

1-1-1976

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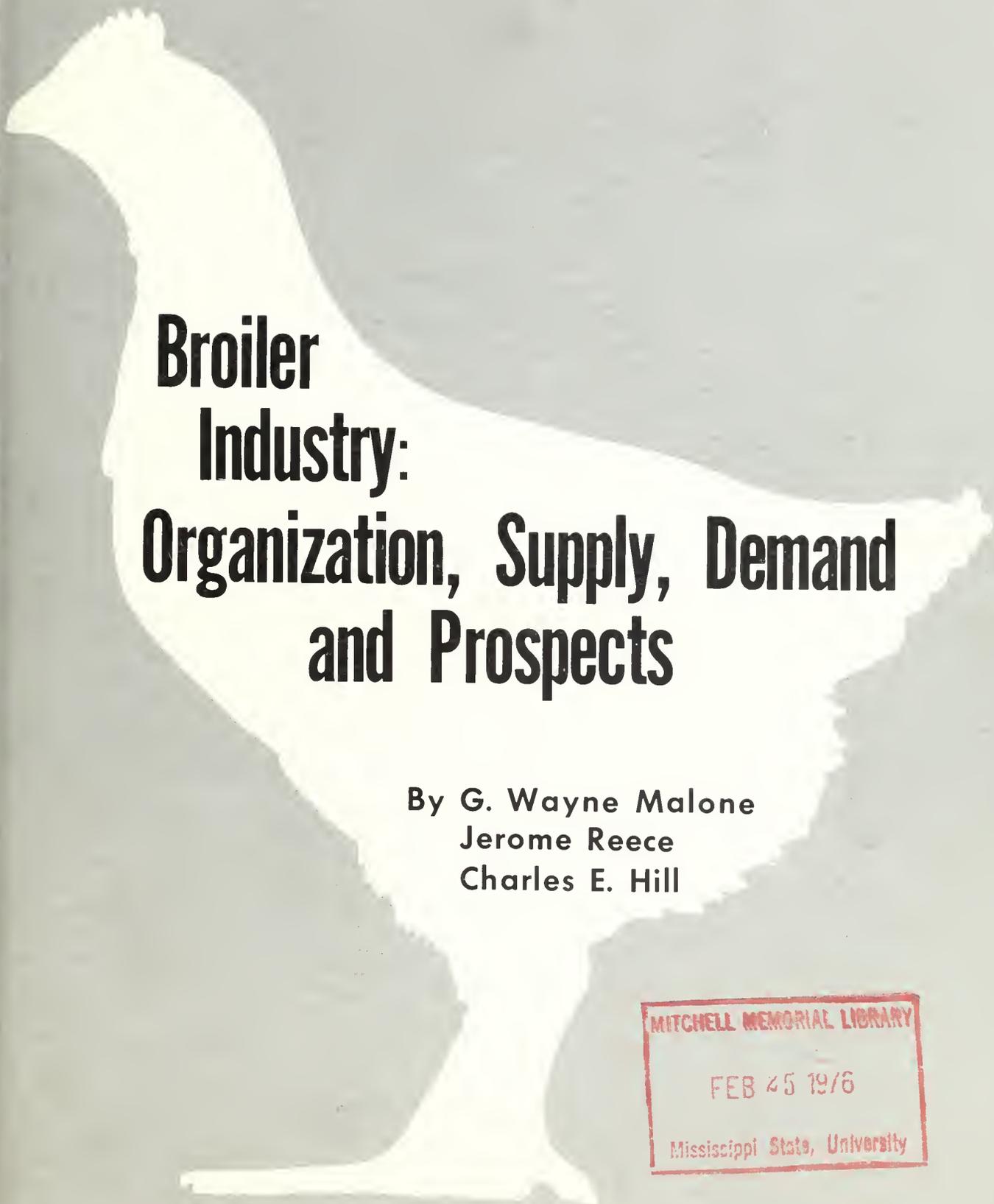
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### **Recommended Citation**

Malone, G. Wayne; Reece, Jerome; and Hill, Charles E., "Broiler industry : organization, supply, demand and prospects" (1976). *Bulletins*. 245.

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# Broiler Industry: Organization, Supply, Demand and Prospects

By G. Wayne Malone, Assistant Agricultural Economist, Jerome Reece, Graduate Research Assistant and Charles E. Hill, Graduate Research Assistant, MAFES Department of Agricultural Economics

The rapid growth of the commercial broiler industry in the United States is generally recognized and well documented (3,4,13,16).<sup>1</sup> Per capita consumption increased by almost 55% between 1960 and 1974 ---from 24.3 pounds to 37.5 pounds. In 1969, the \$1.53 billion gross farm income from broilers for the nation was 2.8 percent of total realized gross farm income (3). This was up from \$19 million in 1934, when the broiler share of farm income was only 0.2 percent.

