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Price flexibility in the agricultural processing industries

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PRICE FLEXIBILITY IN THE AGRICULTURAL PROCESSING INDUSTRIES

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INTRODUCTION

In 1959, consumers spent a total of $58.8 billion for domestic farm-produced food. This represented an increase of almost 50 per cent in the ten year period from 1949 to 1959. During the same period, the costs of marketing farm foods increased by more than 60 per cent. As a result, gross incomes of commercial food producers have failed to share in the income increases of nonfarm families (9).

In the first quarter of 1963, farmers received 37 cents of each dollar shoppers spent on food, 2 cents less than a year earlier. The farmers share in March, 1963, 36 cents, was a low for any month on record. The widening spread between farm and retail prices is the cause. Food marketing costs, including processing, packaging and shipping, rose 5 per cent in the quarter from a year earlier, while prices paid to farmers dropped 3 per cent (6).

The general problem, a widening spread between farm and retail prices with decreasing farm prices, may be attacked by studying the agricultural processing industries sector or the commercial food producing sector of the economy. The commercial food producing sector is composed of many producers who have very little or no control over the price they receive and approach perfect competition. The prices paid by the agricultural processing industries is the price received by the farmer for his agricultural products. The agricultural processing industries account for a relatively large part of the spread between farm and retail prices and are considered to have some market power. Since the agricultural processing industries are situated in the midst of the general problem, this study deals with price flexibility in the agricultural processing industries. All of the four-digit Standard Industrial Classification food processing industries with sufficient data available are included in this study.

Price flexibility is the rate at which equilibrium between costs and prices is attained after a cost change is observed, not the frequency or amplitude of cost and price changes or a measure based on the margin. Multiple regression analysis using a distributed lag technique permits estimation of the average delay in passing on cost changes in each industry. The general objective of this price flexibility study is to observe price response with regard to direct costs. The price flexibility observations are associated with the real structural and behavioral conditions, but the results are not explained by them.

REVIEW OF LITERATURE

Early Price Flexibility Studies

One of the most famous price flexibility studies was by Gardiner Means as cited by Ruggles (24, 20) in the mid-thirties. Means defined price flexibility as the frequency of price change. The flexible prices changed frequently and were determined by buyers and sellers in the market, while the inflexible prices were stable except for an occasional administrative change. For the commodities with administered inflexible prices, the fluctuations were present in the quantity demanded at the set price. Since the quantity supplied was relatively stable for the goods with a flexible price, the variation in demand was reflected in the price level.

Means found the frequency distribution of the numbers of price changes for individual items to be U-shaped. The highly flexible prices grouped at one end of the distribution were interpreted as being market determined and around which traditional economic analysis was built. The inflexible prices were grouped at the other end of the distribution and were interpreted as being stable and administratively established. Means claimed that the economy consisted of two quite different pricing systems, flexible and inflexible prices. Means blamed the inflexible administered prices for their disruptive effects on the functioning of the economy and the failure of "laissez faire".

The study by Means did not show whether the economy as a whole was shifting from market to administered prices. Humphrey as cited by Ruggles (24) found that the relative flexibility of agricultural and industrial prices has not changed since 1890. Tucker (28) studied depression price changes from 1837 on and did not find any indication of increasing rigidity in prices. Backmen (2) defined price flexibility as the comparison of the change in a commodity price to the general price level change. If the commodity price advanced as much or more than the general price level, the price was considered flexible and vice versa. The period from 1929 to 1945 gave no indication of a more rigid economy.

Means used a scatter diagram to show that amplitude of price change was highly correlated with the frequency of price change. The frequencies of price change were divided into ten groups. The more frequent the price change for a group; the greater the amplitude of the change.

Then the focus of interest changed from frequency of price change to amplitude of price change because amplitude was theoretically more significant for the incidence of price distortion in the economy. The distribution of the amplitude of price change was found to be unimodal rather than U-shaped as Means had found the distribution of the frequencies of price change to be. The studies on price flexibility and the amplitude of price change generally compared groups, such as the flexibility of foods compared with chemicals and drugs as a group.

The price (21, p. 132) of a good was found to be less sensitive as the good moved toward the consumer. The sensitivity index was defined as the difference between the price in 1932 and the average of the prices in 1929 and 1937. The more sensitive a good's price was; the larger the price decrease during the depression. For example, the price of wheat was more sensitive than the price of flour, while the price of bread was less sensitive than either wheat or flour.

Mills as cited by Ruggles (24) used the change in price per unit of a commodity relative to its change in quantity to define price flexibility. The studies on the price-quantity relationship contained scatter diagrams or lists of commodities which showed the amplitude of quantity change and the amplitude of price change. The price-quantity relationship concept was used to show differences in the reaction of prices of products having different attributes, but it was not a meaningful concept for price flexibility.

Dunlop as cited by Ruggles (24, 7) defined price flexibility as the change in the degree of monopoly. Lerner's measure of the degree of monopoly (18), the ratio of the difference between price and marginal cost to price, increased when the marginal cost of the producer fell faster than the price of the final output during a period of falling prices for a given commodity. The price of the final good was as flexible as costs, when input prices and output prices moved together. Dunlop's measure of price flexibility was based on the price-cost relationship in an industry and indicated that the degree of monopoly increased in the depression of the thirties.

Neal as cited by Ruggles (24, 22) measured price flexibility in terms of a price-cost relationship too. A flexible price was defined as one where the output price changed by the same amount as the costs, (the absolute overhead margin is a constant amount per unit). The difference between Dunlop's and Neal's measures of price flexibility is that Dunlop expected a constant percentage margin, while Neal expected a constant absolute margin. Since Neal found a close relationship between the expected prices and the observed prices, he felt that output price changes could be explained by direct cost behavior, rather than by concentration of industry.

Sho-Chieh Tsiang as cited by Ruggles (24, 27) measured price flexibility as a percentage gross profit margin, (the ratio of the difference between the total value of product and prime costs to the total value of product). This concept utilized both Lerner's degree of monopoly and the percentage margin between price and marginal cost. In the period 1919 to

1937, the gross profit margin for the aggregate of all United States manufacturing was observed to be negatively associated with the average unit price cost, which indicated that the price system in the manufacturing industries had become less flexible.

Recent Price Flexibility Studies

In the mid-fifties, Ruggles (24) summarized the early studies on price flexibility and his review has been used quite extensively so far in this chapter. The cost, price, and output behavior of the agricultural, agricultural processing, mining, manufacturing, and distributive trades industries were discussed for the period from 1929-1932 and indicated a close relationship between costs and prices. The prices (24, p. 492) of agricultural raw materials and semi-finished goods were expected to show greater variability than the prices of highly processed goods. This was expected because the labor-cost was less variable than the prices of agricultural inputs and the more highly processed the good, the more important relatively labor was in the cost of the good.

Yordon (49, 50) defined price flexibility as the rate at which changes in cost and demand were passed on to price. This concept was based on the rate at which equilibrium was attained rather than the equilibrium value used in the studies prior to the fifties. Yordon studied fourteen United States manufacturing industries, half of which are classified as unconcentrated, half as concentrated, over the period from 1947 to 1958. The purpose of Yordon's study was to estimate price response and the influence of demand under different levels of concentration.

Price response, the price change considered in relation to changes in price-determining variables, was measured and symbolized by R. The price response for a price change, ΔP, induced by a change in direct costs, ΔC, or in demand, ΔD, was symbolized as: $R_c = \Delta P/\Delta C$, and $R_d = \Delta P/\Delta D$, respectively. The variables ΔP and ΔC were measured by price indexes, while the unit of measurement of ΔD was arbitrary. R_c equals one when the change in price was absolutely equal to the direct cost change, while R_c equaled one plus M for a price change which maintained a constant percentage margin. The symbol M was defined as the normal percentage mark-up over direct costs.

The least squares multiple regression equation used by Yordon follows:

$$\Delta P = \beta_1 \Delta L + \beta_2 \Delta M \tag{2.1}$$

where: $\beta_1 = R_1 = \Delta P/\Delta L$

$\beta_2 = R_m = \Delta P/\Delta M$

ΔL = the change in labor cost

ΔM = the change in material cost.

The equation provided separate estimates for the positive and negative changes of the dependent variables, since Yordon felt there were reasons for believing that the rate of response to cost decreases may differ from the rate for cost increases. Other than changes in productivity and monopoly power, one would have expected the increases and decreases to operate symmetrically. If the response rate was faster upward than downward, the industry must have had some monopoly power.

Yordon used the above price flexibility equation with monthly data series. The month-by-month cost and price data for material input and output prices were obtained from the Bureau of Labor Statistics wholesale price indexes, while the labor costs were the Bureau of Labor Statistics series of average hourly earnings. First differences were used rather than the price indexes as such in estimating the regression coefficients.

A quarterly index of utilization was selected to measure changes in demand. The index of utilization, designed to measure short-run changes rather than absolute levels, was the deviation of average weekly hours for a quarter from the twelve year average for that quarter. The demand variable was added to the above equation to estimate the effect of increased and decreased demand separately. For the equation with demand incorporated, the data series have quarterly observations to avoid erratic variation. The quarterly data did not permit the complete response pattern to be observed, since the observations were widely spaced.

Yordon found that the characteristics of the concentrated and the unconcentrated industries were very similar. The lag between a cost change and the corresponding price change was short, usually not longer than one month. The price did not respond significantly to demand changes for any of the industries. The percentage gross margins remained relatively stable throughout the period or during times of both recession and inflation. In short, Yordon found that prices were rapidly and fully responsive to cost increases, but were insensitive to demand changes for both levels of concentration.

Yance (47) also measured price flexibility by the rate at which equilibrium between costs and prices was attained. Yance defined price flexibility as the delay between cost changes and the corresponding price changes. Yance derived a detailed price flexibility model based on the following assumptions: (1) most price changes can be accounted for by changes in direct costs for labor and materials, (2) in equilibrium, a commodity's price is a linear function of the raw materials' price and the wage rate, and (3) the "normal price", a hypothetical entity, exists and is defined as the price to which the actual price would tend, if the costs remained at their current levels.

Yance's normal price model was:

$$P_t^* = \beta_0 + \beta_1 M_t + \beta_2 W_t \tag{2.2}$$

where: P_t^* = the current normal or equilibrium price for finished commodities

M_t = the current price of raw materials

W_t = the current wage rate.

Yance postulated that an industry changes its output price to approach the normal price by means of a price change this period which makes up part of the difference between last period's price and the current normal price. The price flexibility model derived by Yance follows:

$$P_t = P_{t-1} + \alpha(P_t^* - P_{t-1}) \tag{2.3}$$

where: P_t = the actual price this period.

This mechanism (2.3) represented a distributed delay in the sense that if the normal price moved from one level to another, the actual price would gradually approach the new normal price level.

In view of the interest in price behavior, perhaps the most useful practical implication of the model was the measure of price flexibility that emerged. There was only one constant, α, in Equation 2.3. The larger the α, the faster the output price approached the normal price. Therefore a large α implied more flexible prices.

A direct connection could have been shown between the magnitude of α and a measure of price flexibility. In terms of Yance's model, a natural measure of price flexibility was the average delay between a cost change and the resulting price changes. Part of the total resulting price change for a given cost change appeared the first month, a smaller part the next month, and so on. The aggregate price response effect was of a more or less continuous response, even though particular manufacturers made discrete price jumps. The model attempted to describe the continuous aggregate price adjustment which averaged one or two months, rather than automatic price changes after one or two months. Therefore, the resulting price series was a smooth and damped version of the cost series. Yance derived the following equation to calculate the average number of months that the various proportions of the complete price change were delayed.

(2.4) $$\bar{D} = 1/\alpha - 1$$

where: $\bar{D}$ = the average delay in the resulting price changes (periods).

Yance substituted the normal price, 2.2, into the price flexibility model, 2.3, and then simplified it to obtain the following model:

(2.5) $$\Delta P_t = \alpha\beta_0 + \alpha\beta_1 M_t + \alpha\beta_2 W_t - \alpha P_{t-1}$$

The above model was used to estimate the regression coefficients, which provided estimates of the parameters for models 2.2 and 2.3. The dependent variable was the first differences of the output price and was expected to reduce autocorrelation in the model. In spite of this precaution, the Durbin-Watson d statistic indicated positive autocorrelation for one and two month data series.

Yance applied the price flexibility model to the tanning and the shoe manufacturing industries and obtained average delays in the price response of one and four months, respectively.

Yance felt that there may be different price responses up and down and developed a model to test for phase differences. The two-phase price flexibility model follows:

$$(2.6)\quad P_t = \delta\left[P_{t-1} + \alpha(P_t^*-P_{t-1})\right] + (1-\delta)\left[P_{t-1} + \alpha(P_t^*-P_{t-1})\right]$$

where: $\delta = 1, \text{ if } (P_t^* - P_{t-1}) \geq 0$

$\delta = 0, \text{ if } (P_t^* - P_{t-1}) < 0$

The above model provided two estimates of the regression coefficients, but only one coefficient of multiple determination. Yance found that the differences between corresponding estimates were not significant, indicating that the price responses up and down were similar.

PRICE FLEXIBILITY MODEL

Introduction

The assumptions underlying the price flexibility model are similar to those stated by Yance (47). A price flexibility model was developed to relate the variable cost changes to the output price changes for the agricultural processing industries. This chapter contains the assumptions behind the price flexibility model, the derivation of the model, the reasons for the time-period selected, the industries selected for this study, the data sources, and the advantages and disadvantages of the model.

Glossary of Symbols

There are a number of symbols found in this chapter in the Assumptions and the Derivation of the Price Flexibility Model. The symbols are listed in alphabetical order and defined below:

a = the proportion of the cost change that is reflected in the first month after the cost change

$\bar{D}$ = the average delay in passing on a cost change

P_t^* = the normal price of a commodity in month t

$P_t^{I_A}$ = the price index of agricultural inputs in month t

$P_t^{I_{NA}}$ = the price index of nonagricultural inputs in month t

P_t^o = the output price index in month t

P_{t-1}^o = the output price index in month t-1

W_t = the hourly earnings of production workers in month t.

Assumptions

The price flexibility model is based on several assumptions which are stated in this section. The assumptions apply to market conditions, price responses, and the margin (overhead) of firms in an industry.

In traditional economic theory, price (47) is determined by supply and demand in the market, while the followers of full-cost pricing argue that price is determined primarily by cost for a given volume. In this study, we assume that price responds to variable (direct) costs. Since the price of a good is assumed not to change unless the variable costs have changed, the relation of supply to demand will not cause the price to change unless costs change. An example is found during the Korean War when the supply of wool was short, so the price was bid up and the price of rugs also went up.

In the processing industries, cost changes are assumed passed on to price in a systematic manner. Rather than changing the price at the time of the cost change or at a designated time after the cost change, the price is assumed to respond to the cost change with a successively smaller price change each period. In all cases, the price is assumed to change incrementally in the period of the cost change. The systematic manner in which cost changes are passed on forms a distributed delay.

In equilibrium, we assume that the price of a commodity is a linear function of the prices of the raw materials and the wage rate. If the labor cost increases \$.02 and the price increases \$.01, then the price will increase \$.10 for a \$.20 increase in the labor cost.

The normal price of a commodity is the hypothetical price that the actual price would tend toward if the costs remained at their current levels. The normal price is an equilibrium price based on the direct costs of the good. The normal price is defined as follows:

$$P_t^* = \beta_0 + \beta_1 P_t^{I_A} + \beta_2 P_t^{I_{NA}} + \beta_3 W_t \qquad (3.1)$$

The inputs are classified as agricultural products, nonagricultural products, and labor. Yance used only one input for each of his industries, since a single input accounted for most of the material cost.

The margin between price and costs is assumed to remain stable, as a per cent of the price, or change in a linear manner with cost changes. The margin may increase at a slower, similar, or faster rate than the costs, but we have to assume that it changes in a linear manner consistent with cost changes for our model. The margin includes the return to overhead, risk, profit, and all costs other than those classified as inputs above.

The model implies continuity of price changes rather than discrete price changes in an industry. Administratively set prices which are seldom changed to meet the current conditions violate our assumption of continuity in price changes. An industry with a price leader is also likely to observe discrete aggregate price changes rather than continuous changes. As long as costs are stable in an industry, we do not expect the price to be changing; but when costs are continually changing, we expect price to change often too.

The delay for a corresponding price change is assumed not to be significantly different when the costs are increasing and decreasing. The hypothesis (24) has been proposed that firms pass on cost decreases rapidly and cost increases slowly to keep the goodwill of the customers. The cost increases may be passed on slowly since improved technology may absorb part of the cost increase. On the other hand, the firm may lower prices slower inorder to benefit from the decreased costs with an increased profit. We are assuming that the various factors cancel out and the price delays, up versus down, are identical, since we only have one estimate of the delay at this point which is estimated from both the up's and down's.

Deriving the Price Flexibility Model

The assumptions underlying the price flexibility model were stated in the preceding section. The price flexibility model is also based on the assumption that this month's price is determined by last month's price plus a portion of the total expected output price change due to a variable cost change. If the costs of an industry change, we assume that the output price responds immediately with an incremental price change. The price flexibility model is:

$$P_t^o = P_{t-1}^o + \alpha(P_t^* - P_{t-1}^o) \qquad (3.2)$$

The new normal or equilibrium price is the output price which would be stable in the long run given the new variable costs. The difference between the new normal price and the previous month's actual output price is the output price change required for a new equilibrium output price. Since the cost changes are passed on to price by increments, the new price is somewhere on the continuum between last period's output price and the current normal price. The estimated parameter α determines where the new output price will lie on this continuum. The parameter α is assumed to be between zero and one for each industry. The larger parameter α is, the faster the actual price approaches the normal price. The parameter α determines the portion of the difference between the current normal price and last period's output price that is added to last period's output price or how much of the cost increase (decrease) is passed on in the first period.

In all of the industries in this study, the α was observed to lie in the range from zero to one. If the parameter α is less than one, the output price would change inversely to the input price change. If parameter α is greater than one, the firms would overcompensate and the actual price would be on the opposite side of the normal price. The actual price fluctuations eventually would converge to the normal price.

The parameter α can be estimated from the price flexibility model, 3.2, if only we knew P_t^O, P_{t-1}^O, and the difference between the current normal price and last month's output price. The Bureau of Labor Statistics' Wholesale Price Index (39) contains individual commodity price index series for the output price index and for the variables determining the normal price in model 3.1. We do not have a series nor can we estimate a series for the normal price at this time. By substituting model 3.1 into the price flexibility model 3.2, we obtain an equation for which time series data were available for all the variables. The price flexibility model with the normal price substitution is:

$$(3.3) \quad P_t^O = P_{t-1}^O + \alpha(\beta_0 + \beta_1 P_t^{I_A} + \beta_2 P_t^{I_{NA}} + \beta_3 W_t - P_{t-1}^O)$$

After simplifying Equation 3.3, we obtain the following price flexibility model:

$$(3.4)\quad P_t^o = (1 - \alpha)P_{t-1}^o + \alpha\beta_0 + \alpha\beta_1 P_t^{I_A} + \alpha\beta_2 P_t^{I_{NA}} + \alpha\beta_3 W_t$$

Since time series data are available for all the variables in model 3.4, multiple regression analysis was used to estimate the regression coefficients or parameters in the model. Since the regression coefficient for the past period's output price is one minus α, α is calculated by subtracting the quantity, one minus α, from one. Now that an estimate of α is obtained, the parameters for model 3.1 can be calculated by dividing the remaining coefficients from model 3.4 by α. The normal price can be calculated from the normal price model, 3.1, now that the variables are known and the parameters estimated. The regression coefficients from the price flexibility model, 3.4, provide an estimate of parameter α and the normal price.

The parameter α determines the portion of the difference between the current normal price and last period's actual output price that is reflected in the current output price. The larger parameter α is; the faster the actual price approaches the normal price. The average price delay, $\overline{D}$, is a measure of the time required for the actual output price to reach the normal output price. The magnitude of α and the number of output price changes required to obtain equilibrium are inversely related. The average price delay is a weighted average of time during the period from the cost change to the new equilibrium output price. The output price observations are weighted by the portion of the original difference between the past period's output price and the new normal price that is added to output price in each successive period. The average price delay, $\bar{D}$, is calculated from the equation:

$$\bar{D} = 1/a - 1 \qquad (3.5)$$

which is derived in Appendix A.

Selection of the Time-Period

A time-period with the characteristics of the present economy and detailed data readily available was desired to obtain an insight into the present behavior of the agricultural processing industries. The period following World War II through the present meets the objectives just described.

The price ceilings were withdrawn during the latter part of 1946, so 1947 is the first year following the war when an industry was permitted to quote its own price. The period from 1947-49 is commonly considered a base period for price indexes and is the base period for the price series used in this study.

The post World War II era (17) has experienced mild periodic recessions and upswings. In November, 1948, the peak of the post war expansion was reached, but the following recession was very mild. Then in October, 1949, the economy started another upswing and the Korean War boosted the upswing which lasted until July, 1953. The recession from August, 1953, through August, 1954, was represented by a liquidation of inventories. The expansion from August, 1954, through July, 1957, was characterized by strongly rising production and employment during the first half and rapidly rising prices during the second half. The recession of July, 1957, through April, 1958, was relatively short and moderately severe, but the following upswing was both moderate and short-lived. The recession from May, 1960, through February, 1961, was mild, but the economy experienced continued high unemployment.

At the time the data was being compiled, the most recent data available were for December, 1961. The period from 1947 through 1961 includes cyclical effects and represents our economy since World War II. This study is primarily interested in price flexibility since World War II in our modern economy.

Industries Selected for Study

Bain (3, p. 110) defined a theoretical industry as a group of products which are close substitutes to buyers, relatively distant substitutes for all products not included in the industry, and available to a common group of buyers.

The theoretical industry is based on a group of products; it is a group of firms only to the extent that they supply the products classified as an industry. A firm producing several products may be classified in several industries, but the size of the firm in each industry depends on the output which is supplied to that industry.

The Bureau of Census as quoted by Bain (3) defines an industry as a branch of trade. "This means in general that an industry is identified as a group of firms (or divisions of firms) which either (a) produce similar products, or (b) employ similar processes, that is, have a good deal in common productwise, process-wise, or both." The Census industry usually does not coincide with the theoretical industry, since the Census industry very frequently includes or excludes products from an industry which are close substitutes.

The Census industry classification is the standard used by the various government agencies and the best one available. The most recent Census grouping (40) is commonly called the 1957 Standard Industrial Classification (SIC). The four-digit Census grouping (3, p. 113) most closely conforms to the theoretical industry concept. The three-digit and broader groupings contain too many products to constitute a group of close substitutes, while the five-digit and narrower groupings exclude products which are close substitutes.

The agricultural processing industries were selected in an objective manner with the availability of data as the critical factor. All of the four-digit industries included under the two-digit classification, 20, "food and kindred products", and 21, "tobacco products", for which an input and output breakdown and price indexes were available are included in this study. The woven carpets and rugs industry from the major group 22, "textile mill products" was also studied, since the industry produces wool rugs. In the next section, the data sources are discussed in detail. The Census industries studied in this thesis are listed in Table 1.

Table 1. The Census code and title of the four-digit 1957 Standard Industrial Classification industries included in this study

Census code	Industry
2011	Meat packing plants
2015	Poultry dressing plants
2021	Creamery butter
2022	Natural cheese
2023	Condensed and evaporated milk
2024	Ice cream and frozen desserts
2026	Fluid milk
2033	Canned fruits and vegetables
2035	Pickles and sauces
2037	Frozen fruits and vegetables
2041	Flour and meal
2042	Prepared animal feeds
2043	Cereal preparations
2044	Rice milling
2045	Blended and prepared flour
2051	Bread and related products
2052	Biscuit and crackers

Table 1 (Continued).

Census code	Industry
2062	Cane sugar refining
2071	Confectionery products
2072	Chocolate and cocoa products
2073	Chewing gum
2082	Malt liquors
2085	Distilled liquor except brandy
2086	Bottled and canned soft drinks
2091	Cottonseed oil mills
2092	Soybean oil mills
2111	Cigarettes
2121	Cigars
2131	Chewing and smoking tobacco
2271	Woven carpets and rugs

Data Sources

In a previous section, price flexibility model, 3.4, is derived because time series data are available for all the variables in the model. The Bureau of Labor Statistics' Wholesale Price Index (39) lists monthly individual commodity price indexes with 1947-49 as a base of 100. When the B. L. S. price index does not list a series for a commodity listed in the Census of Manufactures (40, 41) breakdown, a close substitute listed in the B. L. S. price indexes was used. An example is the substitution of transportation upholstery for transportation floor covering. The B. L. S. price index series are not seasonally adjusted, therefore the model is faced with both short-run (seasonal) and long-run effects in estimating an average price delay.

The B. L. S. Wholesale Price Index does not list a price index series for the output of the rice milling and the confectionery products industries until December, 1950, and December, 1952, respectively. The regression coefficients for the rice milling industry were estimated from data for January, 1951, through December, 1961. The confectionery products industry used the period from January, 1953, through December, 1961, to estimate the regression coefficients.

Since an industry's output frequently consists of more than one commodity, a price index of the industry's output rather than individual commodity price indexes was required for the price flexibility model. The Census of Manufactures is the source of the kinds and the value of the various commodities produced by an industry. The weight for an individual output product is the ratio of the value of the commodity in question to the total value of output for the industry. The weighted output price index is composed of the sum of the products of the individual price indexes and the corresponding weight. The output price index is a weighted price index of all the commodities produced by the firm. When an industry has only one output commodity, the weight for the commodity is one and the price index listed in the B. L. S. Wholesale Price Index is also the weighted output price index. Any output, which comprises less than 1 per cent of the total value of the industry's output, is omitted from the weighted price index. The term output price index refers to the weighted output price index in this study.

The Census of Manufactures contains the kinds and the value of output for the years 1947, 1954, and 1958. The weights for the different output commodities were computed for the three bench mark years, 1947, 1954, and 1958. Whenever a new output commodity constituted 1 per cent or more of the total value of an industry's output, it was included in the weighted output price index. Any output commodity, which contributed less than 1 per cent to the total value of output, is not included in the current output price index. The number of commodities included in the output price index and the weights for the individual output commodities are variable for the years included in this study. Since the mix of the output products was observed to change during the period studied, the weights for the individual commodities were interpolated between the bench mark years. Since the pattern of product mix change is not known, it is assumed that a linear or consistent change occurred between the bench mark years. The output mix is assumed to remain constant from 1958 on, since more recent information on the output mix was not available. The 1958 output mix was applied to the three following years rather than trying to predict the output mix from the trends that were observed prior to 1958, since the output mix change is usually slow and subject to changes in the rate and direction of change. Since the bench mark weights for 1947 are partly or completely missing for twenty-three industries, the 1954 weights were used for the earlier years. In the prepared animal feeds, bread and related products, and the biscuit and crackers industries, the weights are available for all three bench mark years. The only commodity weights available for the bottled and canned soft drinks, cigarette, cigar, and the chewing and smoking tobacco industries are for 1958 and used for the entire period studied.

The delayed output price series is the output price series for the period immediately preceding the current period. The first complete observation for the price flexibility model is February, 1947. The output price series begins with January, 1947, but the model must start with February inorder to have the past period's output price index available.

The variable costs of each industry are classified as an agricultural input, nonagricultural input, or labor. The individual commodities comprising the agricultural and nonagricultural inputs and their value were available in the <u>Census of Manufactures</u>. The agricultural inputs are defined as all farm products without any off-the-farm processing, while the nonagricultural inputs are all processed products or commodities. The weights for the individual agricultural and nonagricultural inputs are obtained in the same manner as the weights for the output commodities. Any agricultural input which comprised less than 1 per cent of the total value of the agricultural input was omitted from the weighted agricultural input price index, while any nonagricultural input contributing less than 1 per cent to the total value of the nonagricultural input was included in the other materials classification. The Census of Manufactures listed the miscellaneous inputs in the other materials classification. The B. L. S. price index for "all commodities other than farm and foods" was used for the other materials price series. The B. L. S. Wholesale Price Index did not list "all commodities other than farm and foods" for 1947-1950, so an other materials price index was constructed by computing the mean price index for all the two-digit industries other than farm and food for each month.

The B. L. S. Wholesale Price Index did not list a price index series for cream or carpet wool. Since the price of cream is based on the milkfat in cream, the monthly average price per pound of milkfat in cream was obtained from Dairy Statistics (43). The monthly milkfat price was divided by the mean price for 1947-49 to produce a price index for cream based on 1947-49 as 100. The price index for carpet wool is the ratio of the average monthly carpet wool price to the mean wool price for 1947-49. The Wool Statistics (33, 34) contains the monthly carpet wool price for the United States. Since the data is not available prior to October, 1947, the base period is from October, 1947, through December, 1949, rather than from January, 1947, through December, 1949, and the price flexibility model, 3.4, was started with October, 1947, which was the first complete observation.

