The Demand for Pork and Chicken in Colombia 1955-78: Implications for Cassava as an Animal Feed

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The successful diffusion of a new agricultural technology is critically dependent upon the access of the resultant increased output to profitable markets except in the case of a subsistance crop. Although cassava has historically been primarily a subsistance crop throughout much of Latin America, new yield increasing technology may be widely adopted by farmers only if the additional production can readily be marketed, especially given the strong trends towards commercialization of agriculture in Latin America and the shift of a large part of the population out of subsistance agriculture into the urban market economy.

Of the several potential markets for cassava one of the most promising markets may be the animal feed market (Pachico 1980a). While there is some evidence to indicate that new cost reducing production technology could enable cassava to become competitive as an animal feed for swine and chickens in Colombia (Pachico 1980 b), a full assessment of the opportunities facing cassava in this market requires some study of the demand for pork and poultry products since the demand for cassava as an animal feed is a derived demand, dependent ultimately on the final demand for livestock products.

Once new cassava production technology enables cassava to be produced

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cheaply enough to displace sorghum or other feed grains in least cost diets for animals, then the crucial determinent of the level of total demand for cassava as an animal feed becomes the demand for the final products: poultry meat and pork. An important measure of the demand conditions for pork and poultry is their own price elasticity of demand.

This paper, therefore, estimates the price elasticity of demand for pork and chicken in Colombia in order to attain a fuller understanding of the potential market for cassava as an animal feed. First, there will be a brief description of trends in the meat markets in Colombia. Then the price elasticities of demand for pork and chicken are estimated, and finally, conclusions and implications for further research are presented.

The Colombian Meat Sector

Meat comprises an important part of the diet in Colombia with over 17% of urban food expenditures being devoted to meat in all income classes (Musgrove 1978). Animal products, of which meat forms a substantial proportion, provide 44% of available protein in the Colombian diet as well as 15% of available calories (FAO 1977). The role of meat and other animal products in the Colombian diet has been declining, however, leading to a slight deterioration in per capita food availability and quality. In the decade 1961-63 to 1972-74, per capita availability of animal proteins declined 12%, causing a drop in total protein availability as well as lowering the per cent of total proteins from animal products. At the same time, a fall in calories from meat and other animal products counteracted a rise in available vegetable calories resulting in a stagnation of calories per capita.

These developments are reflected in Figure 1 which depicts the annual per capita consumption of pork, poultry, and beef in Colombia from 1955-1978. The importance of beef is emphasized by this figure which shows that over the last two decades beef has almost always accounted for three quarters of total meat consumption in Colombia.

Despite the strongly cyclical nature of beef consumption, associated with the beef production cycle, there appears to be a declining trend in beef consumption per capita over the last two decades. Both the peaks and the troughs are a bit lower in each successive cycle so that the recent 1977 peak is lower than the 1961 trough.

Given the historic importance of beef in the Colombian diet, this decrease in per capita beef consumption may have serious nutritional consequences.

Although there has been no growth in the pork sub-sector, where per capita production has been stagnant since 1955, in recent years there has been a dramatic upsurge in the production and consumption of chicken which to some extent is offsetting the decline occurring in the beef consumption. Chicken consumption has risen from 0.8 Kg. per person per year in the late 1960's to almost three Kgs. in the period 1974-1978.

The advent of modern industrial methods of chicken production appears to be largely responsible for this striking growth in the poultry sub-sector. Two necessary conditions for the diffusion of improved systems of poultry production have been the concommittent growth of the feed concentrates industry and the production of sorghum, the main component of feed concentrates in Colombia (see Pachico 1980b, 1980c).

Figure 1 : Consumption of pork, poultry and beef in kg. per head, 1955 -1978.

