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EFFECTS OF ALTERNATIVE MARKETING MARGINS FOR BEEF AND PORK

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ABSTRACT

Price spreads between retail and wholesale markets for beef and pork have shown several distinct increases over the past decade. Both consumers and producers have felt the "middleman" receives too large a share of the consumer meat dollar. But little has been said concerning the longrun effects of the amount and form of the margin on production and prices.

Three sets of alternative margin plans are examined by simulation. One compares the effects of a change in the form of the margin, from fixed to percentage. The two other plans involve changing the levels of the fixed and percentage margins.

For each of these margin strategies, prices and production of beef and pork and the size of the domestic beef herd are compared with expected results under the current practices (the base projection) through 1985.

Keywords: Beef, margins, market performance, pork, simulation.

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SUMMARY AND IMPLICATIONS

The level of the wholesale-to-retail marketing margin may have substantial effects on the long-term performance of the livestock economy. Also, two margin forms tested--the fixed margin, in which a constant marketing charge is added to the wholesale price; and the percentage margin, in which the added charge is a percentage of the wholesale price--affected performance. In a simulation for 1973-85, prices of beef and pork were generally as high as in recent years and adequate supplies were available for consumption, regardless of the margin formula.

When the fixed carcass-to-retail margin for beef and the wholesale-to-retail margin for pork were reduced by 10 percent and compared with expected results under current margin practices through 1985, beef and pork supplies increased substantially. Beef prices were lowered throughout most of the period because an initial increase in producer prices stimulated an overexpansion in beef production. On the other hand, a 10-percent increase in the margin initially lowered producer prices but did not trigger a reduction of breeding stock. Thus, the price change in later years was minimal.

A percentage margin, compared with a fixed margin, produced more immediate effects on short-term prices. Since it hastened producer and consumer reaction to imbalances in supply and demand, it stabilized longer-term patterns of prices and output. The stability created by such a margin strategy tended to stimulate overall production slightly, with a corresponding lower price level.

A 5 percentage point increase in the percentage margin tended to lower producer returns enough to generate long-term reductions in supply. Even if producer prices eventually increased above those obtained under average margins, the enduring reductions in breeding stock would still hold production down. On the other hand, a 5 percentage point decrease--especially when initiated at a time of high producer prices--overstimulated productive capacity. This caused substantial increases in meat supplies--especially beef, which could be marketed only at lower prices.

No value judgments are made about the relative merits or disadvantages of the various margin plans examined in this report. What is best or worst for producers, consumers, or others in the beef industry depends on their special criteria and interests. A comparison of simulated values under alternative policies with those under the current situation--the base projection--provides insight into what might happen to prices and domestic production in the U.S. livestock industry.

These simulated values are not forecasts of future prices and output. They assume no change from the base period in either industry structure or basic economic and behavioral relationships affecting production and consumption of livestock products. The simulations are based on specific assumptions regarding future values of variables such as income, population growth, and feed grain prices. To the extent that industry structure and basic economic relationships change and future values differ from those projected in the analysis, future prices and output of livestock will differ from those projected here. However, useful insights are provided into possible impacts of changes in margin policies, since each of these comparisons is based on the same industry structure, basic economic and behavioral relationships, and assumptions.

EFFECTS OF ALTERNATIVE MARKETING MARGINS FOR BEEF AND PORK

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INTRODUCTION

The widening retail margins for beef and pork over the past decade have caused continuing concern among producers and consumers. During this period, the increasing demand for meat and the services associated with the final product have increased the prices of retail beef and pork cuts about 40 and 30 cents, respectively. Consumers have continued to insist on a wider selection of closely trimmed cuts of uniformly high quality, packaged to maintain that quality.

The composite retail price of Choice grade beef increased from 73.9 cents per pound in 1964 to 115.3 cents in 1972 (fig. 1). The carcass-to-retail price spread--which measures the gross margin received by all marketing and transportation agencies between the packing plant and the consumer--showed three distinct increases in level during 1961-72.

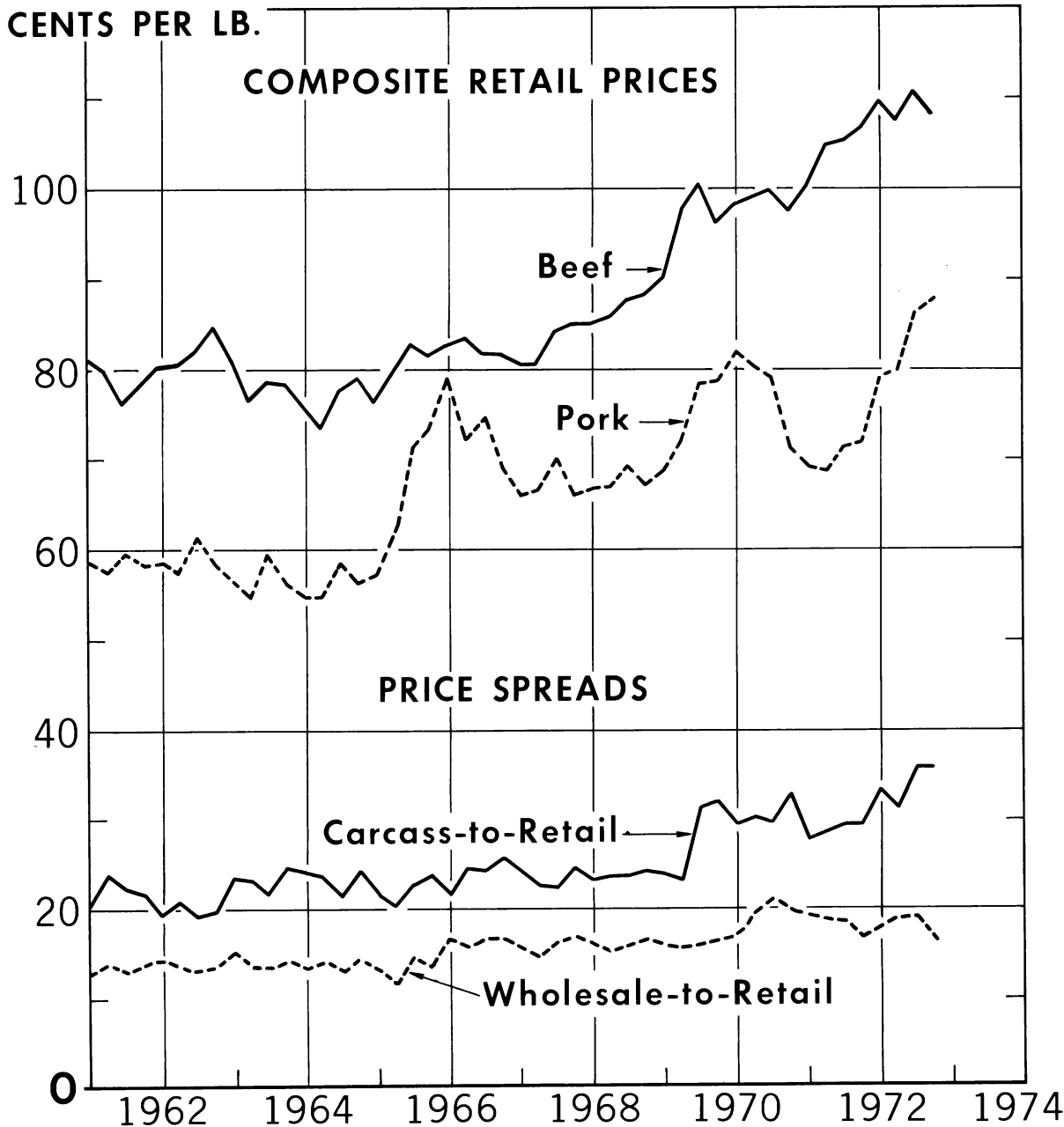
The composite retail price of pork (fig. 1) exhibited a 33-cent range. The wholesale-to-retail price spread ran in the 13-14 cent range until 1966, jumped to the 15-16 cent range during 1966-69, and increased to 18-20 cents during 1970-72. It measures the gross margin received by transportation interests and retailers for both fresh pork and cured pork products.