Since the agricultural input, rice, is not listed in the B. L. S. Wholesale Price Index for the rice milling industry, a rice price index was constructed from the monthly rice price for the United States with 1947-49 as a base of 100. The average monthly price per hundred pounds of rough rice was obtained from the Grain and Feed Statistics (29).

The Census of Manufactures does not list a breakdown of the inputs for the cottonseed oil mills and the soybean oil mills industries; so the entire input was classified as agricultural, cottonseed or soybeans, since they account for most of the industries' input. The bread and related products, biscuit and crackers, cane sugar refining, chewing gum, bottled and canned soft drinks, and the woven carpets and rugs industries do not purchase any direct agricultural inputs.

The hourly earnings of production workers were obtained from the B. L. S. Employment and Earnings (35, 36) and the Monthly Labor Review (38). Employment and Earnings lists the hourly earnings of production workers by month for the three-digit and the four-digit SIC industries. The hourly earnings of production workers include overtime premiums. When the series from Employment and Earnings were incomplete or missing for an industry, the Monthly Labor Review was used to complete the series or provide a complete hourly earnings series.

The hourly earnings of production workers for the meat packing, poultry dressing plants, ice cream, confectionery products, malt liquors, and the bottled and canned soft drinks industries are from the Employment and Earnings. Since the earnings series for the poultry dressing plants is for 1958-1961, the price flexibility model, 3.4, is used with complete data for 1958-1961 and then without a hourly earnings variable for the entire period studied. The frozen fruits and vegetables, and the bread industries have hourly earnings series for the three-digit industry from 1947 through 1957 and the respective four-digit industry from 1958 on. Neither the Employment and Earnings nor the Monthly Labor Review contained hourly earnings series for the chocolate and cocoa products industry, so the earnings series for the confectionery products industry was used because the two industries are very closely related.

The condensed and evaporated milk, chewing and smoking tobacco, and the woven carpets and rugs industries' earnings series were obtained from the Monthly Labor Review. The hourly earnings for the chewing and smoking tobacco industry were not available for 1961; so the average monthly variation was computed and the series for 1961 were estimated by adding the monthly change to the previous month's hourly earnings. Since the hourly earnings series were not available for the creamery butter and natural cheese industries, the earnings series were borrowed from the condensed and evaporated milk industry, which is a closely related industry and would experience similar hourly earnings changes.

Both the Employment and Earnings and the Monthly Labor Review contributed to the hourly earnings series of the fluid milk, canned fruits and vegetables, flour and meal, prepared animal feeds, cereal preparations, biscuit and crackers, cane sugar refining, and the distilled liquor industries. The earnings series from the prepared animal feeds industry was substituted for the cottonseed oil mills and the soybean oil mills industries, since neither the Monthly Labor Review nor the Employment and Earnings listed hourly earnings series for them and the industries are in a similar sector of the economy. The earnings series of the flour and meal industry was used for the blended and prepared flour industry, since the two industries are nearly one and the data for the blended and prepared flour industry was not available.

The three-digit hourly earnings series from the Employment and Earnings were the best available for the pickles and sauces, frozen fruits and vegetables, cereal preparations, rice milling, bread and related products, biscuit and crackers, cane sugar refining, chewing gum, distilled liquor, cigarette, and the cigar industries. The four-digit cigarette and cigar industries are nearly identical to the three-digit industry. In general, the hourly earnings data were not as complete as the price indexes.

Advantages and Disadvantages of the Price Flexibility Model

The price flexibility model, 3.4, has several advantages which some of the previous measures and models of price flexibility did not have, but it has some limitations which are also discussed in this section.

The delay of management in reflecting cost changes is a more logical approach to price flexibility than the frequency or amplitude of price change. The price flexibility model, 3.4, is independent of cost fluctuations which bothered Means frequency of price change.

The effect of a given cost rise can be followed through the model generated output price. Every month a smaller portion of the difference between the current normal and the previous month's output price is added to the output price until the quantity added becomes negligible. The first month a cost change is measured, the model assumes that the quantity α times the difference between the current normal and the previous month's output price is added to the previous month's output price. The next month the quantity $\alpha(1 - \alpha)$ times the original difference is added to the output price. The third month the quantity $\alpha(1 - \alpha)^2$ times the original difference is added to the output price index with respect to time.

The price flexibility model is similar to full cost pricing in that both determine output prices from costs. Full cost pricing (14) implies total average cost because it includes fixed and variable costs. The price flexibility model determines the output price from the given variable costs, but it does not determine the level of return to the factors of production. The overhead or gross margin of an industry is allowed to vary in the price flexibility model provided the changes are linear and can be associated with the variable cost inputs. Linear changes in the overhead or gross margin associated with variable cost changes can be explained by the price flexibility model. The changes in overhead are explained, if the variable costs are a good indicator of their changes. Since the multiple regression model is fitted so that the squared deviations are a minimum, changes in overhead may be camouflaged in the regression coefficients.

The multiple regression price flexibility model permits all the factors that help explain output price changes to be incorporated in the model as independent variables. In a later chapter, additional factors are incorporated in the model to aid in explaining the output price changes. The individual regression coefficients are tested for differences from zero by means of the t test.

The price flexibility model (47, p. 404) is sensitive enough that it can deal with industries rather than commodities which Means was restricted to. The model is workable in the manufacturing industries, but it does not work in the commodity markets because demand is of primary importance. For manufacturing industries, the changes in demand are assumed reflected in the quantity produced rather than the output price. There is statistical evidence indicating that marginal costs (14, p. 370) are fairly constant for a wide range of output rates in manufacturing industries. Since the model assumes that demand is of secondary importance, it breaks away from the classical theory of demand in the short run and assumes that direct costs are the major factor in determining price changes. Yordon (49, p. 287) found that output prices of manufacturing industries were fully responsive to cost increases, but insensitive to demand changes. The model is adapted to any industry where direct costs are more important than demand in determining price. It does not matter whether the industry is purely competitive, oligopolistic, or monopolistic in structure so long as variable costs are the basis for price determination.

The results from the price flexibility model are no better than the price series used in it. The Wholesale Price Index (46, p. 7) is designed to measure average changes in price, not the changes in quality and product. Quality and product changes are kept to a very minimum by specifying items specifically, such as: "Jelly, pure, grape, 10 oz. jar, 2 dozen jars to case, in lots of more than 25 cases, manufacturer to jobber, f.o.b. distribution point, per case" (46, p. 7). The commodities selected for the precise specifications are usually those which describe the largest dollar volume of sales for the commodity. The prices are obtained from a representative reporter sample which contains a minimum of three reporters for one predetermined day of the month. When most buyers receive a discount from the quoted price, the reduced price is used rather than the quoted price. The Bureau of Labor Statistics tries to base the price changes on an identical good each month, but changes in the size of container and grading standards, new items coming on the market, and old items disappearing from the market make it very difficult to continually price an identical commodity.

The price flexibility model is a mulsiple regression model and quite rigid. For example, the output price is expected to respond in the same manner each time the input's price changes. In an industry with a price leader, the output price may be changed in one large discrete change rather than a series of small price changes. The inflexibility of the price flexibility model is a disadvantage, but the simplicity of the model overcompensates for the loss due to rigidity.

Least squares multiple regression assumes that the disturbance term is not autocorrelated. Yordon (50) used first differences for the variables rather than the price index series, as was mentioned in the Review of Literature. The first differences were used to eliminate serial correlation from the variables. Yance (47) used first differences for the dependent variable to reduce autocorrelation in the disturbance term. In Yance's study, the residuals in general turned out to be autocorrelated which was indicated by the Durbin-Watson d statistic. The price flexibility model in this study uses price indexes for all the variables to eliminate a considerable amount of computational work. The estimates of the regression coefficients are (16) unbiased, but the variances for the regression coefficients are underestimated. Since the coefficient of multiple determination is overestimated when autocorrelation is present and least squares estimates are used, the model does not fit the data as well as indicated. Since the estimated variances are not too good when autocorrelation is present, the t test is not too good either. The saving in computational work was considered more important than eliminating some of the autocorrelation. The efficiency of the estimated variances decreases as the average delay increases, since the quantity $1 - \alpha$ is increasing or the autocorrelation between the output price and the lagged output price is increasing. Yordon and Yance found the price delays to be relatively short (less than 4 months generally), but in this study some long average delays were observed. The variances and t tests for the industries with relatively long average delays are not very reliable.

The model has limitations which must be kept in mind when one is studying the results. The assumptions undoubtedly deviate from the real world situation on several occasions, but they permit us to make a statistical estimate of the average delay for the agricultural processing industries.

RESULTS FROM THE PRICE FLEXIBILITY MODEL

The results from the basic price flexibility model are summarized in Table 9 by industry. The coefficients of multiple determination, R^2, which measure the goodness of fit, are found to lie in the range from .84 to .99 with twenty-five above .90. Yance (47) used a ten year time-period instead of a fifteen year period as in this study and obtained an R^2 around .50, which he considered satisfactory because the R^2's refer to an explanation of the change in price rather than to the absolute price level.

The intercept, b_0 for the normal price equation, 3.1, ranges from a low of -1452.93 to a high of 127.38. The assumptions do not restrict the sign or the magnitude of the intercept.

The parameters, b_1, b_2, and b_3, determine the contribution of the individual input price series to the normal price. The assumptions imply that the parameters are positive indicating that output price increases for cost increases. Some of the estimated regression coefficients are negative, indicating that a cost change is inversely related to the resulting price change. A situation of gradually decreasing output prices, increasing costs, and improved technology that more than compensates for the increasing costs and decreasing prices is represented by negative regression coefficients.

In a multi-input industry, one input may be increasing (decreasing) in price, while another input is decreasing (increasing) in price by a larger absolute amount which might indicate a price change in the opposite direction for one input. Since the confectionery products industry, 2071, is the only one with all negative regression coefficients, which are not significant, the second explanation of the above two is the more likely.

The estimated regression coefficients for the hourly earnings series are significantly greater than zero for thirteen of the thirty industries. It seems logical that fewer of the regression coefficients for labor are significant because the per cent of value of shipments allocated to the wages of production workers is usually 5 to 10 per cent with a maximum of 19.7 per cent as shown in Figure 4. The average per cent of value of shipments allocated to the agricultural input, nonagricultural input, or overhead is considerably higher than for labor as shown in Figures 2-5. From 1947-49 to 1958, the noninflationary (31, p. 23) increase in hourly earnings was similar to the growth of output per man-hour in the food processing industries.

The data indicate that a cost change in labor was not always large enough to force management to change the output price. The fact that the production-worker hourly earnings series were not as complete and accurate as the price indexes in several of the industries may be a partial explanation for more negative regression coefficients and less statistically significant coefficients.

All but three of the empirical estimates of a were statistically significant at the 5 per cent level of confidence. These three industries, as shown in Figures 26, 27 and 28, have the longest average delay and relatively inflexible output prices which violate the assumption of continuity of price changes. The estimated a for the malt liquors industry was not even statistically significant at the 10 per cent level of confidence. The regression coefficients are generally more highly significant for the shorter average delays than for the longer average delays because the industries with a longer delay violate the assumption of continuity of output price changes and autocorrelation lowers the variance of the regression coefficients.

Examination of Figure 1 indicates considerable variation of the average delay from industry to industry in this study. The creamery butter industry has the shortest average delay, 0.12 months; while the malt liquors industry has the longest average delay, 49.00 months. However, the distilled liquor except brandy industry has the longest statistically significant average delay, 29.30 months as shown in Table 9. The distribution of the average delays can be partitioned into fourths as follows: zero to one month, one to six months,

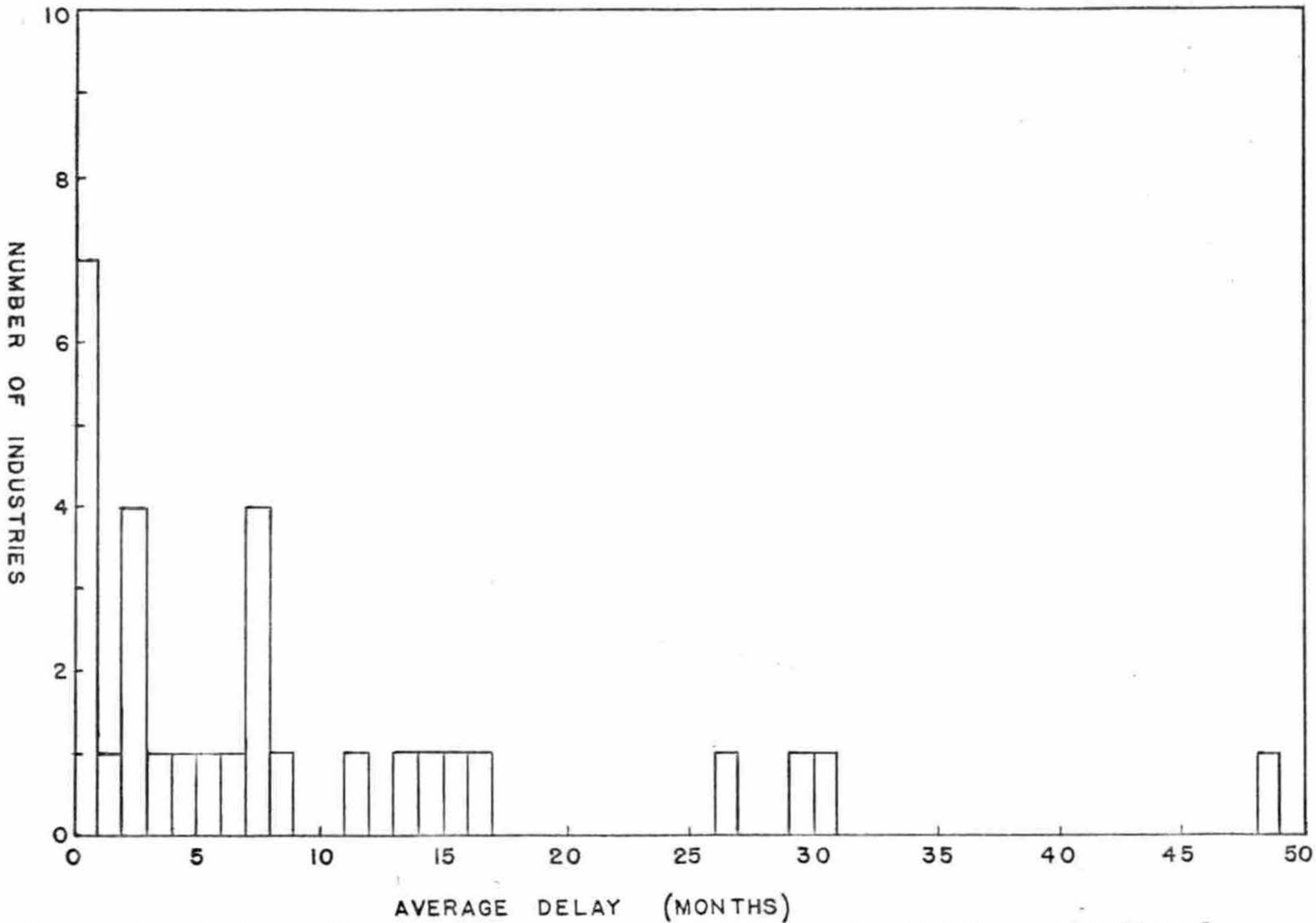

Figure 1. Distribution of the average delays for the thirty agricultural processing industries

six months through one year, and longer than one year. Since the height of the distribution bars tends to decrease as the average delay increases, we observe the left half of an U-shape.

The elasticities of the output prices with respect to the various inputs are explained and listed in Appendix C. The magnitude of elasticity decreases as the average delay increases because the past month's output price is more important in determining the current price. Therefore the importance of each input in the determination of the output price decreases as the average delay increases.

Another concept associated with the length of the average delay is the importance of the various factors of production. As shown in Figures 2-5, the importance of the agricultural input decreases as the average delay increases, while the importance of the nonagricultural input, wages, and overhead become more important as the average delay increases. Since the agricultural input experiences seasonal changes and variations in the year-to-year price level, an industry must change price often to maintain a consistent margin. Since the nonagricultural inputs and wages are more stable, industry will absorb small changes in their cost and change price only when the margin is outside of the normal range. The more highly processed products (21) experience stabler prices than the less highly processed products. The observations in this study agree with the above statement because the more highly processed the output product, the less agricultural input that is used for production.

The number of companies and the level of seller concentration do not appear to be correlated with the length of the average delay in price response. The industries with the higher levels of concentration have relatively long average delays, but the data (Appendix E) is not complete enough to uphold any hypothesis. Yordon (49) was not able to find any correlation between the level of concentration and price flexibility.

The industry graphs (Figures 6-35) with the normal and equilibrium prices are not to illustrate the goodness of fit of the model, but they show the effect of the various delays and how well the actual price follows the normal price as can be observed by studying the graphs. The actual price curve should be a damped and smoothed version of the normal price curve and lie to the right of the normal price curve by a horizontal distance equal to the average delay. The actual price curve follows the normal price curve more closely for the short average delays than for the longer average delays.

In the previous chapter, we saw the path of the business cycle during the period from 1947 through 1961 and a sketch of its characteristics. The actual and normal price curves tended to rise during upswings in the economy and decrease during recessions in the economy. Since the duration of the business cycle in the general economy has been steadily decreasing, the effect of the cycles on the price curves is less pronounced as we progress through the fifteen year period. In the pickles and sauces industry, which has a relatively stable output price, the actual price increases occurred during upswings in the economy, while the decrease in price occurred during the recession of 1957-58. Another example of the effect of the general economy on the actual price is found in the rice milling industry. During the recession of 1953-54 the actual price was below the normal price. Then during the latter part of 1954 and 1955 the actual price was considerably above the normal price because the economy was booming.

In the creamery butter industry, the actual price followed the normal price quite closely until late in 1959, when the actual price rose about 10 per cent above the normal price and then followed the normal price changes very closely. During this time, the price support level of the Commodity Credit Corporation (5) remained stable and large surpluses of butter were accumulating.

Twelve industries, represented by Figures 14, 18, 21, 22, 24, 26, 27, 28, 29, 32, 33, and 34 have actual price curves which are quite stable except for an occasional large change. Eight of these industries have a steadily increasing normal price with the actual price following in a stairstep manner. The malt liquors industry has a steadily increasing normal price with the actual price following in a stairstep manner and is the only one with the actual price always below the normal price.

The normal price model, 3.1, was used to estimate the margin (overhead) change for a variable cost change. The equilibrium output price change was computed for a 10 per cent increase in the variable costs which consisted of an agricultural input, nonagricultural input, and the hourly earnings of production workers. The equilibrium output price was determined when the agricultural and nonagricultural price indexes are 100 and the hourly earnings are $1.00, then the equilibrium output price was obtained for an agricultural and nonagricultural price index of 110 and hourly earnings of $1.10 to find the change in the equilibrium output price for a 10 per cent increase in the variable costs. A 10 per cent increase in the equilibrium output price is expected for an industry which maintains a stable percentage margin or percentage return to overhead, while an increase of less than 10 per cent in the equilibrium output price is anticipated for an industry which maintains a constant absolute margin or a constant absolute return to overhead.

Table 2 lists the equilibrium output price changes and the average delay for all thirty industries. The average

Table 2. The estimated output price increase for a 10 per cent increase in the variable costs by industry

Census code	Industry	Est. output price increase (per cent)	$\overline{D}$ (months)
2011	Meat packing plants	13	0.38
2015	Poultry dressing plants	10	0.82
2021	Creamery butter	8	0.12
2022	Natural cheese	12	0.27
2023	Condensed and evaporated milk	11	2.92
2024	Ice cream and frozen desserts	14	15.95
2026	Fluid milk	8	2.32
2033	Canned fruits and vegetables	3	7.55
2035	Pickles and sauces	3	26.78
2037	Frozen fruits and vegetables	2	13.09
2041	Flour and meal	9	0.96
2042	Prepared animal feeds	13	0.34
2043	Cereal preparations	9	6.30
2044	Rice milling	1	1.86
2045	Blended and prepared flour	8	2.53
2051	Bread and related products	11	11.05
2052	Biscuit and crackers	7	16.54
2062	Cane sugar refining	8	4.24
2071	Confectionery products	-1	7.13
2072	Chocolate and cocoa products	14	7.33
2073	Chewing gum	-4	30.25
2082	Malt liquors	9	49.00
2085	Distilled liquor except brandy	10	29.30
2086	Bottled and canned soft drinks	17	7.93
2091	Cottonseed oil mills	6	2.72
2092	Soybean oil mills	7	0.59
2111	Cigarettes	8	8.09
2121	Cigars	2	5.67
2131	Chewing and smoking tobacco	12	14.63
2271	Woven carpets and rugs	19	3.41

delays were included because the industries with short delays have output price changes approximating the anticipated percentage price change, while the industries with medium and long average delays experience considerable variation in the output price change. The longer average delays have a larger portion of the value of shipments as return to overhead as shown in Figure 5. Since the industries with short average delays have a small portion of the value of shipments as return to overhead, a change in overhead does not affect the output price like in an industry where overhead is a relatively important cost. Since a 10 per cent increase in an input price index usually occurs over several periods, the industry may gradually be changing the intensity of the variable and fixed costs in production. An example is the substitution of a machine for manual labor in the processing of a food product. An industry which is becoming more capital intensive would experience an increasing percentage return to overhead as the variable costs increased throughout the period. The increasing or decreasing percentage margin may be due to changes in the profit level or more or less capital intensive production. Improved technology may permit the overhead cost to decrease, which may offset part of the variable cost increase.

The change in the equilibrium output price for given variable cost changes is studied as an accompanying characteristic of the various average delays, rather than a measure of price flexibility as used by Dunlop (7) and Neal (22).

REVISED MODELS AND RESULTS

In the previous chapter, agricultural inputs, nonagricultural inputs, and hourly earnings series were used as independent variables in the basic price flexibility model.

Other factors, which are considered to be important in determining price changes, are incorporated in the model for a few selected industries in this chapter. Only one independent variable was changed or added to the model at a time, although it is possible to include most of the new variables in a single model. Each new variable is individually incorporated in the basic model to determine its value as an independent variable. Multiple regression was run on a few selected industries for each revised model rather than all the industries, since each new independent variable or factor was considered of similar influence from industry to industry in determining an output price change. Since the squares of the multiple correlation coefficients for the basic model were already in the 90's for most industries, it is not possible to observe any large improvements in the new coefficients of multiple correlation.

All equations were estimated from monthly data for the 15 years, 1947-1961, except for the rice milling industry which was estimated from monthly data for 11 years, 1951-1961.

Hourly Earnings Adjusted for Productivity per Man-Hour

Since output per man-hour increased 29 per cent from 1947-49 to 1958 for domestic farm food products, the hourly earnings of production-workers series was discounted to obtain a series based on a constant output per man-hour.

The bulletin Output per Man-Hour in Factories Processing Farm Food Products (31) is the source of output per man-hour for the three-digit food processing industries on a yearly basis from 1947 through 1958 with 1947-49 as a base of 100. The yearly output per man-hour index series is based on all employees and hours worked. The productivity per man-hour was brought up to date by dividing the yearly output by the yearly number of production-worker man-hours. The productivity per man-hour was calculated for 1958 too, so the productivity per man-hour for the later years could be included in the output per man-hour index series. The yearly output is an aggregation of the industry's monthly production, which is listed in the Survey of Current Business (42). The production-worker man-hours per year were calculated by taking the sum of monthly hours (four times the average weekly hours) and multiplying by the total number of production workers. The production-worker average weekly hours paid for and the total number of production workers in an industry were obtained from the Employment and Earnings (35, 36).

The adjusted hourly earnings were substituted for the actual hourly earnings series in the condensed and evaporated milk and the blended and prepared flour industries. These two industries were selected because they were felt to be representative and the regression coefficients for labor were very highly significant. The revised price flexibility model follows:

$$(5.1)\ P_t^o = (1 - \alpha)P_{t-1}^o + \alpha\beta_0 + \alpha\beta_1 P_t^{I_A} + \alpha\beta_2 P_t^{I_{NA}} + \alpha\beta_3 W_t'$$

The symbols in 5.1 are defined as those in model 3.4, except for W_t', which represents the hourly earnings of production-workers in month t adjusted for productivity changes.

The results for the condensed milk and the flour industries from both price flexibility models are summarized in Table 3. The degree of confidence of significant t is listed directly below each regression coefficient. A dash is found below the regression coefficients which are not statistically significant at the 10 per cent level.

In the flour industry, the regression coefficient for the nonagricultural input in model 5.1 is significant; but the coefficient for adjusted hourly earnings is not significant as shown in Table 3. The coefficient of multiple determination for the flour industry decreased from .86 to .84. In the condensed and evaporated milk industry, the only

Table 3. The estimated coefficients for the basic and the hourly earnings adjusted for productivity per man-hour price flexibility models

Industry and model	R^2	$\bar{D}$	a	b_0	b_1	b_2	b_3
2023 Condensed and evaporated milk							
basic	0.97	2.92	0.26	-10.14	0.66	0.35	6.82
significance			.01		.01	.01	.05
adj. labor	0.97	3.00	0.25	-18.78	0.62	0.42	11.00
significance			.01		.01	.01	-
2041 Flour and meal							
basic	0.86	0.96	0.51	6.54	0.96	-0.19	12.26
significance			.01		.01	.10	.01
adj. labor	0.84	1.43	0.41	2.25	0.67	0.32	-0.95
significance			.01		.01	.01	-

significant change observed is that the regression coefficient for hourly earnings is statistically significant, although the coefficient for adjusted hourly earnings is not.

For the two industries studied, the substitution of adjusted hourly earnings for unadjusted hourly earnings caused the statistical quality of the results to decrease slightly. Since the hourly earnings series were adjusted with annual production per employee man-hour data for three-digit industries rather than month-to-month productivity changes for the given four-digit industry, perhaps the data is not specific enough to provide improved results.

The hourly earnings adjusted for productivity changes per man-hour series is similar to a unit labor cost series because both series are based on wages or labor cost for a given output. The hourly earnings series is based on the labor cost per hour; but when the hourly earnings series is adjusted for productivity changes per man-hour, the new series is the labor cost for a unit of output equal to the output per man-hour in the base period, 1947-49. The U. S. D. A. (31) constructed the index of output per man-hour to study the relation between changes in hourly earnings per employee and unit labor costs. Since the hourly earnings adjusted for productivity per man-hour approach to unit labor cost has not improved the results with the available data, the monthly production-worker labor cost per unit of output approach is followed in the next section.

Labor Cost per Unit of Output

Changes in average hourly earnings (24, p. 454) have been shown to be a rather poor indicator of changes in labor costs per unit. The labor cost per unit of output was calculated by dividing total production-worker wages by the total number of units produced for a given month.

The monthly physical production by industry is listed in the Survey of Current Business (42). The industry output series do not include quality changes. The total production-worker monthly earnings are four times the product of average weekly wages and the total number of production workers. The average weekly wages and the total number of production workers were obtained from the Employment and Earnings (35, 36), and the Monthly Labor Review (38), respectively. The B. L. S. average weekly wages include overtime payments, but they do not include fringe benefits other than paid vacations, holidays, or sick leave. Since the weekly wages are for the number of hours paid for rather than the number of hours worked by the production workers, the labor cost per unit is biased downward. Yordon (50) found that fringe benefits and wage rates generally increase by the same proportions. Neither the output series nor the monthly earnings series are seasonally adjusted.

The labor cost per unit of output was substituted for the hourly earnings of production workers in the basic price flexibility model. The price flexibility model incorporating unit labor cost follows:

$$(5.2) \quad P_t^o = (1 - \alpha)P_{t-1}^o + \alpha\beta_0 + \alpha\beta_1 P_t^{I_A} + \alpha\beta_2 P_t^{I_{NA}} + \alpha\beta_3 U_t$$

The symbols are defined as before, except U_t which is defined as the labor cost per unit of output in month t, dollars per unit. The correlation coefficient for the hourly earnings series and the unit labor cost series is 0.98 and very highly statistically significant.

Table 4 lists the estimated coefficients for the meat packing industry with both the basic and revised price flexibility models. Each regression coefficient is statistically significant for the degree of confidence of the significant t listed directly below it.

Table 4. The estimated coefficients for the basic and the labor cost per unit of output price flexibility models

Industry and model	R^2	$\bar{D}$	α	b_0	b_1	b_2	b_3
2011 Meat packing plants							
basic	0.97	0.38	0.73	-28.92	0.53	0.81	-4.70
significance			.01		.01	.01	.01
labor cost/unit	0.97	0.41	0.71	-23.21	0.63	0.62	-0.97
significance			.01		.01	.01	.10

The coefficient of multiple determination for the meat packing industry remained the same with both the basic and the present models as shown in Table 4. The coefficient for hourly earnings is significantly less than zero, while the coefficient for labor cost per unit is just significantly less than zero at the 10 per cent level. The revised price flexibility model indicates that the labor cost per unit is less highly negatively correlated with the normal price than the hourly earnings series. Since the assumption of positive correlation between the independent and dependent variables has been implied, the labor cost per unit provides slightly better results than the hourly earnings series for the meat packing industry. The meat packing industry was selected for this model because the production data and the total production-worker wages were available and the regression coefficient for hourly earnings was negative as shown in Table 4.

