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Vol. 24 No. 2  
OCTOBER 1985

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BIANNUAL JOURNAL  
ON AGRICULTURAL  
ECONOMICS

Issued by the Department of Agricultural Economics and Marketing



# AN ECONOMIC ANALYSIS OF DEMAND AND POLICIES IN THE BEEF INDUSTRY

by W.L. NIEUWOUDT\*

## ABSTRACT

Production costs of beef vary because of seasonal changes in the weather and a seasonal variation in prices, which because of its counter-cyclic effect, could have a stabilising effect on supply. The analysis shows that the permit/quota scheme increases the price at the main city abattoirs and it depresses the price farmers receive on country auctions. If permits/quotas reduce production by as little as 5%, then the value of the permit/quota is estimated at R52 per animal. Large feeders who are allocated quotas receive a windfall gain, but the small farmer who does not receive a quota because he is an irregular supplier is harmed. The effect of quotas is to restrict beef production artificially. This is in direct contrast to the effect of research on output, that is, to promote productivity. Because the pressure to sell cattle is greater during droughts, the quota value increases then. Quotas then aggravate the farmers' position during adverse times by limiting the offtake. After good rains quotas may have no value or a negative value as feeders sell cattle just to maintain their quotas.

## INTRODUCTION

The per capita consumption of beef and veal in South Africa declined from 35,3 kg in 1948/49 to 22,3 kg in 1980/81 and the per capita consumption of poultry increased from 2,2 kg to 12,1 kg during the same period. During this period the consumption in kg per capita of mutton (and goat) declined from 10,8 to 7,0 and of pork from 4,1 to 3,2. If the per capita consumption of beef, mutton, pork and poultry is compared then it will be seen that the position of poultry improved from fourth to second place. Poultry consumption at present exceeds that of mutton and pork taken together. This paper focuses on the demand for beef with a view to drawing conclusions about policy from current policies.

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## PRICE ELASTICITY OF DEMAND AND CONSUMPTION TREND

Hancock *et al.*, using simultaneous equations, estimated retail price elasticities of beef (-0,96), poultry (-1,66), mutton (-1,93) and pork (-1,86). These figures indicate that the consumption of different types of meat is sensitive with respect to its price. Positive cross elasticities reported by Hancock *et al.* confirm the view that the decline in poultry prices relative to other types of meat reduced demand for the latter. The policy implication is that an increase in the price of beef, through the restricted issue of permits/quotas and floor prices, discourages consumption of beef, but stimulates the consumption of chicken. The Meat Board, however, has no influence on the price of poultry meat. Broiler producers must welcome any attempt by red meat producers to increase their prices.

The relation between the price of meat and its consumption is further illustrated in Figures 1 and 2. Figure 1 shows that the real price of beef (adjusted for inflation) and the consumption of beef moved in a symmetrical fashion over time. When the price increases, consumption decreases and vice versa. According to Figure 2 the rapid increase in poultry meat consumption is a response to a decline in poultry meat prices (real). Similar symmetrical consumption movements are evident for mutton and pork, but are not presented in the interest of space.

Per capita poultry consumption throughout the world exceeds that of beef. In South Africa, although beef is more important, the per capita