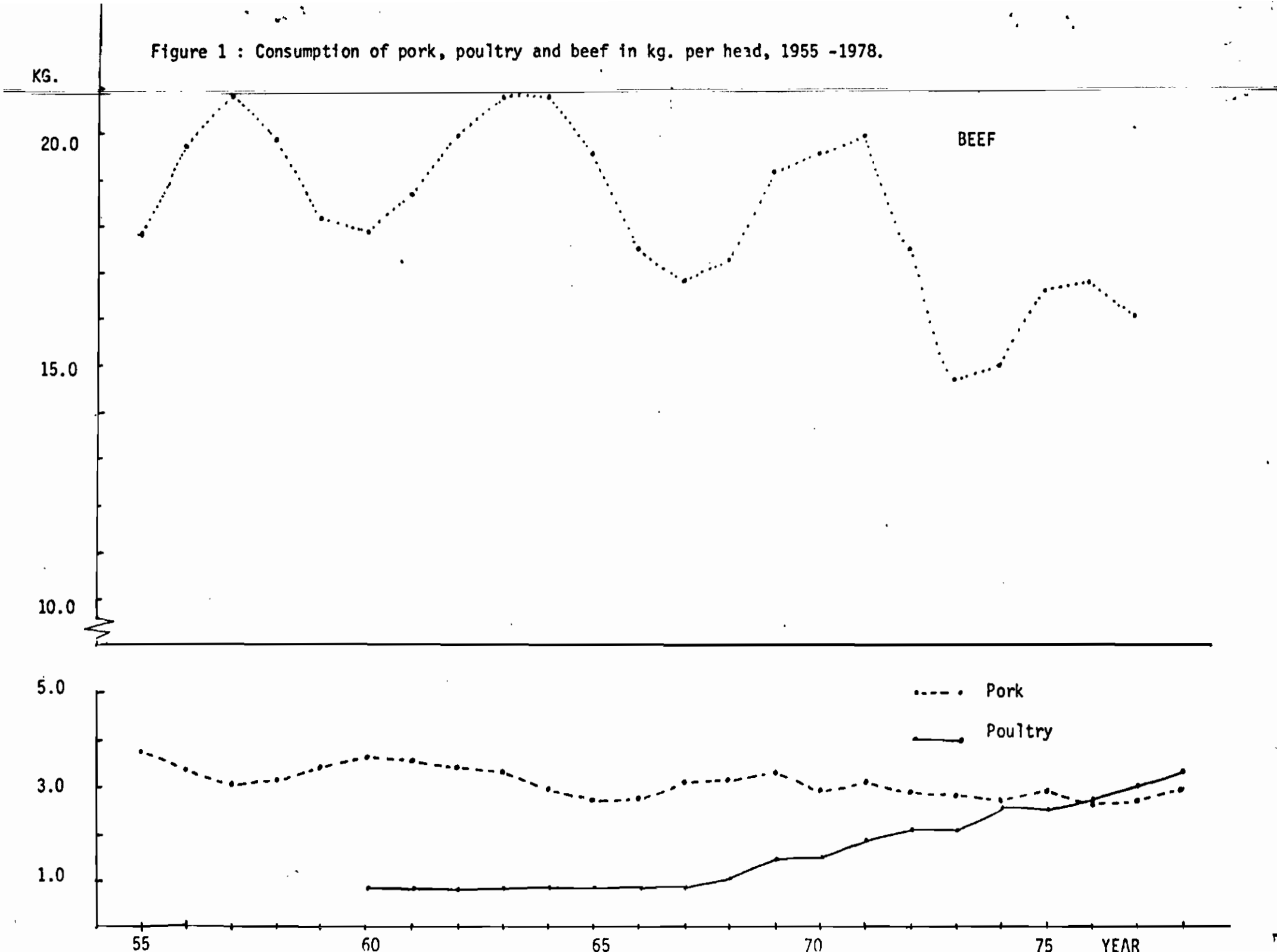
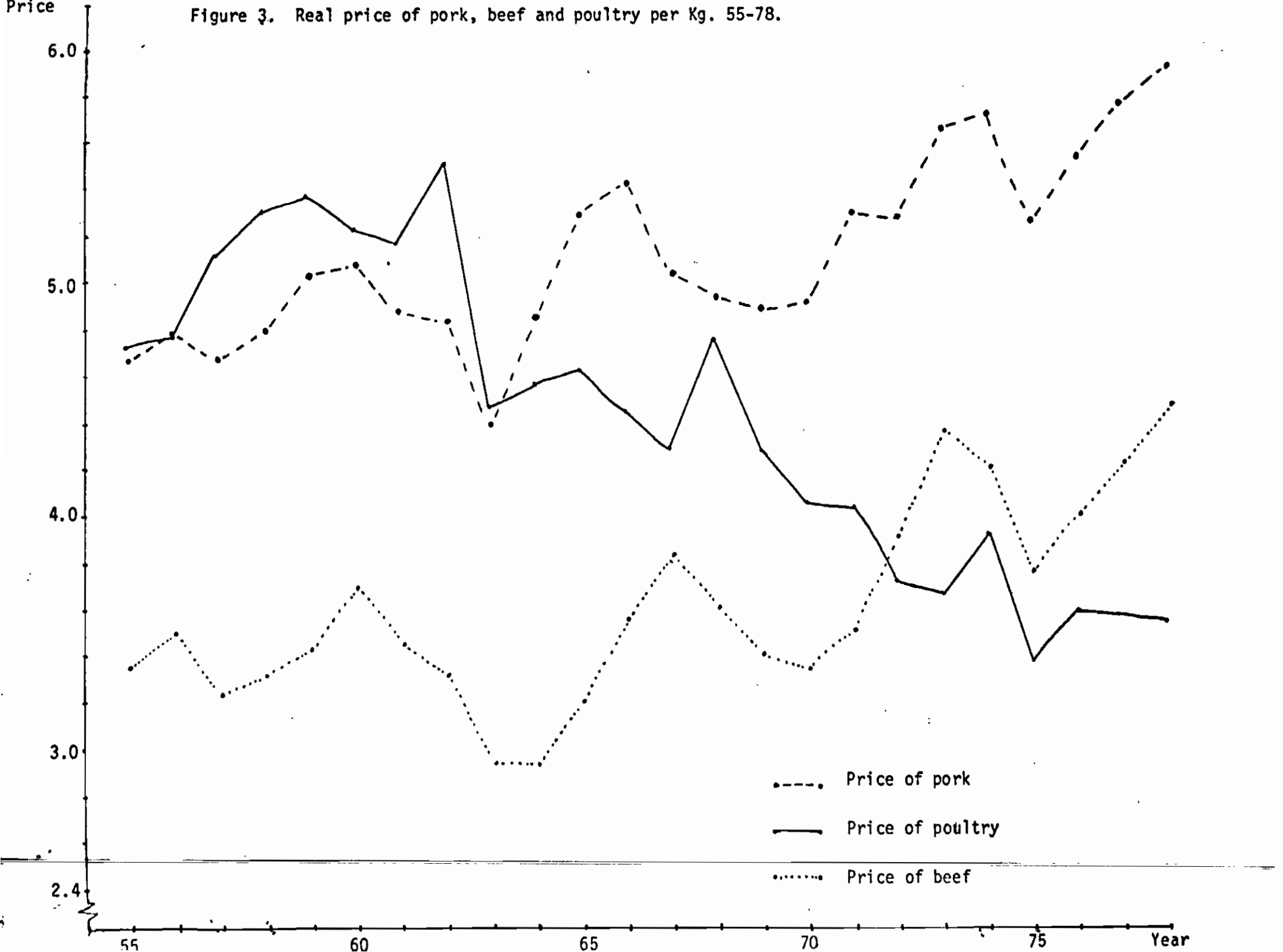


