain a good deal of this decline. The increased geographic dispersion of production and technological improvements has led to a more uniform level of annual production.

Poultry and Eggs

The seasonal pattern for poultry and eggs as shown in figure 6, has two peaks and two troughs. Prices are at a seasonal peak in January, decline to a seasonal index of 93.9 in May, increase to a seasonal index of 103.5 in September, and then decline to a second trough of 97.5 in October. The seasonality of poultry and eggs with its wider "zone of irregularity" does not appear to be as strong as in dairy products.

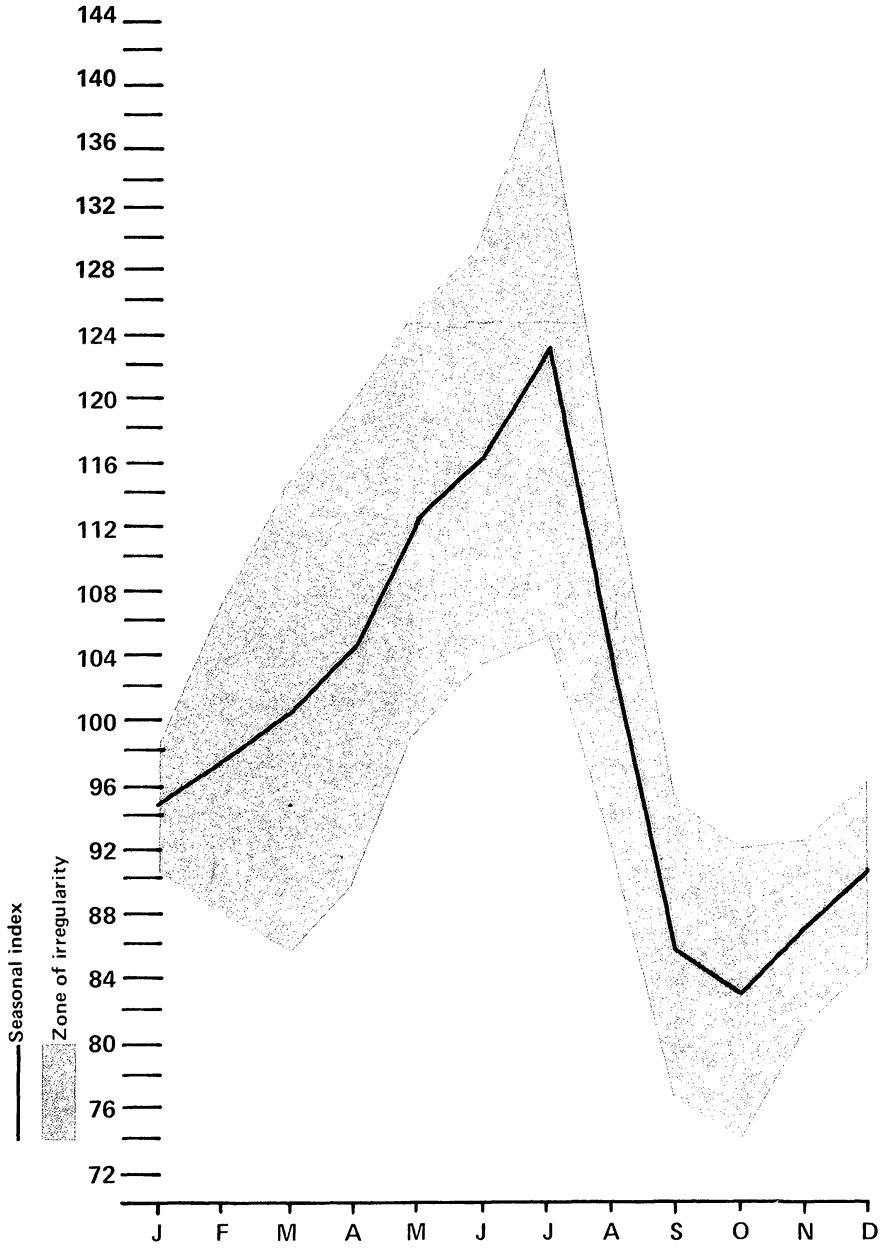
Figure 7 shows that the change in the seasonal pattern in poultry and eggs from 1960 to 1978 is similar to the change that occurred for dairy products. The magnitude of the seasonal fluctuations is not as great in 1978 as in 1960. There is a decrease in the seasonality of March and June. The seasonality for July has switched over time from a seasonal index below 100 to a seasonal index above 100. October has changed over time from a seasonal index above 100 to a seasonal index below 100. Technological advancements that have smoothed the yearly production and advertising that has smoothed the yearly consumption have led to a decline in the overall seasonality of poultry and eggs.