Both consumers and producers have felt the "middleman" receives too large a share of the consumer's meat dollar. But little has been said concerning the longrun effects of the amount and form of the margin on industry production and prices. Accordingly, USDA's Economic Research Service undertook an analysis of the longrun effects of a range of margin strategies on the beef and pork industries, using a computer model to simulate the economic activity under each margin strategy.

SCOPE OF THE ANALYSIS

Both the form of the margin (percentage or fixed) and its size are assumed to affect producer prices--and, therefore, the production of beef and pork--over time. The implications of changing the size and form of the gross margin between packer and consumer are examined. Specifically, three

COMPOSITE RETAIL PRICES AND PRICE SPREADS FOR BEEF AND PORK, BY QUARTERS, 1961-72



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Figure 1

sets of alternative margin plans are examined. One compares a change in the form of the margin, from fixed to percentage. The other two simulation experiments involve changing the levels of the fixed and percentage margins.

For each of these margin plans, projected cattle and hog prices, production and consumption of beef and pork, and the size of the domestic beef herd are compared with expected results under the current practice (the base projection) through 1985. ^{1/} Prices, commercial slaughter, and livestock inventories are first projected under the current margin. Next, alternative methods of determining retail prices from wholesale prices are incorporated into the model, and the ensuing prices, slaughter, and inventories are projected through 1985. These simulated results of different pricing strategies are then compared with the projected values under the current margin.

The purpose of the simulation is to project and compare results of the current margin and selected alternative margins under specific assumptions regarding future values of such variables as population, income, feed grain prices, and initial levels of cattle prices, inventories, and production. This will provide insights into what might happen to prices and domestic production in the U.S. livestock industry. These simulated values are not forecasts of future prices and output. The simulations assume no change from the base period either in industry structure or in basic economic and behavioral relationships affecting production and consumption of livestock. Changes in any of the assumptions would alter the projected values of the variables. However, useful insights are provided into possible impacts of changes in margin policies, since each of these comparisons is based on the same industry structure, basic economic and behavioral relationships, and assumptions.

CURRENT MARGIN PRACTICES

Both the carcass-to-retail price spread for beef and the wholesale-to-retail price spread for pork are essentially fixed spreads in that an absolute marketing charge is added to the wholesale price. Graphic analysis of the carcass-to-retail price spread for beef and the wholesale-to-retail price spread for pork presents an initial hypothesis about the form of the margin. When the composite retail price is represented by the vertical axis and the wholesale value on an equivalent retail weight basis is represented by the horizontal axis, the 45° line represents a zero margin situation (fig. 2). Addition of a fixed amount to the zero margin line (10 cents, for example) yields a fixed margin. Addition of a percentage markup (20 percent, for example) represents a percentage margin.

The actual price spreads for beef and pork by quarter over 1961-70 are plotted in figures 3 and 4. The zero margin line is established. A percentage

^{1/} These projections are based on a recursive model of the livestock industry published in Richard Crom's "A Dynamic Price-Output Model of the Beef and Pork Sectors," U.S. Dept. Agr., Econ. Res. Serv., Tech. Bul. No. 1426, Sept. 1970.