Plant Utilization

The market demand for a good is assumed to be reflected in the level of plant utilization. When the demand for a good increases, the plant will be more fully utilized and vice versa.

My hypothesis is that an industry's output price is raised when the demand is above average or excess capacity is less than average. The industry is reluctant to increase the output price when the plants already have more than average excess capacity. The output price is likely to be lowered when the industry has excessive excess capacity in an effort to increase production or keep it from falling still lower.

Yordon (50) used production worker average weekly hours as the index of capacity utilization. Yordon's index is the deviation of average weekly hours for a quarter from the twelve-year average for the given quarter and measures relative changes rather than absolute changes. Yordon's index measures the long-run variation in the work week, which would correspond to cyclical changes in the economy rather than seasonal changes. The plant utilization index measures month-to-month changes in the production level; the month-to-month changes within a year indicate the seasonal variations and the effects of a short-period cycle. Neither index measures the absolute level of production in terms of the industry's maximum capacity.

In this study, the relative changes in monthly output determine the plant utilization series. The plant utilization series is the ratio of plant output in month t to average plant output per month for the calender year containing month t. The plant utilization series measures the relative level of production during the year rather than the absolute level of production. The monthly production for the meat packing and the condensed and evaporated milk industries was obtained from the Survey of Current Business. Both industries experience seasonal variation in plant utilization or production and produce products which are not as easily stored as some other products.

The plant utilization variable is added to the other independent variables in the basic price flexibility model to remove the demand effect. The price flexibility model with the plant utilization variable added follows:

$$(5.3)\quad P_t^o = (1 - \alpha)P_{t-1}^o + \alpha\beta_0 + \alpha\beta_1 P_t^{I_A} + \alpha\beta_2 P_t^{I_{NA}} + \alpha\beta_3 W_t + \alpha\beta_4 C_t$$

The new symbol C_t, represents the plant utilization variable. Since the regression coefficient of the plant utilization variable can be partitioned into the quantities α and β_4, the plant utilization variable contributes to the estimate of both the model generated output price and the normal price.

Table 5 summarizes the results for both the basic and the plant utilization price flexibility models. Directly below each regression coefficient is the degree of confidence of significant t.

Since the statistical results do not indicate any positive relationship between the plant utilization variable and the current output price, the hypothesis of price increases when production is up is not supported by the empirical results. The negative plant utilization regression coefficient for the meat packing industry must be the result of seasonal and cyclical variations, where price and production are inversely related. For both industries, the other regression coefficients in the plant utilization price flexibility model are nearly identical to the regression coefficients for

Table 5. The estimated coefficients for the basic and the plant utilization price flexibility models

Industry and model	R^2	$\bar{D}$	a	b_0	b_1	b_2	b_3	b_4
2011 Meat packing plants								
basic	0.97	0.38	0.73	-28.92	0.53	0.81	-4.70	
significance			.01		.01	.01	.01	
plant utilization	0.97	0.41	0.71	-25.20	0.52	0.83	-4.92	-3.73
significance			.01		.01	.01	.01	.10
2023 Condensed and evaporated milk								
basic	0.97	2.92	0.26	-10.14	0.66	0.35	6.82	
significance			.01		.01	.01	.05	
plant utilization	0.97	2.85	0.26	-11.50	0.65	0.35	6.73	1.04
significance			.01		.01	.01	.05	-

the basic model. The reflection of demand through the plant utilization variable does not appear to help explain output price changes; perhaps demand is negligible in determining price changes as was stated in the assumptions.

Time-Regression

A trend variable (8, p. 336) is incorporated in the price flexibility model to eliminate the long-term linear movements during the period under study. A trend variable in a multiple regression eliminates the trend element from the dependent variable, thereby revealing the net, trend-adjusted relationship between the dependent variable and the other independent variables in the model. This is an effective approach to the extent that the trend is actually linear. The trend variable is justified for short-periods and others where a linear-trend is expected during the period. The fifteen year period studied is relatively long for a linear trend variable, but technology and inflation kept progressing during this time. During the period from 1947-49 through 1958, the unit nonlabor charges (31) increased more than unit labor costs. The trend variable removes the linear effects from the increasing unit nonlabor charges and other factors not included in the model.

Multiple regression with the trend variable incorporated was applied to the chocolate and cocoa products, malt liquors, cigarette, and the cigar industries. Multiple regression was used on these four industries with a trend variable because the trend variable was included by mistake when the parameters for the basic model were to be estimated.

The price flexibility model with the trend variable included follows:

$$(5.4)\quad P_t^o = (1 - \alpha)P_{t-1}^o + \alpha\beta_0 + \alpha\beta_1 P_t^{I_A} + \alpha\beta_2 P_t^{I_{NA}} + \alpha\beta_3 W_t + \alpha\beta_4 T$$

The symbol, T, represents the trend or time-regression variable.

Since the trend variable also is incorporated in the normal equation, the normal or equilibrium price is trend-adjusted as well as the estimated actual price.

The results from the basic and the trend-adjusted price flexibility models for the four industries are listed in Table 6. The degree of confidence of significant t is listed directly below each regression coefficient.

The intercepts for the chocolate and cocoa products, malt liquors, and the cigarette industries changed considerably with the time-regression price flexibility model. In the chocolate and cocoa products industry, the regression coefficients for hourly earnings and trend are statistically signif-

Table 6. The estimated coefficients for the basic and the time-regression price flexibility models

Industry and model	R^2	$\bar{D}$	a	b_0	b_1	b_2	b_3	b_4
2072 Chocolate and cocoa products								
basic	0.99	7.33	0.12	-46.08	0.58	0.67	29.17	
significance			.01		.01	-	-	
time-regression	0.99	6.14	0.14	78.38	0.54	0.49	-89.81	0.09
significance			.01		.01	-	.10	.05
2082 Malt liquors								
basic	0.99	49.00	0.02	9.00	0.30	0.50	10.00	
significance			-		-	-	-	
time-regression	0.99	34.71	0.03	168.96	0.36	0.00	-70.11	0.03
significance			-		-	-	-	-
2111 Cigarettes								
basic	0.99	8.09	0.11	19.73	-0.27	0.82	17.64	
significance			.01		-	.01	-	
time-regression	0.99	8.80	0.10	-11.22	-0.29	0.94	44.41	-0.02
significance			.01		-	.01	-	-
2121 Cigars								
basic	0.99	5.67	0.15	84.87	-0.03	0.13	7.13	
significance			.01		-	.01	.05	
time-regression	0.99	5.41	0.16	88.79	-0.03	0.10	3.99	0.002
significance			.01		-	.01	-	-

icant, but now the hourly earnings are inversely related to the output price. The price flexibility model with the trend variable incorporated produced different estimates of the regression coefficients, but the coefficients of multiple determination do not indicate a change in overall reliability.

Elimination of Seasonal Fluctuations

Since the price indexes and hourly earnings series are seasonally unadjusted, seasonal indices (8, p. 327) were derived by multiple regression methods. Dummy variables were incorporated in the price flexibility model to eliminate the seasonal effects from the dependent variable. The seasonals are measured with respect to January. Since the sum of the seasonals is zero, the seasonal for January is the quantity required to give a sum of zero for the seasonals.

The dummy variables permit both the seasonal and the nonseasonal variables to be used in a single equation. Another advantage of using dummy variables rather than a different method is that the seasonal variables may be statistically tested right along with the rest of the variables. The limiting factors of this method are the inflexibility of the seasonal coefficients and the assumption of linearity. Each seasonal regression coefficient reflects an average magnitude of variation for that month during the period studied.

The price flexibility model with the seasonal variables included follows:

$$(5.5)\quad P_t^O = (1 - \alpha)P_{t-1}^O + \alpha\beta_0 + \alpha\beta_1 P_t^{I_A} + \alpha\beta_2 P_t^{I_{NA}} + \alpha\beta_3 W_t + \alpha \sum_{i=2}^{12} \beta_i S_i$$

The S_i's are dummy variables for the months from February through December; S_i is one if that particular month is involved, otherwise it is zero. The seasonal variables can be included in the normal price flexibility model, too. Seven industries were selected for the price flexibility model with seasonal variables because the data were more complete and the average delays were of various lengths.

Table 7 lists the estimated coefficients for the seven industries studied with the seasonal price flexibility model, 5.5. The seasonal regression coefficients are listed as they were estimated by model 5.5, so the seasonal variation can be observed directly from the coefficients. Each seasonal regression coefficient is the quantity added to or subtracted from the estimated output price index because the estimate is for that particular month. The seasonal parameters for the normal price model are obtained from the seasonal regression coefficients in the same manner as the other parameters.

The meat packing, condensed and evaporated milk, flour

Table 7. The estimated coefficients for the price flexibility model with seasonal variables by industry

	2011 Meat packing plants	2023 Condensed and evaporated milk	2033 Canned fruits and vegetables
	Regr. coef.	Regr. coef.	Regr. coef.
R^2	0.98	0.97	0.95
$\overline{D}$	0.43	3.00	8.09
α	0.70[a]	0.25[a]	0.11[a]
b_0	-23.67	-10.36	69.73
b_1	0.57[a]	0.68[a]	0.05
b_2	0.71[a]	0.36[a]	0.36[b]
b_3	-3.57[b]	6.68[b]	-8.45
αb_2	-1.48[b]	-0.01	0.16
αb_3	-1.62[b]	-0.36	-0.15
αb_4	-0.87	-0.90[c]	-0.30
αb_5	0.31	0.15	-0.05
αb_6	-0.14	-0.10	-0.42
αb_7	0.43	0.18	-0.04
αb_8	-0.39	0.33	-0.24
αb_9	1.38[c]	-0.44	0.18
αb_{10}	-1.24	-0.51	0.28
αb_{11}	-0.84	-0.31	-0.34
αb_{12}	-0.89	0.04	-0.47

[a]Significantly different from zero at the 1 per cent level.

[b]Significantly different from zero at the 5 per cent level.

[c]Significantly different from zero at the 10 per cent level.

Table 7 (Continued).

	2037 Frozen fruits and vegetables	2041 Flour and meal	2043 Cereal preparations	2051 Bread and related products
	Regr. coef.	Regr. coef.	Regr. coef.	Regr. coef.
R^2	0.88	0.88	0.99	0.99
$\overline{D}$	13.29	13.29	6.69	11.50
a	0.07[b]	0.07[b]	0.13[a]	0.08[a]
b_0	83.86	83.86	2.54	-3.38
b_1	0.14	0.14	0.31[a]	-
b_2	0.01	0.01	0.15	0.75[c]
b_3	-11.43	-11.43	40.46[a]	30.88[b]
ab_2	0.06	-0.62	0.19	-0.28
ab_3	0.01	1.51[c]	-0.53	0.40
ab_4	-0.05	0.96	-0.29	0.76
ab_5	-0.95	0.44	-0.63	-0.29
ab_6	0.01	-0.84	-0.33	-0.10
ab_7	-0.01	1.06	-0.24	0.15
ab_8	-0.35	0.73	0.43	0.12
ab_9	0.17	1.43	-0.24	-0.12
ab_{10}	-0.20	1.46	1.25[b]	0.50
ab_{11}	-0.08	1.00	-0.17	0.08
ab_{12}	-0.65	0.35	-0.29	-0.26

and meal, and the cereal preparations industries have one or more seasonal regression coefficients statistically significant at the 10 per cent level. The meat packing industry, which has the shortest average delay, has three seasonal regression coefficients statistically significant. The industries without a statistically significant seasonal regression coefficient have an average delay greater than eight months.

The results indicate that seasonal fluctuations are relevant in the industries with a relatively short average delay, while they are not important in the industries with a relatively long average delay. The seasonal output price changes are expected in an industry which passes on cost changes rather quickly, otherwise the seasonal cost change may have returned to its previous level before the output price changed.

Two-Phase Price Flexibility Model

Yance (47) used the two-phase price flexibility model to test for differences in the regression parameters when the output price is increasing and decreasing.

Since we are interested in the value of price flexibility to the agricultural sector of the economy, the agricultural input is partitioned into steady and increasing agricultural input prices and decreasing agricultural input prices to estimate the average delay up and down separately. The two groups of observations provide two estimates of the regression coefficients, an estimate when the agricultural input price is increasing and another when the agricultural price is decreasing. The two-phase price flexibility model used by Yance is modified to provide two estimates of each regression coefficient. Multiple regression with this type of model is almost like making two separate regressions, but with the two-phase model only one R^2 is estimated, which includes the explanatory value of both groups.

The two-phase price flexibility model which was developed to provide separate estimates of the average delay when the agricultural input price is increasing and decreasing, follows:

$$(5.6) \quad P_t^o = \delta\left[(1-\alpha_1)P_{t-1}^o + \alpha_1\beta_0 + \alpha_1\beta_1 P_t^{I_A} + \alpha_1\beta_2 P_t^{I_{NA}} + \alpha_1\beta_3 W_t\right] + (1-\delta)\left[(1-\alpha_2)P_{t-1}^o + \alpha_2\beta_0' + \alpha_2\beta_1' P_t^{I_A} + \alpha_2\beta_2' P_t^{I_{NA}} + \alpha_2\beta_3' W_t\right]$$

The parameter, δ, is used to divide the original time series into two time series. When the agricultural input price is steady or rising, delta equals one; but when the agricultural input price is decreasing, delta equals zero. The parameter δ is defined with symbols as: $\delta = 1$, if $P_t^{I_A} \geq P_{t-1}^{I_A}$; and $\delta = 0$, if $P_t^{I_A} < P_{t-1}^{I_A}$. For each output price observation, one of the two expressions on the right hand side of model 5.6 is identically equal to zero. When the agricultural input price is increasing or delta is equal to one, the left expression on the right hand side of model 5.6 is exactly as written in the brackets, while the right expression is equal to zero because one minus a delta of one is equal to zero. Then when the agricultural input price is decreasing or delta is equal to zero, the left expression is equal to zero and the right expression is used, just the opposite of a price increase. This is the concept of the two-phase price flexibility model. The model provides two estimates of each parameter that the basic price flexibility model estimated except the coefficient of multiple determination.

In the assumptions for the basic model, the average delay was assumed to be the same for cost increases and decreases. This assumption still holds for the nonagricultural inputs and the hourly earnings series, but it no longer includes the agricultural inputs because we are testing for differences between increases and decreases in the agricultural price changes.

Two-phase multiple regression was applied to the eleven industries which had an average delay of less than three months estimated by the basic price flexibility model. These eleven industries were selected because the statistical tests indicated that the results of the industries with a shorter average delay are more reliable. The industries with a shorter average delay more nearly meet the assumption of continuity of output price changes.

Table 8 lists the coefficients estimated by the two-phase price flexibility model for the eleven selected industries. The coefficients were estimated with a different model than model 5.6, but conceptually they are identical and should provide the same results. A different model was used to estimate the coefficients because it enabled us to add a few new variables to the original IBM cards rather than punching all new IBM cards. The new form of the model estimates a parameter for an increase or a decrease and the difference between the parameters up and down. The new form of the two-phase price flexibility model follows:

$$(5.7) \quad P_t^o = (1 - \alpha_1)P_{t-1}^o + \alpha_2\beta_0' + \alpha_1\beta_1 P_t^{I_A} + \alpha_1\beta_2 P_t^{I_{NA}} + \alpha_1\beta_3 W_t + (1 - \alpha_4)P_{t-1}^{o''} + \alpha_4\beta_0'' + \alpha_4\beta_1'' P_t^{I_A} + \alpha_4\beta_2'' P_t^{I_{NA}} + \alpha_4\beta_3'' W_t$$

The variable δ provides an estimate for $\alpha_4\beta_0''$, which is the difference between the intercepts for an increase and a decrease in the agricultural input prices. The other variables preceded by α_4 take the stated value when delta is zero, but they are identically equal to zero when delta equals one.

The estimated regression coefficients for an increasing agricultural price, decreasing agricultural price, and the difference between the two estimates are as follows:

When $\delta = 1$				When $\delta = 0$			
$(1 - \alpha)$	est.	by	$(1 - \alpha_1)$	$(1 - \alpha)$	est.	by	$(1 - \alpha_1)+(1 - \alpha_4)$
β_0	"	"	$b_0 + b_0''$	β_0	"	"	b_0
β_1	"	"	b_1	β_1	"	"	$b_1 + b_1''$
β_2	"	"	b_2	β_2	"	"	$b_2 + b_2''$
β_3	"	"	b_3	β_3	"	"	$b_3 + b_3''$

Difference

$(1 - \alpha)$	est.	by	$(1 - \alpha_4)$
β	"	"	b_0''
β_1	"	"	b_1''
β_2	"	"	b_2''
β_3	"	"	b_3''

The regression coefficients listed in Table 8 correspond to those above. The product αb_1 for the difference cannot be obtained by multiplying α times b_1 in the difference column, since the α used in each column is different.

The degree of confidence of significant t is listed to the right of its regression coefficient under the heading "sig.". A dash is inserted under the heading "sig." for any regression coefficient not statistically significant at the 10 per cent level. The t tests are for αb_1 rather than b_1 as indicated, as is pointed out in Appendix A. With a highly significant α, it logically follows that b_1 is also significant at a level similar to αb_1.

In general, the length of the average delay increased with the two-phase price flexibility model. For instance, the average delay for the butter industry went from 0.12 to 0.31 months. The meat packing, the natural cheese, and the soybean industries have a statistically significant different delay up and down at the 10 per cent level. Only two of the estimated α's are not significant at the 10 per cent level. The meat packing industry is the only one with significantly different intercepts at the 10 per cent level. The coefficient of multiple determination increased by 1 per cent or more for seven industries.

The results do not provide much evidence that the output price response is different for an increasing and decreasing agricultural input price. Yance (47), concluded that the response differences are negligible for an increasing and a decreasing output price change. The available evidence indicates that the assumption of equal output price responses for an increase and a decrease in costs is realistic.

Table 8. The estimated coefficients for the two-phase price flexibility model by industry

	Up		Down		Diff.	
	regr. coef.	sig.	regr. coef.	sig.	regr. coef.	sig.
Industry: 2011 Meat packing plants						
R^2	0.97					
$\bar{D}$	0.70		0.26		0.44	
a	0.59	.01	0.79	-	0.20	.05
b_0	81.31		37.61		43.70	.01
b_1	0.56	.01	0.44	.01	-0.12	-
b_2	6.96	.01	1.01	.01	-5.95	.01
b_3	-4.11	.10	-6.92	.01	-2.81	-
Industry: 2021 Creamery butter						
R^2	0.95					
$\bar{D}$	0.31		0.52		-0.21	
a	0.76	.01	0.66	.01	-0.10	-
b_0	19.06		25.99		-6.93	-
b_1	0.91	.01	0.74	.01	-0.17	.10
b_2	-0.03	-	0.00	-	0.03	-
b_3	-3.35	-	-1.88	-	1.47	-

Table 8 (Continued).

	Up		Down		Diff.	
	regr. coef.	sig.	regr. coef.	sig.	regr. coef.	sig.
			Industry: 2022 Natural cheese			
R^2	0.95					
$\bar{D}$	0.74		0.33		0.41	
α	0.58	.01	0.75	.01	0.18	.10
b_0	-22.07		-20.47		-1.60	-
b_1	1.01	.01	0.84	.01	-0.17	-
b_2	0.21	.05	0.33	.10	0.12	-
b_3	2.12	-	1.60	-	-0.52	-
			Industry: 2023 Condensed and evaporated milk			
R^2	0.97					
$\bar{D}$	2.98		3.15		-0.17	
α	0.25	.01	0.24	.01	-0.01	-
b_0	-2.59		-16.93		14.34	-
b_1	0.64	.01	0.75	.01	0.11	-
b_2	0.32	.05	0.34	-	0.02	-
b_3	6.93	.10	7.10	-	0.17	-

Table 8 (Continued).

	Up regr. coef.	Up sig.	Down regr. coef.	Down sig.	Diff. regr. coef.	Diff. sig.
			Industry: 2026 Fluid milk			
R^2	0.95					
$\overline{D}$	3.08		3.22		-0.14	
α	0.25	.01	0.24	-	-0.01	-
b_0	47.92		-22.41		70.33	-
b_1	0.73	.01	0.55	.05	-0.18	-
b_2	-0.61	-	0.34	-	0.95	-
b_3	41.59	.01	25.23	-	-16.36	-
			Industry: 2041 Flour and meal			
R^2	0.89					
$\overline{D}$	1.72		1.14		0.57	
α	0.37	.01	0.47	.01	0.10	-
b_0	23.23		6.25		16.98	-
b_1	1.03	.01	0.71	-	-0.32	-
b_2	-0.35	.05	0.06	-	0.41	.10
b_3	10.68	.01	7.52	.01	-3.16	-

Table 8 (Continued).

	Up		Down		Diff.	
	regr. coef.	sig.	regr. coef.	sig.	regr. coef.	sig.
			Industry: 2042 Prepared animal feeds			
R^2	0.96					
$\bar{D}$	0.50		0.32		0.18	
a	0.67	.01	0.76	.01	0.09	-
b_0	-21.60		-29.82		8.22	-
b_1	0.05	-	-0.07	.01	-0.12	-
b_2	1.52	.01	1.72	.01	0.20	.10
b_3	-34.33	.01	-36.77	.01	-2.44	-
			Industry: 2044 Rice milling			
R^2	0.85					
$\bar{D}$	3.08		1.59		1.49	
a	0.25	.01	0.39	.05	0.14	-
b_0	69.27		95.52		-26.25	-
b_1	0.65	.01	0.62	.01	-0.03	-
b_2	-0.49	-	-0.93	-	-0.44	-
b_3	6.49	-	23.29	.05	16.80	-

Table 8 (Continued).

	Up		Down		Diff.	
	regr. coef.	sig.	regr. coef.	sig.	regr. coef.	sig.
			Industry: 2045 Blended and prepared flour			
R^2	0.87					
$\bar{D}$	3.72		2.46		1.26	
a	0.21	.01	0.29	.05	0.08	-
b_0	22.78		17.06		5.72	-
b_1	0.85	.01	0.48	.05	-0.37	-
b_2	-0.24	-	0.14	-	0.38	-
b_3	15.38	-	10.28	-	-5.10	-
			Industry: 2091 Cottonseed oil mills			
R^2	0.92					
$\bar{D}$	3.65		1.99		1.66	
a	0.22	.01	0.33	.01	0.12	-
b_0	75.67		23.38		52.29	-
b_1	0.56	.01	0.63	.10	0.07	-
b_2	-					
b_3	-26.42	.05	-0.03	-	26.39	-

Table 8 (Continued).

	Up		Down		Diff.	
	regr. coef.	sig.	regr. coef.	sig.	regr. coef.	sig.
	Industry: 2092 Soybean oil mills					
R^2	0.95					
$\bar{D}$	1.65		0.82		0.84	
a	0.38	.01	0.55	.01	0.17	.10
b_0	29.23		23.94		5.29	-
b_1	0.93	.01	0.71	.01	-0.22	-
b_2	-					
b_3	-18.30	.01	-6.68	.01	11.62	-

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FUTURE RESEARCH

Summary and Conclusions

The concept of price flexibility used in this study is defined as the rate at which equilibrium between costs and prices is attained after a cost change is observed. The average delay was found to be less than six months for one-half of the industries, although the range was from 0.12 months through 49.00 months. For most industries, the actual price followed the normal price quite closely. The magnitude of the elasticity of an output price with respect to an input price was observed to decrease as the average delay increased. The importance of the agricultural input was negatively correlated with the average delay, while the importance of a nonagricultural input, the wages of production workers, and overhead were positively correlated with the average delay. There was no clear indication that the level of concentration and the average delay are related. The estimated output price response for a given cost change was computed to determine the margin change for cost changes. The margins appeared to be more stable for the industries with the shorter average delays. The length of the average delay, not the other associated factors, determined whether a price is flexible or not.

Hourly earnings adjusted for productivity per man-hour, labor cost per unit of output, plant utilization (demand), and time-regression variables did not improve the overall statistical significance of the results. Seasonal fluctuations were found to be important in the industries with a short delay. The average delay was found to be the same for increases and decreases in the agricultural price.

Recommendations for Future Research

In this thesis, only the one-period-change model with actual observed lagged values was used. The model can be treated as a process model using the model-generated lagged values. The one-period-change model is corrected so that it is always correct when it starts, while the process model uses model-generated values and has to live with any errors that the model has generated. The equations of the process model with the observed exogenous variables are treated as a closed dynamic system. Cohen (4) states that the process model faces a tougher test than the one-period-change model. The price flexibility model could be converted to a process model very easily.

The output price was assumed the dependent variable in this study, but it is possible that in some industries an input is the dependent variable. The model is basically the same except that an input and the output series are reversed. Maki (19) found that the critical price adjustments occur at the wholesale market level for the meat packing industry. If this is the case, the output of the meat packing industry is an independent variable rather than a dependent variable as it was treated here.

The cyclical fluctuations in the economy appear to be the most important factor that is not included in the model. A variable reflecting conditions in the economy may account for a great deal of the unexplained variation.

By studying vertical producing marketing sequences, it would be possible to determine the total average delay in changing the price of the finished product. A complete study may give information on the critical levels in determining a finished good's price.

Gross profits vary because of changes in volume and the margin per unit. The industries with a long average delay are expected to have larger fluctuations in the profit level, since they absorb the effects of cost changes for a relatively long period of time. The industries with a short average delay should be able to maintain a more uniform margin than the industries with a longer delay.

The price flexibility model has been applied primarily to the food-processing industries in this study, but it's application to the textiles industries, retail distribution industries, and others with some market power would be just as rewarding.

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APPENDIX A

Computations for the Multiple Regressions

The multiple regressions were computed on the IBM 650 in the computing center. The standard program for multiple regressions from their library was used on the price indexes, hourly earnings, and other series. The estimated regression coefficients, the analysis of variance, calculated t's, the partial correlation coefficients, the actual prices, the estimated actual prices, and the normal prices were printed out.

The computing center calculated t for all the estimated coefficients. The calculated t is the ratio of αb_i to $s_{\alpha b_i}$. A calculated t is listed for the quantity $1 - \alpha$ rather than α, so the t for α was calculated later. If the t for α is statistically significant, it logically follows that $\bar{D}$ is also statistically significant.

The calculated t's for $\alpha_1 b_i$ and $\alpha_4 b_i''$ which were estimated with the two-phase price flexibility model, 5.7, were computed by the computing center. The t formula for $\alpha_1 b_i$ plus $\alpha_4 b_i''$ is $[(\alpha_1 b_i + \alpha_4 b_i'') - 0]/[s^2(c_{ii} + c_{jj} + 2c_{ij})]^{1/2}$. With this model, there are two separate regression lines with different intercepts and slopes. The coefficients of each line and their difference were tested statistically by means of the t test.

Deriving the Average Price Delay

The average price delay (47, p. 415) is derived from the basic model assuming a step increase in costs. The average delay is defined as the delay between a change in costs and the resulting change in prices. The original equation is:

$$P_t = P_{t-1} + \alpha(P_t^* - P_{t-1}).$$

Expressing the equation as a difference, we have:

$$\Delta P_t = \Delta P_{t-1} + \alpha(\Delta P_t^* - \Delta P_{t-1}) = (1 - \alpha)\Delta P_{t-1} + \alpha\Delta P_t^*.$$

We can now calculate the normal price change. With a step increase in P_t^* in period 0,

$$\Delta P_t^* = P_t^* - P_{t-1}^* = \overline{P} \quad \text{for } t = 0.$$
$$0 \quad \text{for } t > 0.$$

From the above equation, the price change is:

$$\Delta P_0 = \alpha\overline{P},$$
$$\Delta P_1 = \alpha(1 - \alpha)\overline{P},$$
$$\Delta P_2 = \alpha(1 - \alpha)^2\overline{P},$$

and so on. The sum of the ΔP_t's is $\overline{P}$.

