2

Short-Time Changes in Agricultural Prices

Over a long period of time, as Figure 1.1 shows, agricultural prices have gradually risen and then fallen, relative to nonagricultural prices. In addition to this long-time, gradual dissimilarity of price movements, there is a more marked dissimilarity within short periods of a decade or so in length. Over these shorter periods of time, agricultural and nonagricultural prices may move in opposite directions, or at least move different amounts in the same direction, more markedly than they do over long periods of time.

This dissimilarity of short-time movements is clearly revealed if attention is focused on the movements of agricultural and nonagricultural prices and production during the past 35 years. These movements are shown in Figure 2.1. The price data are the same as those shown in Figure 1.1, but on a 1947–49 index base.

Figure 2.1 shows that the chief difference between the movements of agricultural and nonagricultural prices since 1913 is the difference in the amplitude (size) of their movements. During World War I the two price series rose to about the same extent, but since that time agricultural prices have fluctuated about twice as much (that is, over about twice as great a range) as nonagricultural prices. This was true during World War II as well as during peacetime (nonagricultural prices were held down more by price controls during the war than agricultural prices were). It was true also during the post-World War II boom, when all prices were carried upward by general inflation.

WHY ARE INDUSTRIAL PRICES MORE STABLE THAN AGRICULTURAL PRICES?

Why are nonagricultural prices (or to use a less clumsy term, industrial prices) so much more stable than agricultural prices?

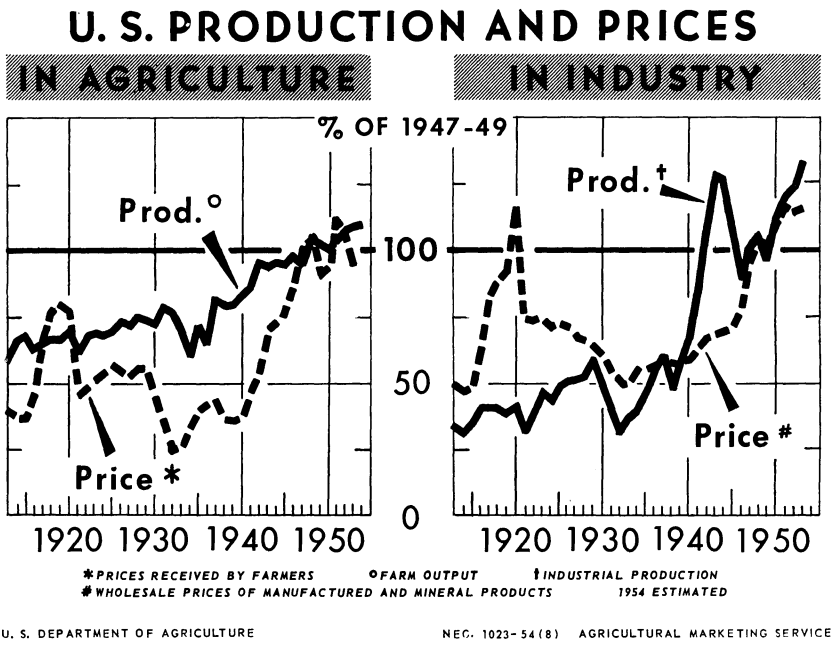

Fig. 2.1 — United States production and prices in agriculture and in industry, 1913–54.

It is not because the demand for industrial products is more stable than the demand for agricultural products. The demand for industrial products fluctuates as much as the demand for agricultural products—perhaps more. The reasons for the comparative stability of industrial prices must lie in the conditions of supply.

Figure 2.1 shows that this is indeed true. The production of industrial products has fluctuated widely, while the total production of farm products, in spite of the effects of the record-breaking drouths of 1934 and 1936, varies very little from year to year.

These charts show that industrial prices are comparatively stable, in spite of the great fluctuations in demand that go with prosperity and depression, because industrial production fluctuates greatly and concurrently with those fluctuations in demand. The changes in demand are largely offset, in their effects on price, by corresponding changes in supply. The charts also show that agricultural prices are unstable because agricultural production remains comparatively constant in the face of great fluctuations in demand. The small changes in agricultural production that do take place result chiefly

from changes in such physical things as weather, and show practically no correlation with fluctuations in demand, except for World War II. Since agricultural supply is relatively constant, great fluctuations in demand cause great fluctuations in agricultural prices.