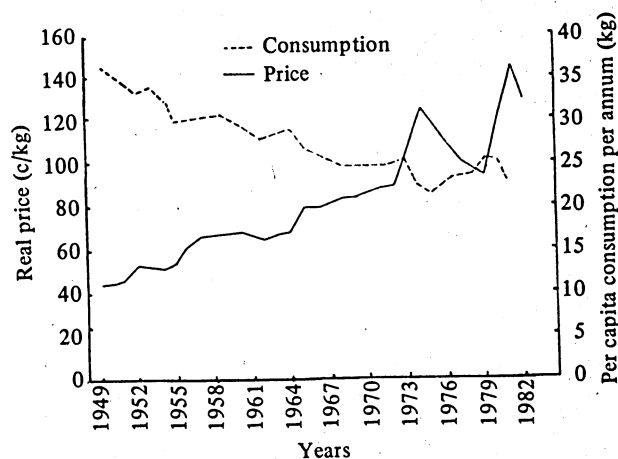


FIG. 1 - Real price and per capita consumption of beef, 1949 to 1982

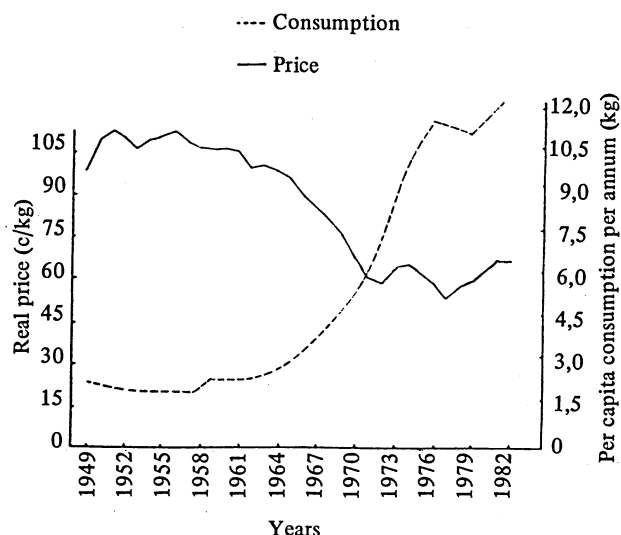


FIG. 2 - Real poultry prices and per capita consumption 1949 to 1982

consumption of beef and mutton has declined by 37% since 1948/49, but per capita poultry consumption has increased sixfold. About 70% of South Africa is suitable only for livestock farming and the substantial loss in the market share of red meat must be of concern to the meat industry.

### INCOME AND PRICE ELASTICITIES

Consumption functions were fitted for beef, based on data obtained from the Bureau of Market Research at UNISA, for different cities. The income elasticity of beef was estimated as 0,47 (Blacks, based on 12 regressions, were  $t > 2$ ) and 0,41 (Coloureds, based on 4 regressions were  $t > 2$ ).

When time series demand functions were estimated for the period 1962-1981, the income elasticity of beef was estimated as 0,71 (Hancock *et al.*). Both estimates imply that beef is an essential item (income elasticity smaller than 1,0), although the latter estimate appears the more realistic. The following income elasticities are reported for other countries: USA (0,67), Austria (0,34), Germany (0,76), Australia (1,23) and Denmark (0,32) (Greenfield).

Hancock *et al.* report a retail price elasticity of beef of -0,96. Estimates for other countries are USA (-0,61), Austria (-1,07), Germany (-0,50), Australia (-1,71) and Denmark (-0,46). The finding that the income elasticity of beef for South Africa (0,71) is numerically smaller than its price elasticity (-0,96) is in accordance with the Slutsky-Schultz and Hicks-Allen relations (Wold and Juréen). The latter relation states "as a rule income elasticities of necessities are smaller than their price elasticities".

An application of the Hotelling-Juréen relation is that changes in beef prices have a far greater impact on the consumption of mutton, pork and poultry in South Africa than vice versa. For instance, a change in pork prices is predicted to have

a minor impact on beef consumption. The Hotelling-Juréen relation (Wold and Juréen) states that the ratios between cross-elasticities of two products are in inverse proportion to expenditure on the two commodities.

During 1980/81 the consumption per kg of beef (22,3 kg) exceeded that of mutton (7,0 kg), pork (3,2 kg) and poultry (12,1 kg), implying that beef prices have a dominant impact on the consumption of the other types of meat. The policy implication is that an increase in beef prices through the restricted issue of permits/quotas or high floor prices stimulates the consumption of other types of meat (i.e. poultry) significantly. The fact that per capita expenditure on poultry meat is increasing also implies that poultry prices are having an increasing effect (cross-elasticity is increasing) on the consumption of the other meat types, depressing their consumption.