Figure 3. Real price of pork, beef and poultry per Kg. 55-78.



Movements in the prices of beef, pork and poultry are closely associated with the above discussed patterns in consumption. Beef prices, like consumption, are highly cyclical with the price troughs occuring regularly around the production peaks and price highs coming with production lows. However, Figure 2 which displays the real consumer price per Kg. of beef, pork, and chicken 1955-78, indicates that the real price of beef has been trending upwards so that the recent 1975 price low was above the 1961 price high. This rise in real beef prices is a logical correlate of the downward drift in per capital beef availability.

Pork prices have moved in very closed correspondence to beef prices, following the same cycles and the same long term upward drift. Poultry prices, on the other hand, are neither closely tied to the beef price cycle, nor, more importantly, have they been rising in real terms. Instead, there has been a clear trend of declining prices for chicken since the mid-1960's. This fall in the price of chicken is related to the rising production of chicken due to the new poultry systems. Moreover, the decrease in real poultry prices has been substantial. Whereas in the late 1950's chicken was the most expensive of the three meats, by the mid 1970's it had become the cheapest.

Estimation of Pork and Poultry Demand Elasticities

Economic theory suggests that the demand for a commodity is dependent on its own price, the prices of other commodities, incomes, and consumer tastes. This provides a firm basis for the specification of demand equations.