The question, therefore, boils down to this: Why is agricultural production stable, in spite of great cyclic changes in demand, and why is industrial production unstable, fluctuating with cyclic changes in demand?

WHY DOES AGRICULTURAL PRODUCTION REMAIN STABLE WHEN DEMAND FLUCTUATES?

It may seem strange that agricultural production remains stable when demand fluctuates greatly. Elementary economic theory teaches that under a freely competitive system, with positive sloping supply curves, a decrease in demand reduces prices; and this reduces production to the point where equilibrium between costs and prices is restored, at lower levels than before. An increase in demand brings about similar but opposite adjustments.

But this is true only of long-time changes and adjustments. Things work out differently when the changes in demand are severe and sudden. So high a proportion of the costs in agriculture are fixed that once the investment is made, when prices decline suddenly the farmer cannot reduce his costs much by reducing his production. In fact, in the face of falling prices he may attempt to meet his fixed costs by producing more, not less.

The situation is complicated by the further fact that in the short run a farmer has even less control over the prices at which he sells his products than he has over his costs of production. If he does reduce production, as an individual act, that will have no appreciable bolstering effect on the prices of his products. If all farmers reduced production, that would at least reduce the fall in agricultural prices. But since no one farmer has any assurance that the bulk of his competitors (other farmers) will reduce their production, he dares not reduce his; so nobody reduces production.

Even nationwide programs for reducing agricultural production, organized by the federal government, have not been very successful. The AAA programs of the 1930's reduced the acreage of cotton, wheat, corn, etc., by percentages ranging from 10 to 40, but yields per acre increased, partly as a result of the reductions in acreage. Except for cotton, production was not reduced appreciably below previous levels. This was true in the 1950's also. The "emergency" programs of the 1960's were more effective.

Conversely, when agricultural prices rise, agricultural production as a whole cannot expand very much. The expansion during World War I was slight—only about 5 per cent. During World War II, the expansion was considerably greater—about 33 per cent—but a large share of this expansion was the result of good weather.

The plain fact is that agricultural production runs very close to capacity all the time, and cannot be expanded much under any circumstances. Livestock production, for example, is limited by livestock feed production, and that cannot be expanded much. Additional fertilizer can be applied if prices are high, and land farmed somewhat more intensively, but the agricultural "plant" cannot run more than twenty-four hours a day, and only very small additions to the plant can be made. To put it in a sentence: The short-time elasticity of agricultural supply is low—even lower than the long-time elasticity.

SHORT-TIME ELASTICITY OF SUPPLY

Technological improvements in agricultural production, which shift the whole supply curve to the right, make it difficult to determine the elasticity directly from price and production data. It is likely that the supply of farm products is inelastic with respect to changes in the prices of farm products when those changes are accompanied by corresponding changes in the prices of nonfarm products. The supply of farm products probably is more elastic with respect to changes in the prices of farm products *if other things (nonagricultural prices, especially) remain unchanged.* The elasticity of agricultural supply for any one farm product, the prices for other farm products remaining unchanged, is still more elastic. It would vary directly with the length of time involved.

SHORT-TIME ELASTICITY OF DEMAND

E. J. Working estimates the elasticity of the demand for food as —0.251.[1] His equation, and the effect of different levels of income on the position of the demand curve, is shown in Figure 2.2.

Working illustrates the drastic effects of this low elasticity on prices by a concrete arithmetical example. During 1950, food exports, plus military and other government purchases, amounted to 9.9 per cent of the 1935–39 average food production. If they had been only 2.3 per cent, as in 1940, supplies available in the domestic market would have been increased by 7.6 per cent of the 1935–39 level of production. Such an increase of food supplies (assuming

[1] E. J. Working, "Appraising the Demand for American Agricultural Output During Rearmament," *Journal of Farm Economics,* Vol. 34, No. 2, p. 221.