FORM OF THE MARGIN

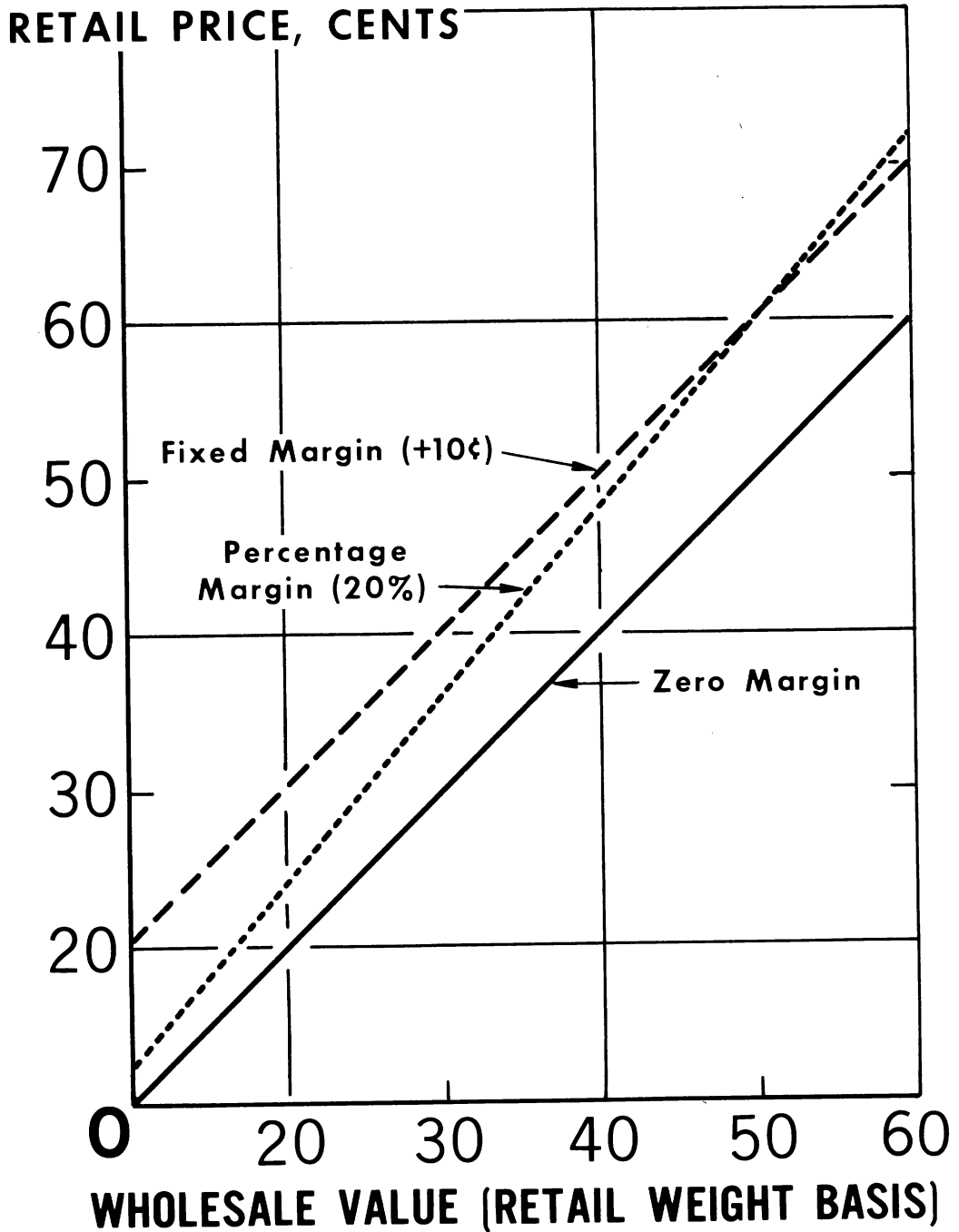


Figure 2

FIXED, PERCENTAGE, AND ACTUAL CARCASS-TO-RETAIL MARGINS FOR BEEF, 1961-70

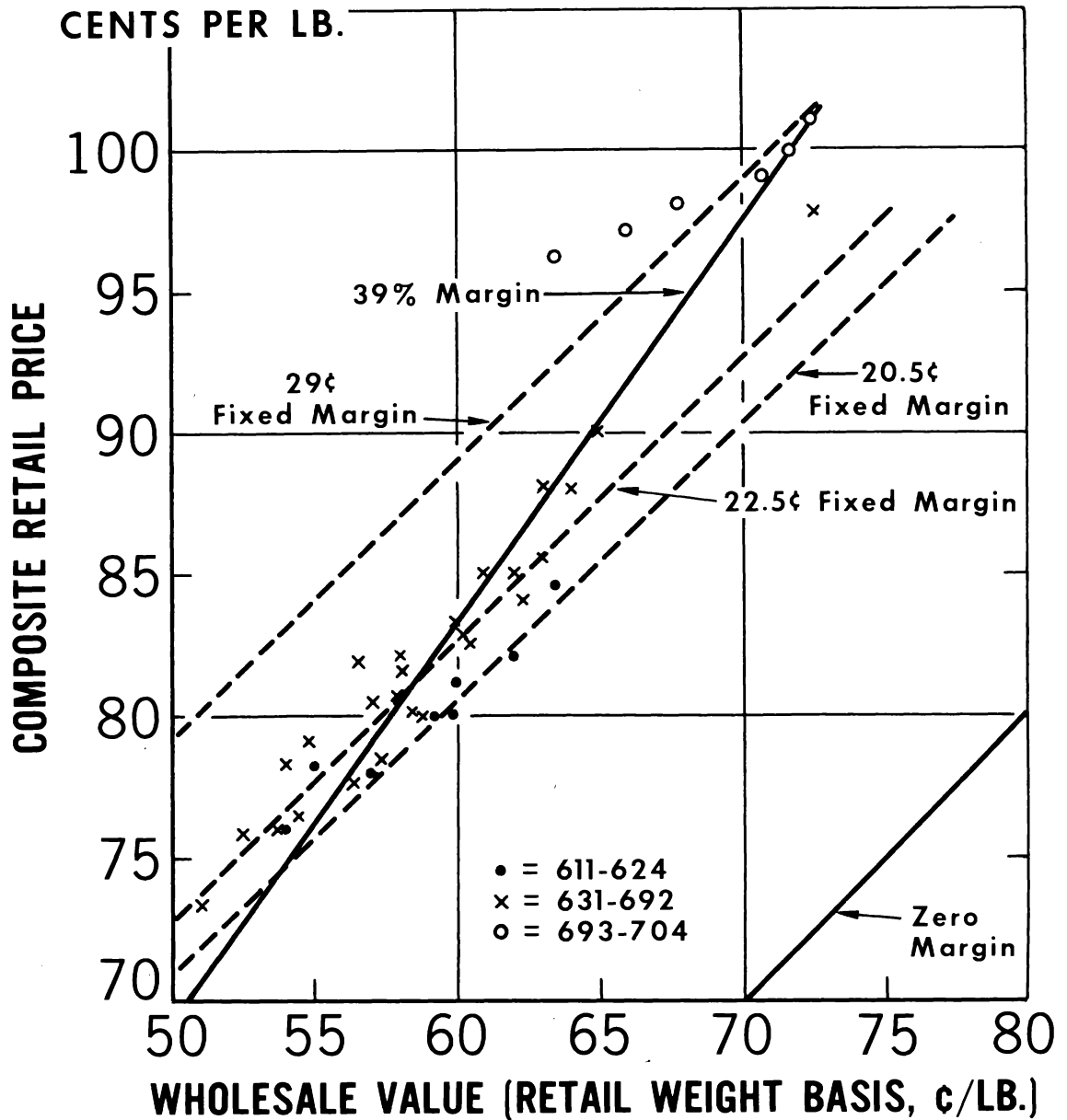


Figure 3

FIXED, PERCENTAGE, AND ACTUAL WHOLESALE-TO-RETAIL MARGINS FOR PORK, 1961-70

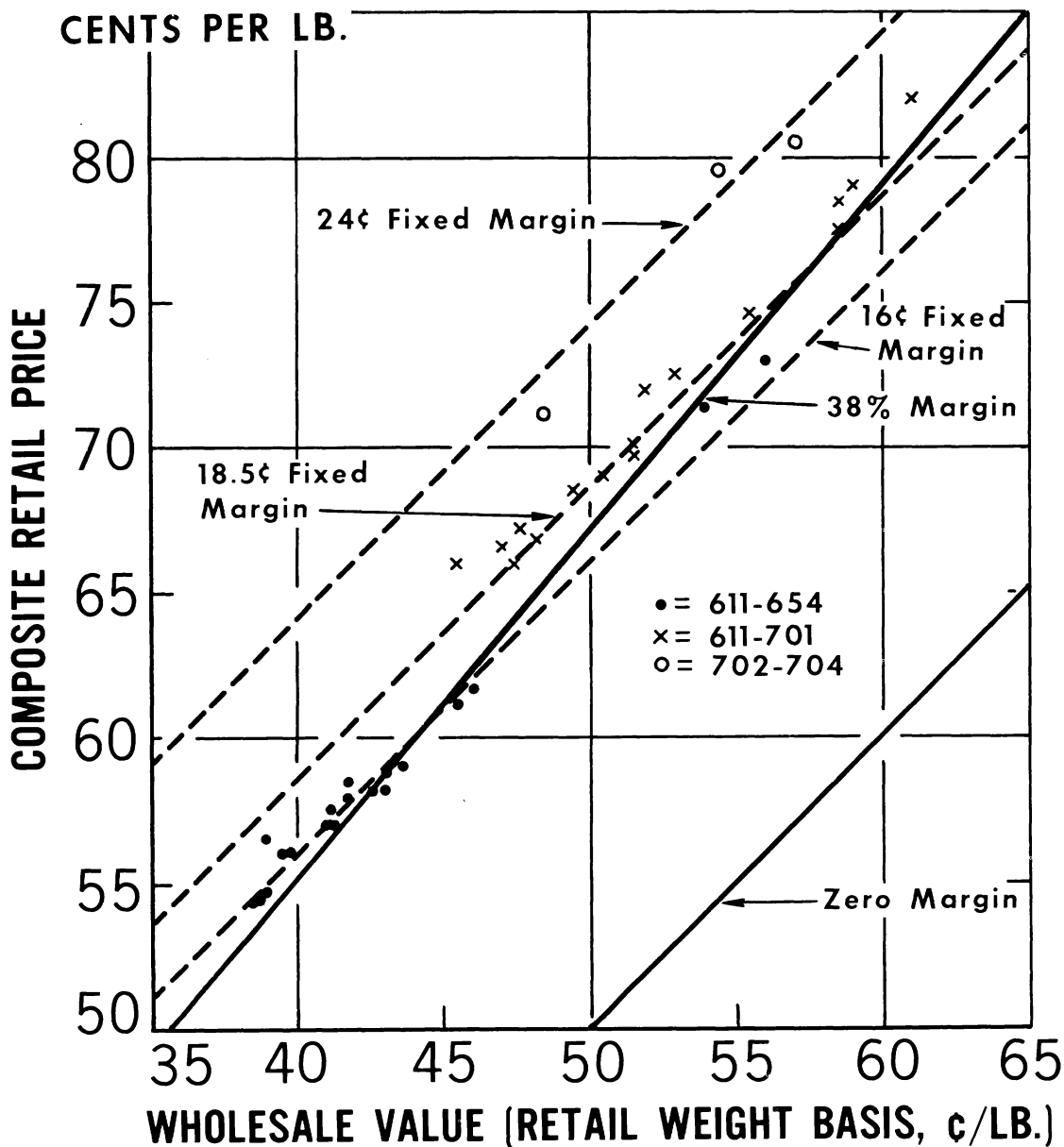


Figure 4

markup equal to the ratio of the average retail price to the average wholesale value is used to establish the percentage margin. Finally, several levels of a fixed margin are plotted by inspection. If the observed data are stratified into the time periods shown in figures 3 and 4, the margin appears to be more fixed than variable (percentage) in nature. Covariance analysis using 0-1 variables to shift the regression plane relating retail price to wholesale value is used to test the hypothesis of the nature of the aggregate price spread.

Least squares regression techniques were used to relate the composite wholesale prices of beef and pork over the 40 quarters in the 1961-70 period.

$$P_b^R = 20.46 + 1.36 P_b^W + 2.03 D_1 + 8.54 D_2 \quad R^2 = 98$$

(0.066) (0.51) (0.83)

$$dw = 1.75;$$

$$P_p^R = 14.05 + 1.05 P_p^W + 2.82 D_3 + 6.70 D_4 \quad R^2 = 99$$

(0.022) (0.29) (0.46)

$$dw = 2.47$$

where R indicates retail, W indicates wholesale, b indicates beef, and p indicates pork. The D_j 's represent 0-1 variables which measure shifts in the entire relationship between the price levels--for example, the abrupt increases shown in figures 3 and 4. D_1 took on a value of 1 in 1963-68 and D_2 was equal to 1 in 1969. D_3 and D_4 took on a value of 1 in 1966-69 and 1970, respectively.