The average delay is the sum of the products of price times the delay divided by the sum of the price rises:

$$\bar{D} = \frac{0a\bar{P} + a(1 - a)\bar{P} + 2a(1 - a)^2\bar{P} + \cdots}{a\bar{P} + a(1 - a)\bar{P} + a(1 - a)^2\bar{P} + \cdots}$$

It is a property of the model that if the normal price increases, the actual price gradually approaches the normal price. The denominator of $\bar{D}$ adds up to $\bar{P}$ as shown:

$$a\bar{P}[1 + (1 - a) + (1 - a)^2 + \cdots] = \frac{a\bar{P}}{1 - (1 - a)} = \bar{P}$$

Given the new denominator, $\bar{D}$ reduces to:

$$a(1 - a)[1 + 2(1 - a) + 3(1 - a)^2 + \cdots]$$

Letting $z = (1 - a)$, the term inside the above bracket is shown to be the derivative of the geometric series, $1/(1 - z)$:

$$\frac{d}{dz}\left[\frac{1}{(1 - z)}\right] = \frac{d}{dz}[1 + z + z^2 + \cdots] = 1 + 2z + 3z^2 + \cdots$$

and

$$\frac{d}{dz}\left[\frac{1}{(1 - z)}\right] = \frac{1}{(1 - z)^2}$$

Now by substituting into $\bar{D}$, we can show that $\bar{D} = 1/a - 1$:

$$\bar{D} = a(1 - a)\left[\frac{1}{[1 - (1 - a)]^2}\right] = \frac{1 - a}{a} = 1/a - 1.$$

This average delay assumes that a cost change has an effect on price during the first period of the cost increase.

APPENDIX B

The following table contains a summary of the coefficients by industry. The coefficient of multiple determination, R^2, is the fraction of the total sum of squares attributable to regression. The α is the coefficient found in Equations 3.2 and 3.3, while $\bar{D}$ is the average delay determined by Equation 3.4. The b_i's are parameters for the respective variables in the normal price equation, 3.1. The estimated values of the parameters are listed beside the industry Census code number. The regression coefficients for the basic price flexibility model can easily be obtained from the parameters listed in Table 9 by computing the appropriate products.

The t values were calculated for the regression coefficients, αb_i, of the price flexibility model rather than the parameters, b_i, of the normal price equation. If αb_i is statistically significant and is divided by a statistically significant parameter, it logically follows that b_i is also significant.

All equations were estimated from the monthly data for the 15 years, 1947-1961, except for the poultry dressing plants with labor, rice milling, confectionery products, and the woven carpets and rugs industries for which a shorter period was used due to limitations of data as discussed previously in Data Sources. For the normal industries, there are 174 degrees of freedom for the t test.

Table 9. The estimated coefficients for the basic price flexibility model by industry

Industry*	R^2	$\bar{D}$	a	b_0	b_1	b_2	b_3
2011	.97	.38	.73[a]	-28.92	0.53[a]	0.81[a]	-4.70[a]
2015	.98	.82	.55[a]	-1.76	0.99[a]	0.01[a]	-
2015 with labor	.95	.06	.94[a]	-1452.93	15.18[a]	23.63[a]	-601.28[a]
2021	.94	.12	.89[a]	19.60	0.87[a]	-0.03	-2.09
2022	.95	.27	.79[a]	-19.90	0.91[a]	0.25[a]	2.56[a]
2023	.97	2.92	.26[a]	-10.14	0.66[a]	0.35[a]	1.74[b]
2024	.99	15.95	.06[a]	-46.83	0.34[a]	1.42[a]	-20.09[b]
2026	.94	2.32	.30[a]	16.09	0.68[a]	-0.26	37.96[a]
2033	.94	7.55	.12[a]	69.92	0.03	0.39[b]	-9.33
2035	.96	26.78	.04[c]	76.81	-0.17	1.03[c]	-54.31[b]
2037	.88	13.09	.07[b]	5.62	0.23	0.06	-13.65
2041	.86	.96	.51[a]	6.54	0.96[a]	-0.19	12.26[a]
2042	.96	.34	.75[a]	-24.14	0.03	1.57[a]	-34.75[a]
2043	.99	6.30	.14[a]	4.93	0.26[a]	0.20	38.92[a]
2044	.84	1.86	.35[a]	81.17	0.62[a]	-0.70[b]	15.87[b]
2045	.85	2.53	.28[a]	15.29	0.74[a]	-0.11	16.69[a]
2051	.99	11.05	.08[a]	-6.00	-	0.77[b]	30.23[b]
2052	.98	16.54	.06[a]	33.88	-	0.72[a]	-3.28
2062	.97	4.24	.19[a]	17.38	-	0.71[a]	8.70[a]
2071	.86	7.13	.12[b]	127.38	-0.02	-0.01	-6.82
2072	.99	7.33	.12[a]	-46.08	0.58[a]	0.67	29.17
2073	.96	30.25	.03[c]	125.78	-	-0.75	42.88[b]
2082	.99	49.00	.02	9.00	0.30	0.50	10.00
2085	.96	29.30	.03[b]	4.58	-0.03	1.15	-14.15[c]
2086	.99	7.93	.11[a]	-75.62	-	0.96	81.64[b]
2091	.91	2.72	.27[a]	38.53	0.63[a]	-	-8.06
2092	.93	.59	.63[a]	26.40	0.83[a]	-	-13.20[a]
2111	.99	8.09	.11[a]	19.73	-0.27	0.82[a]	17.64
2121	.99	5.67	.15[a]	84.87	-0.03	0.13[a]	7.13[b]
2131	.98	14.63	.06[b]	-17.17	0.72	0.23	19.81
2271	.99	3.41	.23[a]	-73.07	-	0.88[a]	63.95[a]

*The Census code is defined in Table 1.

[a]Significantly different from zero at the 1 per cent level.

[b]Significantly different from zero at the 5 per cent level.

[c]Significantly different from zero at the 10 per cent level.

APPENDIX C

The elasticities of the output price with respect to the factors of production were computed for some of the industries. The elasticity of the output price is the ratio of the percentage change in the output price to the percentage change in the input price $(\Delta P_t^O/P_t^O)/(\Delta P_t^I/P_t^I)$. If the part of the price flexibility model, which experienced a price change, is used $(\Delta P_t^O = \beta_1 \Delta P_t^{I_1})$, the regression coefficient is shown to be equal to the quotient of the price changes $(\beta_1 = \Delta P_t^O/\Delta P_t^{I_1})$. The average output price and input price were used in computing the elasticity.

The elasticity coefficient adopts the sign of the input regression coefficient. The elasticities were computed for all the industries which have two or more highly statistically significant input regression coefficients. The elasticity was not computed for any input which did not have a statistically significant input regression coefficient.

Table 10. The elasticity of the output price with respect to the inputs by industry

Census code	Industry*	$e_{P_t^O - P_t^{IA}}$	$e_{P_t^O - P_t^{INA}}$	$e_{P_t^O - W_t}$
2011	Meat packing	0.37	0.64	-0.07
2015	Poultry with labor	0.60	2.00	-5.8
2022	Cheese	0.70	0.20	0.03
2023	Condensed milk	0.15	0.10	0.03
2024	Ice cream	0.02	0.08	-0.02
2026	Fluid milk	0.17	-	0.17
2041	Flour and meal	0.47	-0.11	0.11
2043	Cereal	0.03	-	0.09
2044	Rice milling	0.24	-0.35	0.12
2045	Prepared flour	0.19	-	0.08
2051	Bread	-	0.05	0.03
2062	Cane sugar	-	0.14	0.04
2092	Soybean oil mills	0.57	-	-0.15
2121	Cigars	-	0.02	0.01
2271	Carpets and rugs	-	0.16	0.18

*The Census code is more fully defined in Table 1.

APPENDIX D

The total value of shipments or total revenue is allocated to four factors of production, agricultural inputs, nonagricultural inputs, wages of production-workers, and overhead. The agricultural inputs, nonagricultural inputs, and the wages of production-workers correspond to the inputs used in deriving the basic price flexibility model. The value of shipments, the cost of the agricultural inputs, the cost of the nonagricultural inputs, and the wages of production-workers were obtained from the _1958 Census of Manufactures_ (40). Overhead covers the return to all fixed costs and includes profit. Overhead is the value added by manufacture, including electricity, fuels, etc., minus the production-worker wages which is the residual of the total value of shipments after the agricultural inputs, nonagricultural inputs, and production-worker wages have been removed. The _1958 Census of Manufactures_ lists the value added by manufacture, but it does not list the residual which is obtained in the above manner.

The weight of a factor of production is the ratio of the total cost of the factor to the total value of shipments. The weights of the factors of production were computed for all thirty industries for 1958. A graph for each factor of production was constructed by plotting the weight of the factor against the average delay of the industry as shown in Figures 2-5. Each point on a graph is the observation on the given factor of production and the average delay for one of the industries. A regression line (23) was calculated and plotted on each group of observations to show the relation between the weight of a factor of production and the average delay. The coefficient of determination for the nonagricultural input is statistically significant at the 10 per cent level, while it is statistically significant at the 5 per cent level for the wages of production-workers. The coefficients of determination for the agricultural input and overhead are statistically significant at the 1 per cent level.

The regression lines were not extended into the negative quadrants because they are unrealistic in the negative range. A negative average delay indicates that output prices rise before costs rise, an assumption that is not reasonable in either the real world or our framework. A negative weight for an input means that the industry produces the input rather than using it in production, which is a contradiction to the definition of an input.

The slope of the regression line for a factor is $\Delta\overline{D}/\Delta I$, where $\overline{D}$ represents the average delay and I represents the input. To show the meaning of the slope, let us assume that the output price responds differently to the various inputs and the average delay is a weighted average of the delays associated with the factors of production. In the above assumption, the weights of the various factors of production can not be changed for a given industry, but the weights of the factors of production do vary from industry to industry. As the weight of a factor of production increases, it has a larger role in determining the average delay for an industry. If the average delay decreases as more of a factor is used, the factor must be one that output price responds readily to. The output price must respond slowly to a factor, if as more of the factor is used, the average delay increases. A positive slope indicates that both the average delay and the weight of the factor are increasing, which means that the output price responds slowly to this factor's price changes. A negative slope indicates that the average delay is decreasing as the weight of the factor is increasing, which means that the output price responds readily to this factor's price changes. The greater the absolute value of the slope, the faster or slower the output price responds to a factor of production cost change.

The regression lines are used to indicate the general relationship between the various inputs and the average delay.

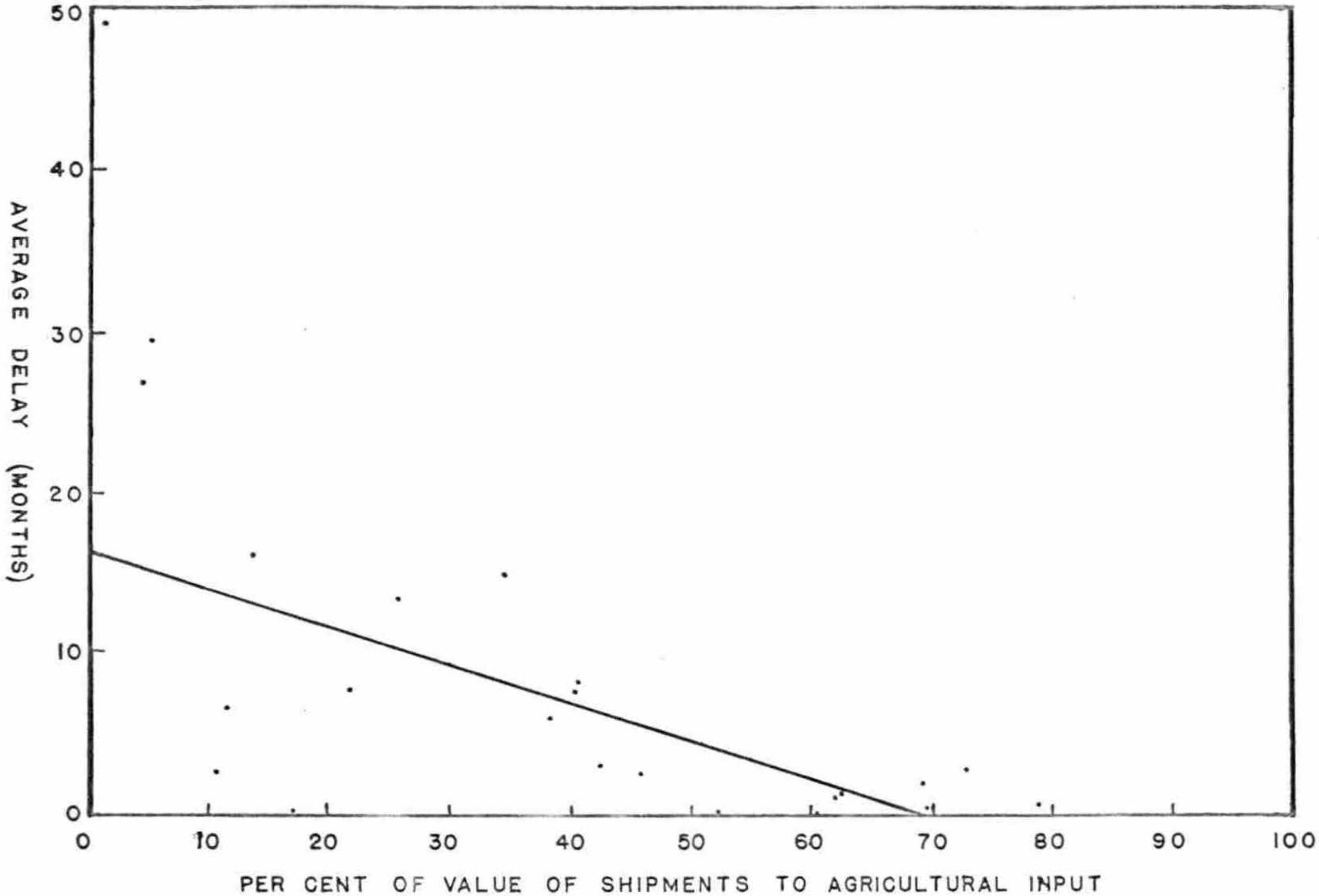

Figure 2. Correlation of the agricultural input and the average delay for the thirty agricultural processing industries

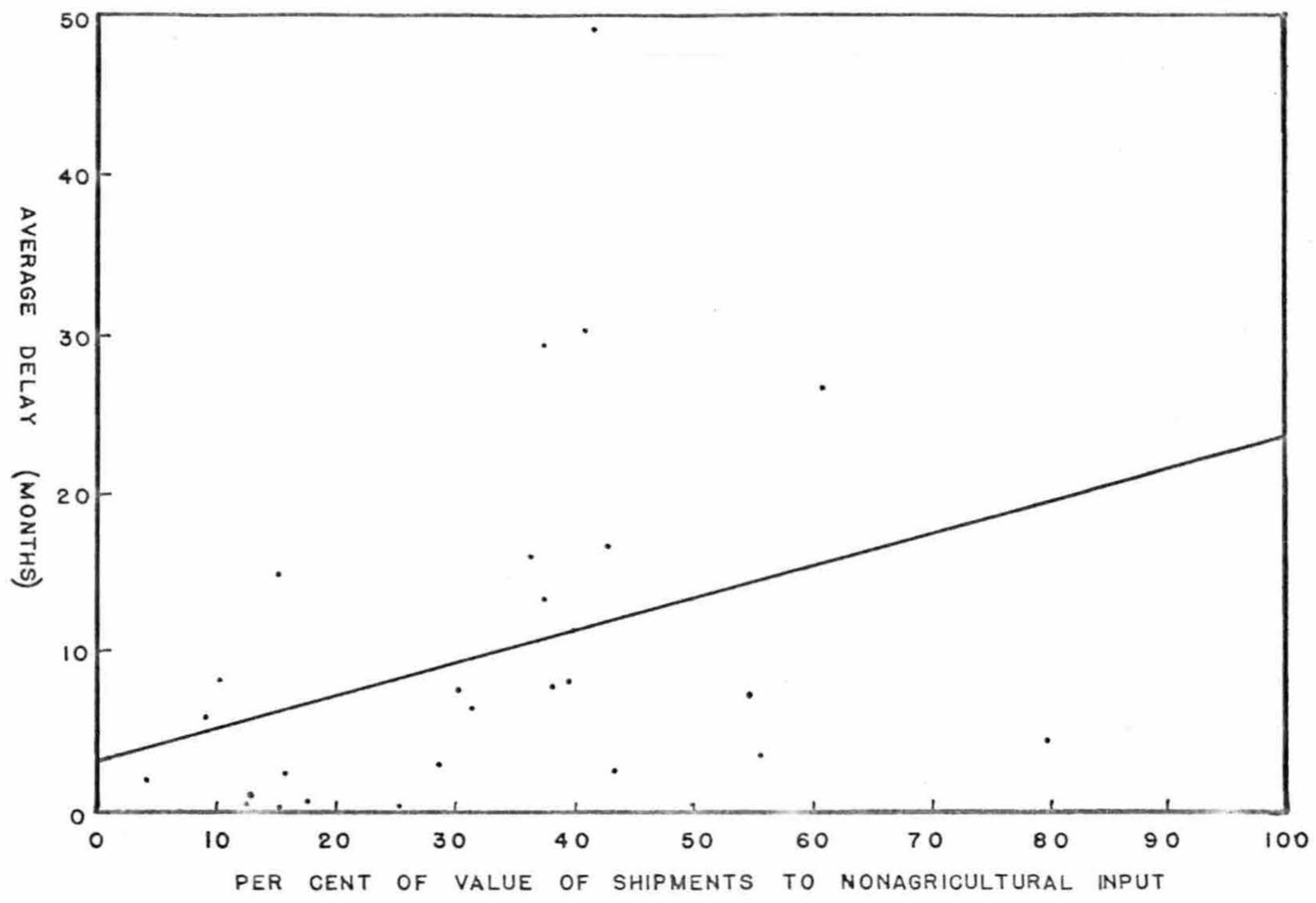

Figure 3. Correlation of the nonagricultural input and the average delay for the thirty agricultural processing industries

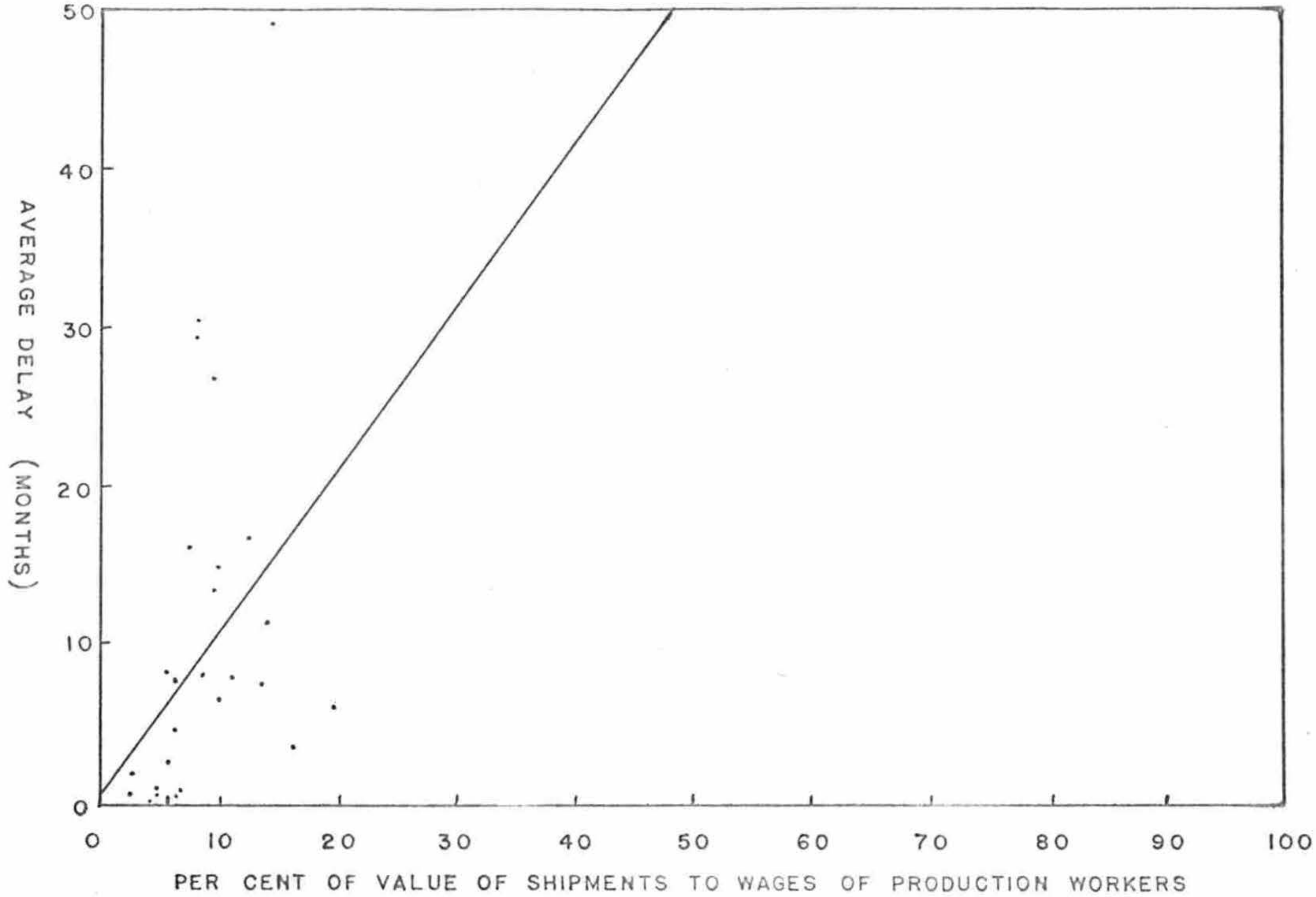

Figure 4. Correlation of the wages of production workers and the average delay for the thirty agricultural processing industries

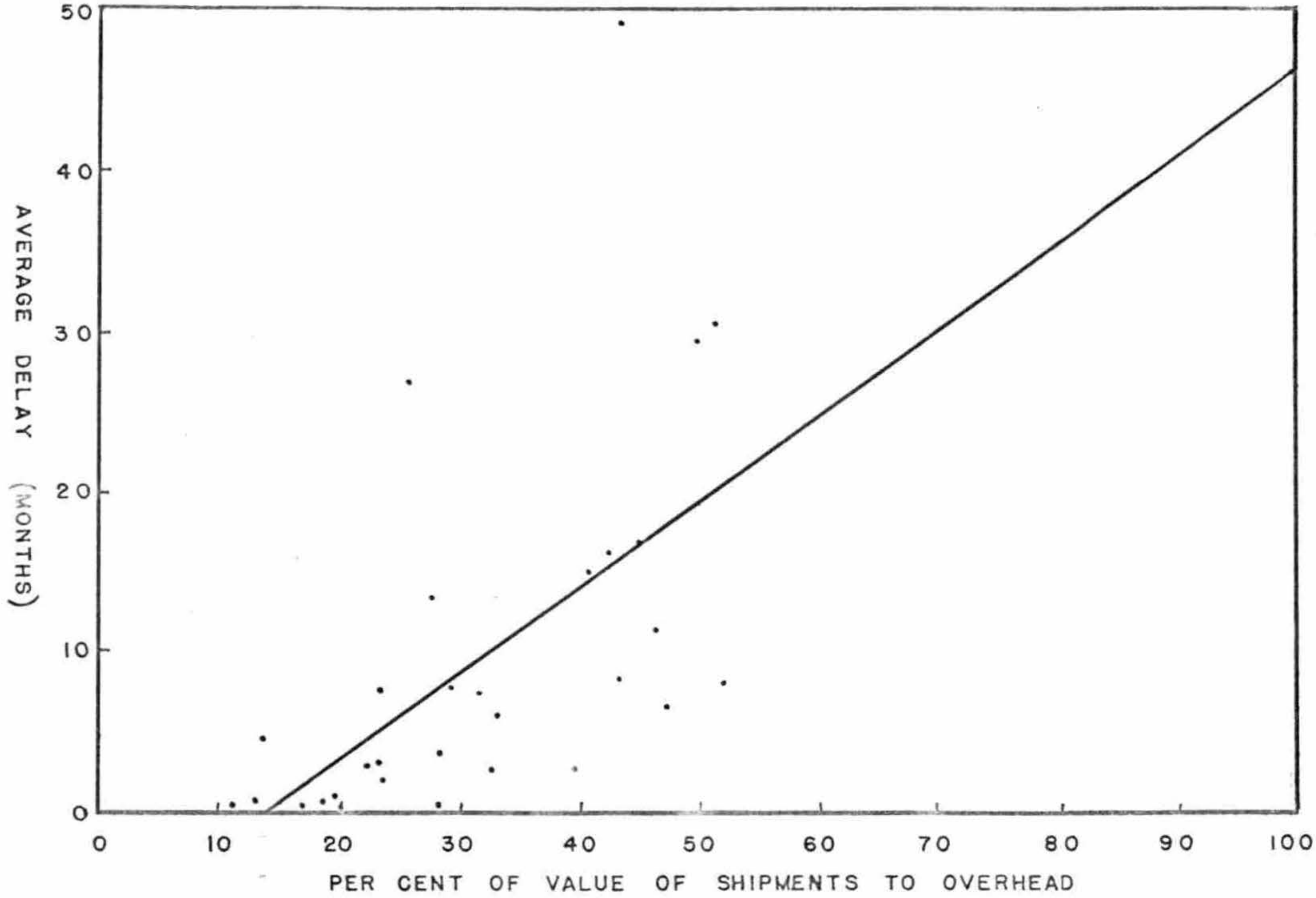

Figure 5. Correlation of the overhead and the average delay for the thirty agricultural processing industries

APPENDIX E

Table 11 lists the available concentration ratios for the largest 4, 8, and 20 firms in an industry for 1947 and 1958. The concentration ratio (15) is the percentage of value of shipments accounted for by a specified number of the largest firms. The concentration ratios and the number of companies in an industry were obtained from the bulletin, Concentration and Ownership in Food Marketing Industries (15). The number of companies is listed rather than the number of establishments to measure the number of sellers in an industry. The establishments in a company behave more like one firm than a number of independent firms.

The concentration ratios (15, p. 24) have limitations because of industry definitions. Some industries produce products which are quite unrelated in use and are not reasonably part of the same market, therefore, an underestimation of market concentration results. Concentration ratios overestimate market concentration, when the products of two industries are close substitutes. An example is the substitution of flour and meal for blended and prepared flour in the market. The concentration ratios are for the United States, therefore they do not indicate the local concentration in an industry. Since the bread industry produces a highly perishable product, the concentration may vary considerably over the

United States.

Bain (3, p. 124) has suggested a classification of industries according to seller concentration. Most of the industries included in this study with concentration ratios available are classified as "low moderate" or "low" level seller concentration. The industries in these two groups are associated with average delays of various lengths. The cereal preparations, blended and prepared flour, biscuit and crackers, and the cane sugar refining industries are classified in the higher levels of seller concentration. Bain classifies the distilled liquor and the cigarette industries as highly concentrated industries. The industries with higher levels of seller concentration are associated with relatively long average delays in price response. The level of seller concentration and the length of the average delay in price response are not observed to be significantly correlated.

Table 11. The share of total shipments accounted for by the largest companies and the number of companies in an industry for 1947 and 1958

Census code	Industry and year	No. of companies	Concentration ratio top 4 (per cent)	top 8 (per cent)	top 20 (per cent)
2011	Meat packing plants				
	1947	1999	41	54	63
	1958	2646	34	46	57
2015	Poultry dressing plants				
	1947	330	32	40	58
	1958	1041	12	16	25
2021	Creamery butter				
	1947	1482	18	24	32
	1958	997	11	18	28
2022	Natural cheese				
	1947	1313	27	32	40
	1958	1095	35	42	50
2023	Condensed and evaporated milk				
	1947	182	50	63	76
	1958	149	50	60	73
2024	Ice cream and frozen desserts				
	1947	1273	40	48	57
	1958	1171	38	48	59
2026	Fluid milk				
	1947				
	1958	5008	23	29	37

Table 11 (Continued).

Census code	Industry and year	No. of companies	Concentration ratio top 4 (per cent)	top 8 (per cent)	top 20 (per cent)
2033	Canned fruits and vegetables				
	1947	1856	27	35	46
	1958	1347	29	39	55
2035	Pickles and sauces				
	1947	637	33	43	59
	1958	637	35	48	62
2037	Frozen fruits and vegetables				
	1947				
	1958	246	31	43	67
2041	Flour and meal				
	1947	1084	29	41	57
	1958	703	38	51	68
2043	Cereal preparations				
	1947	55	79	91	98
	1958	34	83	95	99
2044	Rice milling				
	1947	61	33	48	72
	1958	75	43	64	84
2045	Blended and prepared flour				
	1947	115	41	60	78
	1958	109	75	86	94
2051	Bread and related products				
	1947	5985	16	26	36
	1958	5305	22	33	42

Table 11 (Continued).

Census code	Industry and year	No. of companies	Concentration ratio top 4 (per cent)	top 8 (per cent)	top 20 (per cent)
2052	Biscuit and crackers				
	1947	249	72	78	86
	1958	253	65	72	82
2062	Cane sugar refining				
	1947	17	70	88	100
	1958	16	69	88	100
2091	Cottonseed oil mills				
	1947	177	43	55	68
	1958	125	42	54	71
2092	Soybean oil mills				
	1947	105	44	63	81
	1958	66	40	63	86

APPENDIX F

The monthly actual prices and normal prices for each industry were plotted to show the average delay and fit between the two curves. The actual price is the solid curve on all the graphs, while the broken line is the normal price on all the graphs except malt liquors, 2082, where the normal price curve is also solid. The actual price is the price index for the industry's output, while the normal price is the price index estimated by Equation 3.1.