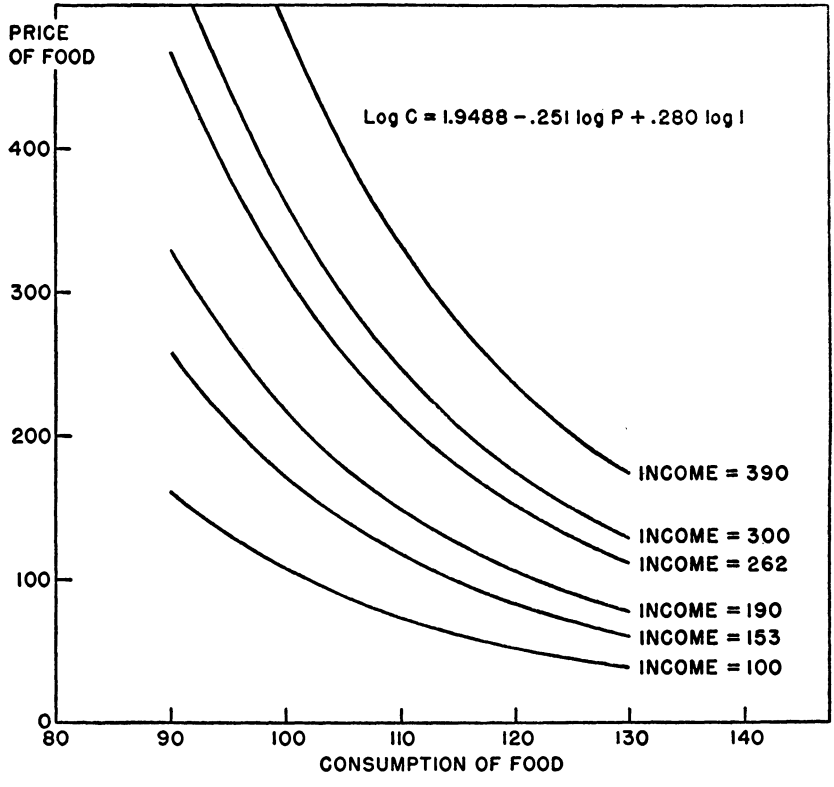

Fig. 2.2 — Demand curves for food at several income levels. (Average 1935–39 = 100.)

that it was not temporary so that its effect would be moderated by building up stocks) might be expected, based on the above elasticity, to decrease retail food prices by about 30 per cent. This illustrates how a comparatively small change in supply has a drastic effect on prices, because of the low elasticity of demand.

The corresponding elasticity of the demand for food at the farm (based on farm prices) must be lower still, because of the relative inflexibility of distributors' margins. If distributors' margins were absolutely inflexible, and the margins took half of the consumers' dollar, the corresponding elasticity of the demand for food at the farm would be just half of the elasticity at retail given above.

The effects of these differences in elasticity are well shown in Figure 2.3 and Table 2.1. The index of the cost of a representative "market basket" of food (the quantity purchased multiplied by the retail price) rose 9 points from 103 in 1964 to 112 in 1966, then de-

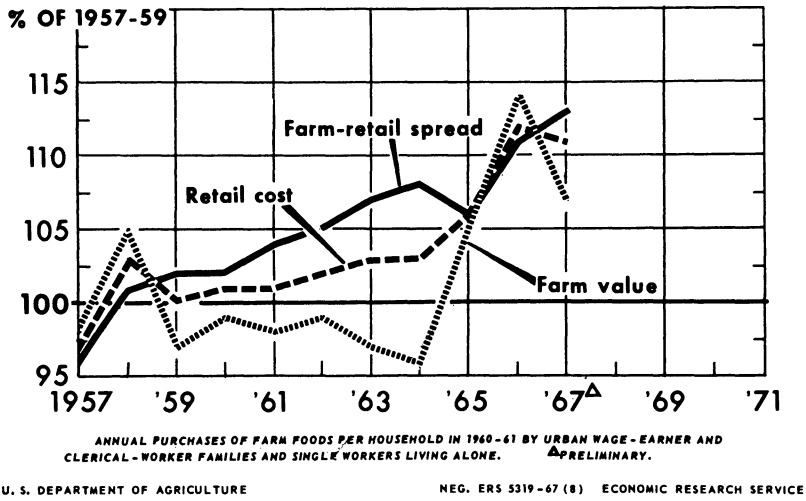

Fig. 2.3 — Retail cost for market basket, farm value, and spread, 1957–67.