The coefficient in the beef price relationship, 1.36, is almost identical to the wholesale-to-retail weight conversion factor of 1.35. 2/ Since this coefficient represents only the weight conversion factor, the high statistical significance of the shift (0-1) variables offers proof of the fixed nature of the gross carcass-to-retail beef margin. The intercept value plus the associated shifts in the regression plane (as measured by the coefficients on the D_j 's) measure the amount of the fixed carcass-to-retail margin. In 1970 this amounted to 29.00 (20.46 + 8.54).

The coefficient relating wholesale pork price to the composite retail price, 1.05, also approximates the weight conversion factor of 1.0, 3/ since the estimated coefficient of 1.05 does not differ statistically from 1.00 at the 5-percent probability level. Again, the statistical significance of the shift variables offers proof of the fixed nature of the wholesale-to-retail margin for pork. The intercept value of 14.05 plus the coefficient D_3 or D_4 measure the fixed wholesale-to-retail margin for pork during 1961-70. In 1970 this amounted to 20.75 (14.05 + 6.70).

2/ This assumes 100 pounds of carcass beef yields 74 pounds of retail cuts; thus (100 ÷ 74 = 1.35) represents the carcass-to-retail conversion factor.

3/ No weight conversion is needed between 100 pounds of wholesale pork products and 100 pounds of retail pork cuts.

ALTERNATIVE MARGIN POLICIES

The sensitivity of the production-marketing system is first tested under alternative levels of the fixed margin. Then the form of the margin is changed from a fixed to a percentage margin. The fixed margin--in which a constant marketing charge is added to the wholesale price--represents one extreme in pricing practice. A percentage margin represents the other extreme--the margin added is a percent of the wholesale price. It allows a maximum reflection of short-term wholesale price movements in the retail price, thereby providing an immediate basis for consumer reaction to wholesale market conditions. Finally, the sensitivity of the system to alternative levels of the percentage margin is tested.

Alternative I: Variations in the Fixed Margin

In this series of experiments, there is a 10-percent increase in the carcass-to-retail margin for beef (from 29 to 31.9 cents) and the wholesale-to-retail margin for pork (to 22.83 cents). Then both margins are reduced 10 percent (beef to 26.10 cents and pork to 18.67 cents). Since the price level in the model is initially determined at the wholesale level, these simulations are accomplished by reflecting the change in the margin in the value of the constant term of the wholesale price equations. 4/

Alternative II: Percentage Versus Fixed Margin

In this experiment, the carcass-to-retail margin for beef and the wholesale-to-retail margin for pork are each expressed throughout the 13-year simulation period as a percentage margin, which is equivalent to the ratio of the average wholesale prices to the average retail prices of the base projection. This ratio is 0.5505 for beef and 0.7031 for pork, which approximates a 25-percent margin (33-percent markup)--25.13 for beef and 26.18 for pork. 5/

To simulate this margin in the model, the pricing level was shifted from the wholesale price level to the retail price level:

$$P_b^R = 29.0 + 1.36 \hat{P}_b^W$$

and

$$P_p^R = 20.75 + 1.05 \hat{P}_p^W;$$

4/ The value of the constant term in the wholesale price equation was lowered when the fixed margin was increased and the retail price equation was not changed. This was necessary to maintain a market clearing price at the retail level.

5/ Margin is defined as $[(P^R - (P^W \times 1.36)) \div P^R] \times 100$. For example, in the case of beef, $[(115.4 - (63.5 \times 1.36)) \div 115.4] \times 100 = 25.13$.

then wholesale prices were derived using the percentage margin:

$$P_b^W = 0.5505 P_b^R$$

and

$$P_p^W = 0.7031 P_p^R.$$

Alternative III: Variations in the Percentage Margin

In this final series of experiments, the average carcass-to-retail percentage margin for beef, 25.13 percent, is first increased by 5 percentage points to 30.13 percent and the average wholesale-to-retail percentage margin for pork, 26.18 percent, is increased to 31.18 percent. Then, both margins are reduced 5 percentage points, to 20.13 percent for beef and 21.18 percent for pork. ^{6/} In the model, the base prices for beef and pork are first determined at the retail level. Then the margin equations to determine the wholesale price become

$$P_b^W = 0.5873 P_b^R$$

and

$$P_p^W = 0.7507 P_p^R$$

to simulate the margin decrease and

$$P_b^W = 0.5138 P_b^R$$

and

$$P_p^W = 0.6545 P_p^R$$

to simulate the margin increase.

RESULTS

The price-output model is used to simulate market performance of the beef and pork industries for July 1, 1972 through December 31, 1985. The "base" projection as indicated involves operating the model to simulate prices and output to 1985. Then, each of the three alternative margin strategies is incorporated and the modified models are used to simulate the resulting prices and production for 1973-85.

^{6/} Using the margin equation, $[(P^R - (P^W \times 1.35)) \div P^R] = 0.2513$, the margin is changed to 0.3013 and the equation is solved for $P^W = 59.28$. Then $P_b^W \div P_b^R = 59.28 \div 115.4 = 0.5138$.

Both the cattle and hog subsectors of the livestock industry contain persistent price-production cycles. Large production from large inventories of breeding stock results in low prices, which in time reduce the number of animals in breeding herds. The beef cycle is more enduring than the hog cycle, since 2 or 3 years are needed for a new-born heifer to grow into a producing beef cow. To represent this basic mechanism of the cycle, the model commences with determination of domestic production from cattle and hog inventories, imports, and changes in stock of beef and pork products.

Most beef calves and yearlings not intended as herd replacements are placed on feed. The calf crop and the January 1 inventory of beef calves less than 1 year old serve as primary indicators of feedlot placements, depending on the season of the year. The beef-corn ratio, an indicator of the gross feeding margin, also affects feedlot placements. By definition, fed cattle marketings are solely determined by earlier placements, while their average weight is also conditioned by the beef-corn ratio. Commercial fed beef production is the product of fed cattle marketings and their average weight.

Domestic nonfed beef production consists primarily of cull beef and dairy cows. The rate of cull is conditioned by feeder cattle prices, corn prices, and range conditions. Thus when favorable beef and corn prices (and price relationships) are stimulating placements of cattle in feedlots and heavier weights of fed cattle, they are also inducing a lower cull rate, leading to lower domestic nonfed beef production. On the other hand, beef and corn prices less favorable to feeding tend to lower feedlot placements and average weights of fed cattle. At the same time, cull rates are increased and some young animals are shifted to immediate slaughter as nonfed beef.

Sow farrowings are affected by recent changes in the hog-corn ratio. Commercial hog slaughter depends on the number of sows farrowing 6 to 9 months earlier, the size of the litters, and the number of hogs currently withheld for breeding stock.

Domestic supplies of lower grade beef and wholesale beef prices affect the quantity of beef imports. However, world market conditions and the incentive to maintain or increase quotas keep U.S. beef imports near the maximum allowable level. Foreign trade in pork is affected by recent wholesale prices.

Thus, beef consumption in the United States consists of a fed component determined by number of placements, subsequent fed cattle marketings, and average cattle weight; and a nonfed component determined by cull rates, feeding profitability, and quantity of imported beef. Pork consumption is primarily a function of domestic production. At the wholesale market, retail and institutional buyers representing consumers meet with packers and processors, who hold the supply of domestic and imported beef and pork products. The prices of wholesale pork products, Choice grade carcass beef, and manufacturing beef are affected by the per capita fed beef supply, per capita nonfed beef supply (including imports), and per capita pork supply due to the degree of substitutability of meat products by consumers. Prices are also affected by consumers' incomes, tastes, and preferences.

Wholesale prices and byproduct values determine live steer and hog prices. The Choice steer price is the primary determinant of feeder cattle price, along with feeding margins and range conditions. The margin strategy applied to the wholesale price determines the retail price.

The production-pricing sequence has longer-run effects on changes in the livestock inventories--for example, the cattle and hog cycles and the future supply of fed versus nonfed beef. The beef cow inventory, exclusive of death loss, changes as the number of beef heifers added to the herd exceeds or falls below beef cow slaughter. Heifer replacement depends on the number of heifer calves on hand the previous year and the current and prospective feeder cattle prices. While cow slaughter is largely determined by mandatory biological considerations, it can be stepped up or retarded when feeder cattle prices appear favorable or unfavorable.