(1) $PP = f(SP, PB, PC, Y)$

(2) PC = g(SC, PB, PP, Y)

where

PP = Price of pork

PB = Price of beef

PC = Price of chicken

SP = Supply of pork

SC = Supply of chicken

Y = Income

In these equations the price of pork and chicken are each dependent on the quantities of the respective product available for purchase on the market; the price of other meats which may be substitutes; and income. Since theory does not favor any particular functional form, in this paper the equations are specified in double log form for the convenience of the interpretation of the results. For results using a linear functional form, see Janssen 1980.

A key issure in the empirical estimation of demand functions is whether price and supply are simultaneously or recursively determined. If they are related recursively, ordinary least squares estimation provides unbiased parameter estimates; if they are simultaneously determined, more sophisticated estimation techniques are needed. Most evidence indicates that the price and supply of pork are not simultaneously determined due to the length of time involved in the production process.

In the United States, where the production period for hogs is about one year, 95% of the production of pork can be explained by prior events (Tomek and Robinson 1977). In Colombia, where animal nutrition is generally less than optimal (Buitrago et al 1979), it is likely that the production period is even longer, hence making the use of recursive models all the more reasonable.

Because the production period for chicken broilers is less than a year, there is a possibility of simulataneity when annual data are used, as in the case in this study.

However, the rapid growth in the production of poultry during the time span considered here probably imposed powerful limits on the ability of producers to adjust output. It is likely that production was near peak capacity throughout this period. Consequently, availability of physical plant may well have been a binding constaint on producers' ability to expand production in response to prices. This would result in a time lag in adjustment to new prices, and given such a lag, it is acceptable to use OLS estimators.

Nevertheless, because of the potential existance of this problem, the poultry demand equation was also estimated with two stage least squares. Since the results of this estimation were similar to those obtained from OLS, the OLS results will be reported here for both pork and poultry. For two stage least squares estimation of this model, see Janssen 1980.

Annual data for the period 1955-1978 are used to estimate the demand equations. Prices are derived from DANE retail price series for pork, poultry and and beef. These series are available for certain cities. Poultry prices are available only for Bogota. Beef price series for four Colombian cities are very similar, so the series for Bogota is used. Because the Bogota pork price is not available, the Cali pork price is used. Prices are all deflated by the DANE consumer price index for white collar employees.

Since slaughters of hogs are required to take place in Municipal slaughterhouses, reliable data on the number of hogs slaugtered can be obtained from the

Banco de la Republica. According to Rivas and Nores (1979), average dressed weights per hogs have remained constant between 1960-76, so the number of hogs slaughtered seems to be an adequate measure of the total production of pork. Poultry production is in tons. In the estimating equations, the supply variables are expressed in per capita terms.

A disposable income series is available from the Banco de la Republica. This variable is deflated by the DANE consumer price index. Annual population is estimated by extrapolation between the ten year censuses. Income is entered in the estimating equations as real per capita disposable income.

Table I presents the results of the estimated demand function. For both equations a reasonable fit is acheived and the Durban Watson statistics do not indicate the presence of serial correlation. In the pork equation, all variables have the expected sign; and the chicken price and disposible income variables are statistically significant as are also the supply of pork and the price of beef.

In the poultry equation, however, the only statistically significant variable is the supply of poultry, though the estimated coefficient of the beef price variable is of the right sign and of a reasonable magnitude. Inclusion of the pork price or the disposible income variables does not substantially improve the explanatory power of the estimating poultry equations and leads to illogical results in terms of the signs and magnitudes of the coefficients both for the supply and other variables.

From these equations the own price elasticity of demand for pork is computed at-3.58 and that for poultry at-3.76. Although these estimates are

TABLE 1. Demand Equations for Retail Price of Chicken and Pork, Colombia 1955-1978. Standard Errors in Parentheses.

	Price of Chicken	Price of Pork
Intercept	1.362	0.169
Supply of Chicken	- .266 (5.06)	
Supply of Pork		- .289 (4.21)
Price of Beef	.129 (0.64)	.477 (7.82)
Price of Chicken		.192 (1.71)
Disposible Income		.176 (1.72)
R^2	.79	.86
DW	1.76	1.67

rather high, they are in the range of reported own price elasticities for meat products in Europe (Ven Dyk 1978). Moreover high price elasticities may be expected for preferred goods such pork or poultry, and the elasticity results are consistent with the observed tripling of chicken consumption in response to falling real prices.