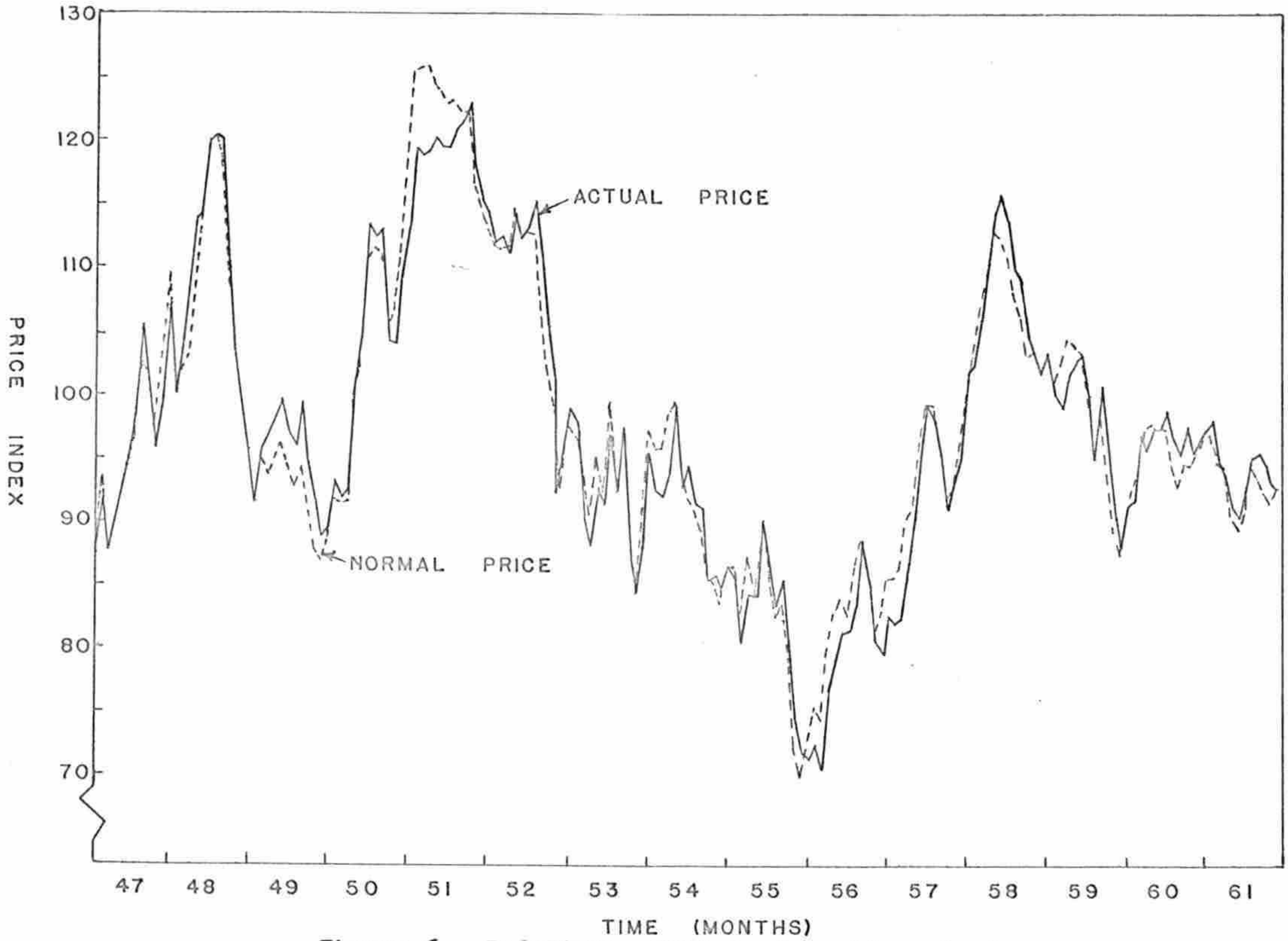

Figure 6. Industry: 2011 Meat packing plants

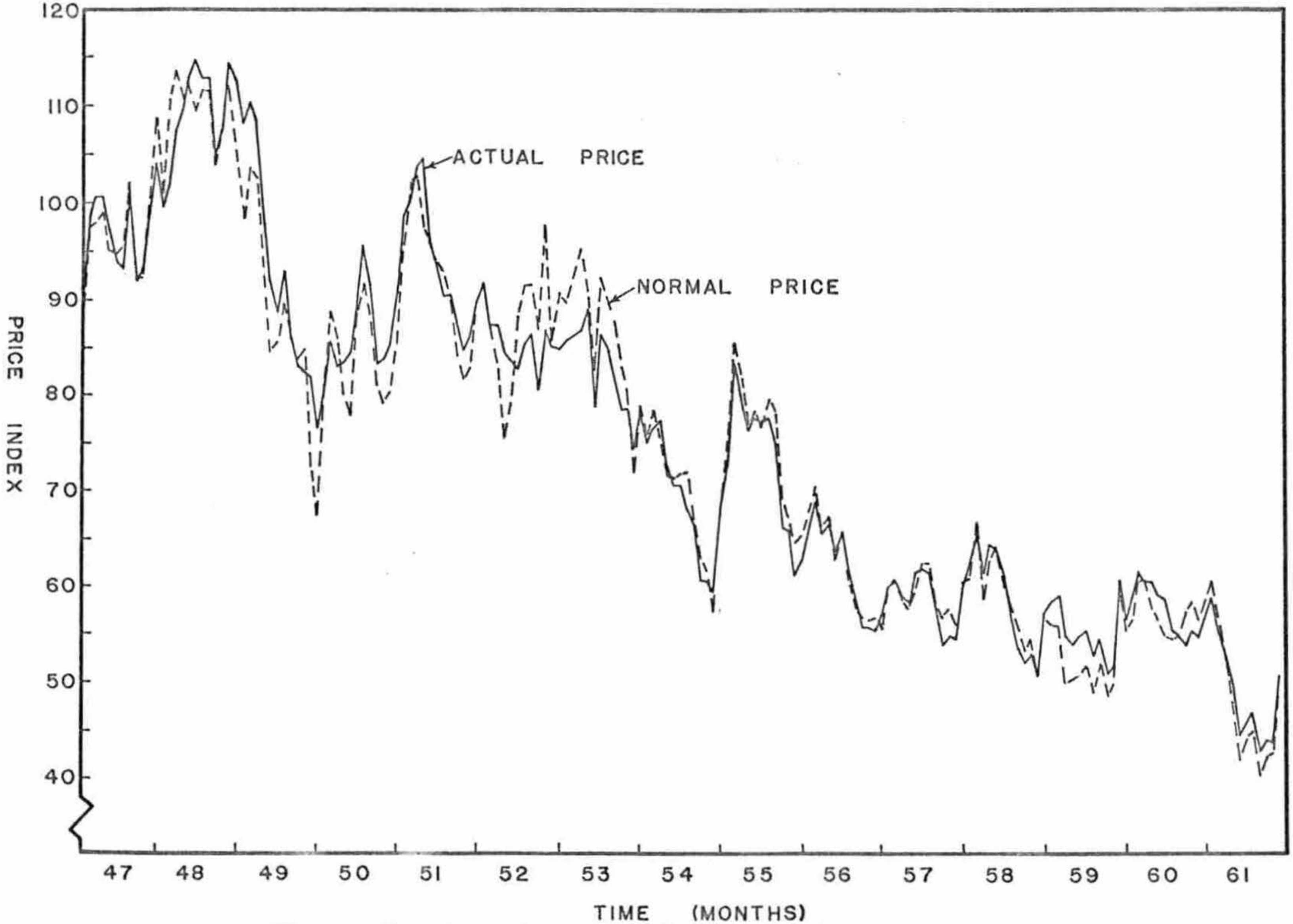

Figure 7. Industry: 2015 Poultry dressing plants

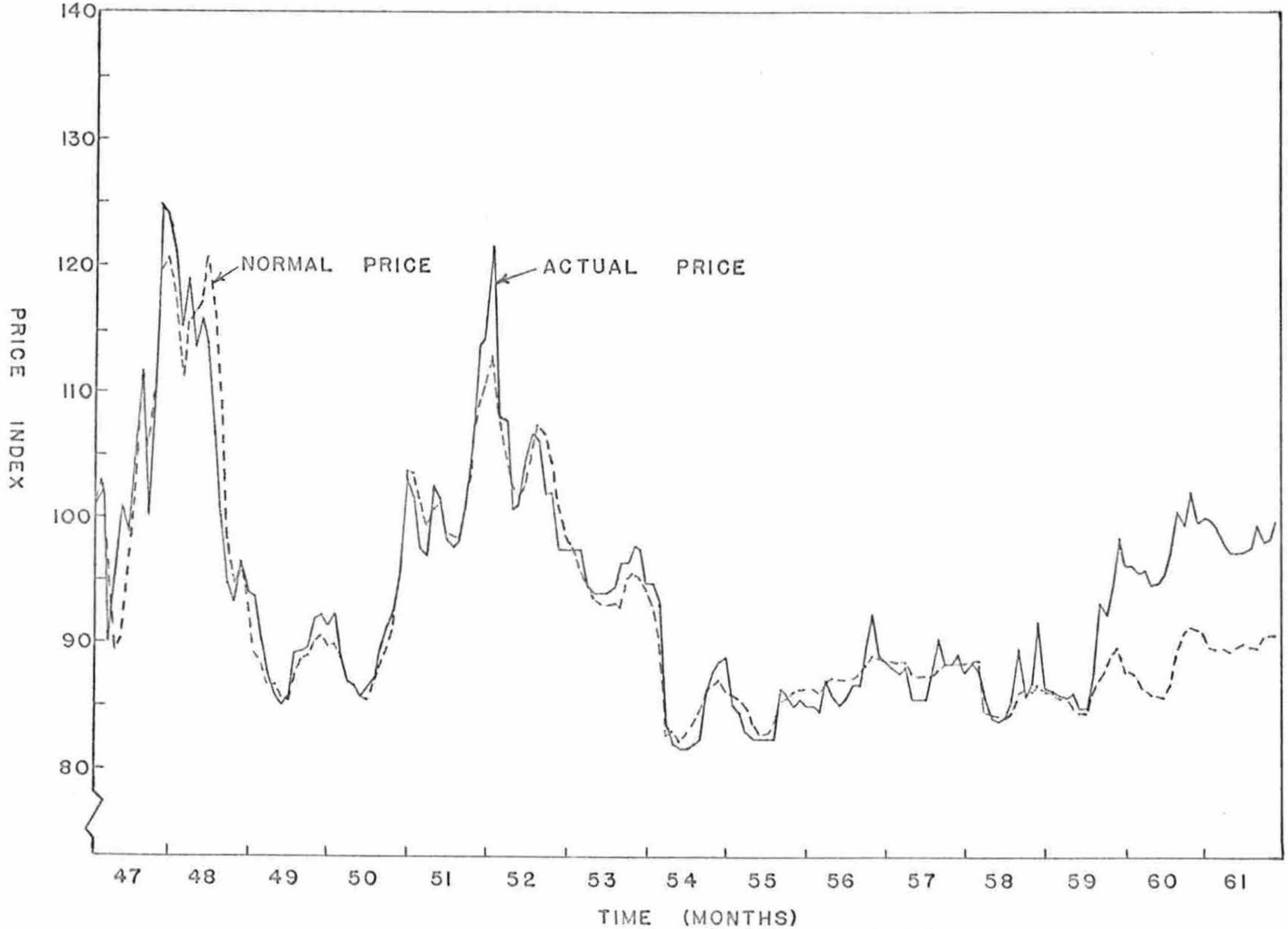

Figure 8. Industry: 2021 Creamery butter

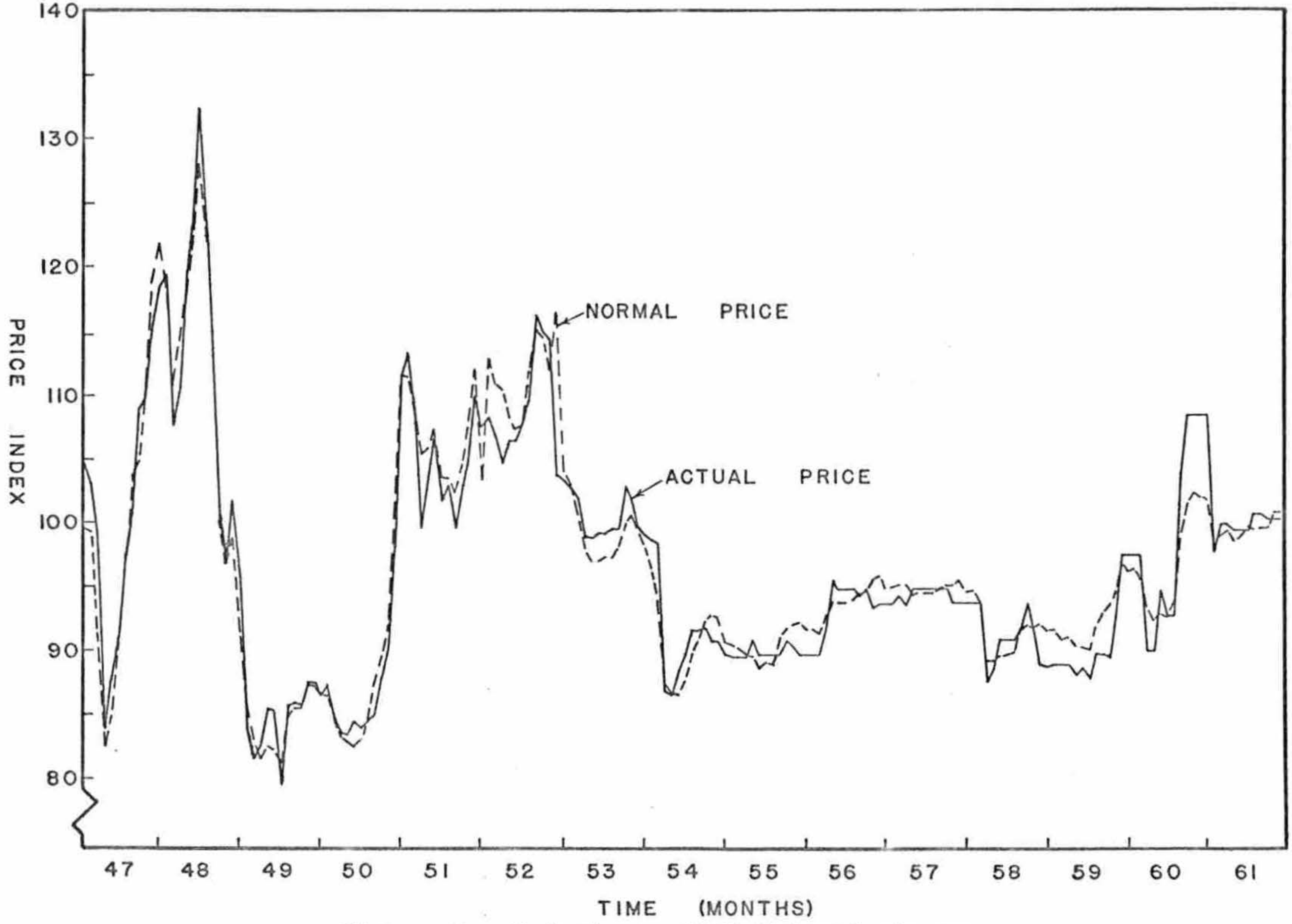

Figure 9. Industry: 2022 Natural cheese

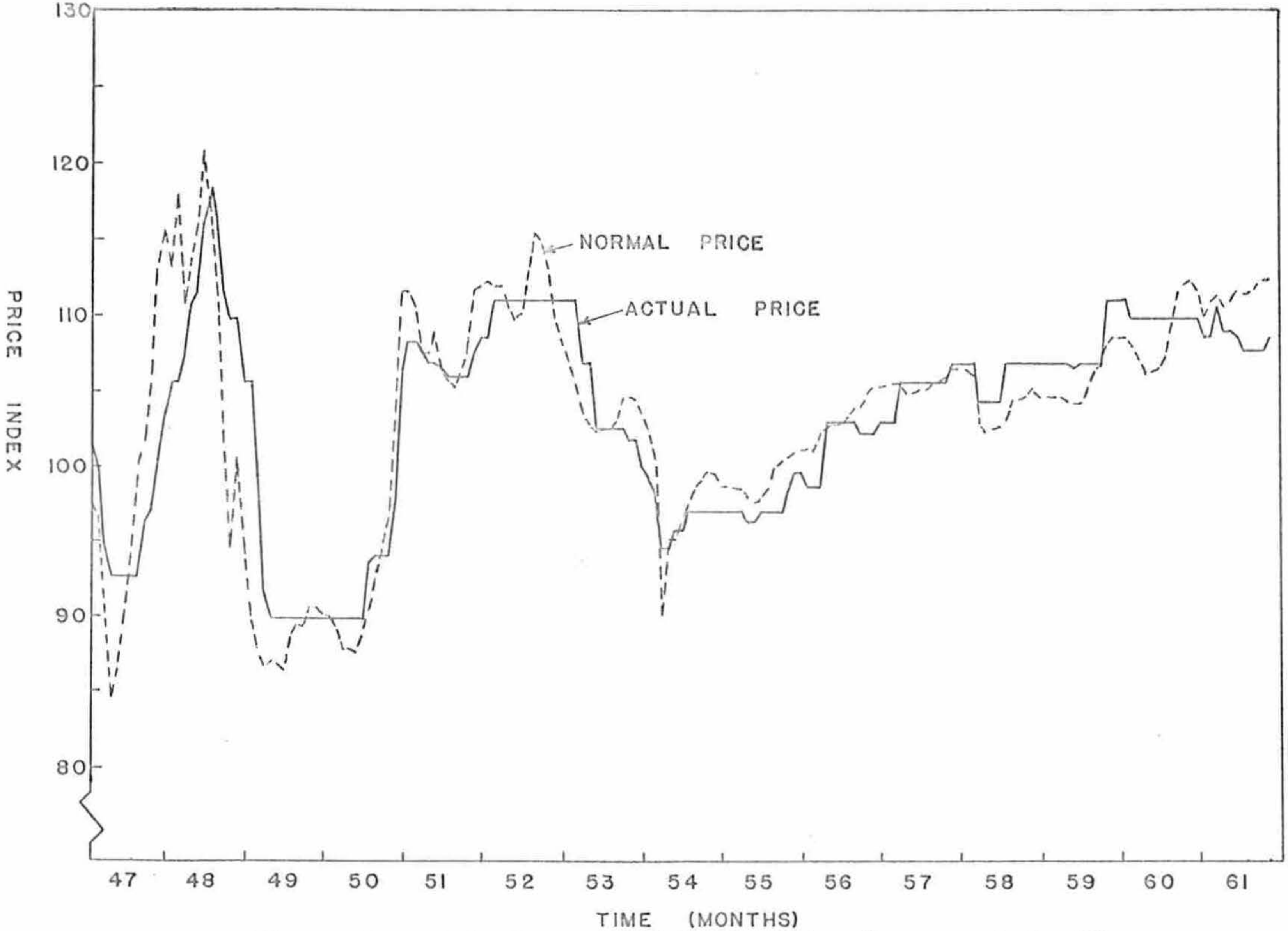

Figure 10. Industry: 2023 Condensed and evaporated milk

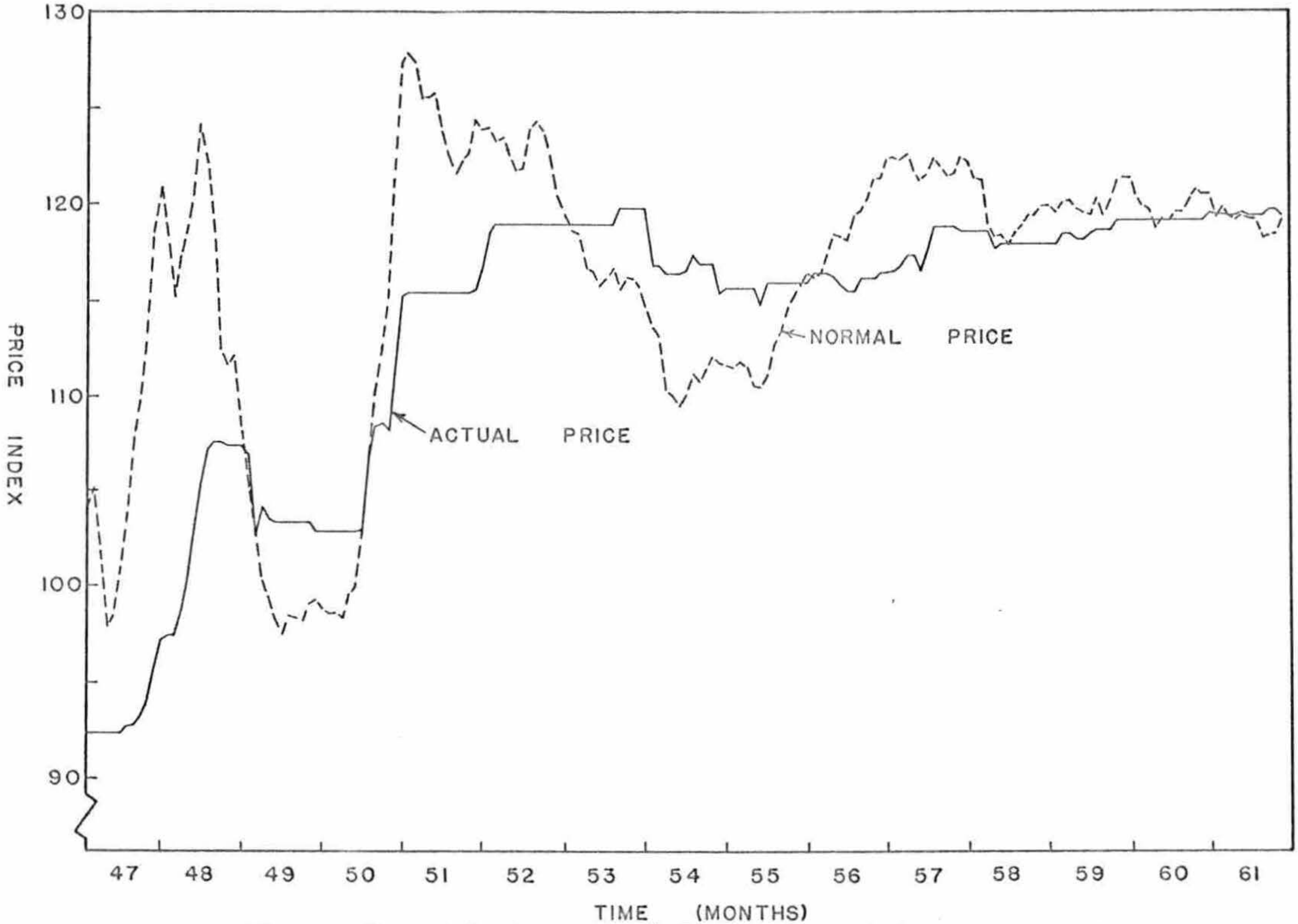

Figure 11. Industry: 2024 Ice cream and frozen desserts

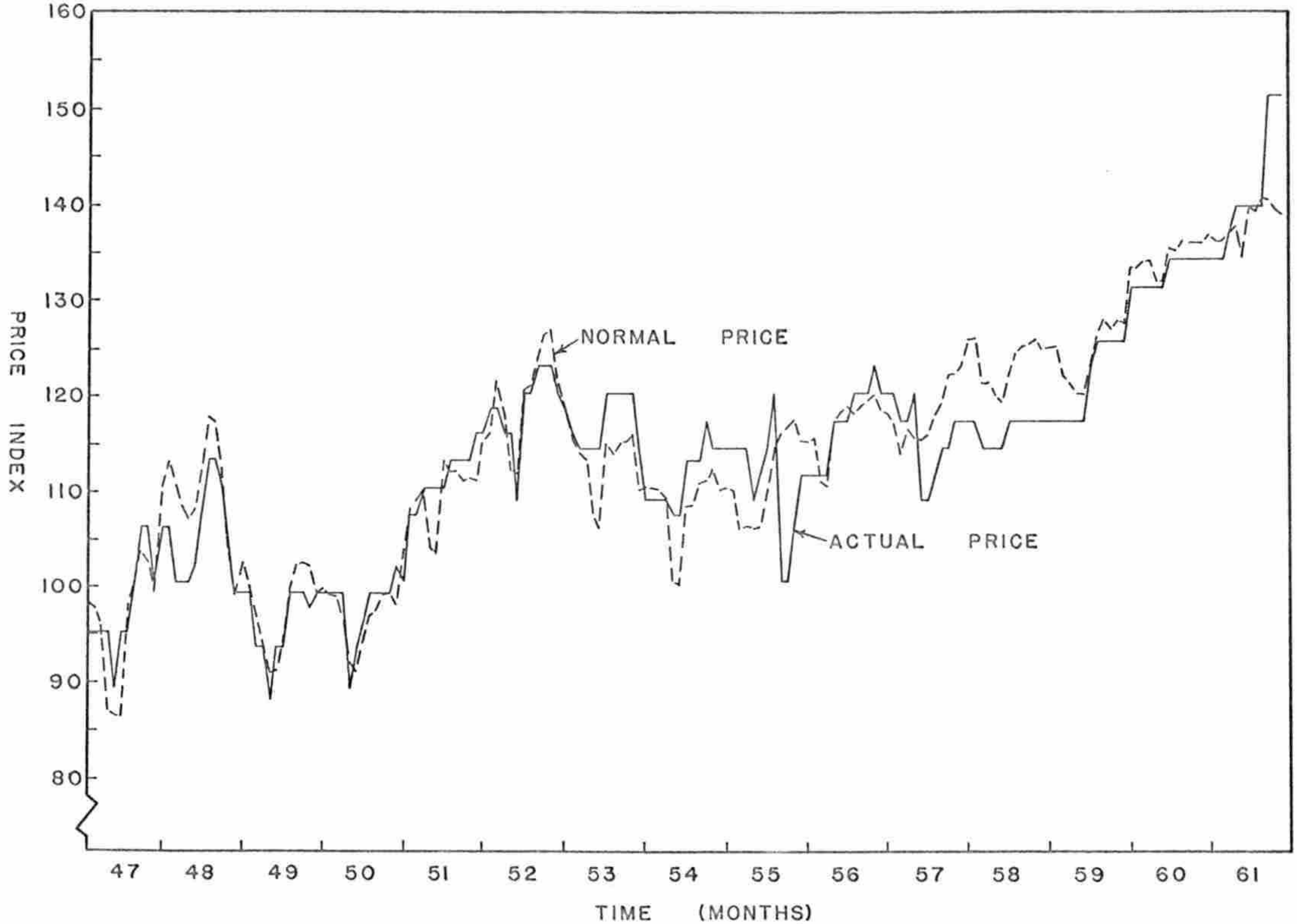

Figure 12. Industry: 2026 Fluid milk

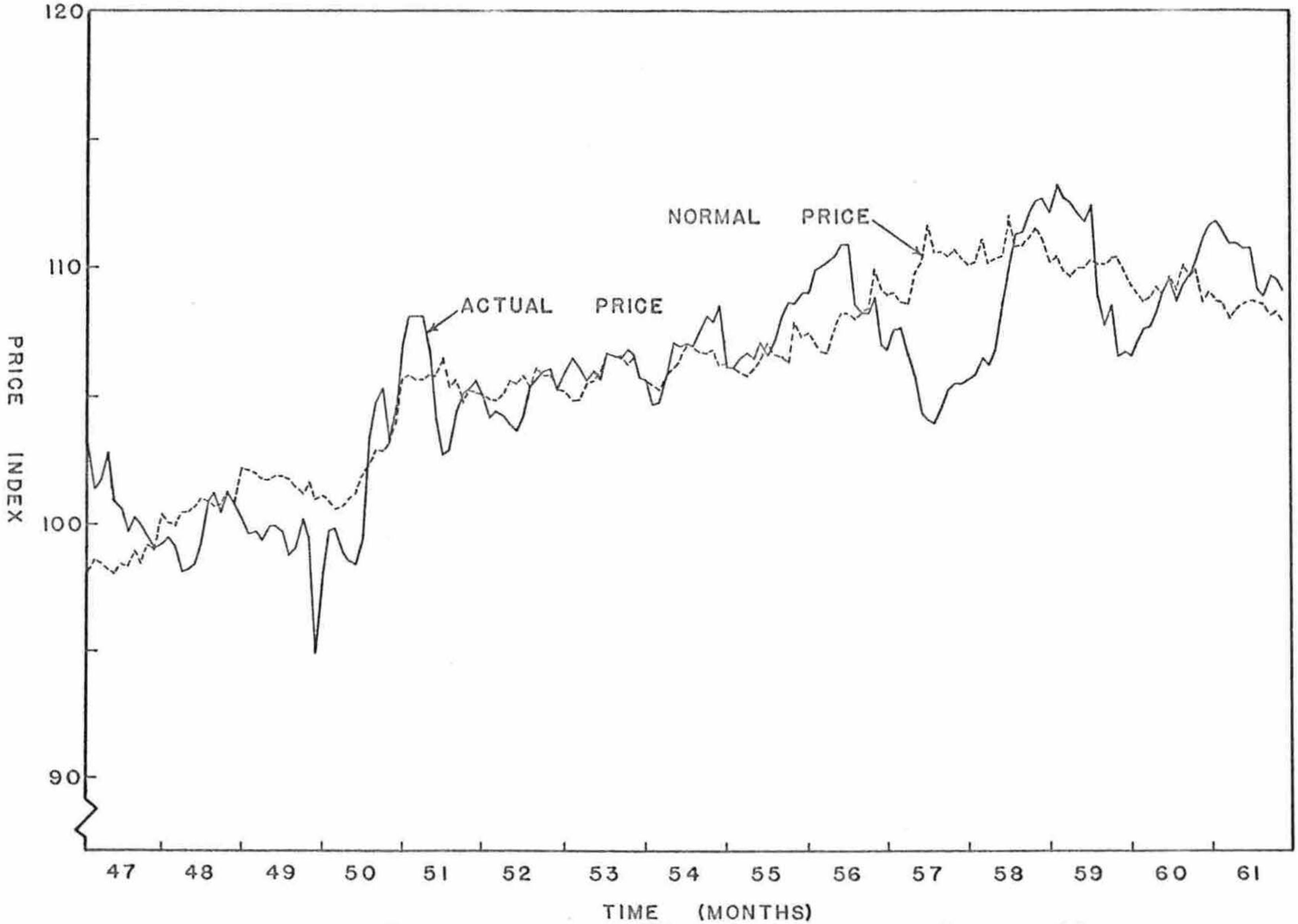