The broiler industry also is an important sector of Mississippi's agricultural economy. Processing plants in the state slaughtered 239.1 million birds in 1973 with an approximate producer value of \$207.9 million (20). This volume continued to place Mississippi fifth in the nation in broiler production.

The broiler industry is considered to have further growth potential. Per capita consumption increased from 0.5 pounds in 1934 to 37.5 pounds in 1974 and it has been predicted that consumption will approach 41.4 pounds by 1985 (3).

The growth of the broiler industry and its potential for further growth are attributed primarily to the technical efficiencies gained in

production and processing. Efficiencies have been gained through integration---the ownership and contract linkages of successive stages of production, processing and marketing. Processing efficiency has been improved as evidenced by the decrease in numbers of plants and the resulting larger throughput of the ones in business now. However, there now is excess processing capacity and using existing facilities at capacity would result in declining prices and less than normal returns to the industry.

All dynamic industries---and few, if any, are more dynamic than the broiler industry---must probe the future. Basic questions to which the broiler industry requires answers are:

1. What changes can be expected in the structure and operating practices of the industry?
2. What do the prevailing price-quantity relationships indicate for the future of the industry?
3. What is the potential for supply management by the industry---particularly since it is a highly integrated industry operating at less than its processing capacity?

## Introduction

<sup>1</sup> Numbers in parentheses refer to Literature Cited at the end of the bulletin.

## Objectives and Procedures

We initiated a study designed to more fully document the current status of the broiler industry and to generate information needed for answering the questions now being posed by the industry. Our specific objectives were to:

1. Examine the current structural and operational status of the broiler industry,
2. Analyze current supply-demand relationships,
3. Estimate the potential demand for broilers relative to the supply capacity of the industry, and
4. Evaluate the potential effect of

unexpected supply-demand relationships on the structure and operating practices of the broiler industry, including the potential for supply management by the industry.

Current operating practices of the Mississippi broiler industry were obtained by a survey of broiler firms. Expected changes in the structure and operational practices of the industry were obtained by a survey of broiler firms throughout the Southeast. Supply-demand relationships were estimated by statistical analysis of time series data.<sup>2</sup>

## Structure, Organization and Marketing Practices

The broiler industry in the United States is concentrated on a regional basis.<sup>3</sup> There are relatively few buyers and sellers of dressed broilers and competitive emphasis is on price at the wholesale level, with buyers having the overall balance of power (6,18). This power balance has been granted to buyers by the broiler industry as a consequence of the rapid infusion of technology that has resulted in the great expansion in broiler production and processing capacity.

The National Commission on Food Marketing projected in 1966 that 31 firms would handle 70 percent of the broiler volume in 1972 (13). This projection was virtually substantiated by a report that 34 firms supplied 70 percent of the Nation's broiler volume in 1970 (12). Even so, the National Commission concluded that concentra-

tion in the broiler industry was low relative to that prevailing in the processing and distribution of most other foods. However, these studies indicated that the largest firms were expected to handle larger shares of future broiler output.

Most broiler firms in the United States are corporations. Only four of the major firms are recognized as cooperatives and only two of these are ranked among the top 25 firms (13). Integrated cooperatives account for only about 10 percent of total broiler output (17) but an additional small segment of the industry is cooperative, in that a small number of integrated firms participate jointly in processing.

*The Mississippi broiler industry*—Our survey indicated that eight of the 13 integrated broiler processors in Mississippi had expanded in the last five years. Also, six of the eight

who had expanded in the last five years indicated their intentions of additional expansion (5). Only three of the Mississippi processors reported per hour processing capacity of 6,000 birds or less—eight of the 13 were at or above the 9,000 bird capacity.

Over two thirds of the birds processed in Mississippi were supplied by contract growers (Table 1). Most of the birds processed by firms of medium size came from contract growers. The small processors relied heavily on production from their own farms.

Two thirds of the birds processed came from within 25 miles of the plant and another 28 percent were drawn from within 50 miles. The procurement area was smaller and supply of live birds was much more concentrated than it was almost twenty years ago (1).

<sup>2</sup>See the Appendix for details of the statistical procedures and results.

<sup>3</sup>It has been described as a type of bilateral oligopoly with competitive fringes.

**Table 1. Procurement of birds, by type of supplier, by size of firm, 13 broiler processing firms, Mississippi, 1971.**

Type of supplier	Size of firm <sup>1</sup>			All firms
	Small	Medium	Large	
	-----Percent-----			
Contract growers	39	94	72	67
Company farms	45	4	27	27
Company leased farms	7	2	0	2
Officers and directors	9	0	2	3
All sources	100	100	100	100

<sup>1</sup> Small, 6,000 and less (rated capacity, per hour); Medium, 6,001 to 9,000 birds; Large, over 9,000 birds.

