VI. WHAT CAUSES FARM PRICES AND INCOMES TO VARY?

by George W. Ladd

Previous chapters have examined different segments of agriculture, how each segment fits into the total agricultural industry and some of the basic differences between agriculture and other sectors of the United States economy. The role of foreign trade and the implications for agriculture have also been discussed. However, each of these has been looked at in isolation. In real life, all these areas are grist for the farm price and income mill. Just as in a milling operation, it is necessary to know about each ingredient to understand how each contributes to the make up of the final product. In this case, the final product is the variation of prices and incomes in agriculture. How do these various influences mesh together in determining prices and incomes in agriculture?

The earlier chapters have given a foundation for discussion of this problem in terms of particular sectors of the agricultural economy. This discussion will center on variations in prices and incomes for livestock producers; however, the same procedure can be applied to other products or to total farm output.

It is well known that United States farm income at times undergoes large year-to-year variations. Farm income of a single state frequently fluctuates even more than United States farm income. For example, from 1947 to 1949, United States farm income fell seven percent; Iowa farm income fell 16 percent. Between 1957 and 1958, United States farm income rose by 11 percent, and Iowa farm income rose by 17 percent.

Although farmers know their incomes vary they may be less well acquainted with reasons for the change. This section looks at some reasons for variations in cash receipts from livestock and livestock products by United States farmers and by Iowa farmers.

Cash receipts from sales of livestock and livestock products amount to 70 to 75 percent of gross farm income for Iowa farmers and to 55 percent of United States gross farm income. The rest comes from sales of crops, government payments, home consumption of farm-grown food, and the rental value of farm dwellings. The two largest items in Iowa livestock and livestock products sales are hogs and cattle; other products included are poultry, eggs, cream, milk, sheep, and lambs.

Iowa and United States Farm Incomes Act Alike

Variations in farm income in one state should be compared with variations in farm income in other areas. Many things that affect farm income in one state

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also affect farm income in other states. For example, in the 35-year period 1925-59, United States and Iowa cash receipts from sales of livestock products rose together in 19 years and fell together in 10 years. In only six years did one rise while the other fell. Thus 80 percent of the time United States and Iowa cash receipts changed together.

The physical volume of livestock products sold by farmers directly affects their income. Between 1925 and 1959, the volume sold by Iowa farmers and the total volume sold by United States farmers rose together in 21 years and fell together in eight years; they rose and fell together 80 percent of the time. So a big reason why Iowa and United States livestock incomes rise and fall together 80 percent of the time is because Iowa and United States production volume rise and fall together 80 percent of the time.

There are other reasons why livestock incomes of farmers in one state usually move with total United States livestock incomes. Two important forces that increase demand for livestock products are growth of population and growth of consumer income. As consumer incomes rise, consumers increase their purchases of high value products such as livestock products. Iowa livestock products are sold to consumers all over the country along with livestock products from other states. Any increase in income or population that affects the demand for livestock products affects all livestock producing states, including Iowa.

A Closer Look at Prices and Farm Incomes

Figure 10 shows production, consumption, and exports. Figure 11 shows how income, population, and consumption are related to retail prices. Figure 12 relates retail prices and marketing charges to farm prices.

Figure 10 shows that a one percent increase in Iowa production increases total national production by one-tenth of one percent. About 95 percent of all livestock products marketed by farmers are consumed in this country; five percent are exported. Only one percent of the livestock products consumed in this country are imported.

Figure 11 shows how increases in population and in per capita income raise retail prices. Figures 10 and 11 together show how increases in production reduce retail prices. Nearly all of any increase in production goes into the domestic market. To sell this increased volume to consumers, dealers reduce prices. The relation between consumption and retail prices is reversible. That is, a one percent increase in consumption of livestock products reduces retail prices by 2.5 percent. This represents a price inelastic demand since prices must fall by more than one percent to increase consumption by one percent.