Conclusions and Implications for Further Research

High price elasticities of demand for pork and chicken clearly present a more favorable environment for the expansion of cassava production as an animal feed than would an inelastic demand for these commodities. With an elastic demand for these products, consumers are willing to purchase substantially greater quantities in response to falling prices. Such a strong demand for the final goods results in a strong demand for inputs to their production e.g. cassava as an animal feed. On the other hand, with an inelastic demand for pork and poultry, consumers would not significantly increase their consumption even if prices of pork and chicken fell, so that all other things being equal, the demand for inputs such as cassava as an animal feed would not be as strong.

Price elasticities, though, only reflect consumer responses to changes in relative prices. Are there any reasonable grounds for expecting that the relative prices of pork and poultry might fall, thus strengthening the demand for animal feeds? One important source of such a price fall could be the animal feed sector itself.

New cassava production technology, for example, could increase the supply

of pork and poultry by reducing the cost of feed. Because of the highly elastic demand for pork and poultry, some additional production could be readily absorbed on the market without dramatic declines in prices to pork and chicken producers. Hence, improved cassava production technology could lead to a growing demand both for livestock products and for animal feed.

Furthermore, there has been a major decline in the costs of poultry production in Colombia over the last fifteen years as new technology has been adopted. Although this history of technological innovation may leave less scope for future cost reductions in poultry production induced by new technology, it does demonstrate the potential that may still exist for the pork sector, which has yet to widely adopt modern production technology. Thus, there are two reasons for anticipating strong potential growth in demand for animal feeds brought on by changes in the relative prices of final products: new sources of cheaper feed and improved animal husbandry.

The animal feed market, therefore, may be a particularly attractive one for cassava. Although it has been suspected that cassava might face less than promising growth prospects due to an inelastic demand for cassava as a direct human food, the demand for cassava as an animal feed may be relatively elastic. Moreover, the development of new cassava production technology that lowered the price of cassava could to some extent create a growing market for itself by reducing the cost of animal feed which in turn lowered the price of pork and poultry and consequently raised demand for livestock products.

These findings, like those of the analysis of least cost feed mixes (Pachico 1980b), present a fairly positive, though incomplete, view of the potential for cassava as an animal feed in Colombia. Several important

research tasks remain, however. Estimates of income elasticities of demand for pork and poultry are be essential for making long term projections of the total demand for animal feeds. A more detailed study of the prospects for other animal feeds (eg. sorghum, maize, soybeans) is also needed in order to make a sound appraisal of the future competitivity of cassava. Research into the animal feed sector ought also be extended beyond Colombia to include other major Latin American countries. Data availability, of course, remains the key constraint to this activity. Finally, further thought needs to be given to the identification of specific feed market segments and specific regions of cassava production for the priority development of production/processing systems of cassava as an animal feed.

BIBLIOGRAPHY

1. BUITRAGO, J., C. Trujillo and C. Beltrán. (1979). La Producción Porcina en Colombia. Cali, Colombia: CIAT.

2. FAO (1977). Production Yearbook. Rome, Italy

3. JANSSEN, W. (1980). Meat Demand in Colombia and the Prospects for Pork and poultry. Cali, Colombia: CIAT.

4. MUSGROVE, P. (1978). Consumer Behavior in Latin America. Wash. D.C. Brookings.

5. PACHICO, D. (1980a). Position Paper on Economics of Cassava Marketing and Utilization Project. Cali, Colombia: CIAT.

6. PACHICO, D. (1980b). The Potential For Cassava in Feed Concentrates in Colombia: Some Preliminary Results. Cali, Colombia: CIAT.

7. PACHICO, D. (1980c). "Sorghum," in Latin America: Trend Highlights For CIAT Commodities. Cali, Colombia: CIAT.

8. RIVAS, L. and G. NORES (1979). La Producción Porcina en América Latina 1960-76. Cali, Colombia: CIAT.

9. TOMEK, W. and ROBINSON, K. (1977). "Agricultural Price Analysis and Outbook," in A Survey of Agricultural Economics Literature. Minneapolis: Univ. of Minnesotta Press.

10. VAN DYK, G. (1978). Price Formation and Margin Behaviour of Meat in the Netherlands and the Federal Republic of Germany. Wageningen, Holland: Univ. of Wageningen.