**Table 2. Distribution of output, by type of product, by size of firm, 13 broiler processing firms, Mississippi, 1971.**

Type of Product	Size of Firm <sup>1</sup>			All firms
	Small	Medium	Large	
	-----Percent-----			
Fresh				
Whole	67	72	69	69
Cut-up	17	10	11	12
Total Fresh	84	82	80	81
Frozen				
Whole	10	10	6	8
Cut-up	6	8	14	11
Total Frozen	16	18	20	19
All Products	100	100	100	100

<sup>1</sup> Small, 6,000 and less (rated capacity, per hour); Medium, 6,001 to 9,000 birds; Large, over 9,000 birds.

Slightly over one third of the total output of the Mississippi broiler processing industry in 1971 went directly from the plant to tailers and 56 percent of the industry's output went to retailers through various wholesale intermediaries (Figure 1). Exports accounted for slightly more than 7

percent of the broilers processed in that year.

Mississippi processors sell both fresh and frozen broilers, either whole or "cut-up."<sup>4</sup> Slightly less than 20 percent of their 1971 output was sold frozen---the form that accounts for most exports. More than 23 percent of their sales were "cut-

up" (Table 2), representing a 4 percent increase over their 1965 sales (13).

Price discovery continues to be a major problem of the broiler industry. Most of the output of processors is priced and committed for delivery a week in advance. Price reporting is adequate but

<sup>4</sup> A private survey of meat merchandisers indicated a wide range in the proportion of "cut-up" broilers handled. The tonnage moved as whole birds ranged from 30 to 60 percent, whole "cut-up" ranged from 10 to 25 percent and parts ranged from 25 to 60 percent.

remains "after-the-fact" for decision-making purposes. Therefore, most sales managers in Mississippi

supplement their knowledge of immediate past prices with knowledge gained by telephone

contacts with other suppliers and with buyers.

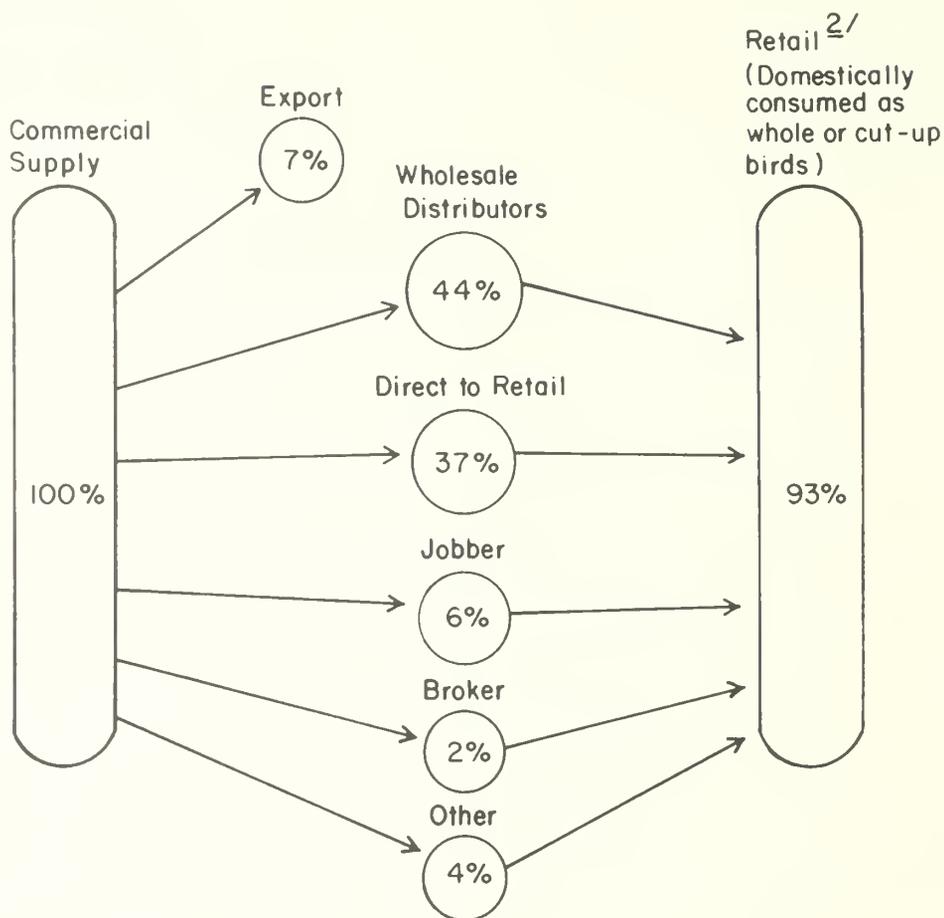


Figure 1. Major marketing channels for broilers, 13 broiler processing firms, Mississippi, 1971.<sup>1/</sup>

<sup>1/</sup> Adapted from "The Chicken Broiler Industry: Structure, Practices, and Costs; USDA, ERS, Marketing Research Report No. 930, P. 30, Figure 4, May 1971.

<sup>2/</sup> Includes stores, institutions, and restaurants.

