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AN ANALYSIS OF THE MONTHLY PRICES FOR FARM HOGS IN GEORGIA

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Introduction

Short run price movements in the hog markets often seem erratic to many uninformed observers and often confusing to the market participant. Some of the variation of short run hog prices simply cannot be explained on an annual or quarterly basis. Several factors influencing the occuring variation balance out within each year or quarter. With observations on annual averages these influences cannot be isolated. Monthly demand fluctuations or monthly shifts in marketing, for example, cannot be examined without resorting to a shorter breakdown of series data than yearly or quarterly.

Objective and Methods

The primary objective of this analysis was to estimate the effect of factors causing monthly hog price fluctuations in Georgia. The analysis examined variables of the respective schedules of the demand and supply of pork in an effort to study the factors contributing to the makeup of hog price.

A reduced form equation for Georgia market hog price was developed from a model recently specified by Hayenga and Hacklander [1]. Their

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equation incorporated the major factors expected to influence the monthly demand and supply for pork at the national level and thereby determine a competitive market price. Since Georgia is a part of the competitive market, Georgia price will be expected to differ from national price by no more than a constant reflecting location. A least squares procedure was used to estimate the parameters of this reduced form equation. By assuming that seasonal effects could be represented by a discrete variable for month of the year, the model was developed and estimated using short-data series (January 1967 - April 1975).

The specified reduced form equation estimated presents the average monthly hog price in Georgia as a function of the monthly values of U.S. slaughter of hogs, pork cold storage, per capita disposable income, Georgia slaughter of hogs, and Georgia slaughter of hogs as a percent of the monthly slaughter of Georgia cattle. The specified equation is illustrated below:

1. $P_h = f(Q_h, C, Inc, Q_h^*, Q_h^* / Q_c^*, S_i)$

where:

P_h = USDA reported average price of U.S. 1 - 2, 200 220 pound hogs in Georgia, monthly basis;

Q_h = monthly U.S. commercial hog slaughter in millions of pounds;

C = monthly U.S. storage of frozen and cured pork in millions of pounds;

Inc = quarterly U.S. per capita disposable income, at annual levels, in thousands of dollars;

Q^* = monthly Georgia commercial slaughter in millions of pounds, (h = hogs, c = cattle);

S_i = season of the year as represented by month i.

Development of Equation

As indicated, the objective was to estimate the effect of factors causing monthly hog price fluctuations in Georgia. It was felt that these prices were a result of direct and indirect influences at the aggregate and state level. This is due to the interaction between the Georgia and national markets.

With this in mind, several aggregate variables were specified. One of the first considerations was U.S. slaughter of hogs. Traditional economic theory tells one that other things constant, a negative relationship should exist between national supply and the price of hogs. This in turn should carry over into the interaction between Georgia and the aggregate markets. An increase in the aggregate market quantity of pork supplied would decrease aggregate market price. If Georgia prices were differentially higher than nearby aggregate markets, pork would flow into the state to command the higher price. With this net inflow of pork quantity supplied would increase, Georgia prices would thus be depressed. This therefore illustrates an expected negative relationship and the economic reasoning for specification of aggregate U.S. hog slaughter in this model.

Another aggregate variable considered was U.S. cattle slaughter. Beef and pork are considered to be major competitors for the consumer's attention in purchases and to estimate this substitution effect, the original model included aggregate cattle slaughter. With this substitution effect, a negative relationship between cattle slaughter and hog price was expected. The variable was thus tested using least squares but failed to yield a significant F value when related to Georgia hog

prices. It was subsequently dropped from the model.

Pork that is consumed in this country does not consist solely of fresh slaughter product. Product inventories and imports could be expected to contribute influence. However, pork import levels are typically quite small relative to the total supply of pork and its impact is often spread homogenously over several months. Consequently, imported pork was not included in the model. In contrast, however, pork storage is often relatively large and demonstrates a high degree of seasonal fluctuation. Thus, pork cold storage was incorporated in the model as the monthly inventory of U.S. frozen and cured pork. A negative relationship would be expected since inflows of pork to replenish depleted cold storage inventories would indicate increased quantity supplied to the aggregate market and thus decrease price.

Since the effort was to explain Georgia prices, variables were specified and tested to study the exogenous influence of several factors on a state level. As with the variables thought to influence price from the aggregate standpoint, the slaughter of hogs and cattle in Georgia was included in the original model specification. Both of these variables would be expected to have a negative relationship with state hog prices. During the testing procedure, a significant positive correlation was noted to exist between these two variables. To combine these effects, an additional variable was specified and tested expressing Georgia hog slaughter as a percent of state cattle slaughter. Results of the combined variables were encouraging and this percentage relationship was thus specified in the final model. With cattle slaughter expressed in the model in this percentage fashion, cattle slaughter as an independent

variable was dropped. Hog slaughter was kept in the final specification due to its desirable F value, a substantially more direct influence upon hog prices and less direct correlation with the ratio of hog and cow slaughter.

Continuing the effort to show state market influences upon price, the quarterly inventory of Georgia sow farrowing was tested. The logic behind inclusion of this variable was that farmers are quite sensitive in adjusting sow inventories in response to price changes. A positive relationship was thought to exist since pork producers will increase farrowing in the face of increasing hog prices, and will reduce inventories substantially at the onset of a decline in price. However, the least squares estimates failed to provide a significant value and subsequently farrowing was removed from further testing.