Figure 13. Industry: 2033 Canned fruits and vegetables

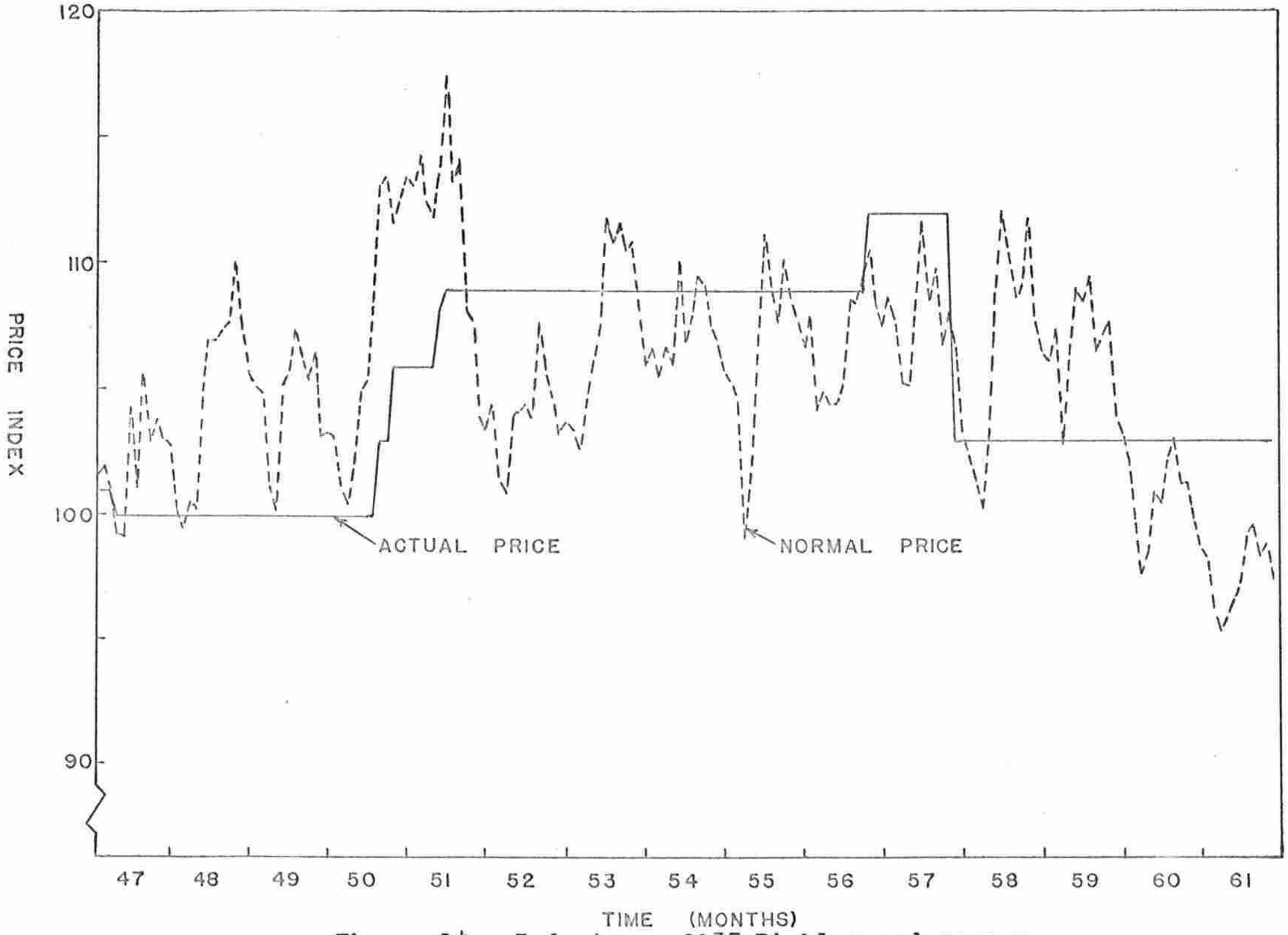

Figure 14. Industry: 2035 Pickles and sauces

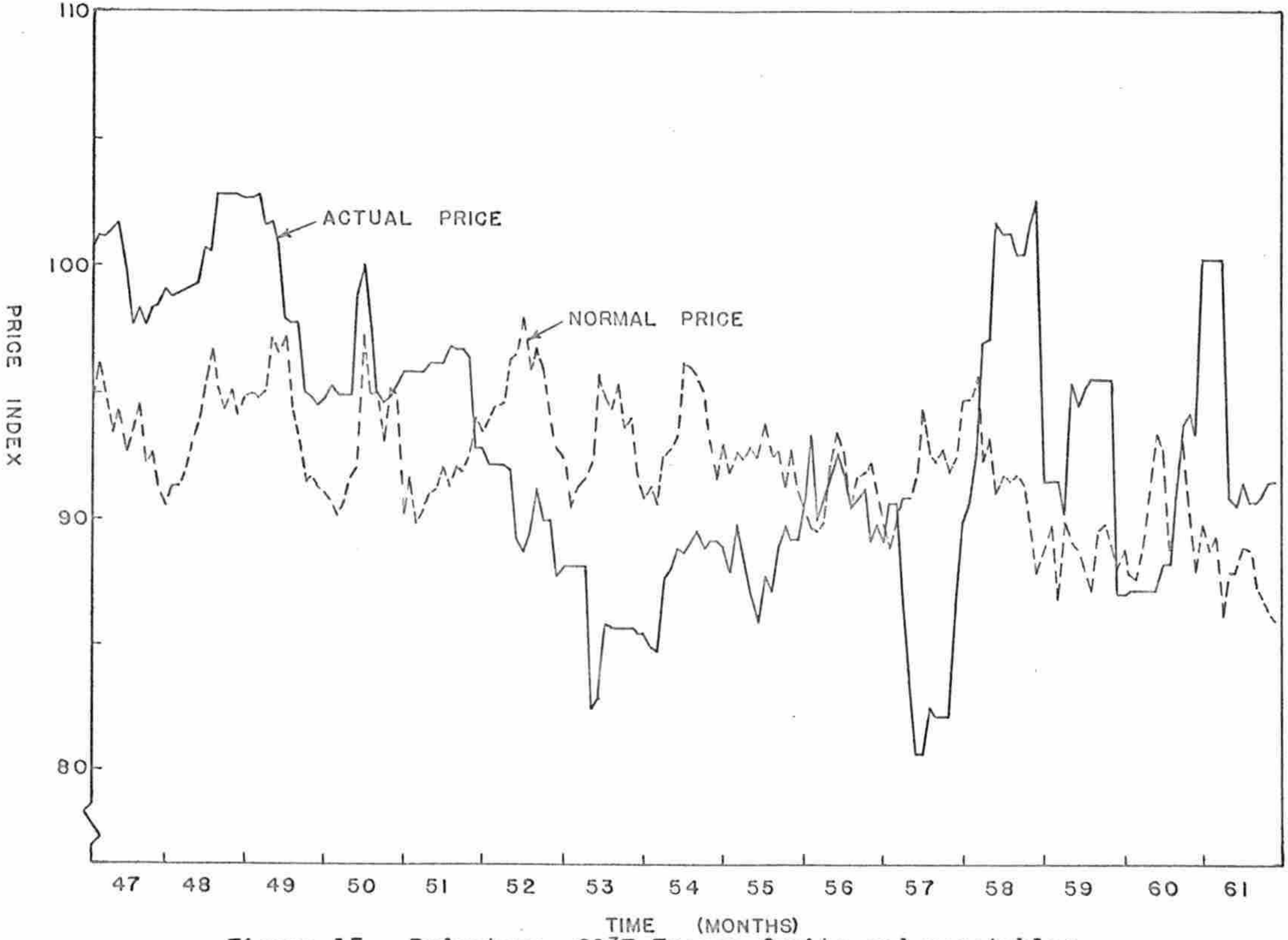

Figure 15. Industry: 2037 Frozen fruits and vegetables

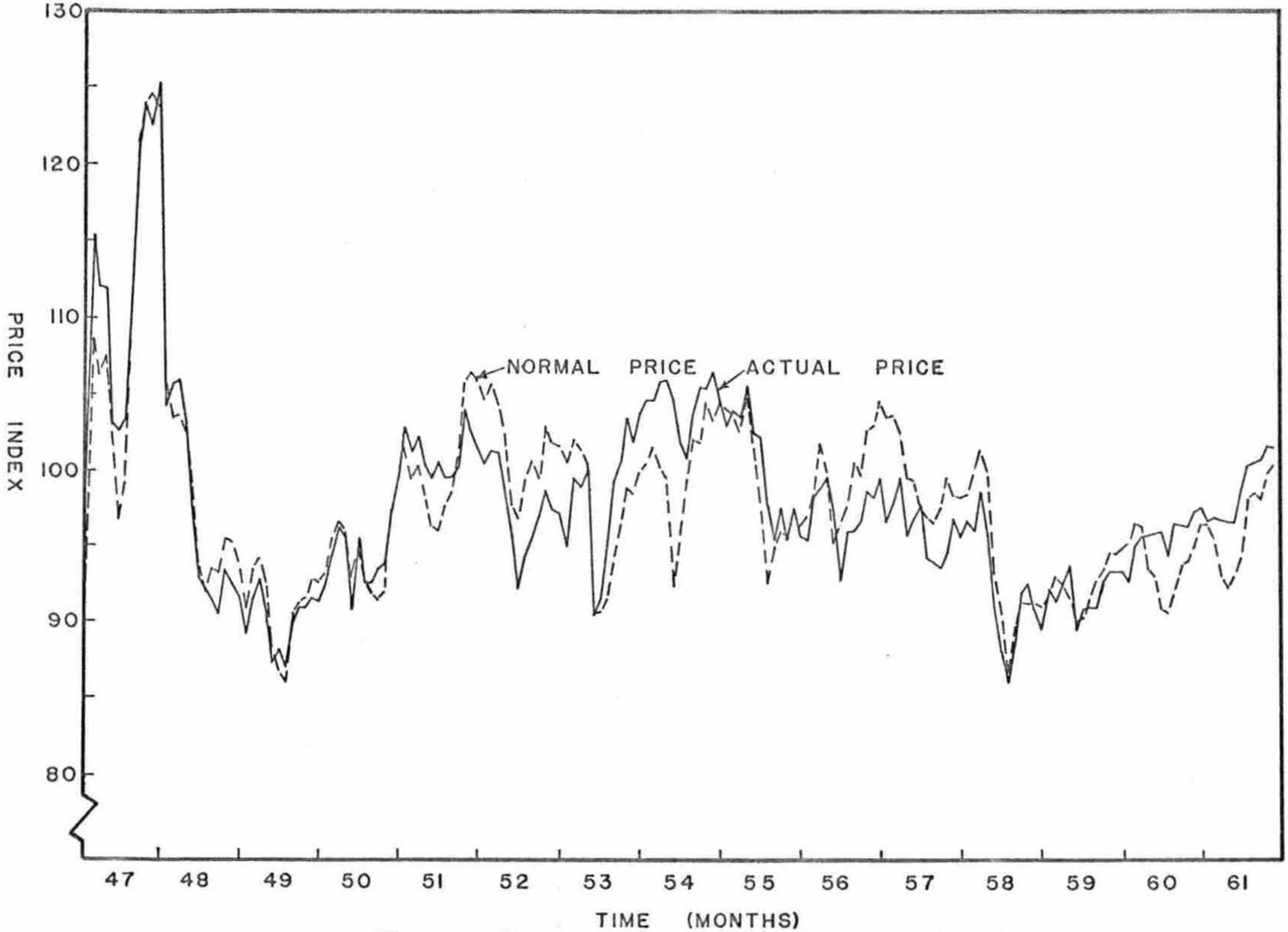

Figure 16. Industry: 2041 Flour and meal

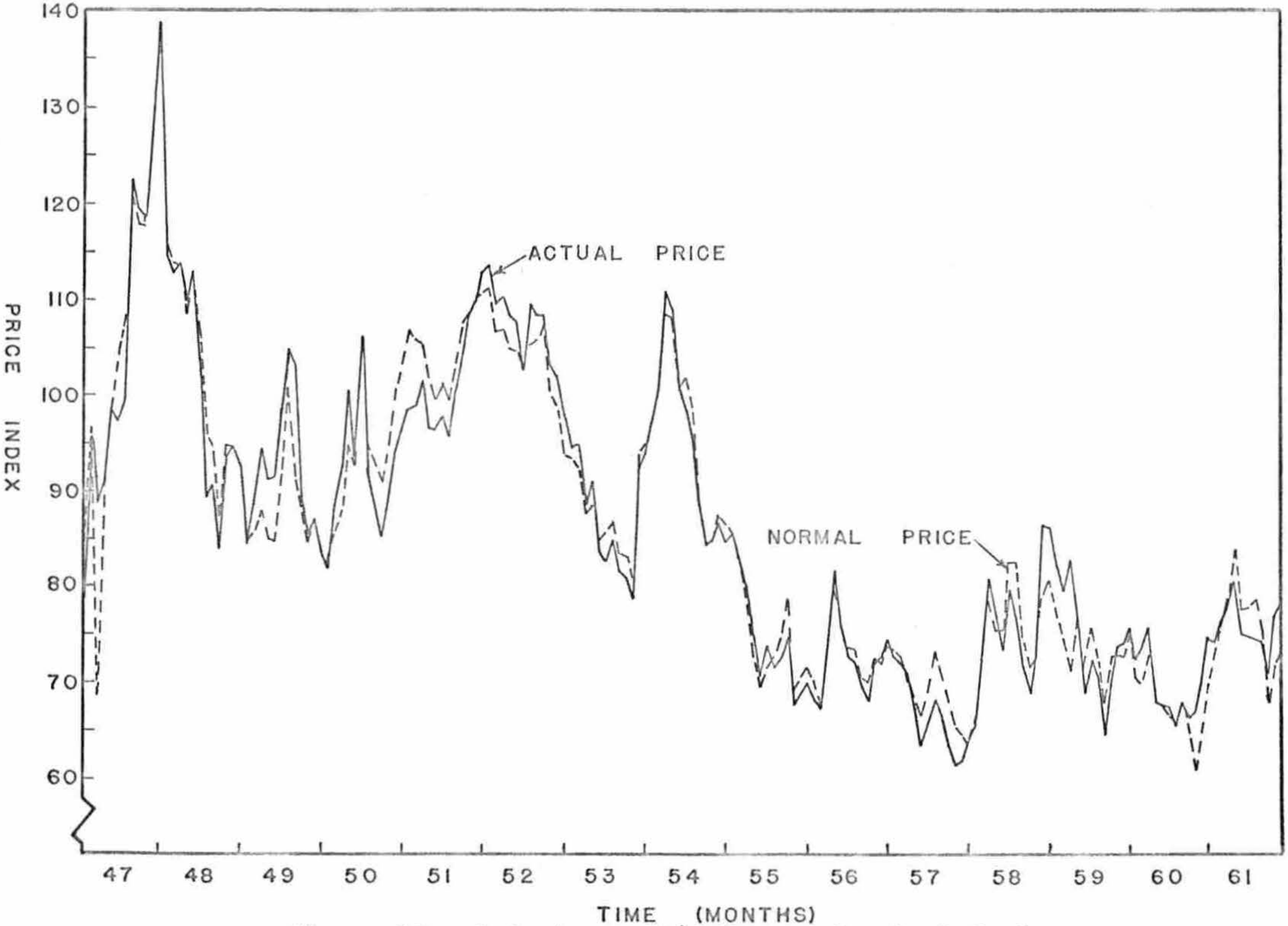

Figure 17. Industry: 2042 Prepared animal feeds

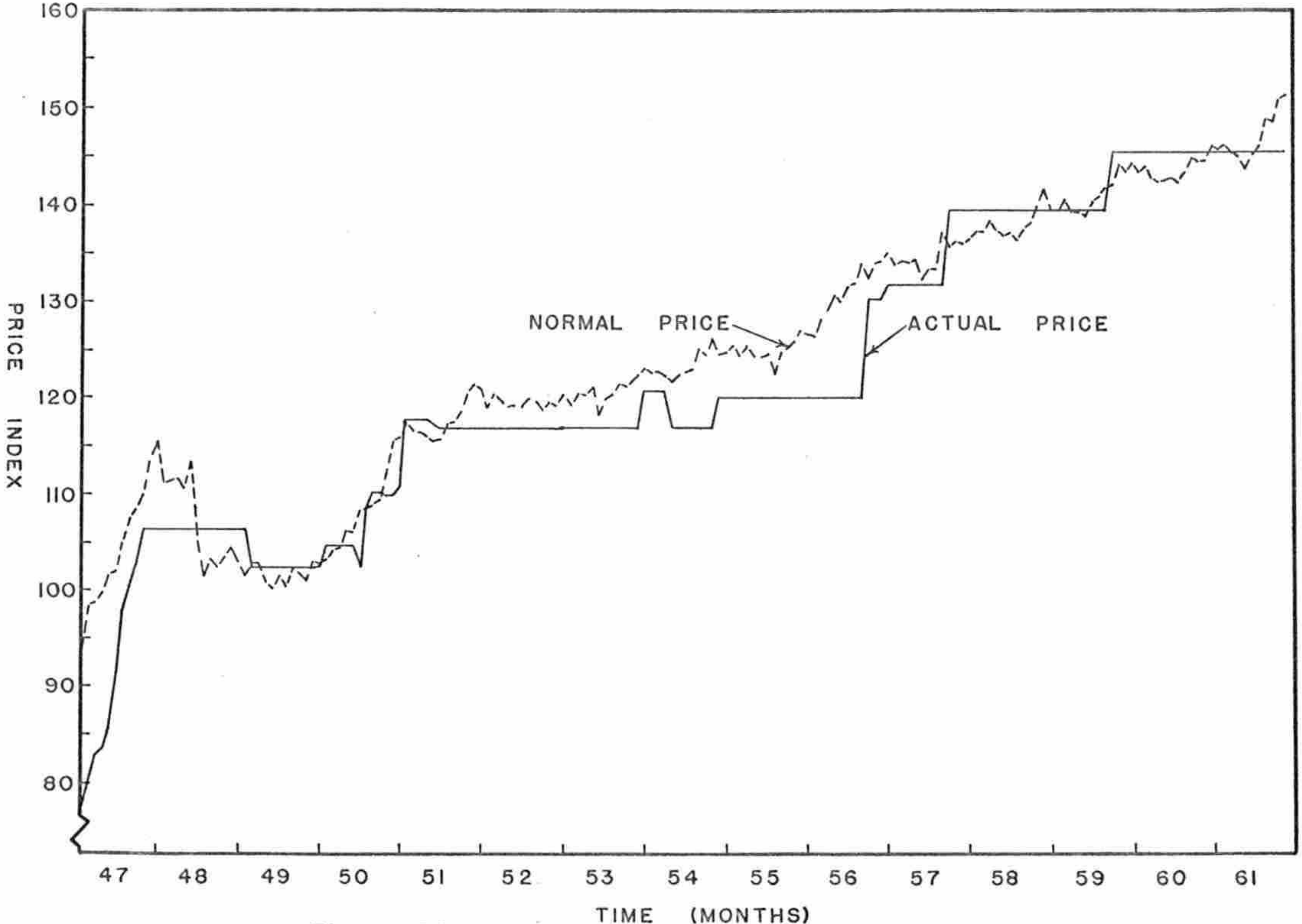

Figure 18. Industry: 2043 Cereal preparations

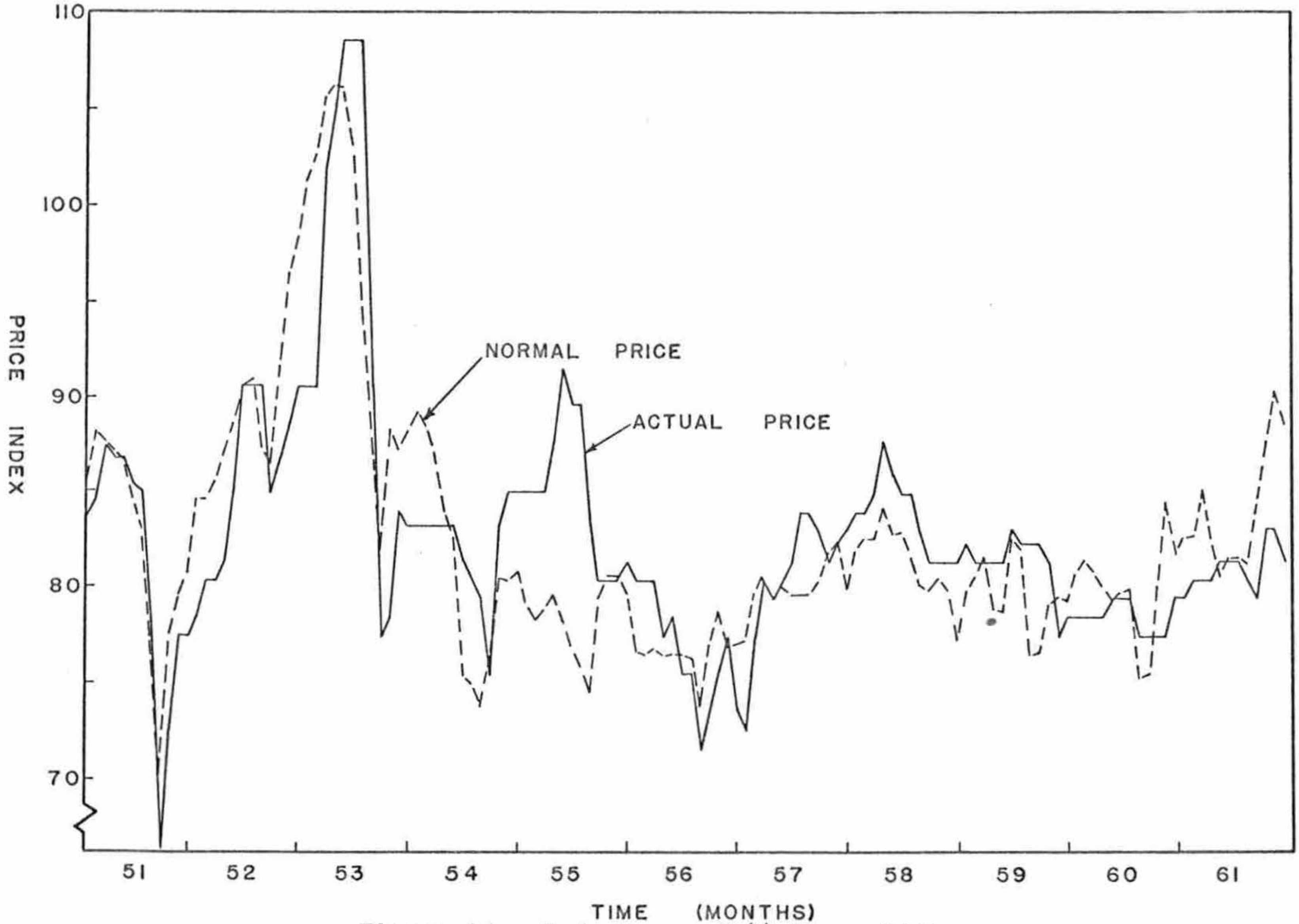

Figure 19. Industry: 2044 Rice milling

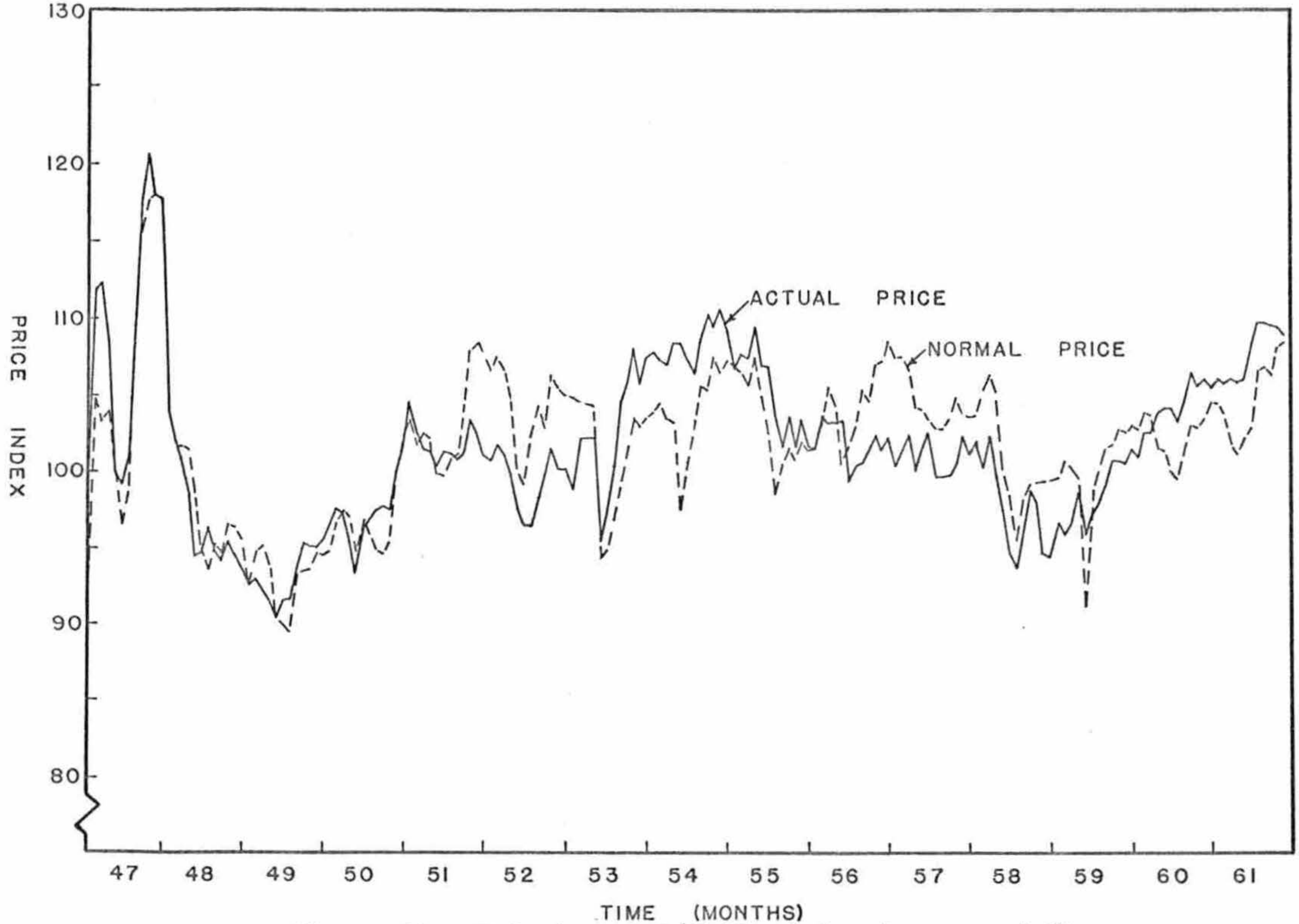

Figure 20. Industry: 2045 Blended and prepared flour