## Demand and Supply

Casual observation of time series data reveals distinct seasonal-- and even monthly-- patterns of broiler slaughter and prices (Figures 2 and 3). Therefore, we estimated supply and demand functions by months using traditional explanatory variables.<sup>5</sup>

Our estimates reveal that broiler demand in eight months (March-

October) exceeded that for January and was less than that for January in three months (February, November, December).

The average price flexibility for the range of prices included in our estimates is -1.66; that is, a one million pound increase in the quantity of broilers available would have resulted in a price decrease of

.08 cents or a quantity decrease of one million pounds would have resulted in a price increase of 8 cents.

Our estimates reveal that the supply of broilers also shifts importantly from month to month. Supply was greater in eight months (March-October) than it was in January; less than that of January

<sup>5</sup> See the Appendix for details of the statistical procedures and results.

SLAUGHTER  
(mil. lbs.)

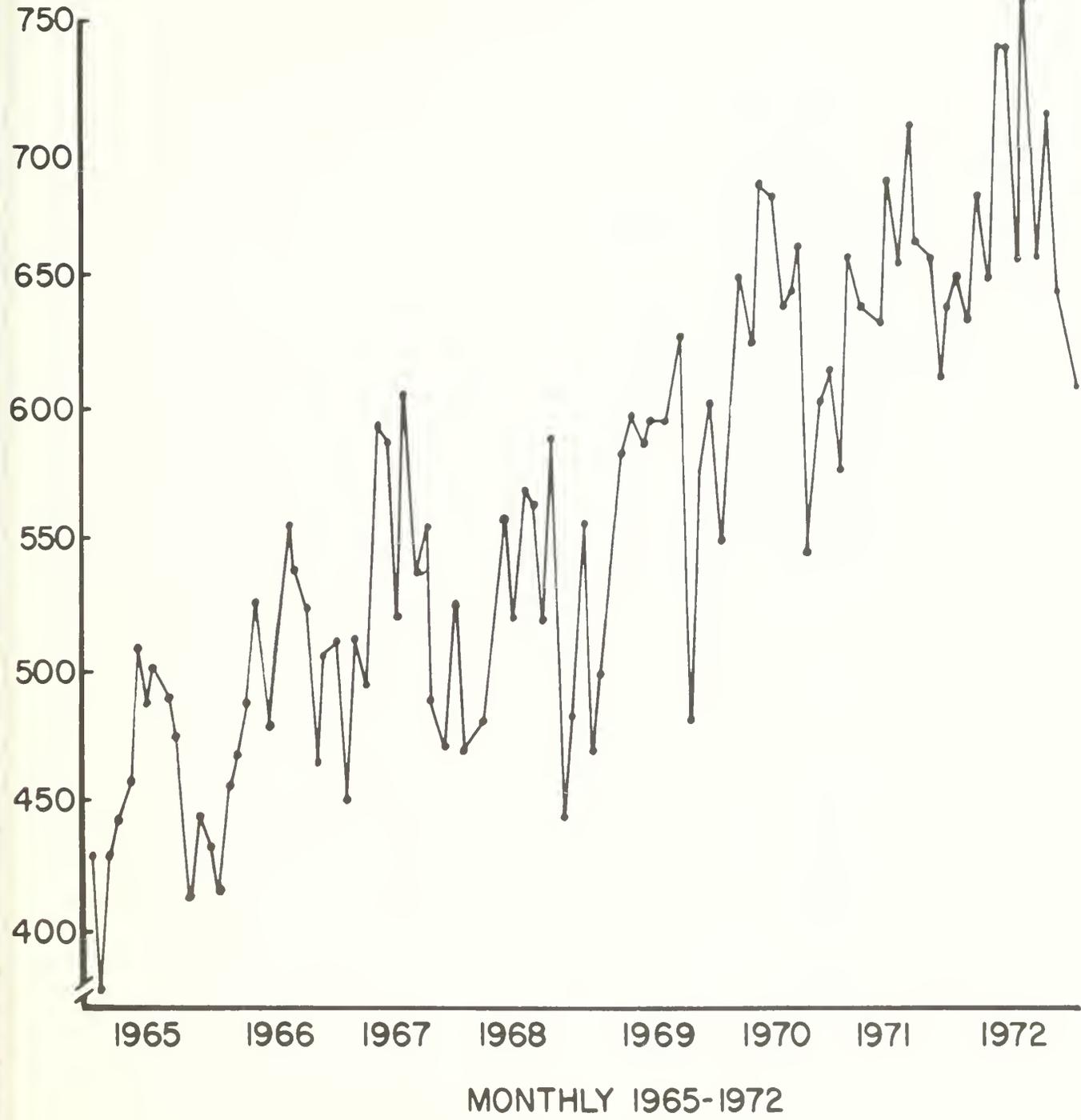


Figure 2. Illustrative time pattern of broiler slaughter.