clined one point in 1967. Retail margins were comparatively stable during this period, so that the index of the farm value of this food (the quantity multiplied by the farm price) rose just twice as much as the retail cost, rising 18 points from 96 in 1964 to 114 in 1966, and falling 7 points to 1967.

Agriculture, then, faces an inelastic short-time demand for its products with an inelastic short-time supply. Under those conditions, a small change in either demand or supply causes a large change in price. Until some means is found for keeping the demand for farm products more stable than it has been in the past, the short-time changes in agricultural prices are likely to continue to be violent.

FORECASTING SHORT-TIME CHANGES IN THE PRICE OF FARM PRODUCTS

Total agricultural production is comparatively stable from year to year, so forecasting short-time changes in the price of farm products as a group reduces chiefly to forecasting short-time changes in the demand for farm products. For this purpose the Agricultural Marketing Service of the United States Department of Agriculture has developed a system of relationships that provides a reasonably good basis for forecasting.

TABLE 2.1
THE FARM-FOOD MARKET BASKET, 1953–67*
(1957–59 = 100)

Year	Retail Cost	Farm Value†	Farm-retail Spread‡
1953	97	109	89
1954	95	103	90
1955	93	96	91
1956	94	95	93
1957	97	98	96
1958	103	105	101
1959	100	97	102
1960	101	99	102
1961	101	98	104
1962	102	99	105
1963	103	97	107
1964	103	96	108
1965	106	105	106
1966	112	114	111
1967§	111	107	113

Source: *Handbook of Agricultural Charts*, USDA, Agr. Handbook 348, Oct., 1967, p. 34.

* The "market basket" contains the average quantities of domestic farm-originated food products purchased annually per household in 1960–61 by wage-earner and clerical-worker families and single persons living alone.

† The return to farmers for the fixed quantity of farm products equivalent to the foods in the market basket.

‡ The difference between the retail cost and farm value. It is an estimate of the charges made by marketing firms for assembly, processing, transportation, and distribution.

§ Preliminary.

FORECASTING THE GROSS NATIONAL PRODUCT (GNP)[2]

The Economic Research Service of the USDA appraises general business conditions in order to analyze the impact of these changes on agriculture. Changes in economic activity affect the level of employment and consumer income, thus changing the demand for farm products. Although per capita use of farm products as a whole is influenced little by changes in consumer buying power, the impact on individual commodities varies. Rising incomes strengthen per capita demand for meats and high-protein food, for example, but tend to reduce the demand for cereals, potatoes, animal fats, and some other high-calorie foods. The farmer is also interested in

[2] The remaining pages of this chapter were prepared by Rex Daly, Chief, Outlook and Projection Branch, Economic and Statistical Analysis Division, ERS, USDA.

changes in business activity as they influence the general price level and the farmers' production costs.

There are no simple mechanical techniques of forecasting general economic activity accurately. A number of empirical frameworks are used but all are tempered by considerable judgment. Forecasts of business conditions are made in the framework of the national income accounts, appraising each major source of demand and its impact on output, employment, income, and the price level.

Major Sources of Demand

Figure 2.4 shows that consumer spending is the biggest source of demand. But nonconsumption outlays usually are the prime movers in changes in economic activity. They vary around a third of total spending for goods and services with government spending the more stable component of nonconsumption expenditures.