Choice beef prices can change because of a shift in the per capita supply of fed or nonfed beef. This price change is reflected in feeder prices, which in turn affect heifer replacements and cow slaughter. The shift in calf crop production eventually changes feedlot placements, fed cattle marketings, and even future cow cull. These influence the supply of both fed and nonfed beef.

Since both the length and the amplitude of the beef and hog cycles may be affected, the simulated prices and output for each alternative may represent a different stage of the cycle in any given projection year. Therefore, differences in prices and quantities from the base in any given year may be greater or smaller than one would expect from the margin strategy alone because they may be at different stages in the cycle. Both Choice steer and hog prices showed similar upward trends throughout the decade for each alternative considered.

Base Projection Under Current Fixed Margin Practices, 1973-85

Since the model is recursive, data given the model were the initial conditions existing prior to July 1, 1972, and the values of exogenous variables through 1985. Thus, values of the following endogenous variables are known: Prices of cattle, hogs, and meat for the preceding four quarters; and January 1, 1972 inventory variables such as beef calf numbers, beef cow numbers, and beef heifers available for replacement. Regarding the values of some exogenous variables, civilian population (48 States) was assumed to reach 245 million in 1985, based on the Census Bureau Projection Series C. Per capita personal income in current dollars was assumed to reach \$6,630 by 1985, implying an annual growth rate of nearly 6 percent during 1973-85. The price of No. 3 corn at Chicago was increased 2 percent per year from the 1970 levels to \$1.71 in 1985 to serve as a proxy for increases in nonfeed production costs during the 1970's. Range conditions were assumed to hold at average levels during the projection period, while byproduct credits for beef and pork were held at 1970 levels. The model was projected through 1985 using the lagged values of variables within the production-marketing system and the values of the variables outside the system.

The annual average values of variables for 1972 provide a basis of reference and serve to describe the system. Fed cattle marketings totaled 27.78 million head, while 8 billion pounds of nonfed cattle were marketed. Per capita fed beef consumption amounted to 85 pounds and per capita nonfed beef consumption was 31 pounds. Commercial hog slaughter in the base year totaled 20.2 billion pounds and per capita pork consumption was 66.8 pounds. The average live value for Choice steers was over \$35 per hundredweight, and live hog prices exceeded \$24. An estimated 13.1 million sows farrowed in 1972 and 30 million head of cattle were placed on feed.

The simulated values of selected variables for the 13-year projection period are presented in figure 5. Fed cattle marketings grew at an average annual rate of 5 percent. Figured on a per capita basis, this growth rate was lower (3.5 percent) because of the growth in population. Marketings of nonfed beef were variable--year-to-year changes in marketings ranged from a 14-percent decrease to a 27-percent increase. On a per capita basis, the supply of nonfed beef followed domestic nonfed slaughter except that the range of the year-to-year change in per capita nonfed supply was somewhat less--minus 11 percent to plus 17 percent. Commercial hog slaughter held steady for 1973-81, but increased to over 23 billion pounds during 1982-85. Per capita pork supplies showed the same pattern of growth.

Although prices were simulated on a current dollar basis, they are presented in index form (1973=100) to avoid their interpretation as absolute price forecasts.

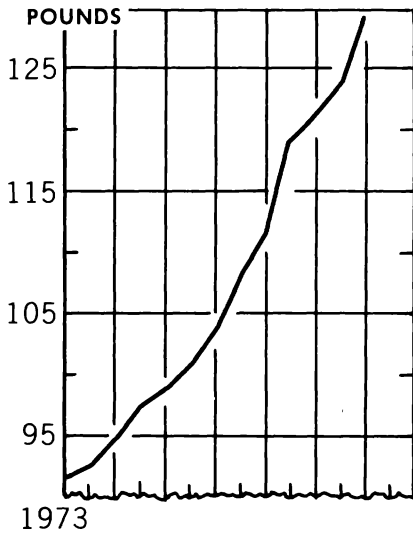
Increases in simulated Choice steer prices averaged 2.5 percent per year, despite the rise in total beef supply (principally fed beef). This is due to growth in income and an increasing consumer preference for beef. Barrow and gilt prices also increased 2 percent per year in response to growth in income. However, year-to-year changes in hog prices ranged from a 12-percent decrease to an 8-percent increase. This variability in hog prices greatly exceeded that in production and stemmed from the combined cross effects of changes in nonfed beef supplies and changing pork supplies.

January 1 beef cow inventory increases averaged about 1-1/4 million head per year over the 13-year period. There is a definite cattle cycle. The annual increase in the January 1 beef cow inventory averaged 1.1 million head through 1974, declined to 0.7 million head in 1975-78, increased to 2.1 million head in 1979-82, and finally fell back to 1 million head in 1983-85.

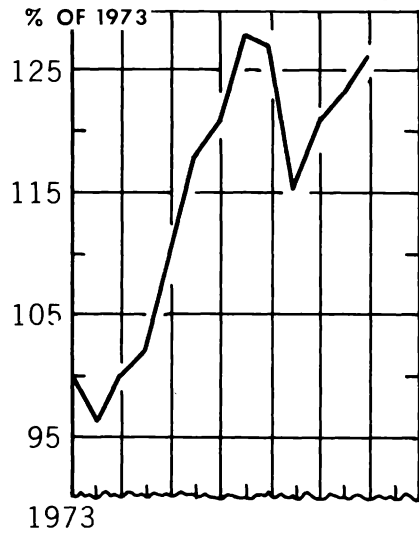
The base projection under the current fixed margin policy may be regarded as an initial experiment with the price-output model operating past the range of the time series values used to develop its coefficients. The simulated base values represent a projection of the economic and institutional structure of the 1955-70 period for which the model was developed. Thus, these values represent an extension of these historical conditions into the 1970's, given assumptions about population, income, and input prices. The projection period is free of random disturbances such as drought conditions and other outside forces. These simulated values serve as a basis for comparing alternative margin policies.

BASE PROJECTIONS FOR CONSUMPTION, PRICE, AND BEEF COW INVENTORY

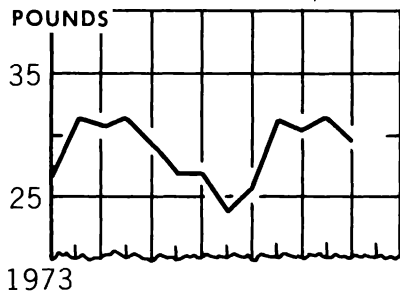
FED BEEF CONSUMPTION, PER CAPITA



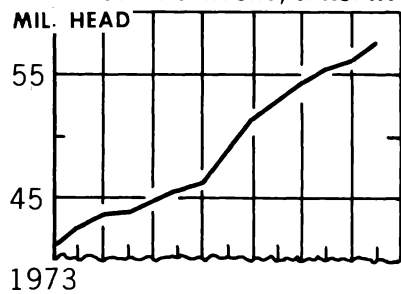
PRICE OF CHOICE STEERS



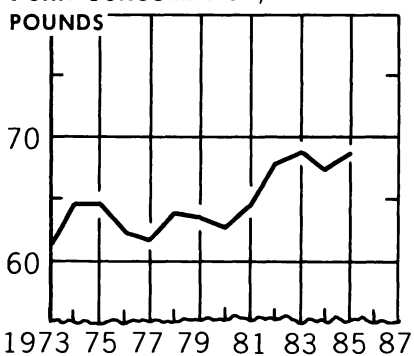
NONFED BEEF CONSUMPTION, PER CAPITA



BEEF COW INVENTORY, JANUARY 1



PORK CONSUMPTION, PER CAPITA



BARROW AND GILT PRICES

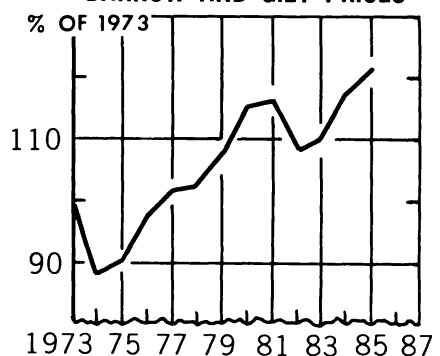


Figure 5

Alternative Margin Policies

The simulated price-output effects over the 13-year projection period for all alternative margin policies are shown in table 1 and figures 6, 7, and 8. Comparisons are made for the six selected variables--three per capita consumption variables, two price variables, and one inventory variable. The shifts in per capita consumption show the change in quantities of fed beef, nonfed beef, and pork available to consumers and reflect shifts in cattle feeding, cow cull and other nonfed beef production, and hog production. While the price variables indicate the results of the supply shifts on producer prices, they also reflect changes in wholesale and retail prices given the margin practices involved. Finally, the January 1 beef cow inventory reflects changes both in overall growth and in the growth of the beef cattle industry.