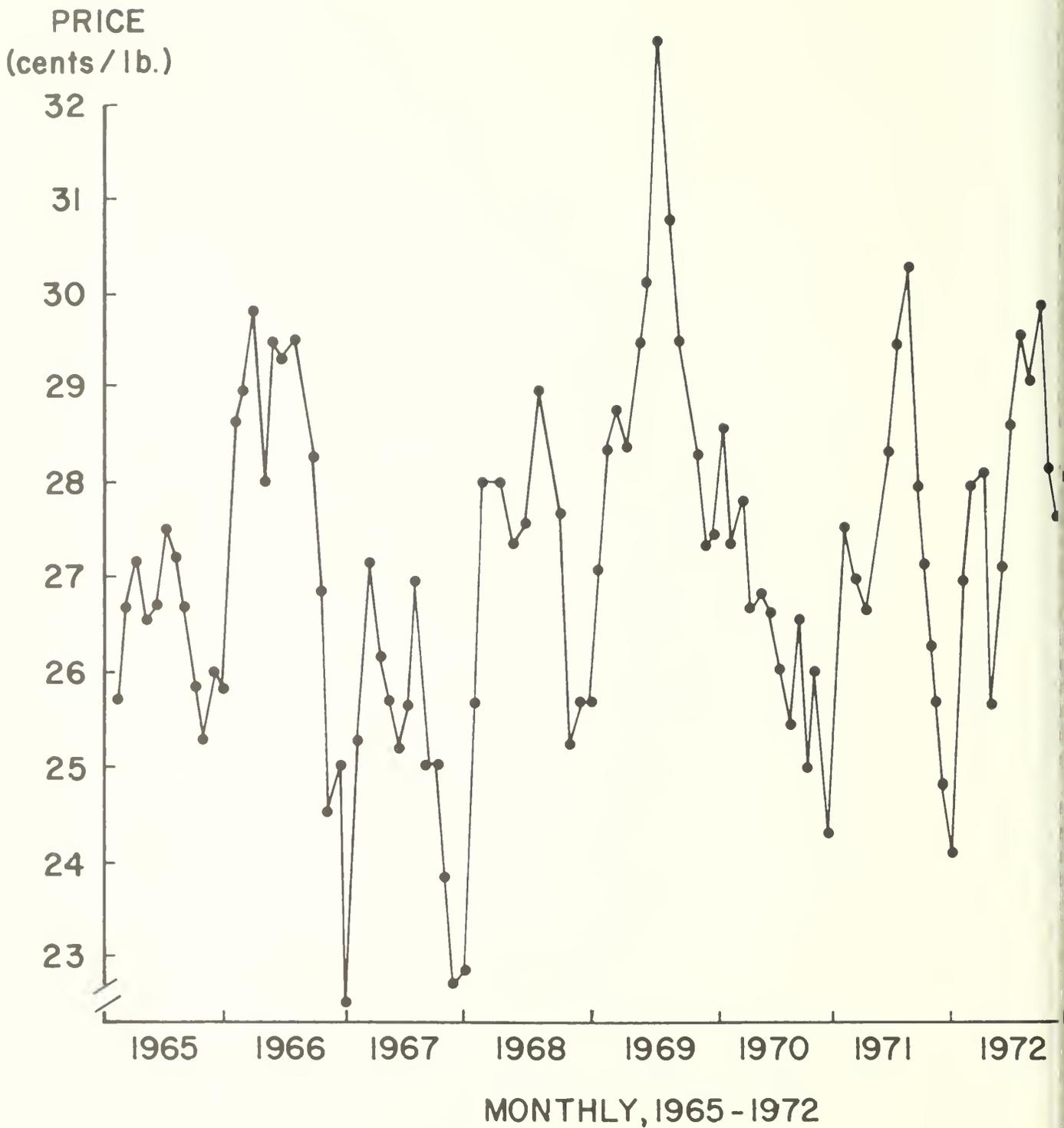


Figure 3. Illustrative time pattern of broiler price.

n February, November and December.

The slopes of the supply functions relative to those of the demand functions indicate that a unit change in price results in a smaller change in the quantity offered for sale than in the quantity bought.

The price of pork, consumer income and the size of the population affected the demand for broilers more importantly than did the other variables included in our estimating equations. Cost of production (primarily as influenced by the price of production inputs) and price expectations exerted more influence on supply than did the other variables considered in our statistical procedures.

Production and marketing plans require both short-and long-run considerations. Ordinarily, consumer income and the size of the population do not change appreciably from month to month. Consequently, the price of other meats, the prices of inputs used in the production of broilers and expectations of prices in the near future are the major factors affecting short-run production and marketing decisions of broiler processors.