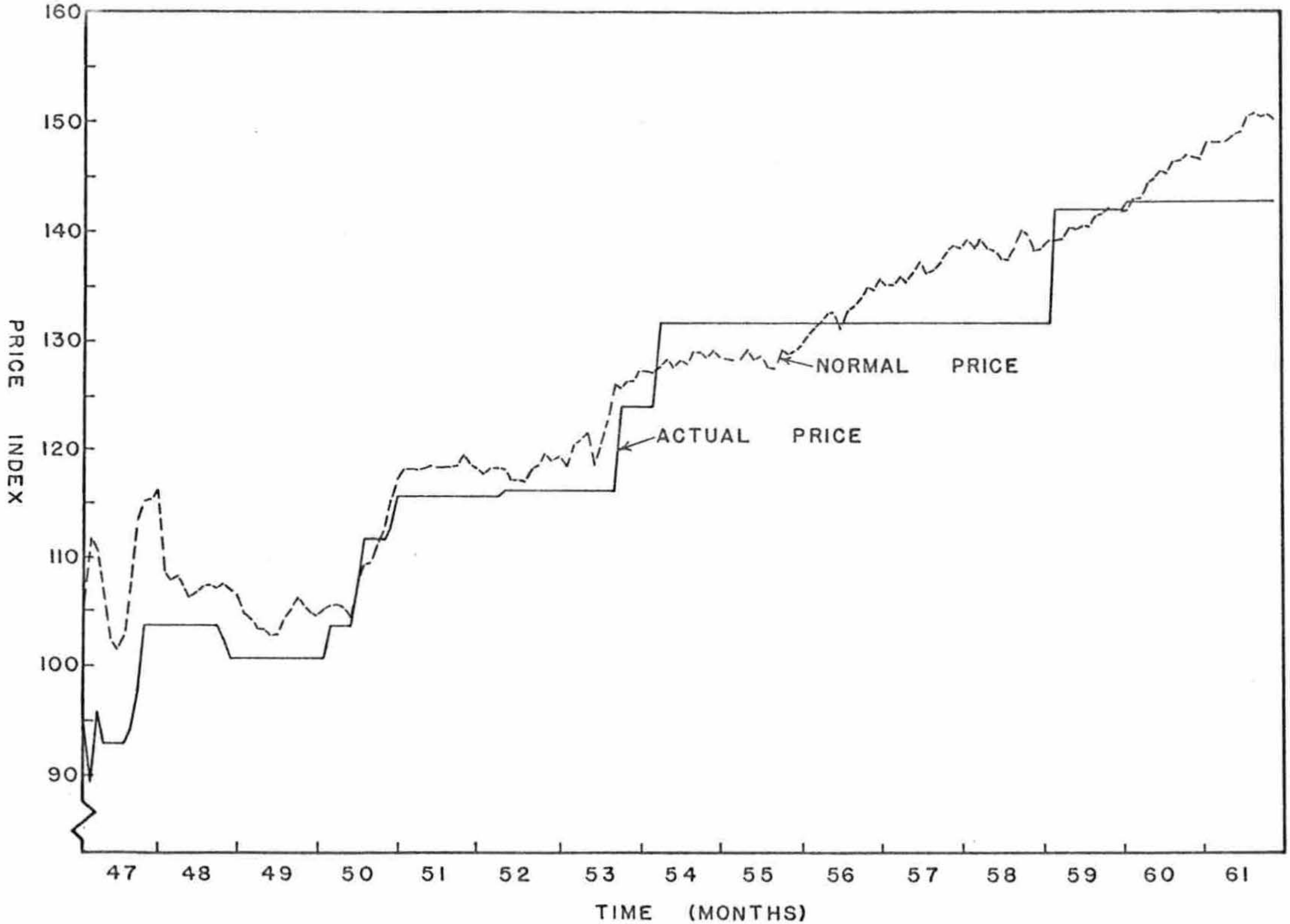

Figure 21. Industry: 2051 Bread and related products

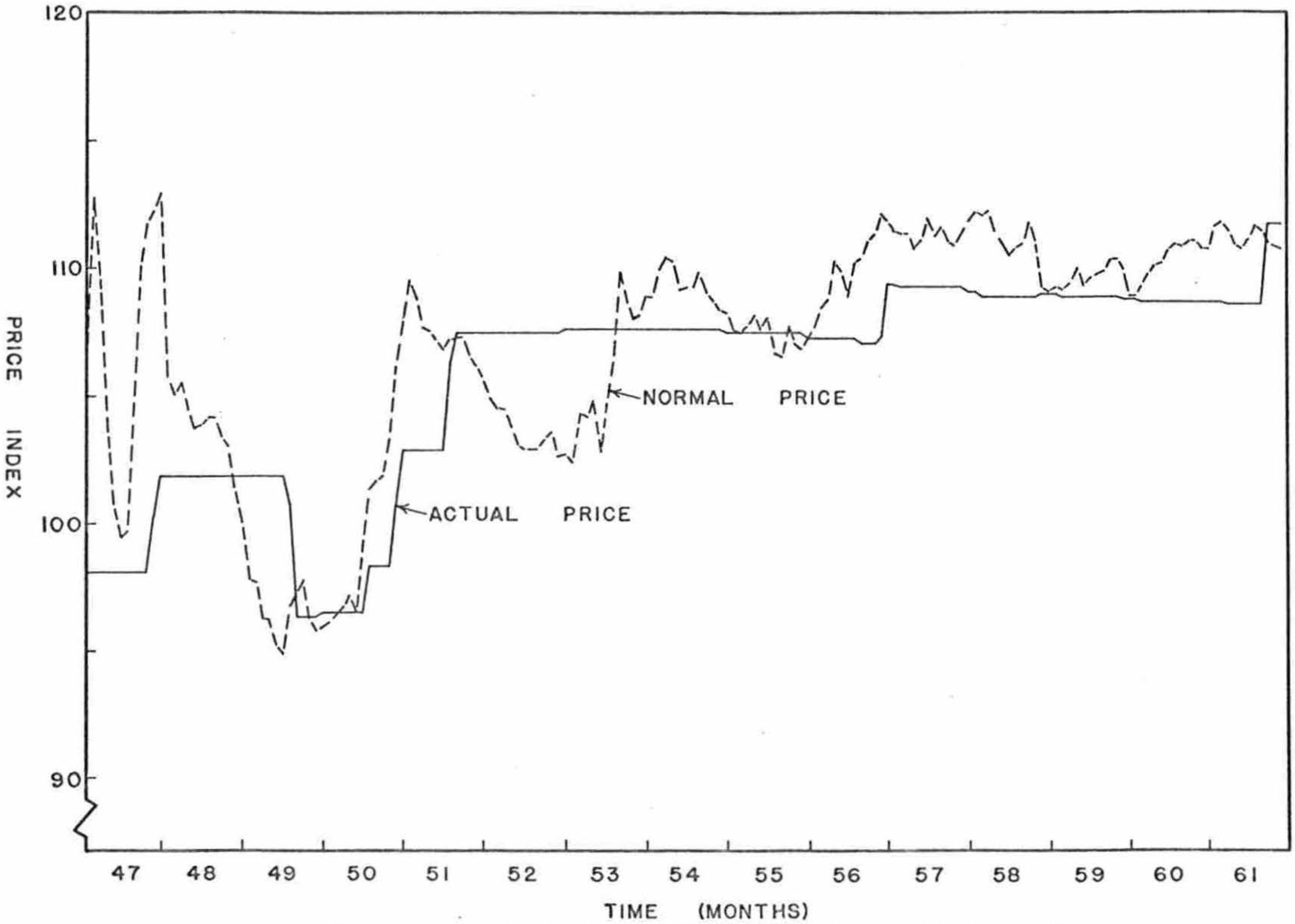

Figure 22. Industry: 2052 Biscuit and crackers

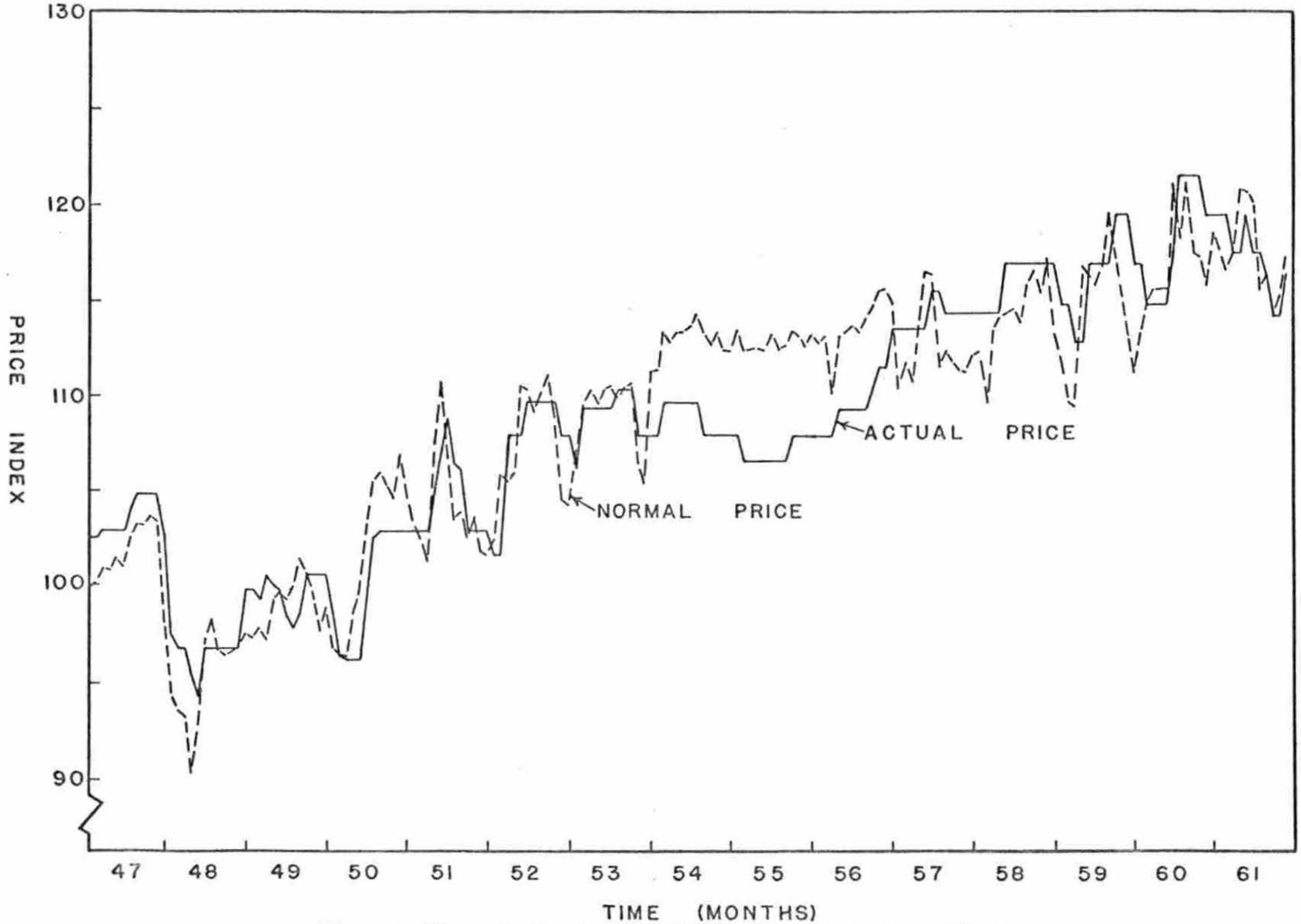

Figure 23. Industry: 2062 Cane sugar refining

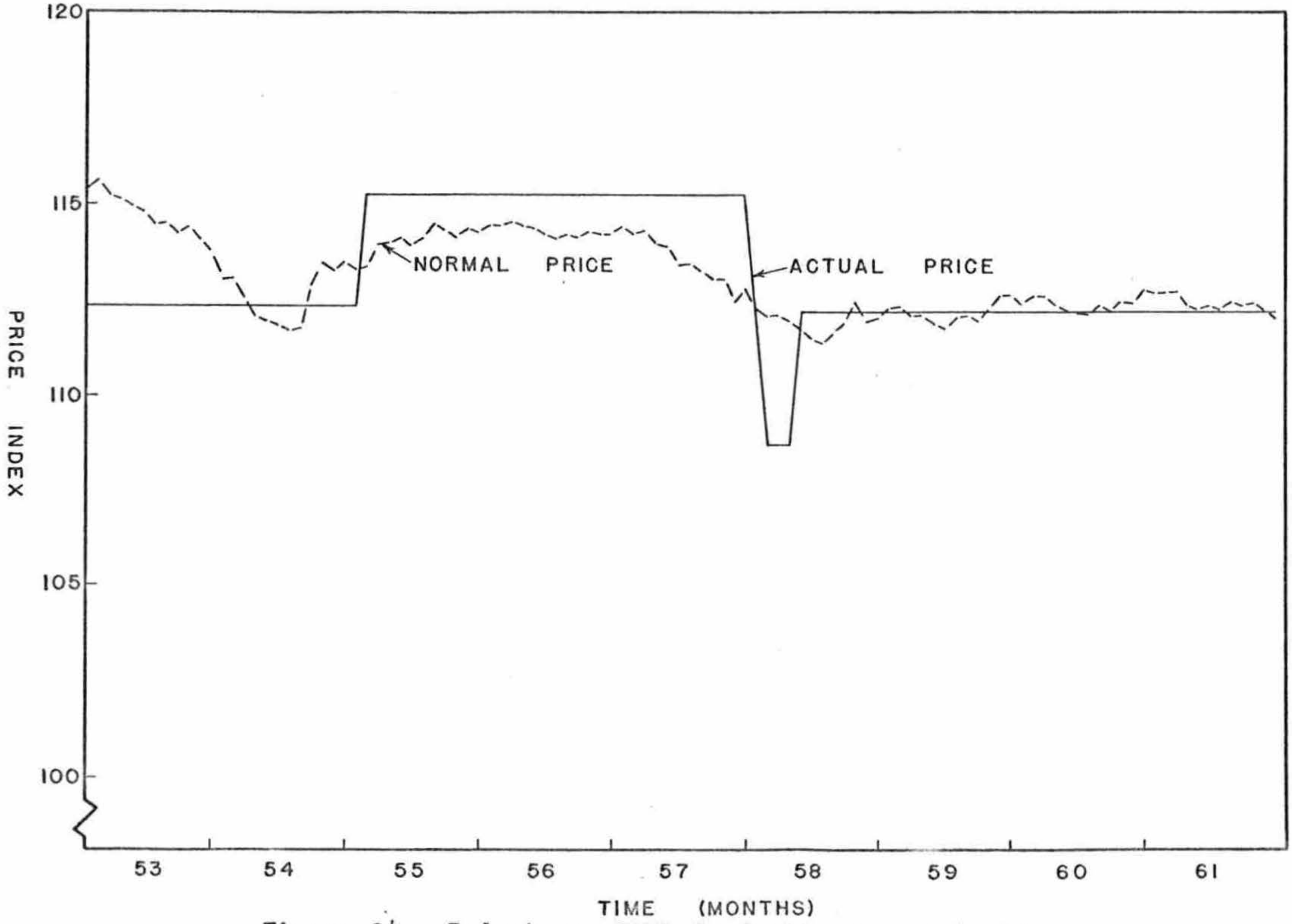

Figure 24. Industry: 2071 Confectionery products

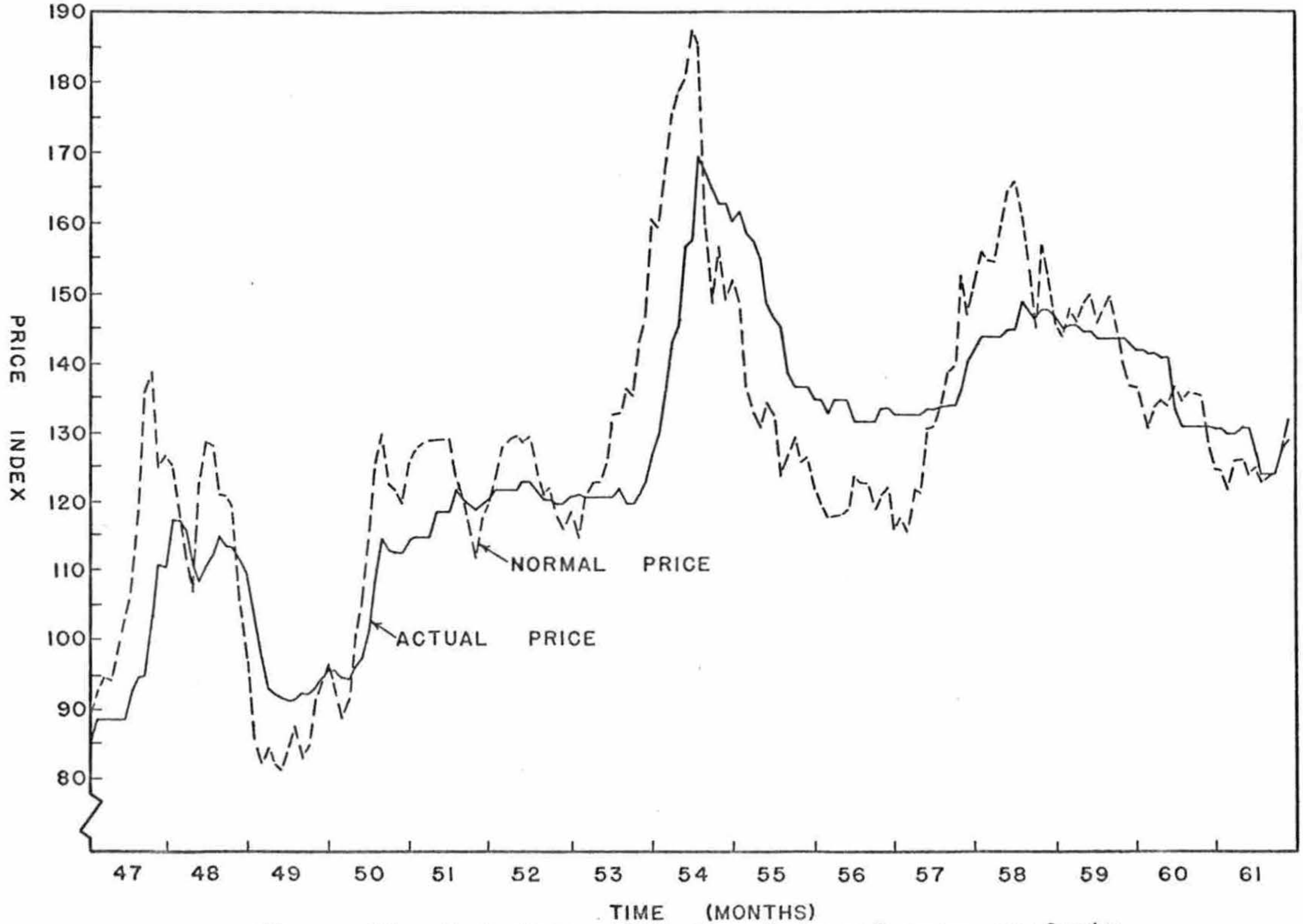

Figure 25. Industry: 2072 Chocolate and cocoa products

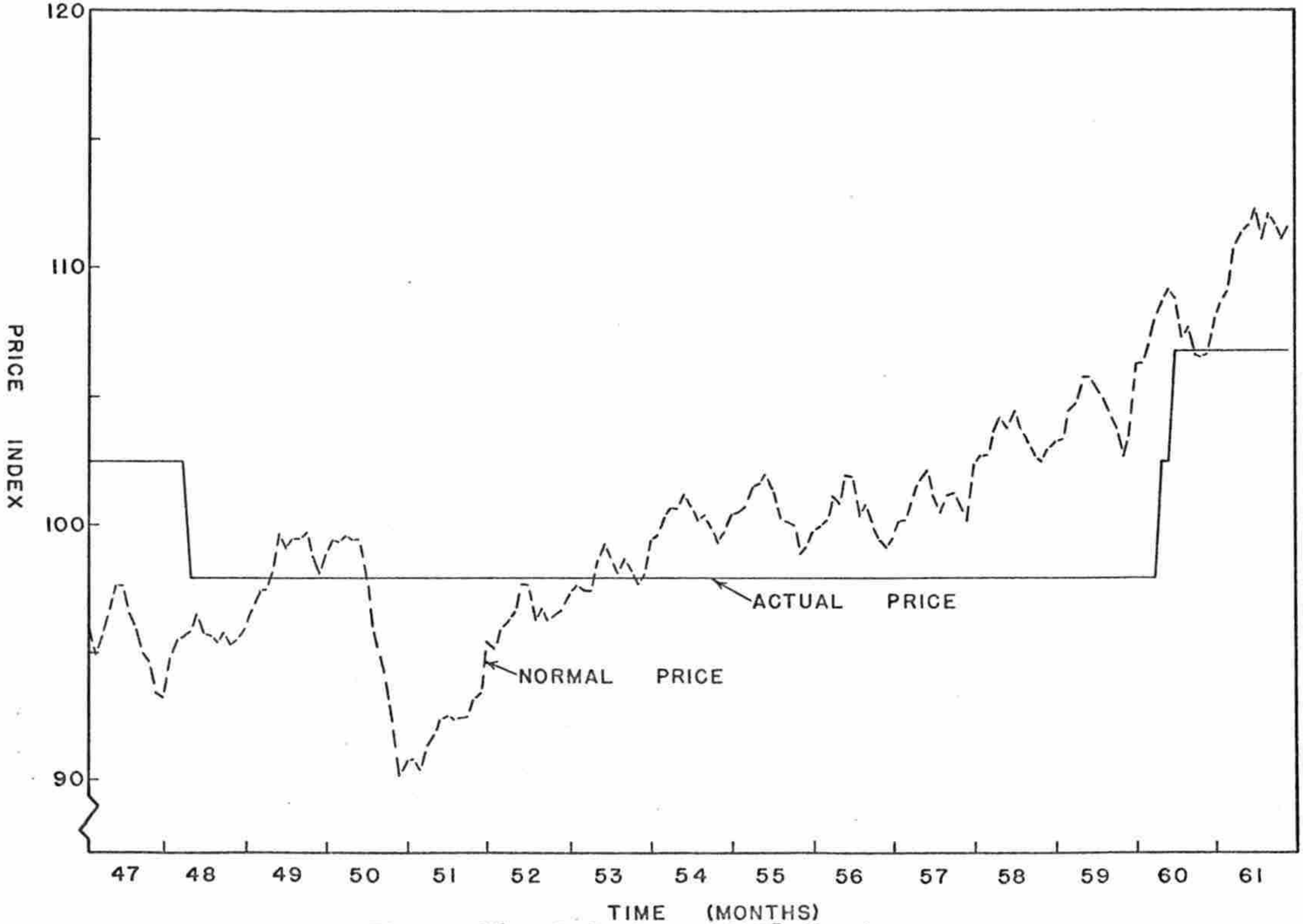

Figure 26. Industry: 2073 Chewing gum

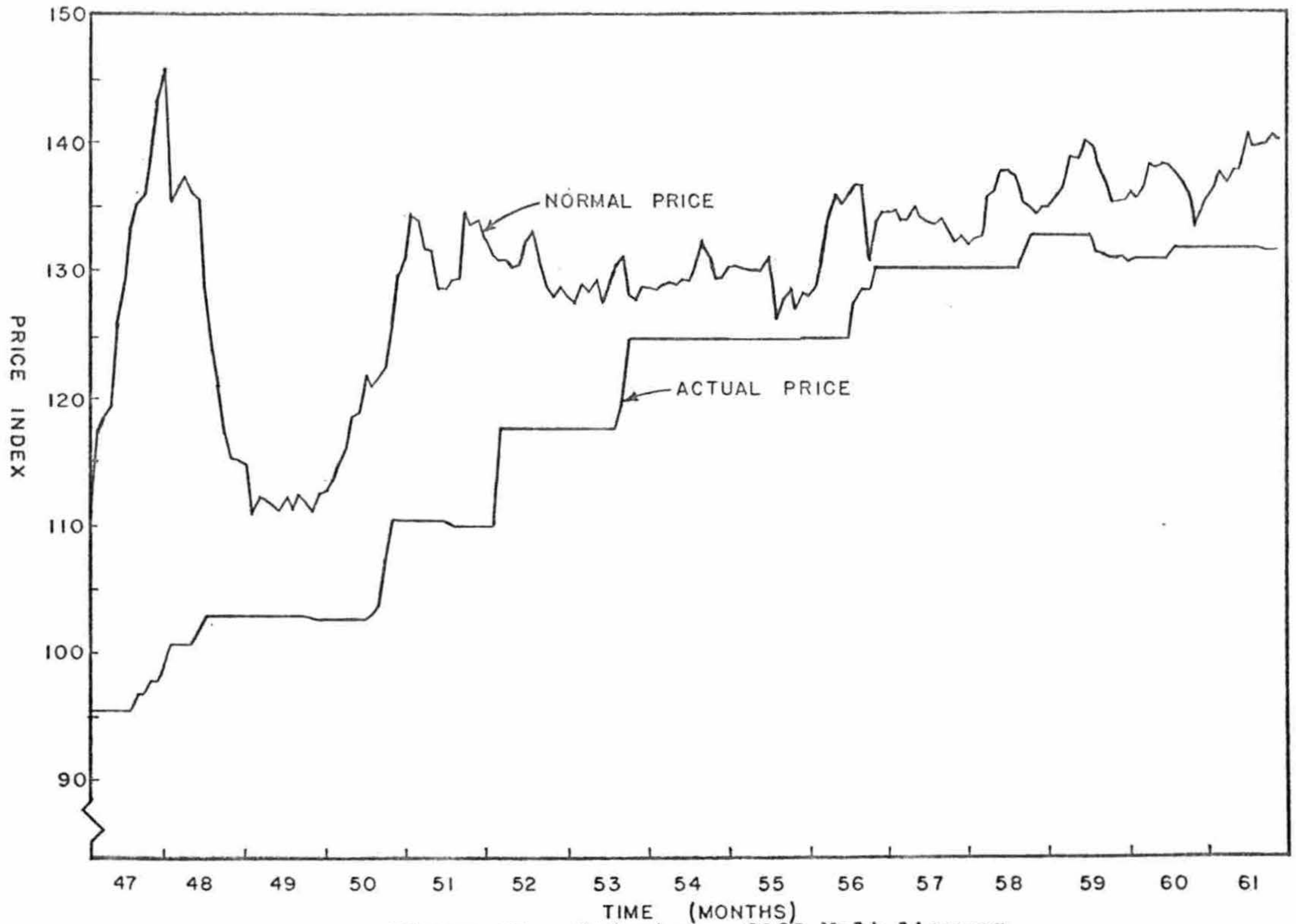

Figure 27. Industry: 2082 Malt liquors

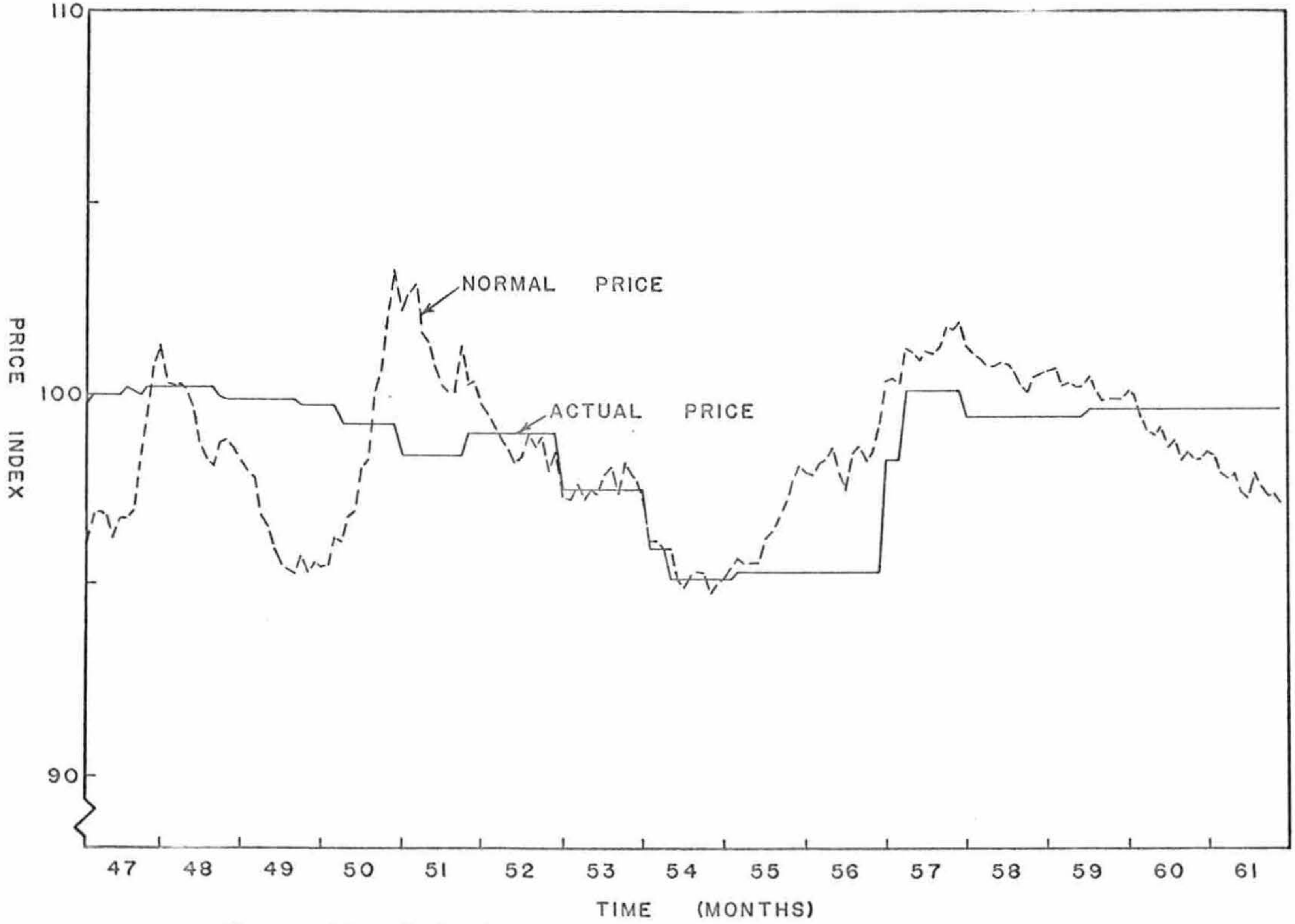