Several other forces may influence the variation of hog prices in Georgia. Since the demand for hogs is derived from the retail demand for pork products, factors influencing retail demand for these products are reflected through the marketing system thereby affecting the quantity of wholesale cuts demanded at various wholesale prices. Primary among exogenous market factors are the level of consumer incomes and the size of the consuming population. Because U.S. population and per capita disposable are highly correlated, a per capita income variable was specified in the model to account for the effect of both income and population.

Many factors affecting demand from month to month and season to season in pork marketing systems are thought to occur regularly as affected by religious and national holidays, temperature changes and associated eating and cooking preferences. Evidence of seasonality in pork storage

is reflected by seasonality in the pork belly futures market and seasonal shifts in the demand for storage space. The supply of pork may also be seasonally affected by such factors as availability of stored feed and the effects of weather on new feed crops. With these factors in mind, binary (dummy) variables associated with each month were specified to account for regular monthly supply and demand shifts in the reduced equation.

Estimation Results

The final specified reduced form equation relates the average monthly hog price in Georgia to the monthly quantities of U.S. and Georgia pork supplied, monthly cold storage levels of pork, per capita disposable income, a percentage relationship of Georgia hog supply to the state supply of beef and seasonal influences on monthly supply and demand schedules. Approximately 96 percent ($R^2 = .96$) of the monthly variation in hog prices was explained by this reduced form equation.

2. $P_h = 34.89 - .0211\ Q_h - .0342\ C + .0085\ inc + .0003\ Q_h^* - 4.4194\ Q_h^* / Q_c^* - 3.641\ FEB - 2.4509\ JULY - 3.8296\ AUG - 2.3490\ SEP + 17.9309\ AUG\ '73$

where:

February (FEB), JULY, August (AUG), September (SEP) and August of 1973 (AUG '73) are discrete variables and all other variables are described in equation 1.

F Ratio = 104.672 and all parameter estimates of independent variables were significantly different from zero at the .05 level of probability.

The monthly hog price in Georgia was responsive to changes in the aggregate slaughter level of pork. As expected, a negative relationship was shown to exist. A one million pound increase in the monthly U.S.

slaughter of hogs normally resulted in a two-cent drop in hog prices in Georgia. The interaction between Georgia and U.S. markets is thus quite significant in affecting statewide prices. The response to national conditions is expanded as the monthly inventories of pork in cold storage are considered. A change of one million pounds in pork cold storage affected Georgia price negatively by three cents per hundred weight. This corresponds with the negative relationship that was hypothesized earlier. One possible reason for the ready response of Georgia prices to both of the aggregate supply variables is that Georgia is a net exporter of pork and thus is a strong participant in the aggregate U.S. market supply.

One aggregate variable showed an opposing positive effect upon Georgia price in contrast to the two previously discussed variables. Increases in per capita disposable income, representing the combined effects of population and income, caused the demand for hogs to rise during the eight year period studied in this analysis. As there are more people with more income to spend, demand is expected to shift at retail and have a positive effect upon live hog prices via the derived demand for pork. This variable contributed significantly to an increase in the average price of hogs per hundred weight during the past eight years.

Thus, Georgia hog prices are strongly affected by exogenous and aggregate forces in the market system and a large majority of variation in live hog prices is explained by these factors. As noted, this was expected since Georgia is a net exporter of pork.

In addition to the aggregate variables considered, two state variables also showed significant affect upon state prices. State hog and cattle slaughter as well as seasonality in supply and demand contributed to

explaining the variation in Georgia price. The interrelationship between Georgia supplies of pork and beef proved to be a pronounced contributing factor to Georgia's makeup of hog price. Due to the substitution effect of beef for pork, the negative relationship hypothesized beforehand is here substantiated. An increase in live hog prices of $4.41 was seen for a decrease of one million pounds monthly of beef supplied to the States livestock markets (hog supplies constant).

The supply of Georgia pork within the State had a contributing impact upon prices but had a positive sign. This suggests that hog prices go up as the supply of pork in the State increases. Such a result may not be consistant with what is to be expected from normal market behavior. Since this is a reduced form equation, it cannot account for both supply and demand function parameters. Any firm conclusion about this variable cannot be reached until structural supply and demand functions are investigated. These preliminary results indicate a need for further study.

The months represented in the specified reduced form equation represent the months in which seasonality associated with the model are explained via use of binary (dummy) variables. Although all months were tested, particular months proved to have significant F values and thereby contributed an explanation of seasonal effects upon price. In most of the important seasonal months, farmers can expect to see prices range from two to three dollars/cwt lower than January levels. It can be noted that slaughter in these particular low price months is usually higher, given the level of the other variables incorporated into the equation.

An August 1973 binary variable was included to explain the abnormally

high prices that occured in that particular month. No reasonable explanation was found for this particular variation in price.

Conclusions

In conclusion, the reduced form equation of this model for monthly demand and supply relationships was specified and estimated via least squares procedure. The overall fit of this equation was quite good. Results indicated that approximately 96 percent of price variation could be explained by this model and parameter estimates were significantly different from zero. This indicates that the prices of Georgia hogs are responsive to changes in the U.S. fresh pork supply, U.S. cold storage inventories, U.S. per capita disposable income, and interaction between Georgia beef and pork supplies with additional influences coming from seasonal supply and demand effects.

The interaction of these variables influence and largely explain the variability of hog prices. These factors work together and it is conclusive that these relationships do exist and are significant in explaining the variation in the farm prices of hogs in Georgia. Further work is indicated to demonstrate the functional supply and demand relationship between Georgia hog price and Georgia market hog quantities.

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