Both pork and beef are competitors with broiler meat and the prices of both affect the demand for broilers more importantly than does the price of either alone. However, it appeared inappropriate to include prices of both pork and beef in our estimating equations because of the high degree of correlation between them. Also, pork appears to be the stronger competitor with broilers in the short run (8). Furthermore, the long-run trend in demand for beef is still upward relative to the

demand for other meats (15) and the strength of this demand will affect the demand for pork and, hence, that for poultry. Consequently, the price of pork was used in our estimating equations.

Long-term demand shifts, however, depend largely upon changes in consumer income and upon the size and composition of the population. Larger populations in the future will require more food and continuation of the rising trend in consumer incomes will provide greater purchasing power, signaling an increase in demand for food over time.

*Projections*---Our equations have given short-run projections that have differed markedly from the quantities and prices of broilers that have prevailed in the immediate past, simply because some of our major variables have behaved abnormally as a result of major shocks to the national and the world economies---short-falls in food and feed grain production in many countries, the energy crisis, rising unemployment and continued inflation at home and unexpected market controls by the Federal Government.

We feel, however, that our estimating equations can be used to improve the accuracy of predictions of long run changes in the broiler industry, because of the greater reliability of trends in the major variables. Further increases in population are projected. Unemployment rates are expected to decline and consumer income is expected to resume its upward trend---all of which tend to increase demand. Beef cattle numbers are at record highs and larger quantities of beef, much of it with less grain finish, are expected to be marketed.

This will reduce the demand for pork which, in turn, will lead to a reduction in the demand for broilers.

Prices of the inputs required for livestock production, particularly feed for heavy consumers of grain, are expected to go up because of rising costs of farm production. This will lead to reductions in broiler supplies unless higher prices compensate for the higher costs of production or unless the broiler industry can find ways of using production inputs more efficiently.

On balance, it appears that the demand for all meats will continue to increase; that livestock producers can meet these demands only with higher prices, because of higher production costs; and that broiler meat will share in the overall increase, with the rate of growth in demand approximating that of past trends. And these are all hypotheses that can be tested with our estimating equations.

The expectations of industry leaders parallel the projections outlined above. All but one of 14 industry leaders interviewed expected the long-term demand for broiler meat to increase at a rate approximating that of the past ten years. Growth of the fast-food industry and the decline in meat-cutting by supermarkets are expected to continue, leading to an increase in the proportion of broilers sold as "cut-up." (2). One respondent was highly optimistic as to the potential growth in demand for further processed broilers, most of the others were only mildly optimistic as to the potential for this. Forecasts by Jones (7) support the expectations of continued growth in further processing, but at a relatively slow rate.

## Industry Organization and Supply Management

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The broiler industry has repeatedly been documented as be-

ing highly vertically integrated (Figure 4). The decision-making

function is centered in the processing sector where the responsibility

for marketing rests and where profits of the industry are centered. However, procurement of breeding stock and marketing of the final product remain basically external to the broiler industry and these two major functions still are handled primarily by spot transactions.

A commonly-accepted goal of both consumers and producers of broilers is the maintenance of price stability, by adjusting supply to the changing demand. Obviously, supply adjustments may be made at any stage of production and processing over which an integrator has control.

Adjusting the supply of broilers to expected long-run changes in demand begins with the reduction or expansion of hatchery egg supply. However, increasing the supply of hatching eggs requires bringing more layers into production and increasing the throughput of the processing plant by this method.