Figure 28. Industry: 2085 Distilled liquor except brandy

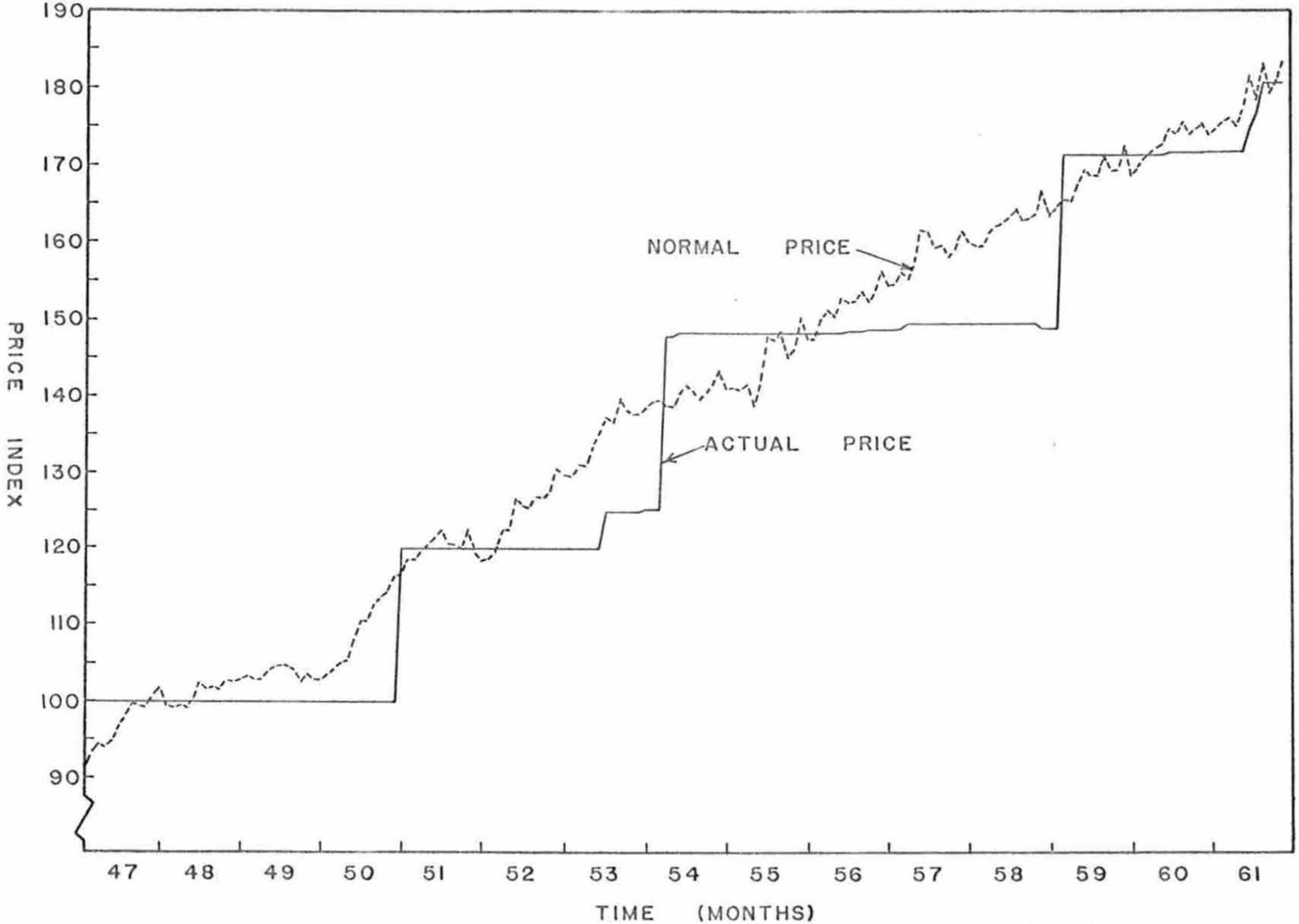

Figure 29. Industry: 2086 Bottled and canned soft drinks

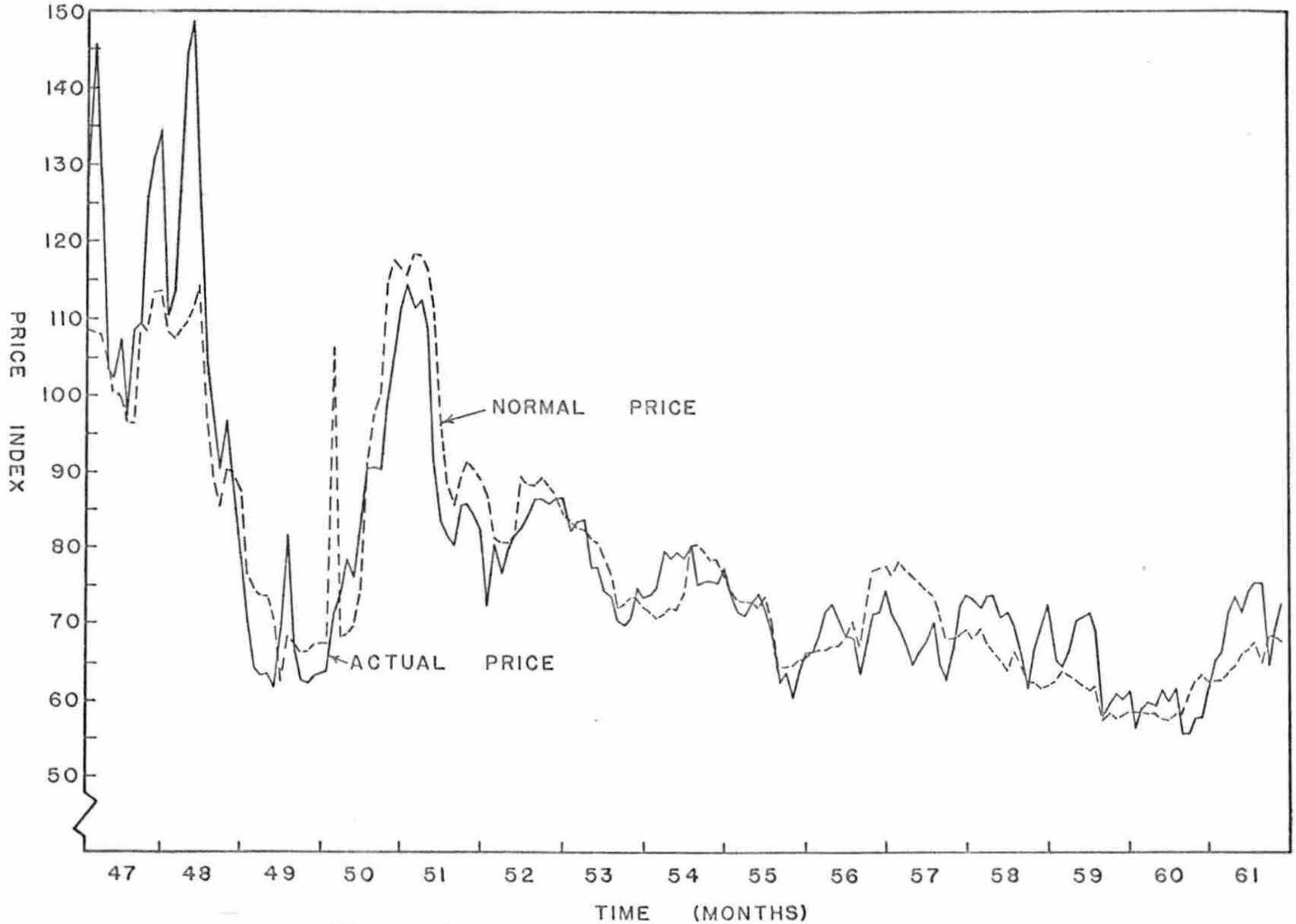

Figure 30. Industry: 2091 Cottonseed oil mills

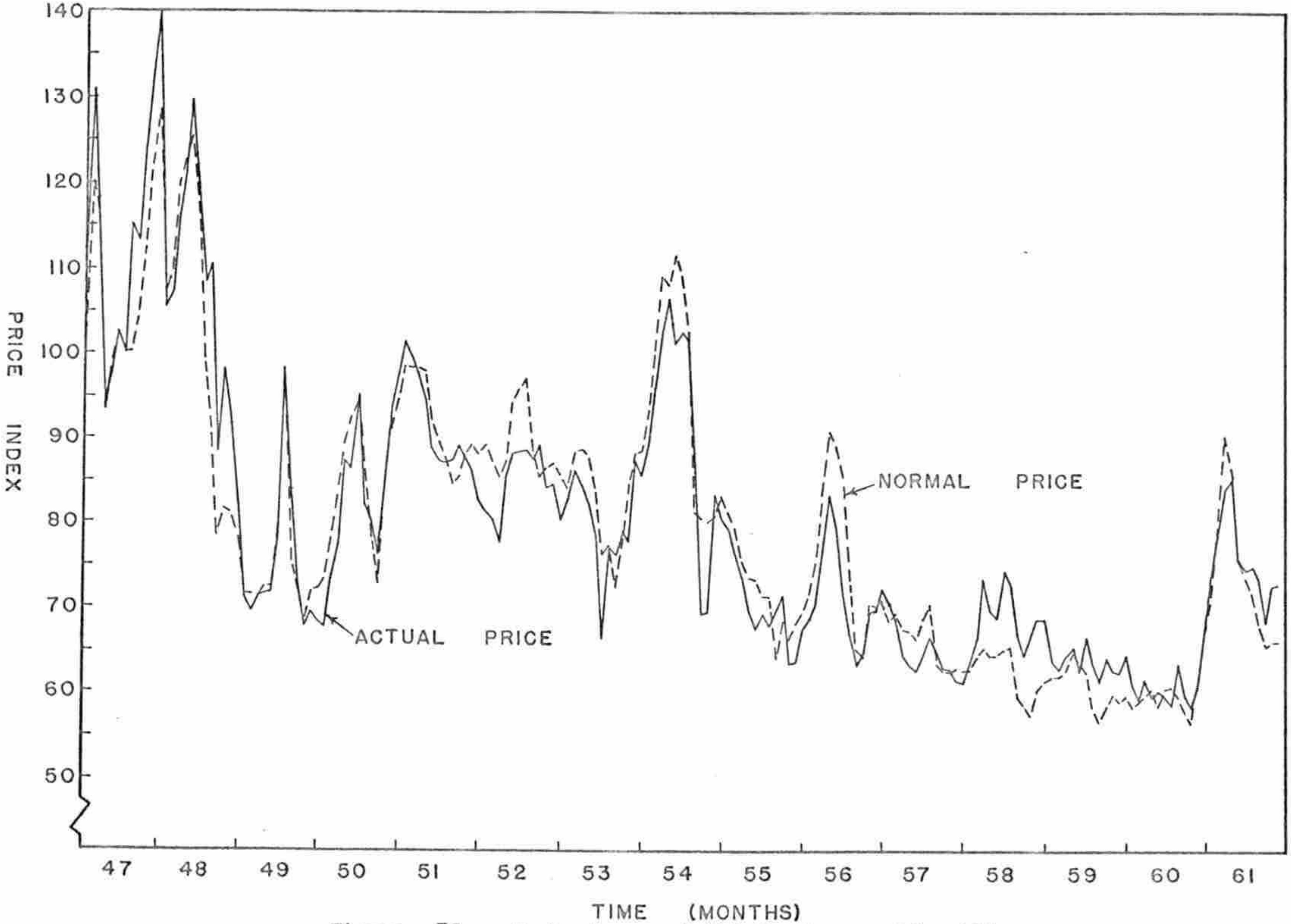

Figure 31. Industry: 2092 Soybean oil mills

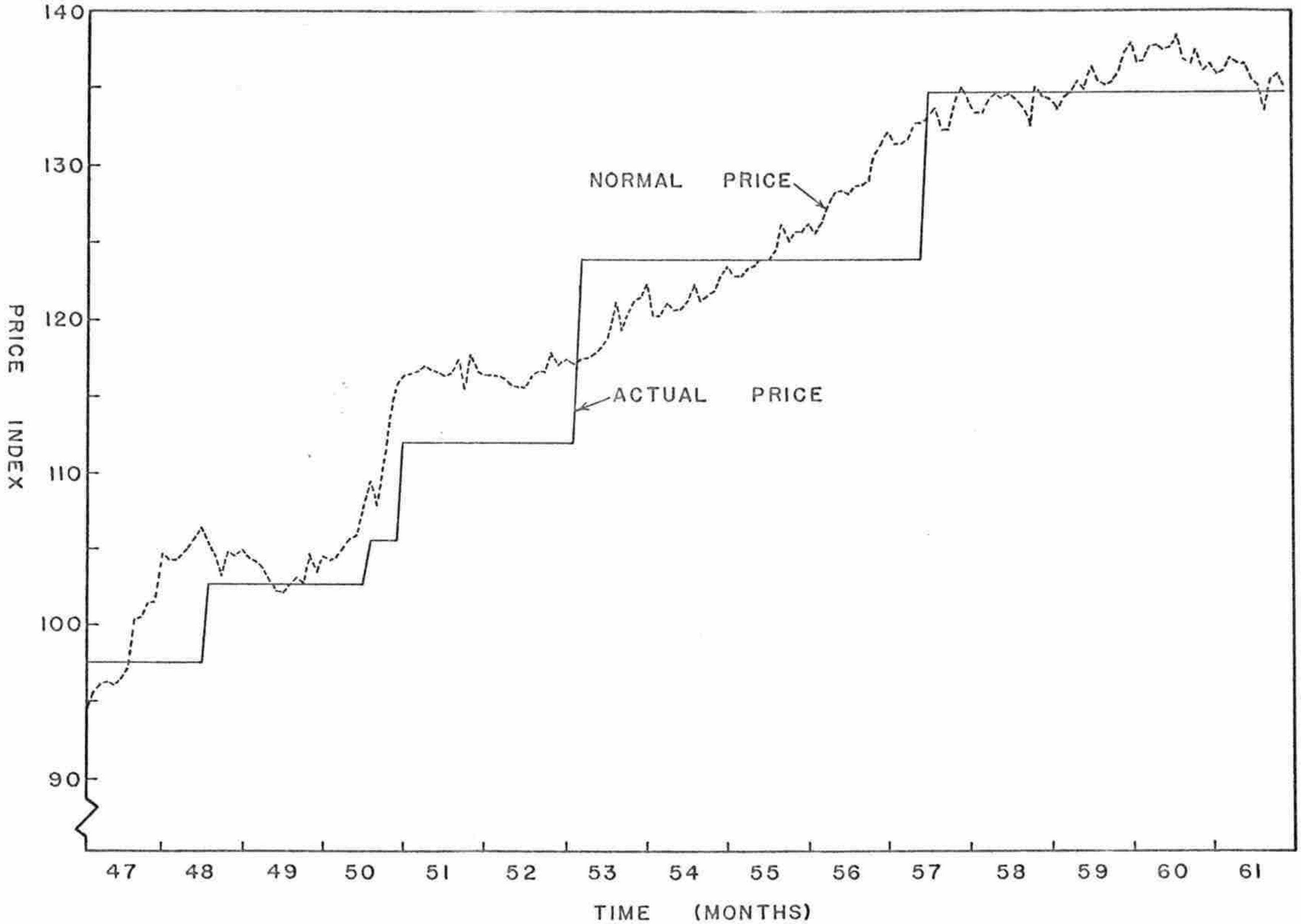

Figure 32. Industry: 2111 Cigarettes

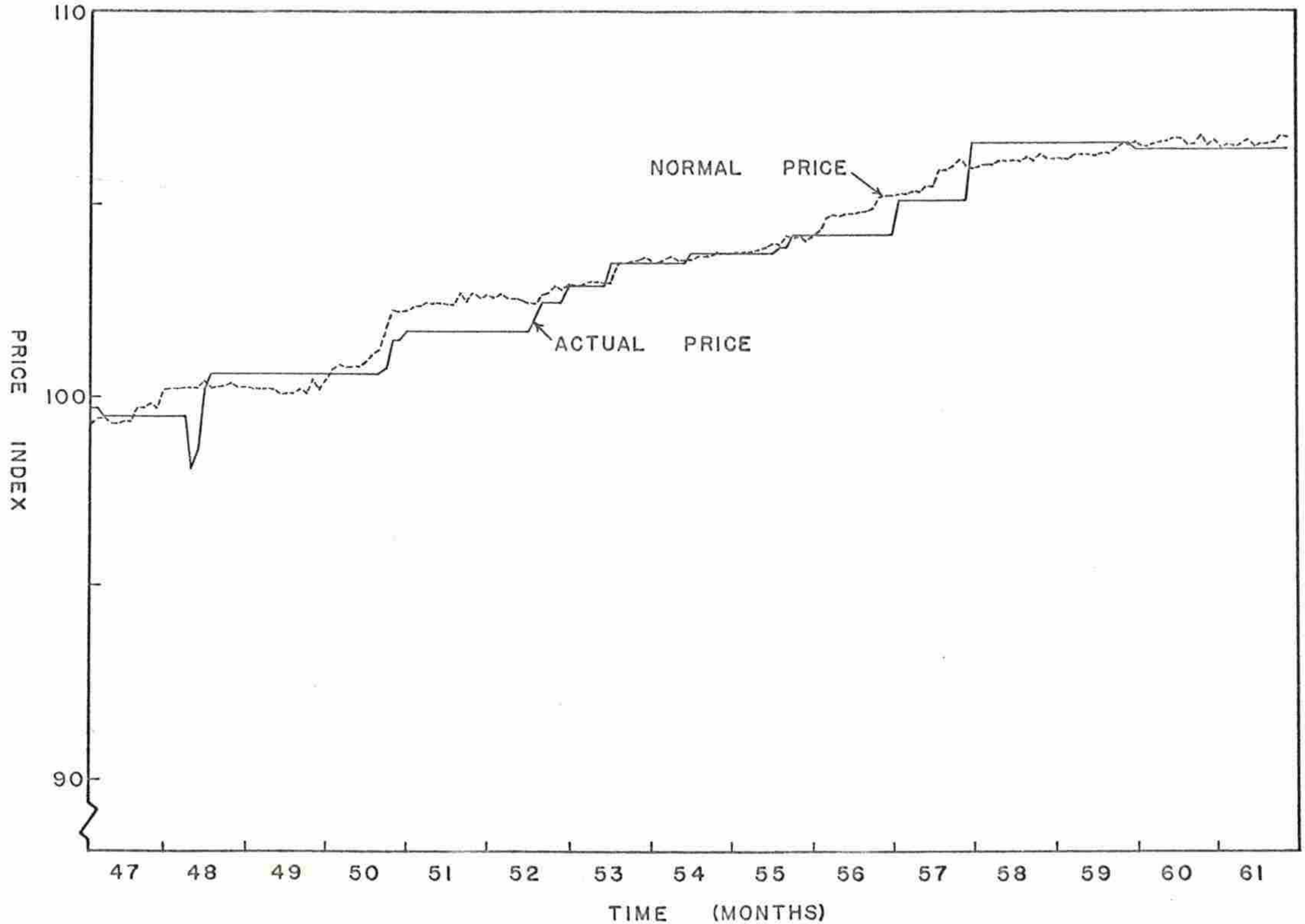

Figure 33. Industry: 2121 Cigars

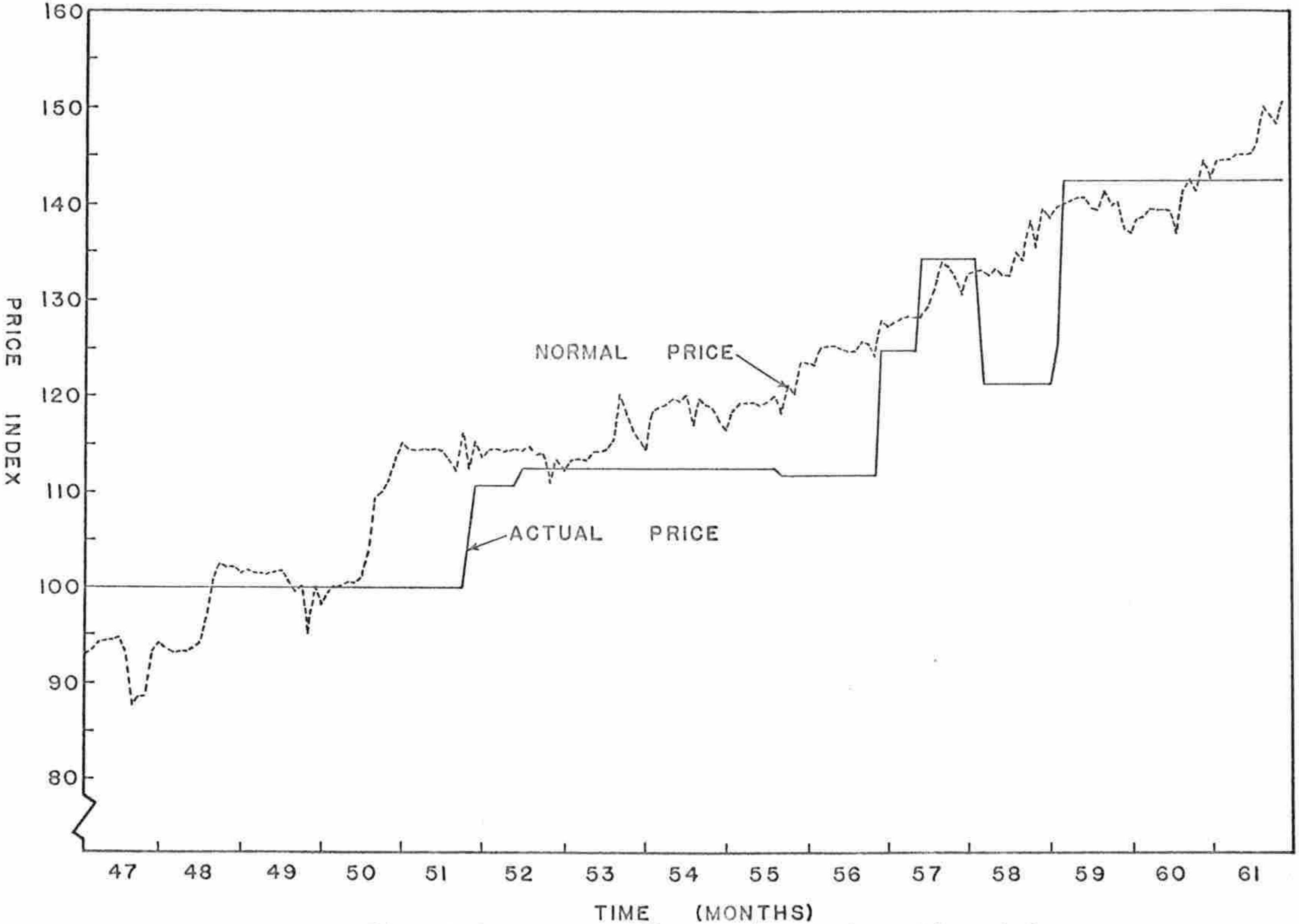

Figure 34. Industry: 2131 Chewing and smoking tobacco

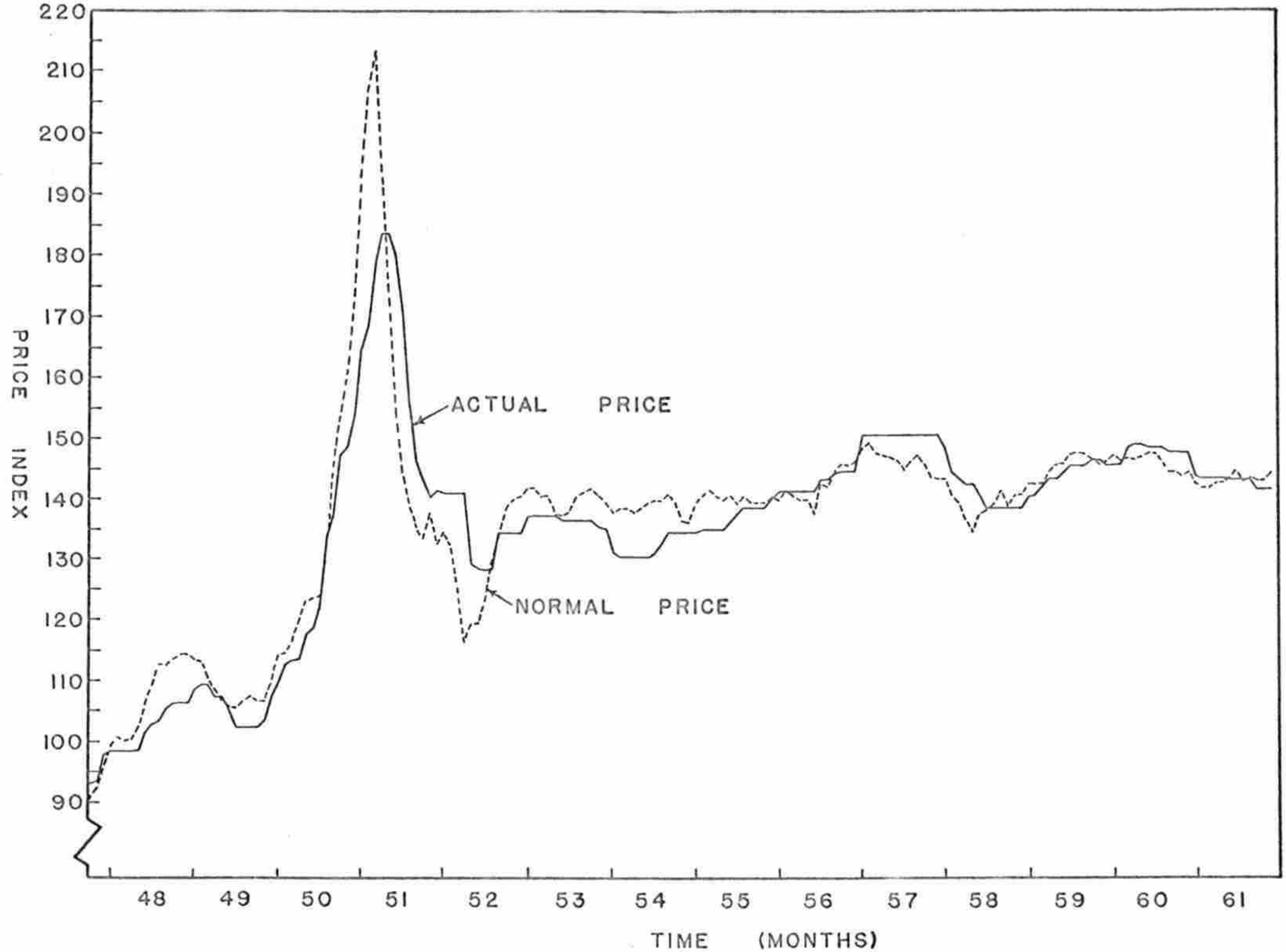

Figure 35. Industry: 2271 Woven carpets and rugs