### MEAT QUOTAS

The Meat Board scheme is officially classified as a surplus removal (floor or minimum price) scheme. This scheme has the desirable feature that it can promote greater price stability. Such a scheme, contrary to popular opinion, cannot increase the market price. To the extent that the price is supported by removing supplies from the market when prices are low, it is depressed when prices are high, as supplies are released from cold storage. In practice, minimum (floor) prices were fixed above free market clearing levels, causing gluts. Van Biljon attributes the oversupply of meat to the introduction of quotas. According to Hancock (P.3), permits to auction livestock on the Witwatersrand and in Pretoria were introduced in 1934 and later extended to the nine major urban centres. Modifications to the scheme were made periodically. At present a 100% permit system prevails, except in Natal and the Eastern Cape, where quotas are issued. Although in economic language the words permits and quotas are synonymous, there is a difference in the way the schemes are implemented in South Africa. In Natal and the Eastern Cape quotas are allocated by livestock agents to farmers and feedlot operators, but in the rest of the country the allocation is undertaken by the Meat Board. In the following analysis no economic distinction is made between the two names. The economic implications of quotas/permits are discussed subsequently.

The impact of a permit/quota scheme on the demand for and supply of beef is shown in Figure 3, where  $D_T$  = total demand,  $D_C$  = demand in controlled areas,  $D_N$  = demand in uncontrolled areas,  $S_T$  = total supply,  $Q_{IC}$  = quotas issued and  $S_N$  = supply on the unrestricted market.

Without quotas, the equilibrium price  $P_O$  will prevail in both controlled and uncontrolled areas and the total consumption  $Q_{OT}$  consists of  $Q_{OC}$  (controlled) +  $(Q_{OT} - Q_{OC})$  (uncontrolled). If quotas

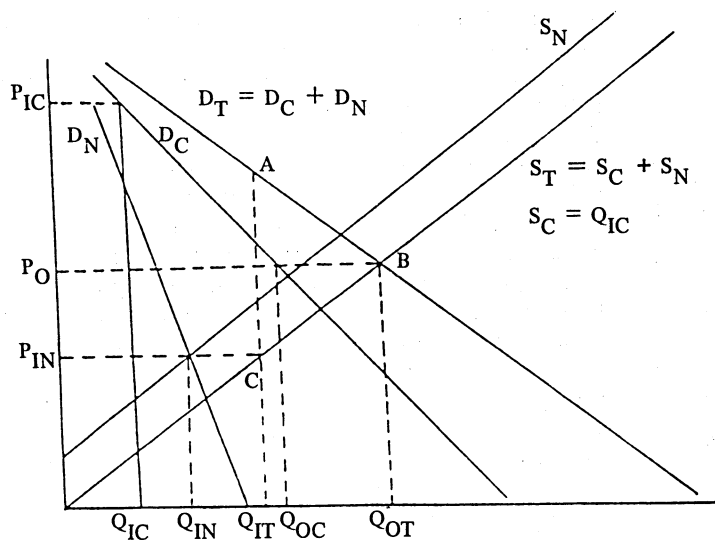


FIG. 3 - The effect of a quota/permit on prices

$Q_{IC}$  are issued in controlled areas, the price increases to  $P_{IC}$  and the vertical line at  $Q_{IC}$  becomes the supply on controlled markets. The supply on uncontrolled markets is  $S_N$ , derived from total supply as  $S_T - Q_{IC}$ . Equilibrium on uncontrolled market is reached at price  $P_{IN}$  and quantity  $Q_{IN}$ . Total consumption in the presence of quotas in controlled areas is  $Q_{IT} = Q_{IC} + Q_{IN}$ .

In summary, without quota control the market price is  $P_O$  and consumption  $Q_{OT}$ . With quotas/permits, the market price in the controlled market increases to  $P_{IC}$ , but in the uncontrolled area, which includes country auctions, it falls to  $P_{IN}$ .

The farmer who does not have a quota/permit is worse off with a permit/quota system because he receives a price ( $P_{IN}$ ) which is lower than the free market price  $P_O$ . The value of permits is ( $P_{IC} - P_{IN}$ ) in Figure 3. The feeder ("speculator") receives a windfall as he can buy cattle at the artificially increased price  $P_{IC}$ .