Figure 12 shows how retail prices and marketing costs affect farm prices. The relation between retail prices and farm prices is also reversible; a 2.3 percent increase in farm prices raises retail prices by one percent.
1% RISE IN IOWA LIVESTOCK PRODUCTION

1% RISE IN OTHER LIVESTOCK PRODUCTION

1% RISE IN U.S. LIVESTOCK PRODUCTION

1% RISE IN U.S. LIVESTOCK PRODUCTION

EXPORTS

U.S. CONSUMPTION OF LIVESTOCK PRODUCTS

FIG. 10. PRODUCTION, CONSUMPTION AND EXPORT RELATIONSHIPS
1% RISE IN PER CAPITA INCOME INCREASES RETAIL PRICES FOR LIVESTOCK AND LIVESTOCK PRODUCTS BY 1.0%
1% RISE IN POPULATION RAISES BY 2.5%
2.5% REDUCTION IN RAISES OF LIVESTOCK PRODUCTS U.S. CONSUMPTION OF LIVESTOCK PRODUCTS BY 1%

FIG. II. INCOME, POPULATION AND PRICE RELATIONSHIPS
FIG. 12. RETAIL PRICE, MARKETING CHARGES AND FARM PRICE RELATIONSHIPS
In each of these three figures, a one percent fall in a variable has the opposite effect from a one percent rise in that variable. For example, in fig. 12, a 1 percent fall in retail prices reduces farm prices by 2.3 percent.

Each of these figures shows only a part of the total livestock picture. Putting together the information in these three figures presents a more complete picture. For example, one can determine how a one percent increase in the volume of livestock products sold by farmers affects farm prices and farm income. This is worked out in steps.

1. From fig. 9, a one percent increase in United States farm production raises consumption by slightly less than one percent -- by ninety-five hundredths of one percent.

2. From fig. 10, a one percent increase in consumption can be attained by reducing retail prices by 2.5 percent. So a ninety-five hundredths of one percent increase in consumption reduces retail prices by 0.95 multiplied by 2.5 percent, or by nearly 2.4 percent.

3. From fig. 11, a one percent fall in retail prices reduces farm prices by 2.3 percent. A 2.4 percent fall in retail prices reduces farm prices by 2.4 multiplied by 2.3 percent, or by 5.5 percent.

4. The percentage change in farm income is equal to the percentage change in farm prices plus the percentage change in the amount sold by farmers. In this case, the amount sold rises by one percent while prices fall by 5.5 percent. Cash receipts fall by 4.5 percent (5.5 minus 1.0).

If Iowa production went up one percent -- the same as United States production -- Iowa farmers would suffer a 4.5 percent decline in cash receipts from sales of livestock and livestock products.

What would happen if the amount of livestock and livestock products sold by Iowa farmers rose by one percent while sales by other farmers remained constant?

1. Total United States farm sales would rise by one-tenth of one percent.

2. Consumption would rise by 0.1 times 0.95, or 0.095 percent.

3. Retail price would fall by 0.095 times 2.5, or 0.24 percent.

4. Farm price would fall by 0.24 times 2.3, or 0.55 percent.

5. Iowa cash receipts directly rise one percent from the increase in volume of sales. Iowa cash receipts indirectly decline by 0.55 percent because of the fall in price. The total result is a 0.45 percent rise in Iowa cash receipts.
In contrast, what would happen if Iowa marketings remained constant while other farmers sold one percent more livestock and livestock products? In this case, cash receipts by other farmers would decline by 3.9 percent. This is a smaller fall than the 4.5 percent decline when Iowa farmers also increase output by one percent. Iowa farmers, on the other hand, would suffer a 4.9 percent decline in receipts. This is a larger decline than the decline suffered by Iowa farmers when all farmers increase their sales by one percent.

These figures point up one problem facing Iowa farmers (or those of any other state). If Iowa farmers increase production while other farmers increase production, Iowa farm income will likely fall. But if Iowa farmers do not increase production and other farmers do, Iowa farm income will fall even more.

This same problem faces each individual farmer. If other farmers produce more and he does not, he will have less income than if he had produced more along with everybody else.