Alternative I: Variations in the Fixed Margin

When the fixed carcass-to-retail margin for beef (\$2.90) and the whole-sale-to-retail margin for pork (\$2.08) were increased by 10 percent, hog and steer prices were lowered (see fig. 6). This in turn reduced placements of cattle on feed in 1973 (these cattle not placed on feed were shifted to nonfed slaughter in 1973). This reduction in feedlot placements reduced subsequent fed cattle marketings in 1974. The increase in nonfed consumption in 1973, coupled with marketings of cattle already on feed and the wider marketing margin, lowered the 1973 price of Choice steers by \$3.50 and the beef cow inventory fell slightly throughout 1973.

Fewer gilts were held and more sows were culled in 1973, thereby increasing hog slaughter. The increased per capita pork supply and the increased nonfed beef supply held 1973 hog prices some \$2.50 below the base level.

During the next 2 or 3 years, the slightly smaller beef cow herd, coupled with a slight shift from fed beef production to nonfed slaughter, balanced total beef consumption so that the Choice steer price nearly equaled the base price level in 1974-75. Growth in the beef industry, then, followed that of the base projection for the remainder of the projection period.

Hog production and pork consumption followed a cyclical pattern similar to the base projection but below base levels. Hog prices often were near or slightly below base levels due to the wider margin. The amplitude of the hog price-production cycle was slightly less than under the base margin, especially during the last few years of the simulation.

A 10-percent reduction in the fixed margin produced substantially greater change. The initial increase in livestock prices strongly stimulated 1973 feedlot placements and reduced nonfed slaughter. The drop in 1973 and 1974 nonfed beef consumption augmented by the lower margin held Choice steer prices above the base level even when per capita fed beef production increased almost 4 pounds in 1974. The sustained increase in Choice steer prices in 1973-74 triggered expansion in the beef cow herd commencing in 1974 (see fig. 6). Once this inventory expansion reached significant proportions, cattle feeding

Table 1--Annual value of selected variables under the base projection and alternative margin policies

Year	Base	+ 10% Fixed	- 10% Fixed	% W. R.	5% + %	5% - %
<u>Jan. 1 Beef Cow Inventory (mil. head)</u>						
1973	40.9	40.9	41.0	40.9	40.9	41.0
1974	42.3	42.1	42.1	42.1	42.1	42.3
1975	43.3	42.8	44.6	44.5	42.9	44.7
1976	43.9	43.2	46.6	46.5	43.3	46.5
1977	44.3	43.8	48.4	46.8	43.9	48.2
1978	45.1	44.9	49.8	48.0	45.0	48.5
1979	46.0	45.9	50.3	49.8	46.2	49.8
1980	48.8	48.3	52.1	50.9	47.0	51.5
1981	51.2	50.2	54.1	52.8	49.4	52.7
1982	52.8	52.7	54.6	54.4	51.9	55.2
1983	54.4	53.9	56.0	55.0	54.8	57.4
1984	55.3	55.8	58.0	57.1	56.0	58.1
1985	56.2	57.3	59.8	59.1	57.5	60.0
1986	57.6	58.0	60.6	61.0	58.5	62.3
<u>Per Capita Fed Beef Consumption (lbs.)</u>						
1973	91.7	91.8	91.8	92.0	92.3	101.4
1974	92.5	90.1	96.4	96.0	91.0	99.7
1975	94.6	93.2	97.5	97.8	92.6	101.4
1976	97.6	95.5	101.8	101.8	94.7	106.0
1977	98.9	96.3	105.7	104.8	95.4	109.7
1978	100.9	99.2	107.6	105.2	98.8	111.0
1979	103.7	104.1	109.1	107.9	100.2	111.3
1980	108.2	106.9	112.0	111.8	104.8	115.3
1981	111.9	109.2	115.8	116.1	106.6	119.6
1982	119.0	117.6	119.9	119.6	112.7	122.3
1983	121.1	119.9	123.7	121.7	118.6	126.8
1984	123.9	122.2	127.0	123.4	121.4	130.8
1985	129.3	126.1	130.1	128.0	121.7	132.9
<u>Per Capita Nonfed Beef Consumption (lbs.)</u>						
1973	26.8	30.5	25.0	25.4	29.8	22.8
1974	31.4	32.1	28.7	28.1	31.4	27.5
1975	30.7	30.2	29.8	30.7	31.8	29.4
1976	31.2	32.2	29.6	31.4	31.2	29.7
1977	29.0	28.9	34.6	31.9	30.5	31.3
1978	26.7	26.4	34.8	33.2	29.3	31.8
1979	26.9	26.5	35.0	33.0	28.0	32.4
1980	23.9	25.1	35.7	30.7	28.8	29.8
1981	25.5	25.7	35.9	32.1	27.8	31.6
1982	31.0	28.0	33.0	32.6	28.4	31.9
1983	30.4	31.8	30.9	34.3	31.1	31.5
1984	31.3	31.9	34.0	33.8	35.6	33.0
1985	29.8	32.5	33.5	33.0	36.3	34.0

Continued

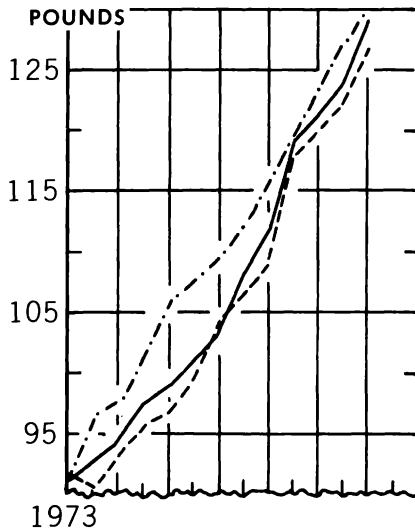
Table 1--Annual value of selected variables under the base projection and alternative margin policies--Continued

Year	Base	+ 10% Fixed	- 10% Fixed	% W. R.	% Base <u>1/</u>	5% + %	5% - %
<u>Per Capita Pork Consumption (lbs.)</u>							
1973	61.0	63.2	62.1	60.2		63.2	61.6
1974	64.6	63.3	65.0	65.4		65.7	66.2
1975	64.6	63.2	64.6	65.4		65.9	67.9
1976	62.1	61.6	61.0	63.2		64.7	66.0
1977	61.6	60.0	61.2	63.1		60.5	65.3
1978	63.7	60.8	64.9	63.5		58.2	66.8
1979	63.6	62.6	65.6	64.1		59.2	67.1
1980	62.7	62.3	64.8	64.5		61.6	65.4
1981	64.1	63.1	65.2	63.8		61.0	65.2
1982	67.9	64.8	64.7	65.2		61.9	67.7
1983	68.8	66.0	65.7	66.0		63.5	69.5
1984	67.2	65.7	68.8	65.6		64.4	70.7
1985	68.4	66.8	69.6	66.7		63.1	70.2
<u>Choice Steer Price (1973 Base = 1.0)</u>							
1973	1.00	.895	1.059	1.054	1.000	.876	1.073
1974	.96	.946	.979	.985	.935	.896	.972
1975	1.00	.993	1.009	.996	.944	.929	.987
1976	1.02	.997	1.018	1.000	.949	.949	.984
1977	1.10	1.105	.937	1.002	.950	1.009	.973
1978	1.18	1.173	.978	1.044	.990	1.037	.993
1979	1.21	1.176	1.032	1.081	1.026	1.087	1.060
1980	1.28	1.237	1.060	1.111	1.054	1.084	1.108
1981	1.27	1.273	1.084	1.128	1.070	1.148	1.083
1982	1.15	1.186	1.149	1.132	1.074	1.130	1.124
1983	1.21	1.164	1.198	1.137	1.078	1.073	1.128
1984	1.23	1.209	1.179	1.189	1.128	1.041	1.130
1985	1.26	1.227	1.222	1.219	1.157	1.100	1.162
<u>Barrow & Gilt Price (1973 Base = 1.0)</u>							
1973	1.000	.883	1.032	1.032	1.000	.853	1.069
1974	.881	.865	.922	.913	.884	.809	.898
1975	.899	.890	.945	.920	.891	.816	.929
1976	.968	.934	1.039	.968	.938	.851	.969
1977	1.012	1.010	.984	.982	.951	.924	.982
1978	1.021	1.039	.959	.986	.956	.980	.980
1979	1.069	1.045	.995	1.009	.978	1.007	1.009
1980	1.151	1.107	1.051	1.053	1.020	1.000	1.084
1981	1.156	1.138	1.094	1.092	1.058	1.047	1.116
1982	1.080	1.128	1.174	1.103	1.069	1.062	1.116
1983	1.099	1.106	1.193	1.101	1.067	1.040	1.109
1984	1.174	1.161	1.161	1.158	1.122	1.049	1.120
1985	1.211	1.186	1.197	1.190	1.153	1.091	1.167