Beef permits are not saleable (transferable) and the value of the permit is therefore not known (visible). In the USA milk (dairy) quotas/permits in California sell for more than the price of the herd and in North Carolina/Virginia tobacco quotas sell for several times the price of tobacco land. In South Africa meat quotas/permits are allocated by the Meat Board to its agents, who reallocate them to suppliers, i.e. farmers and speculators. In the allocation or reallocation of permits the Meat Board (or its agents) favours regular suppliers, such as feeders, over irregular suppliers, such as small farmers (Van Biljon). Small farmers who in the past have sold their cattle on country auction sales have no record of sales at main abattoirs and do not qualify for permits.

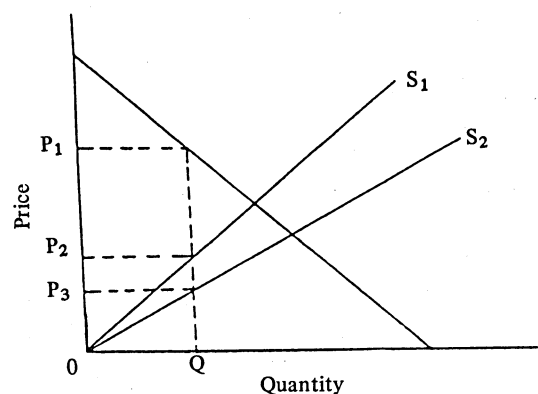


FIG. 4 - Effect of drought on quota values

The permit system worsens the situation during periods of drought such as those experienced in South Africa in recent years. During drought the pressure to sell is greater and the quota value increases. The quota thus becomes more restrictive in limiting offtake from the veld. This is explained in Figure 4, where supply during a drought is  $S_2$  and supply with a good season  $S_1$ . With a drought the value of the permit increases from  $P_1 - P_2$  to  $P_1 - P_3$ . The supply curve during adverse weather lies to the right as it is common for farmers to reduce stocking when grazing is scarce. This can be compared with the value of milk quotas in summer and winter. In Natal in the past milk quotas were sold for R40 per 'gallon' in summer and R28 per 'gallon' in winter. In summer the pressure to sell milk is greater because grazing is abundant and quotas have greater value than in winter when the pressure to sell milk is less because feed costs are high and there is little surplus milk.

In summary, beef quotas increase consumer prices, but depress prices on country auctions. The large feeder/speculator receives a windfall because quotas/permits have a value.

According to Van Biljon, quotas are needed because of the limited available abattoir facilities. If this is so then providing such facilities is a sure way of making agriculture more efficient. The small country butcher is also forced out of business because of regulations concerning the maximum number of animals he is allowed to kill and minimum health standards, putting more pressure on large city abattoirs.

According to Van Biljon meat production is seasonal owing to climatic conditions and the fact that the marketing scheme must adjust supply to demand during the year. Quotas or permits are not needed to achieve this because if production is low (after winter), prices would be higher and vice versa, which would counteract the seasonality in production. In fact large feedlots are located near

city markets, making it convenient for feedlot operators to sell when prices are high and to hold back when prices are low. This could stabilise prices, as happens in the USA. Farmers could inform their agents (or representatives) at the market in advance of their intention to sell, eliminating the possibility that all cattle arrive on a single day. The floor price scheme, if floor prices are low, could also reduce price variation.

## EMPIRICAL ESTIMATES OF SOCIAL COSTS

In the case of a permit scheme it can be shown that costs (including hidden costs) exceed the gain by area ABC in Figure 3. This area is called social cost. The social cost of a quota (refer Figure 3) scheme is derived as:

$$\text{Area ABC} = \frac{1}{2} t^2 P_O Q_{OT} \left( \frac{1}{\eta} + \frac{1}{\epsilon} \right)$$

where  $\eta$  is elasticity of demand,  $\epsilon$  is elasticity of supply and  $t$  is  $(Q_{OT} - Q_{IT})/Q_{OT}$

The following data were used to calculate social cost  $\eta = -0,77$  (Hancock *et al*),  $P_O Q_{OT} = R1\,004$  million represents cattle sold in all areas (*RSA Livestock and Meat Statistics*) and elasticity of supply ( $\epsilon$ ) is taken as either 0,4 or 0,8.