Estimates of Prices and Cash Receipts

Figures 13 and 14 show actual retail and farm prices and retail and farm prices estimated in line with figs. 10, 11, and 12. Figure 15 shows actual and estimated cash receipts from the sale of livestock and livestock products. To see how the estimated retail prices were obtained, take 1951 as an example. From 1950 to 1951, consumption of livestock products rose by nine-tenths of one percent, population rose by 1.8 percent, and per capita income rose by 7.6 percent. The estimated effect on retail price is:

<table>
<thead>
<tr>
<th>Percentage Change</th>
<th>Effect on Retail Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income growth</td>
<td>7.6% income growth raises retail price by 7.6 times 1.0 or 7.60%</td>
</tr>
<tr>
<td>Population growth</td>
<td>1.8% population growth raises retail price by 1.8 times 2.5 or 4.50%</td>
</tr>
<tr>
<td></td>
<td>Total increase</td>
</tr>
<tr>
<td>Consumption rise</td>
<td>0.9% consumption rise reduces retail price by 0.9 times 2.5 or 2.25%</td>
</tr>
<tr>
<td></td>
<td>Net increase</td>
</tr>
</tbody>
</table>

The 1950 retail price index was 94.3. An increase of 9.85 percent from 1950 to 1951 would mean a 1951 estimated price index of 94.3 plus 94.3 times 9.85 percent, or 103.6.

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2/ The actual mathematics involved in obtaining the estimates in figs. 13 to 15 are more complicated than this example, involving the use of logarithms of percentage changes. This example shows the economic logic underlying the estimates without the mathematical complications involved.
FIG. 14. ACTUAL AND ESTIMATED INDEXES OF PRICES RECEIVED BY FARMERS FOR LIVESTOCK AND LIVESTOCK PRODUCTS, AS PERCENT OF 1948 PRICE, 1949-59
FIG. 15. ACTUAL AND ESTIMATED CASH RECEIPTS FROM SALES OF LIVESTOCK AND LIVESTOCK PRODUCTS, AS PERCENT OF 1948, 1949-59
This estimate is evidently low. The actual 1951 price was 106.2. One reason for this difference is that the numbers at the right side of figs. 10, 11, and 12 are averages. For example, fig. 11 shows that a one percent increase in per capita income increases retail prices of livestock products by one percent, on the average. Sometimes it increases retail price by more and sometimes by less. From 1950 to 1951, people may have increased their demand for food by more than an average amount as their income increased. In 1951, people were uncertain about the length of the Korean War; there was a possibility that full-scale war would break out with China or Russia. In 1951, there was a possibility of rationing and price control similar to that of World War II. Under these conditions, people may have felt at little like, "Eat, drink and be merry because tomorrow everything may be rationed or blown up." They might spend more on food and on other things than under average conditions. This would increase retail price by more than fig. 11 indicates.

In addition, government purchases rose sharply between 1950 and 1951. The armed services purchased about twice as much meat, dairy, and poultry products in 1951 as in 1950. In 1951, they took four percent of the livestock products sold. Government purchases are not shown in fig. 10 because they are usually fairly small and stable and, therefore, have little effect on retail price. When government purchases do increase sharply as they did in 1951, they cause retail prices and farm prices to rise. The estimated price increase in fig. 13 is, therefore, too low since it ignores the price-raising effect of large increases in government purchases.

What has happened to these estimates is quite similar to what happens, for example, when a dairy farmer tries to predict how much milk he will sell next year. There might be less disease or fewer deaths of old cows than he had anticipated. Heifers coming fresh during the year may produce more than his heifers usually have. For reasons such as these, his prediction would be low. On the other hand, more sickness, deaths, and unproductive heifers would cause his production to be less than anticipated.

Estimated farm prices in fig. 14 were obtained in a similar way as estimated retail prices in fig. 13.

It can be seen from figs. 13 and 14 that farm prices and retail prices move in the same direction from year to year. This means that the direction of change in farm prices is determined by the same forces that determine changes in retail prices. Variations in marketing charges affect the amount of change in farm prices but not the direction of change.

Although figs. 10, 11 and 12 do not show everything that determines farm livestock prices and farm incomes from livestock products, they show the important causes. Variations in per capita consumer income, population, and volume of farm production are responsible for 85 percent of the variations in Iowa cash receipts from sales of livestock and livestock products. Variations in consumer income, population, and production cause 85 percent of the variation in retail prices.
Retail Prices and Demand Elasticity

It was previously mentioned that the demand for livestock and livestock prices is price inelastic since retail prices must fall by more than one percent to increase consumption by one percent. Since the demand for livestock products is price inelastic, farm incomes tend to decline in years of rising livestock production and to rise in years of falling livestock production. If demand were elastic, the opposite would be true. Farm incomes would commonly rise in years of rising production and fall in years of falling production.