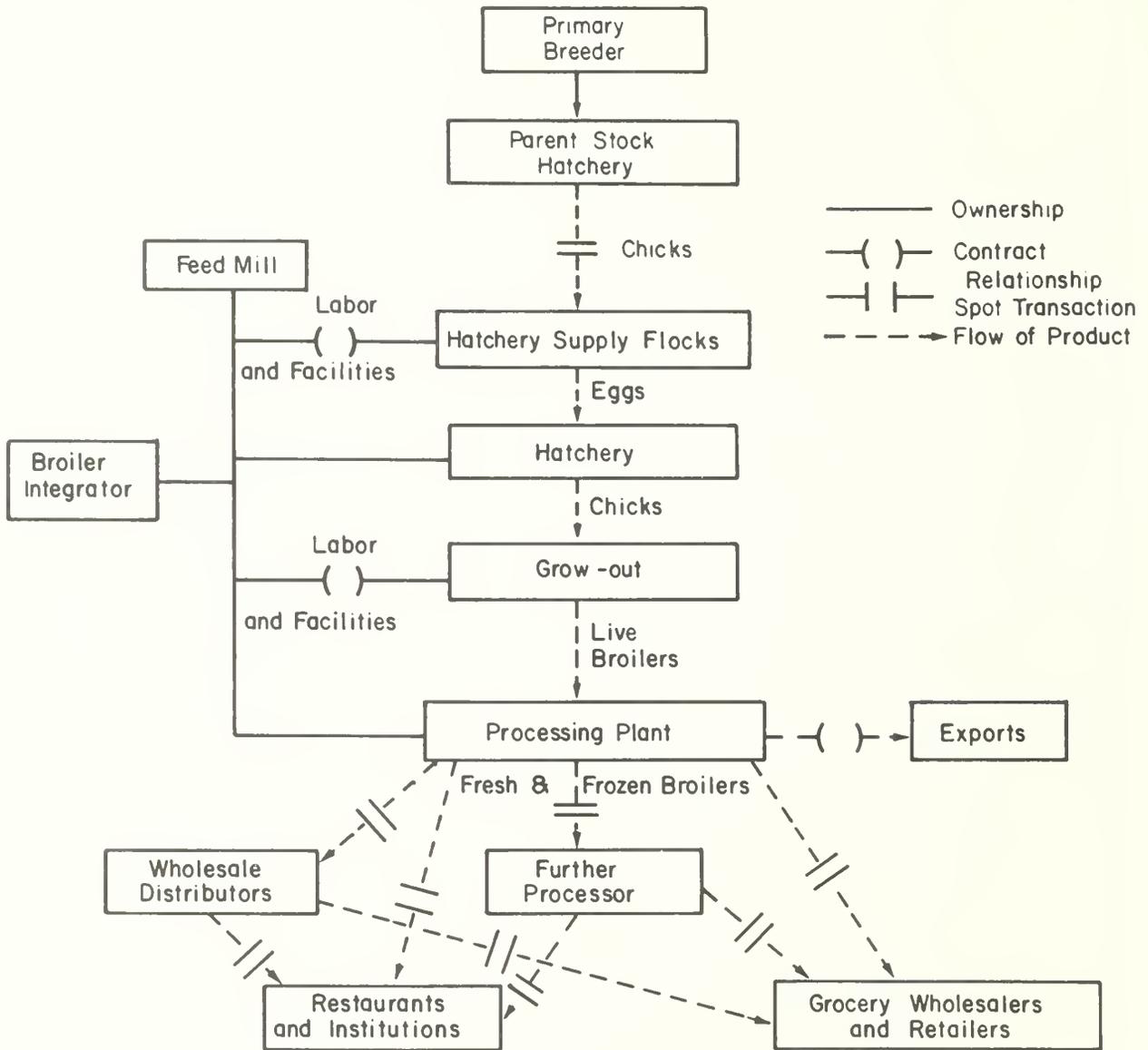


Figure 4. Stages, Proprietary Structure, and Linkages Typical of the Broiler System in 1970.

Source: B. W. Marion and H. B. Arthur, Dynamic Factors in Vertical Commodity Systems: A Case Study of the Broiler System. Ohio Agricultural Research and Development Center, Bulletin 1065, November, 1973.

cannot be accomplished short of about ten months. Also, after new flocks for producing hatching eggs come into production, the influence on the quantity of broilers available for processing will prevail for nearly 18 months. (10).

Estimates of long-run changes in demand most likely will be less than perfect. Also, even if long-run

estimates are "on target," short-run shifts in demand likely will leave the processor with the problem of coping with surpluses or deficits of live broilers. In this event, the most feasible alternatives for adjusting supplies appear to be:

— Changing the laying period of existing hatchery supply flocks,

- Diverting hatching eggs to other uses (breaking, disposal, etc.) or purchasing additional hatching eggs,
- Changing standards for hatching eggs,
- Changing standards for placing broiler chicks,
- Selling or purchasing broiler chicks.

## Summary

The growth of the broiler industry and its potential for further growth are attributed primarily to the technical efficiencies gained in production and processing. Efficiencies have been gained through integration---the ownership and contract linkages of successive stages of production, processing and marketing. Processing efficiency has been improved by the decrease in numbers of plants and the larger throughput of the ones in business now. However, there now is excess processing capacity and using existing facilities at capacity would result in declining prices and less than normal returns to the industry.

There are relatively few buyers and sellers of dressed broilers and competitive emphasis is on price, with buyers having the overall balance of power. Price discovery continues to be a major problem. Most of the output of processors is priced and committed for delivery a week in advance. Price reporting is adequate but remains "after-the-fact" for decision-making purposes. Therefore, most sales managers in Mississippi supplement their knowledge of immediate past prices with knowledge gained by telephone contacts with other suppliers and with buyers.

Casual observation of time series data reveal distinct seasonal---and even monthly---patterns of broiler slaughter and prices. Our estimates, based on 1965-72 data, reveal that broiler demand in eight

months (March-October) exceeded that for January and was less than that for January in three months (February, November, December). Supply was greater in eight months (March-October) than it was in January; less than that of January in February, November and December. The slopes of the supply functions relative to those of the demand functions indicate that a unit change in price results in a smaller change in the quantity offered for sale than in the quantity bought.

The price of pork, consumer income and the size of the population affected the demand for broilers more importantly than did the other variables included in our estimating equations. Cost of production (primarily as influenced by the price of production inputs) and price expectations exerted more influence on supply than did the other variables considered in our statistical procedures.