In building up estimates of demand or total spending, the plans of the government sector are first determined on the basis of the federal budget and programs of state and local governments. Business investment outlays are examined in relation to the investment cycle, trends in manufacturers' new orders relative to productive capacity, surveys of business investment intentions, and investment levels dictated by projected levels of demand, output rate, corporate profits, and funds for financing investment. Residential construction is also appraised in relation to new family formations, surveys of

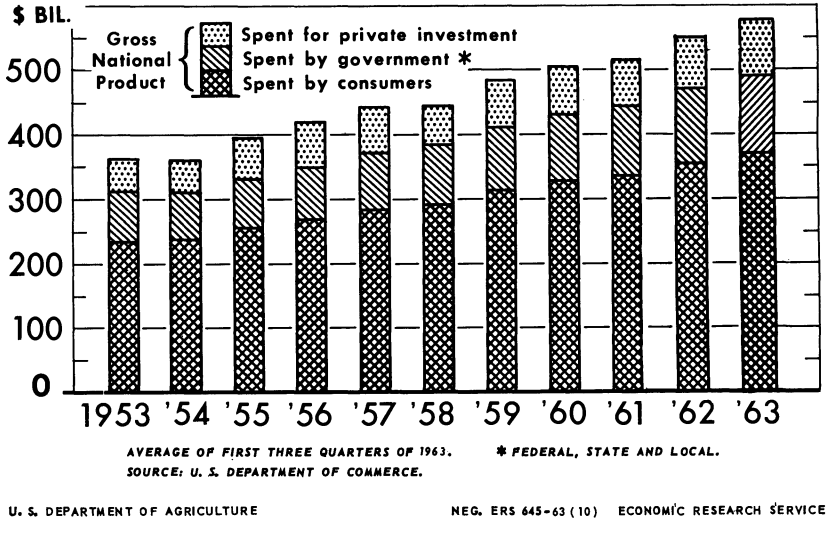

Fig. 2.4 — Comparison of the three sources of demand in the United States, 1947–63.

consumer home-buying plans, consumer incomes, and financing terms. Such investment outlays are prime movers influencing changes in output and employment, but they are also determined to a large degree by changes in demand. Consequently, investment must be simultaneously determined or related to the estimated economic framework.

In accordance with output and employment theory, nonconsumption outlays directly affect total demand and, at the same time, affect changes in the level of output, employment, consumer income, and the demand for food. These secondary impacts — the multiplier effect — multiply the impact of a given change in nonconsumption expenditures. These relationships vary widely with cyclical changes in economic activity. Historically in the United States an increase of $10 billion in nonconsumption outlays has usually been accompanied by an increase of around $20 billion in the gross product, as nonconsumption spending contributes to increased employment, income, and consumer spending. This is an obvious oversimplification. The flow of income to consumers will be influenced also by the tax rate structure and possible changes in it, by corporate dividend policy, government financing, consumer saving and credit, and a host of other factors.

It is not possible in the brief treatment of this subject to outline a sophisticated analytical framework. But a simple framework will indicate the nature of the relationships as well as provide some empirical measurements for the United States economy. Simple relationships can be used to illustrate the consumption function, the multiplier, and an indication of the leakage of the income flow into tax revenues and gross business savings.

Consider the following framework:

Y = Gross national product

C = Consumer expenditures for goods and services

N = Nonconsumption outlay — government expenditures and total domestic and foreign investment

T = Includes mainly taxes and gross business savings which divert out of the flow of income to consumers

$X = Y - T$ = Disposable personal income

u and v = Residuals reflecting the effect of omitted variables and random disturbances