For example, suppose consumption rose by two percent when retail prices fell by one percent (elasticity of 2.0). The solid line in fig. 16 represents the index of farm prices for livestock and livestock products. The dotted line shows what retail prices would have been if a two percent rise in consumption resulted from a one percent fall in retail prices. They would have been lower than they were in 1951 and 1957, when consumption fell. Retail prices would have been higher in the other 9 years, when consumption rose. Farm incomes also would have been lower in 1951 and 1957 and higher in the other 9 years, as shown in fig. 17.

Differences Between Agricultural Demand Today and in the Golden Age

The previous chapters also give background to evaluate further why the period from 1895 to 1915 is called the "Golden Age of American Agriculture." In the years 1910-15, agriculture was prosperous, and farm prices were relatively high. This is one reason why agricultural parity prices are still compared with a 1910-14 base.

Table 18 shows some comparisons between 1895-1915 and 1930-55. The first two columns indicate why 1910-15 is part of the Golden Age of American Agriculture. The ratio of farm prices to industrial prices was high, following a steady increase from 1900. The annual earnings of farm labor compared more favorably with earnings of factory workers in 1910-15 than in preceding years. A farm worker's annual income did not reach as high a percentage of a factory worker's earnings again until World War II. Even though 1895-1915 was a period comparatively favorable to agriculture, farm population declined relative to total population.

Compare 1895-1915 with 1930-55. The price ratio grew rather steadily in the former period. It ended the latter period at the same level as it began the period, after hitting peaks during World War II and the Korean War. The ratio between a farm worker's income and a factory worker's income was somewhat higher in 1955 than in 1930. But it was much lower in either of these years than it had been 1895-1915.
FIG. 16. FARM PRICES FOR LIVESTOCK AND WHAT LIVESTOCK PRICES WOULD HAVE BEEN IF CONSUMER DEMAND HAD A PRICE ELASTICITY OF 2.0
FIG. 17. ACTUAL CASH RECEIPTS FROM SALE OF LIVESTOCK AND LIVESTOCK PRODUCTS, AND WHAT RECEIPTS WOULD HAVE BEEN IF CONSUMER DEMANDS HAD A PRICE ELASTICITY OF 2.0.
Table 18. Comparisons between the Golden Age of Agriculture and recent periods

<table>
<thead>
<tr>
<th>Year</th>
<th>Ratio of prices for farm products to prices for industrial products (1895 ratio = 100%)</th>
<th>Ratio of earnings of a farm laborer to earnings of a factory worker (percent)</th>
<th>Index of agricultural production (1895 production = 100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1895</td>
<td>100</td>
<td>52</td>
<td>100</td>
</tr>
<tr>
<td>1900</td>
<td>98</td>
<td>57</td>
<td>119</td>
</tr>
<tr>
<td>1905</td>
<td>105</td>
<td>61</td>
<td>130</td>
</tr>
<tr>
<td>1910</td>
<td>124</td>
<td>61</td>
<td>132</td>
</tr>
<tr>
<td>1915</td>
<td>115</td>
<td>62</td>
<td>150</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Ratio of prices received to prices paid by farmers (1930 ratio = 100%)</th>
<th>(percent)</th>
<th>Index of agricultural production (1930 production = 100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930</td>
<td>100</td>
<td>38</td>
<td>100</td>
</tr>
<tr>
<td>1935</td>
<td>106</td>
<td>40</td>
<td>92</td>
</tr>
<tr>
<td>1940</td>
<td>98</td>
<td>37</td>
<td>111</td>
</tr>
<tr>
<td>1945</td>
<td>131</td>
<td>66</td>
<td>138</td>
</tr>
<tr>
<td>1950</td>
<td>122</td>
<td>54</td>
<td>138</td>
</tr>
<tr>
<td>1955</td>
<td>101</td>
<td>43</td>
<td>156</td>
</tr>
</tbody>
</table>

Why has agriculture done so poorly in recent years in comparison with 1895-1915? It was shown previously that an increase in farm production of livestock tends to reduce farm prices for livestock products and farm incomes from livestock sales. An increase in total agricultural output -- livestock products and other products -- also reduces farm prices and farm incomes. Table 18 shows, however, that farm output grew at about the same rate in both periods. The differences between the two periods are due to something else.