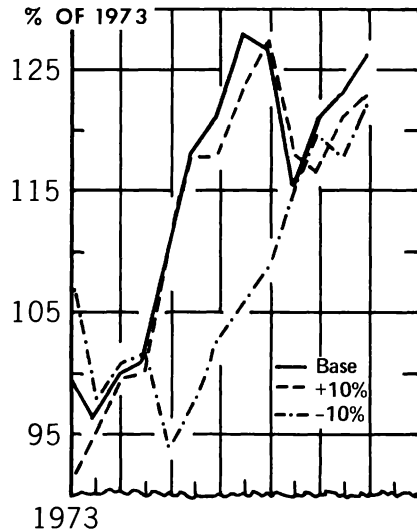
1/ Index calculated when the percentage wholesale-to-retail margin is used as a base for the 5 percent increase and decrease in the percentage margin.

VARIATIONS IN THE FIXED MARGIN: PROJECTED CONSUMPTION, PRICE, AND BEEF COW INVENTORY

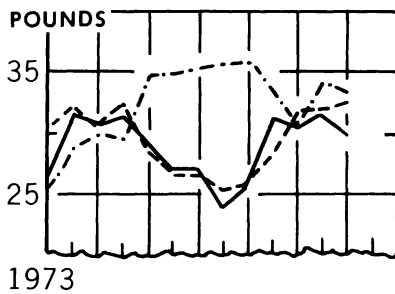
FED BEEF CONSUMPTION, PER CAPITA



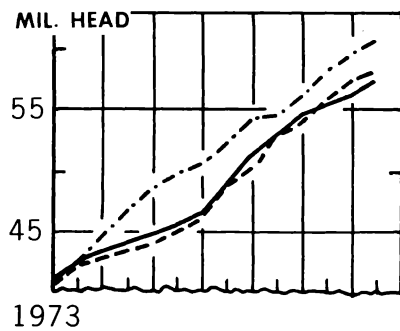
PRICE OF CHOICE STEERS



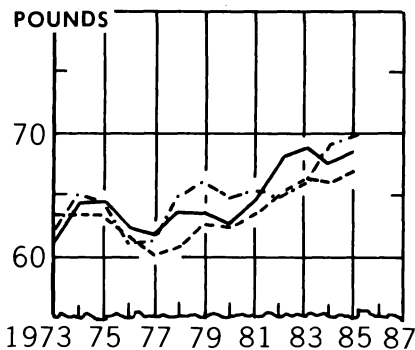
NONFED BEEF CONSUMPTION, PER CAPITA



BEEF COW INVENTORY, JANUARY 1



PORK CONSUMPTION, PER CAPITA



BARROW AND GILT PRICES

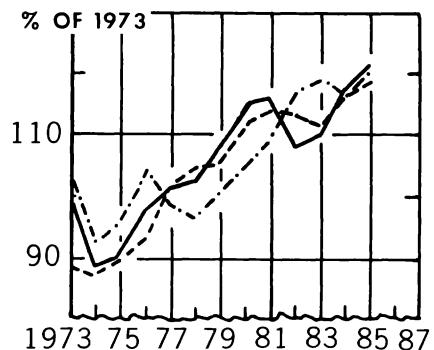


Figure 6

and per capita fed beef consumption increased proportionally. Steer prices fell to a low point in 1977 and nonfed beef consumption increased perceptibly throughout 1977-82. While inventory growth and cattle feeding then grew at a reduced rate, the larger beef herd kept both fed and nonfed beef supplies well above base projection levels until 1982, the year of rapid expansion for beef production in the base projection. Steer prices increased after 1977 due to the increase of consumer incomes, preference for beef, the lower margin, and the relatively slower increase in beef supplies.

Hog production and per capita pork consumption were not affected much until 1977. While hog prices ran above the base level in 1973-75 due to the lower margin, the cyclical pattern changed just enough in the mid-1970's to increase hog production in 1978-81. Hog prices were lower due to the greater supply of pork and nonfed beef, but the price drop was tempered by the lower margin. Finally production and prices became countercyclical to the base projection.

Over the 13-year simulation period, the lower margin increased beef and pork supplies substantially and lowered beef prices throughout much of the period. The overexpansion in beef production stimulated an initial increase in producer prices. A corresponding increase in the margin, the initial effect of which was to lower producer prices, did not trigger a reduction of breeding stock. Thus the change in later years was minimal after the initial "shock" of lower prices. During the years represented in the development of the model, price increases which generated very high levels of price-feed ratios triggered rapid expansion of breeding stock. But very low prices (and price-feed ratios) were followed by periods of inventory maintenance rather than decline.

Alternative II: Percentage Versus Fixed Margin

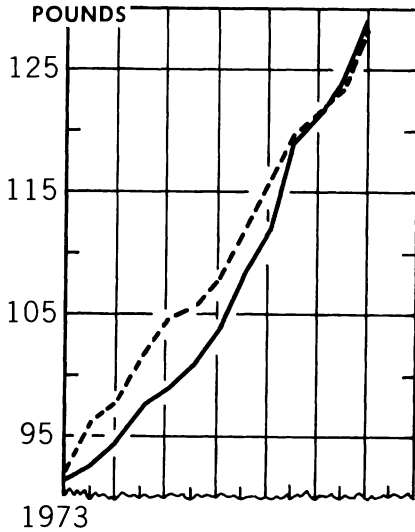
When percentage markups are used on wholesale price, the immediate effect is an increase in the consumer price when price levels are high and supplies are small (relative to a fixed margin), and a decrease in the price to consumers when prices are low and supplies are large. Therefore, we hypothesized that the percentage system would be more price responsive than the fixed system in the long run and thereby the amplitude of the price-production cycle would be reduced.

The simulated values of prices and production under a percentage margin tend to confirm this hypothesis (see fig. 7). Initially, the percentage margin reduced the absolute level of the margin, thereby raising the already high producer price levels. This stimulated cattle feeding activity immediately, with a corresponding reduction in nonfed beef supply (consumption). Pork supplies were cut momentarily as more breeding stock was withheld.

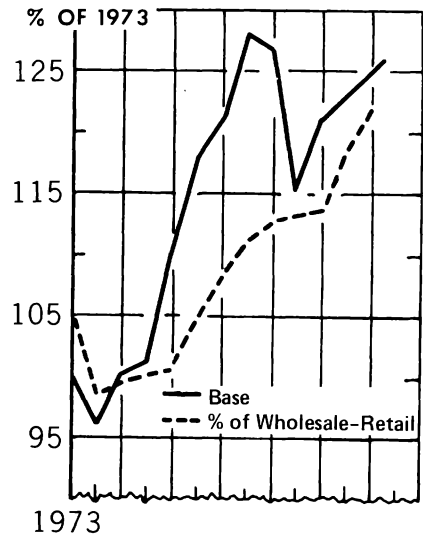
By the mid-1970's, both the size of the breeding herd and the number of sows held for farrowing exceeded that of the base projection under the fixed margin. Note that both per capita fed beef consumption and the beef cow inventory expanded at a more uniform rate under the percentage margin than under the fixed margin. Both nonfed beef consumption and pork consumption were quite stable. Pork supplies in particular showed little growth.