$$Y = C + N$$

$$Y = X + T$$

and

$$\triangle C = a + b \triangle (Y - T) + u \quad (1)$$

$$\triangle T = k + t \triangle Y + v \quad (2)$$

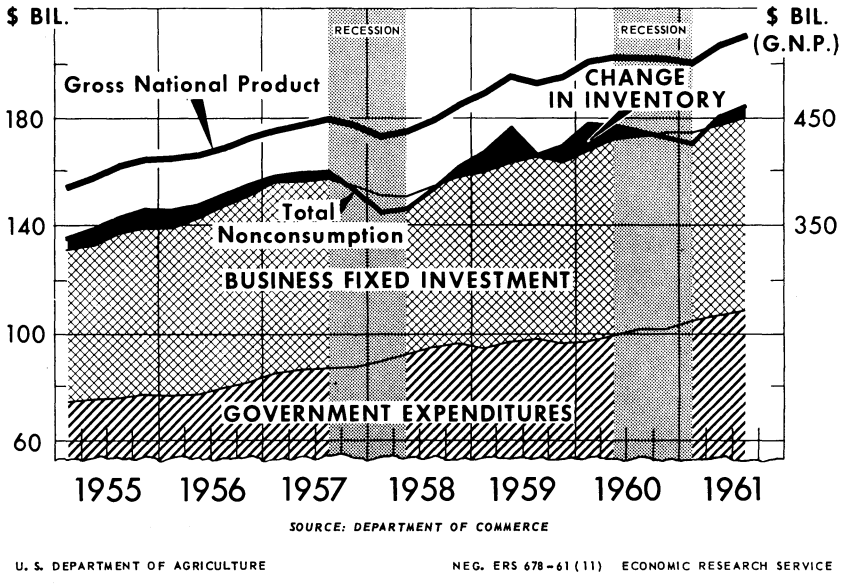

Fig. 2.5 — Comparison of Gross National Product with total nonconsumption outlays in the United States, quarterly, 1955–61.

In the years preceding World War II, year-to-year changes in equations (1) and (2) indicated a propensity to consume (b), the tendency for consumer to spend out of income, of around 0.73. That is, if a man's income increased by $1, his spending increased by 73 cents. The leakage of the income flow to government revenue and business savings represented by (t) was equal to about 0.3. The multiplier, which indicates the change in the gross national product associated with a change in nonconsumption outlays, was a somewhat more involved relationship of the two functional equations resulting in a multiplier of 2.0.

$$\text{Multiplier} = \frac{1}{1 - b\ (1 - t)} = \frac{1}{1 - .73\,(1 - 0.3)} = 2.0$$

The close relationship between changes in nonconsumption outlays and the gross national product are illustrated in Figures 2.5 and 2.6. On the upswing of the cycle, the multiplier effect appears somewhat greater, so that consumer income and buying tends to increase more than dictated by the framework. In a similar manner, consumer spending is "sticky" to downward adjustments in investment and other nonconsumption outlays. The consumer sector is also appraised in relation to surveys of consumer buying plans,

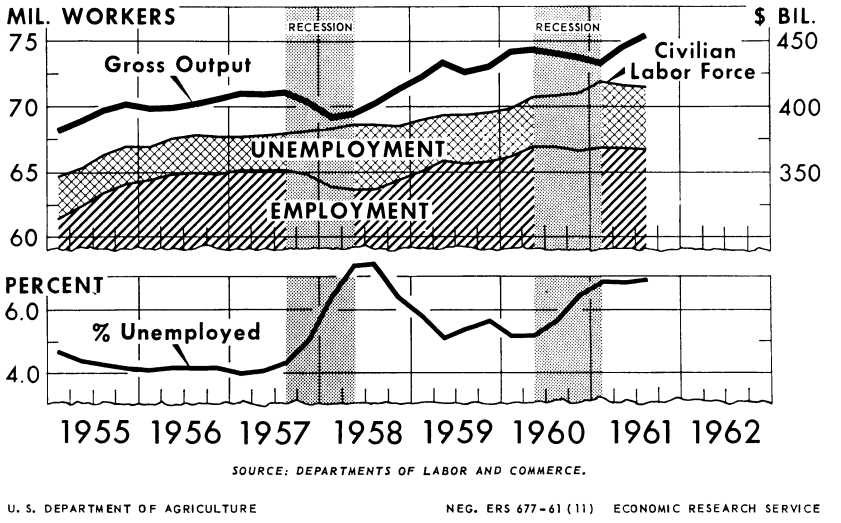

Fig. 2.6 — Comparison of gross output with employment and unemployment in the United States, quarterly, 1955–61.

credit availability, and separate appraisals for major groups of consumer goods such as autos, household goods, food, and services.