Potatoes

The seasonal pattern for potatoes as exhibited in figure 8 shows a minimum seasonal index of 83.2 in October and a continual increase in the seasonal index to 123.2 in July and then a decrease to October. The seasonal index fluctuation for potatoes is far greater than for any of the other commodity categories examined. Because of this large fluctuation, the seasonality of potatoes is considered fairly strong even though the "zone of irregularity" is wide. The wide "zone of irregularity" indicates

Figure 7. Poultry and eggs: changing seasonality

Figure 8. Seasonal behavior of potatoes



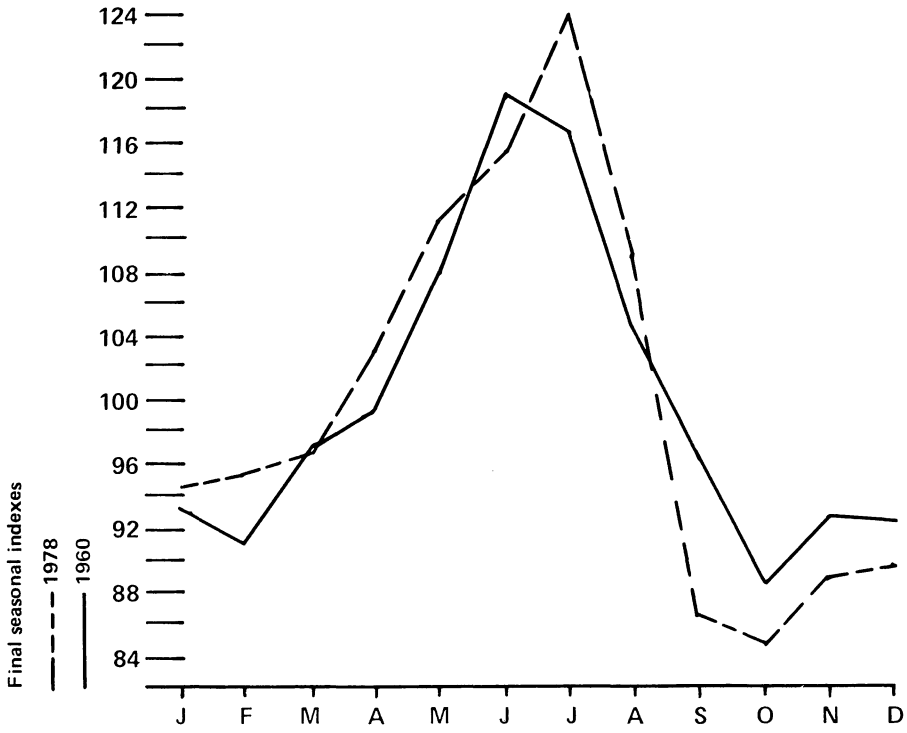
variation in the seasonal pattern from year to year.

The seasonal pattern for potatoes has not changed much over time as evidenced by the similarity of the seasonal pattern for 1960 and 1978 in figure 9. The decline in the seasonal index for potatoes in the fall (September, November, and December) is greater in recent years, but otherwise the seasonal pattern is similar.

Conclusion

An examination of the seasonal component of prices can give insight into the effects of supply and demand on the series of prices received. Familiarity with the seasonal pattern of a commodity can aid farmers and others making production and marketing decisions. Of the five commodity categories, feed grains and hay showed the weakest seasonal pattern. Meat animals, dairy products, poultry and eggs, and potatoes have varying degrees of strength of seasonality and show some changes in seasonality over time. Seasonal swings in agricultural prices are diminishing, but they still exist.

Figure 9. Potatoes: changing seasonality



Please send all address changes for Minnesota Agricultural Economist to Nancy Van Hemert, 231 Classroom Office Building, 1994 Buford Ave., University of Minnesota, St. Paul, MN 55108.

Jerome W. Hammond . . . . . Editor
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