Our equations have given estimates that have differed markedly from the quantities and prices that have prevailed in the immediate past, simply because some of our major variables have behaved abnormally as a result of major shocks to the national and world economies---short-falls in food and feed grain production in many countries, the energy crisis, rising unemployment and continued inflation at home and unexpected market controls by the Federal Government.

# APPENDIX

## General Model

Supply and demand functions were postulated on a monthly basis using traditional economic explanatory variables and zero-one (dummy) variables as a means of allowing the intercept values to

change monthly while holding slopes constant. Additionally, since prices and deliveries are normally negotiated on a weekly basis, a two-equation simultaneous system was estimated using the

Two Stage Least Squares (2SLS) method of estimation (16).

Two relationships, demand and supply, were postulated in equations 1 and 2, respectively.

$$(eq. 1) D: X_1 = a_1 + B_{1,2}X_2 + B_{1,3}X_3 + B_{1,4}X_4 + B_{1,5}X_5 + B_{1,7}X_7 + \dots + B_{1,17}X_{17} + u_1$$

$$(eq. 2) S: X_5 = a_5 + B_{2,1}X_1 + B_{2,2}X_2 + B_{2,3}X_3 + B_{2,6}X_6 + B_{2,7}X_7 + \dots + B_{2,17}X_{17} + u_2$$

Where:

$X_1$  = USDA nine-city weighted average wholesale price of ready-to-cook broilers (cents/pound).  
 $X_2$  = Average price of pork (100 pound wholesale cuts at Chicago) (cents/pound).  
 $X_3$  = USDA nine-city weighted average wholesale price of ready-to-cook broilers, lagged two months (cents/pound)

$X_4$  = Per capita disposable income (thousand dollars).  
 $X_5$  = Quantity; chicken certified as wholesome in federally inspected plants, ready-to-cook weight, plus cold storage stocks (million pounds).  
 $X_6$  = Average broiler price per pound at farm level (cents/pound).  
 $X_7$  = Through  $X_{17}$  = Zero-one (dummy) variables (monthly intercept shifters).

$a_1$  = Price intercept (demand function).  
 $a_2$  = Quantity intercept (supply function).  
 $B_{ij}$ 's = Parameters ( $i = 1, 2$  and  $j = 1, 2, \dots, 17$ ).  
 $u_1$  = Error term (demand function).  
 $u_2$  = Error term (supply function).

# Statistical Model and Results

The 2SLS procedure is to first solve the reduced form equations.\* Thus, the predicted values for boiler price and quantity were obtained in their reduced form. These predicted values were then substituted for the original observations in the supply and demand equations with the following results:

Demand equation:

$$\begin{aligned}
 \text{(eq. 3) D: } X_1 = & 22.42 + .13X_2^{**} + .06X_3^* + 12.37X_4^{**} - .08X_5^{**} \\
 & (.0112) (.0248) (.6127) (.0037) \\
 & - 2.99X_7^* \text{ or February} + .70X_8^{**} \text{ or March} + .43X_9 \text{ or April} + 3.25X_{10}^{**} \\
 & (.3282) (.2654) (.2713) (.2874) \\
 & \text{or May} + 4.94X_{11}^{**} \text{ or June} + 3.32X_{12}^{**} \text{ or July} + 4.66X_{13}^{**} \text{ or August} \\
 & (.3305) (.2825) (.3512) \\
 & + 1.36X_{14}^{**} \text{ or September} + 1.41X_{15}^{**} \text{ or October} - 5.67X_{16}^{**} \text{ or November} \\
 & (.2860) (.3061) (.3308) \\
 & - 4.51X_{17}^{**} \text{ or December} \\
 & (.2872)
 \end{aligned}$$

$R^2 = .93$  Std. error of estimate = .52

Supply equation:

$$\begin{aligned}
 \text{(eq. 4) S: } X_5 = & 280.52 + 73.47X_1^{**} + 2.57X_2^{**} - 1.80X_3 - 126.26X_6^{**} \\
 & (3.684) (.561) (1.177) (4.526) \\
 & - 37.33X_7^{**} + 14.39X_8 + 16.56X_9 + 30.77X_{10}^* + 35.07X_{11}^{**} \\
 & (12.194) (12.239) (12.356) (12.084) (12.227) \\
 & + 26.59X_{12}^* + 62.65X_{13}^{**} + 4.29X_{14} + 35.21X_{15}^{**} \\
 & (12.539) (12.273) (12.542) (12.723) \\
 & - 51.31X_{16}^{**} - 46.08X_{17}^{**} \\
 & (12.632) (12.928)
 \end{aligned}$$

$R^2 = .94$  Std. error of estimate 23.85

Where:

= significant at the 95 percent level    \*\* = significant at the 99 percent level    ( ) = standard errors of the respective coefficients

\*Reduced form is the solution of each endogenous variable as a function of all exogenous variables in the system.

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