It is not known to what extent production is reduced through the quota scheme. However, according to *RSA Livestock and Meat Statistics* (May 1984) permits were granted for only 39,8 % of the cattle for which permits were applied for during the period May 1983 to April 1984. For instance, during September 1983 permits were applied for 270 340 cattle, but granted for only 62 554 cattle or 23,1 %. During April 1984 only 1 065 producers out of 2 133 who applied for permits received permits of 50 %. Admittedly these figures greatly overstate the impact of the permit system as farmers would apply for far more if they realised they would not receive the full quantity. Because permits are not transferable (saleable) no market value exists for permits and the extent by which permits reduce beef output is uncertain.

In Table 1 it is shown that if beef supply is reduced by 5 % and if the elasticity of supply is taken as 0,8 then the social cost (Area ABC Figure 3) is estimated at 3,2 million. This supply restriction is estimated to increase retail prices (price at main city abattoirs) by 6,5 % while it depresses the price at the country auction by 6,3 %. A value of R80 million is attached to permits. Data presented in Table 1 show that even if permits reduce output by only 5 % the value of permits could be astronomical. It is no wonder that Paarlberg (pp 337 - 352) states that in

tobacco farming the value of tobacco quotas exceeds the value of tobacco land by many times. Table 1 also demonstrates the well-known economic view that the welfare redistribution of intervention may be large even although the social cost is relatively small (Johnson).

It was shown earlier that permits derive value from the fact that they raise the retail price and depress the country auction price. It shows that feedlot operators may be receiving a substantial windfall in the form of quotas while the smaller producer who does not qualify for quotas and the consumer are harmed.

## CONCLUDING COMMENTS

The author agrees with the National Marketing Council's Report on the Marketing of Slaughter Animals and Meat (1977) that floor prices should be used only as a protection against exceptional price decreases. He also supports the view of the Council that seasonal price variations should be allowed to occur.

Production costs of beef vary during the season owing to the seasonal changes in the weather. A floor price scheme applied in such a way might reduce some risks, although speculators would also buy when prices are low and sell when prices are high, stabilising the price.

It was shown in the analysis that a permit/quota scheme for cattle increases the price at the main city abattoirs and depresses the price farmers receive on country auctions. During the period May 1983 to April 1984 permits were granted for only 39,8 % of the cattle for which they were applied for. If permits reduce sales on the 9 markets by as little as 5 %, it is estimated that the value of permits would be the astronomical figure of R80 million.

Permits derive their value from the fact that the scheme increases the price on the city abattoirs while it depresses the prices on country auctions. "Speculators" who are allocated permits therefore receive substantial windfall gains while the small farmer (who does not receive a quota) and the consumer are harmed. For instance if permits reduce sales by as little as 5 % then it is estimated that country auction prices could be depressed by 6 % while prices on the main city abattoirs are increased by 6 %, introducing a margin of 12 %.

Pressure to sell cattle is greater during droughts and permit values would also be greater during a drought. The economic implication is that during a drought permits would depress country auction

TABLE 1 - Possible welfare impacts of beef permits

Elasticity of supply $\epsilon$	Supply restriction %	Social cost R million	Value of permits R million	Retail price increase	Country auction price decrease
0.4	5	4.8	120	6.5	12.5
0.8	5	3.2	81	6.5	6.3

prices to a greater extent. When pressure to sell cattle is small, for instance after good rains, permits may have little or no value. Quotas therefore aggravate the position of farmers during adverse times. It is expected that after good rains permit holders would sell cattle, even if they preferred not to do so, just to retain the permit. Speculators might then pay more for cattle and even purchase outside controlled areas just to retain permits.

It may be of interest to express the value of the permit/quota per animal. If permits/quotas reduce production by as little as 5%, then the value of the quota/permit is estimated at R52 per animal. If the Meat Board through its agents allocates 1 000 permits to a speculator then in effect the Board gives the speculator R52 000. This is a windfall, a handout for which no services are rendered.

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