After a skeleton of the national accounts is developed with the aid of historical relationships, a knowledge of tax rates, capital consumption allowances, dividend policy, transfer payments and many other relationships in the economy are employed in building up in detail the expenditure side of the income accounts and the income flows to the business sector, government, and the consumer sector. These relationships are examined for internal consistency by analyzing the saving-investment balance in the accounts and the government revenue-expenditure balance. These calculations are based to a considerable extent on judgment.

Demand for Farm Products

Changes in expenditures for food are highly correlated with changes in consumer disposable income. In the postwar years, a 10 per cent increase in per capita income has usually been accompanied by an increase of about 5 per cent in per capita expenditures for food. But most of this increase in expenditures goes for the services involved in the processing and marketing of food (Figure 2.7). The farm share of changes in retail food expenditures is very small, particularly when supplies are very large. Price and income elasticity of demand for foods measured at the farm level were very

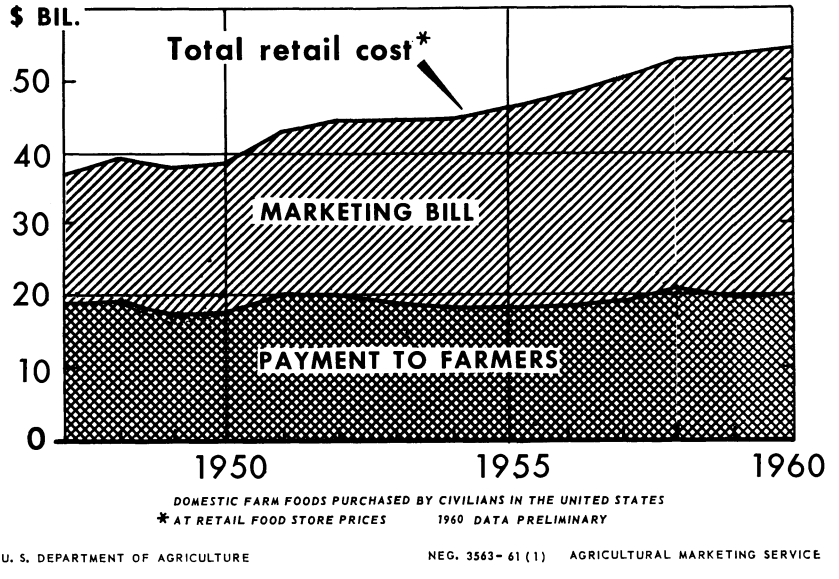

Fig. 2.7 — Comparison of total retail cost of domestic farm food products in the United States, with the marketing bill and the payments to farmers, 1955–60.

inelastic in the postwar period. Both may be as low as 0.1 — minus for price elasticity and plus for income elasticity of demand.

$$\triangle q = k - 0.1 \triangle p + 0.1 \triangle I \qquad (3)$$

In equation (3) a 10 per cent increase in real income per capita may increase per capita food consumption only around 1 per cent, or a price increase of 10 per cent may reduce per capita use of food, measured at the farm, by around 1 per cent. This is for food as a whole which reflects many offsetting trends — uptrends for meat, high-protein livestock products, and convenience foods, and downtrends for animal fats, cereals, and fresh use of many fruits and vegetables.

Prices of many farm products are determined to a considerable extent by the levels of price supports. This is especially true for crops. But crop prices also influence output and consequently, prices of those livestock products not under price support.

The output of farm products likewise depends on farm policy, including the level of farm price supports. Although analytical frameworks are used in appraising probable output and farm product prices, the estimates must allow for the influence of policy. The provisions of the 1961 Feed Grain Program were responsible for

the cut in the 1961 feed grain crop. Consequently, it is helpful to supplement over-all appraisals with the judgment of experts intimately familiar with each commodity. This type of information also gives a basis for estimating marketings and total cash receipts for farm products. Analytical frameworks are continuously improved, but it is unlikely that economic forecasting for agriculture or for the general economy will ever become a mechanical process. This is not to imply, however, that statistical measurement and analysis are not helpful. They are essential. And such analytical work must continue in order to develop better tools and more accurate forecasts.