One reason for the differences is the greater importance of agricultural exports during the Golden Age of Agriculture. A larger proportion of this country's agricultural output was exported then. This strong foreign demand helped raise prices.

The last column of table 19 gives part of the reason for the differences. Population grew 43 percent in the 20 years 1895-1915. It grew 34 percent in the 25 years 1930-55. Population growth is an important force causing increases in the demand for food products. A slowing down of population growth slows down the rate of increase of demand.

Now look at the other two columns. From 1889-98 to 1909-18, food consumption grew at the same rate as per capita income. It rose by one percent for each one percent rise in per capita income (45 divided by 45). From 1929-32 to 1954-57, per capita food consumption grew only one-sixth of one percent for each rise in per capita income (13 divided by 79). Thus a one percent increase in per capita consumer income increases food demand per person by only one-sixth as much as it used to. Income elasticity of demand for food is lower when per capita consumer incomes are higher. In recent years, real per capita income has been about two and one-half times as high as in 1889-98.

In fig. 11, it was indicated that a one percent increase in per capita income raises retail prices for livestock products by one percent. Suppose the effect of increases in income were closer now to what it was around the turn of the century when consumer incomes were lower. Specifically, suppose a one percent increase in income per person raised retail prices by five times as much as it actually does, that is, by five percent instead of by one percent.

The solid lines in figs. 18 and 19 are the actual farm prices and cash receipts from figs. 15 and 16. The dotted lines in figs. 18 and 19 show what farm prices and cash receipts for livestock and livestock products would have been if a one percent rise in consumer income resulted in a five percent rise in retail prices.

Retail prices, farm prices, and farm income would have been the same in 1954 because consumer income did not change between 1953 and 1954. Farm prices and farm income would have been lower in 1949 because consumer income fell in that year. In the other nine years, farm and retail prices would have been higher. Cash receipts from sales of livestock and livestock products would have been higher in these nine years.
If growth in consumer income raised food demand as much now as it did 60 or 70 years ago, farm prices and farm incomes would have been higher in recent years than they actually were.

These two figures show why it is sometimes said that one cause of this country's agricultural problem is the high level of consumer incomes. At low levels of consumer incomes, food consumption increases sharply in response to rising incomes. At high levels of consumer income, food consumption increases less as incomes rise.

The livestock example has illustrated how the information presented in the first five chapters can be used to analyze the price half of the cost-price situation in agriculture. The results of this analysis can be summarized as follows:

1. Retail prices of livestock and livestock products are affected mainly by population, per capita consumer income, and amount produced. Population growth and income growth raise retail prices. An increase in the amount produced reduces retail prices.

2. The amount of livestock and livestock products marketed by farmers determines the amount to be consumed.

3. Farm prices of livestock and livestock products are determined by retail prices and by marketing costs. Increases in retail prices raise farm prices. Increases in marketing costs lower farm prices.

4. Since the demand for livestock and livestock products is price inelastic, increases in farm production result in decreases in farm income.
Table 19. Rate of growth of items affecting agricultural income in two periods

<table>
<thead>
<tr>
<th>Percentage increase from 1889-98 decade to 1909-18 decade</th>
<th>Real per capita income</th>
<th>Per capita food consumption</th>
<th>Population 1/</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>45</td>
<td>45</td>
<td>43</td>
</tr>
</tbody>
</table>

| Percentage increase from 1929-32 to 1954-57              | 79                     | 13                          | 34            |

1/ Percentage increases between 1895 and 1915 and between 1930 and 1955.

FIG. 18. FARM PRICES FOR LIVESTOCK AND LIVESTOCK PRODUCTS, AND ADJUSTED PRICES BASED ON A 5 PERCENT RISE IN PRICE FROM A 1 PERCENT RISE IN CONSUMER INCOME
FIG. 19. CASH RECEIPTS FROM LIVESTOCK AND LIVESTOCK PRODUCTS AND WHAT RECEIPTS WOULD HAVE BEEN IF A 1 PERCENT RISE IN CONSUMER INCOME RESULTED IN A 5 PERCENT RISE IN RETAIL PRICES