PERCENTAGE VERSUS FIXED MARGIN: PROJECTED CONSUMPTION, PRICE, AND BEEF COW INVENTORY

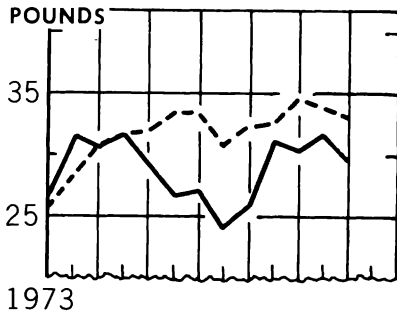
FED BEEF CONSUMPTION, PER CAPITA



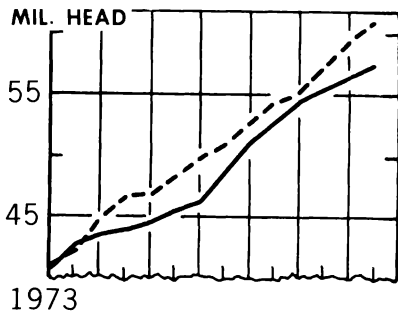
PRICE OF CHOICE STEERS



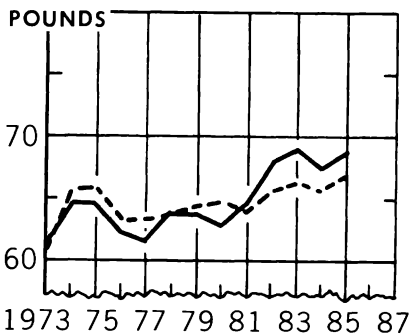
NONFED BEEF CONSUMPTION, PER CAPITA



BEEF COW INVENTORY, JANUARY 1



PORK CONSUMPTION, PER CAPITA



BARROW AND GILT PRICES

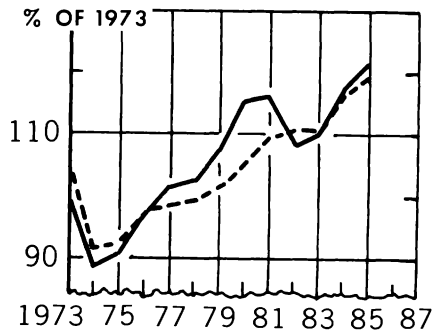


Figure 7

While Choice steer and hog prices still showed some cyclical pattern, the amplitude of the cycle was diminished substantially. By 1985, the total per capita supply of beef and pork was nearly identical with base projection levels. Over the 13-year experimental projection period, consumption increases averaged about 2.6 pounds each for fed beef, nonfed beef, and pork. Prices were slightly lower under the percentage margin than under the fixed margin. Choice steer and hog prices averaged \$2 and 35 cents, respectively, below the average under the fixed margin.

Over an extended period (13 years) the percentage margin evens out cycles, but may raise production slightly with a compensating reduction in price.

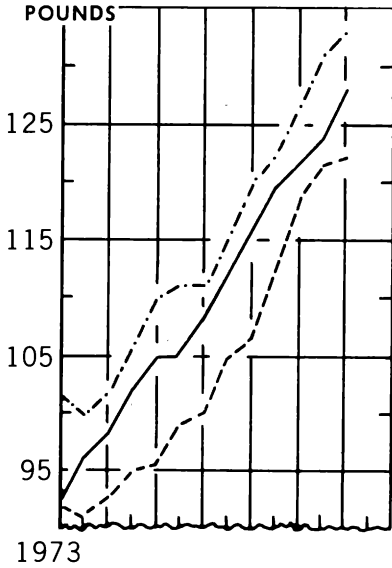
Alternative III: Variations in the Percentage Margin

A 5 percentage point increase in the carcass-to-retail margin for beef amounted to increasing it to a 30-percent margin. A similar increase in the wholesale-to-retail margin for pork raised it to a 31-percent margin. Beef and pork prices fell immediately (see fig. 8). (Note that in this series of experiments, the "base" is the base percentage margin.) Pork production increased immediately since more sows and gilts were marketed, but then equaled the base level for 2 years before falling. Beef production was initially shifted from cattle feeding to nonfed slaughter. Per capita fed beef consumption in 1974 actually fell below the simulated 1973 level. Meat production and industry growth were curtailed substantially by the late 1970's. Prices exceeded the base levels due to the lesser quantities available, but fell below base levels in the latter years of the simulation because of the burdensome marketing margin and an increase in beef and pork supplies which brought them relatively closer to the base supply level.

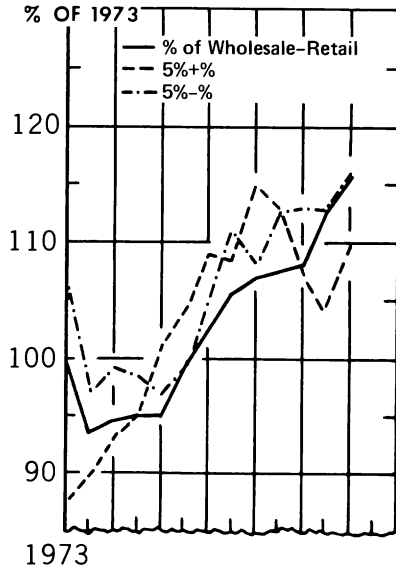
Reduction of the percentage margin to 20 percent for carcass beef and 21 percent for wholesale pork products produced opposite results in most cases. (See dotted lines, fig. 8.) Initial increases in producer prices expanded fed beef production at the expense of nonfed production. This "trade-off" held beef prices near the base level, thus the beef cow inventory was not greatly affected. Pork production expanded by 1974 and the increased supply kept hog prices near base levels throughout the 13-year period. In the final year of the simulation, per capita fed beef consumption was 4.9 pounds over the base, nonfed beef consumption about equaled the base, and pork consumption was 3.5 pounds over the base. Steer and hog prices were equal to base levels.

VARIATIONS IN THE LEVEL OF THE PERCENTAGE MARGIN: PROJECTED CONSUMPTION, PRICE, AND BEEF COW INVENTORY

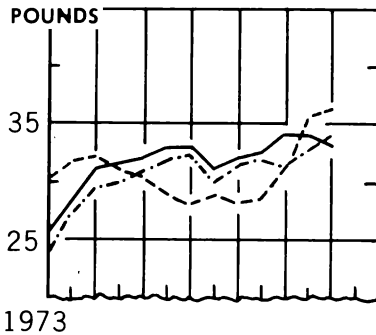
FED BEEF CONSUMPTION, PER CAPITA



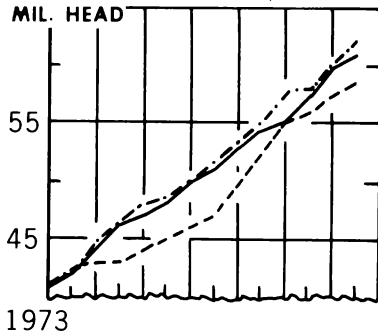
PRICE OF CHOICE STEERS



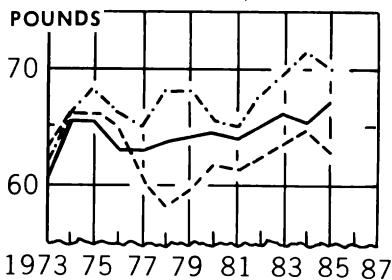
NONFED BEEF CONSUMPTION, PER CAPITA



BEEF COW INVENTORY, JANUARY 1



PORK CONSUMPTION, PER CAPITA



BARROW AND GILT PRICES

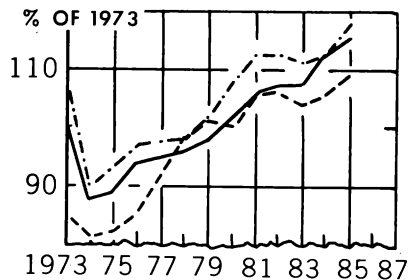


Figure 8