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AN APPRAISAL OF A BUFFER FUND SCHEME FOR BEEF

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A buffer fund scheme has been proposed as a means of stabilizing producer revenue in the Australian beef industry. In this paper the economic consequences of such a policy are evaluated and the conditions under which the scheme would be successful in achieving its principal aim are indicated. In addition to effects on the stability of producer revenue, consequences of the policy for total producer revenue and its distribution among producers are indicated. Finally, the effects on consumers, at home and abroad, and taxpayers are estimated.

Introduction

A preliminary appraisal of a domestic levy scheme for beef was presented in Parton [15]. The research reported here is an extension of that project to a beef buffer fund policy.

As a result of concern for producers in the Australian beef industry, who have for some time been facing low output prices, a number of policy alternatives have been put forward.[1] One scheme which has been proposed and has received a degree of enthusiasm is a buffer fund policy.[2] Various alternative methods of operating the buffer fund have been expounded but the following policy is fairly typical. Its main features are:

(a) a levy on beef and veal sold for domestic consumption when prices to producers are low;

(b) a levy on beef and veal exported when prices to producers are at relatively high levels;

(c) the establishment of a Beef Industry Stabilization Fund into which all such levies would be paid and from which funds would be drawn to assist beef producers when returns fall below acceptable minimum levels.

Thus, a band of prices would be established within which no policy intervention would take place. When the upper price bound is reached a levy would be imposed on beef and veal exported, and proceeds would enter the stabilization fund. When prices fall to the lower bound a levy would be placed on domestic consumption, and levy proceeds would be distributed to all producers supplying a given minimum quantity for either export or home markets. Such levy proceeds would consist of funds from the domestic consumption levy in the given period, and the export levy in previous periods.

The purpose of this study is to examine the economic effects of this

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[1] The range of possible policies can be observed in [2, p. 78].

[2] See, for example, Queensland Department of Primary Industries [16], Bureau of Agricultural Economics [2] and Cameron [3].

scheme and to discover its distributional consequences. The principal aim is to indicate its most likely effects on stability of producer revenue within the Australian beef industry.

Assumptions

To perform this analysis, demand schedules for Australian beef both at home and abroad are required. No precise estimates of such schedules have been made, but the following observations seem plausible.

(a) The world demand curve for Australian beef is subject to periodic shifts. These shifts occur as a result of factors such as variations in the level of self-sufficiency of countries to which Australia exports.

(b) At present the quantities of beef exported are restricted, chiefly by foreign countries' quota arrangements, and a leftward movement of the demand curve has taken place.[3]

(c) As a result of (a) and (b), Australian beef exporters probably face a fairly price elastic foreign demand curve for Australian beef when high prices prevail, because foreign purchasers would seek substitution possibilities. A more inelastic foreign demand curve is experienced when price is relatively low.

(d) A number of studies estimating the domestic price elasticity of demand have been carried out. Main *et al.* [10] summarize the major Australian studies. The range of such estimates is from about —0·9 to —2·0. The view has been expressed that, at current low domestic price levels, demand is quite inelastic with respect to small changes in price [16]. This view is supported by the argument that, at present, price relativities between meats are such that few substitution possibilities in consumption exist. In addition, O'Sullivan [14] indicates that there is evidence that the response of quantity demanded to price changes is lower when prices are rising than when they are falling.

Taking into consideration the observations (a) to (d), the following price elasticity ranges[4] appear to be the most likely. Foreign demand curve high price: —1·00 to —2·00; foreign demand curve low price: —0·25 to —1·00; and domestic demand curve all prices: —0·75 to —1·25.

To perform the analysis some comments about the supply side and some appreciation of recent occurrences in the market for Australian beef and veal at home and abroad are necessary. The figures in Table 1 are the basis for these comments.

Between 1963 and 1969 annual average production was around 950 000 tonnes of which about 45 per cent was exported. During the next five years there appeared to be a rightward shift in the international demand curve for Australian beef. This caused an upward movement in price, and the relative profitability of beef induced expanded production in Australia. Home consumption remained relatively stable, so that a larger proportion of beef production was exported. During the 1974/75 season the disappearance of beef export markets, caused by factors such as quota restrictions by countries to which Australia exports, forced large amounts of beef back on to the domestic market. This change in the situation on export markets can be interpreted as a

[3] See Freebairn and Gruen [6] for further discussion.

[4] The use of these elasticity ranges permits an analysis of sensitivity.

TABLE 1

Australian Beef and Veal Production and Exports[a]

Year ended June	Production	Exports	Proportion exported
	'000t	'000t	%
1963	928·6	405·1	44
1964	1001·1	456·3	46
1965	1026·3	474·7	46
1966	946·3	441·2	47
1967	878·6	386·8	44
1968	903·9	400·9	44
1969	934·8	411·3	44
1970	1010·4	508·1	50
1971	1047·3	516·5	49
1972	1167·9	636·2	54
1973	1437·9	884·4	62
1974	1310·0	738·8	56
1975	1533·8	648·1	42
1976	1784·0	846·0	47
1977[b]	1933·6	1019·4	53

Source: [1].

[a] Carcase weight.

[b] Data for 1977 are provisional.

leftward shift in the foreign demand curve for Australian beef and is an important factor affecting the current situation.

In 1976/77 the supply of beef increased considerably, despite only a small increase in national herd size the previous season. This was an indication that total cattle numbers were declining and that in the medium-term future they will not exceed the 33·4 million reached in 1976. Given this number of cattle, a total annual beef output of about 1·7 Mt can be considered a normal level. In this study the range of annual supply levels examined is from 1·5 to 1·9 Mt, and the export proportion ranges from 45 to 60 per cent.

The Model

There are two parts to the analysis. In the first, policy effects at the high-price end of the range are shown. Such effects at relatively low prices are considered in the second part. The policy considered is one where a 10 per cent levy is placed on domestic sales when low prices prevail. Proceeds from this domestic levy and previous export levies are distributed to all producers as long as prices remain low. The stabilization fund is replenished at the high-price end of the range with a similar 10 per cent levy on export sales. In the policy model, the domestic levy is introduced at a retail price of 120 c/kg and the export levy at 145 c/kg. These could be the mean of monthly average prices over the previous three months. The establishment of such a band would in the actual situation be an extremely hazardous task, requiring very precise forecasting. In addition, the upper and lower limits would presumably be subject to many revisions once the levy policy was under way.

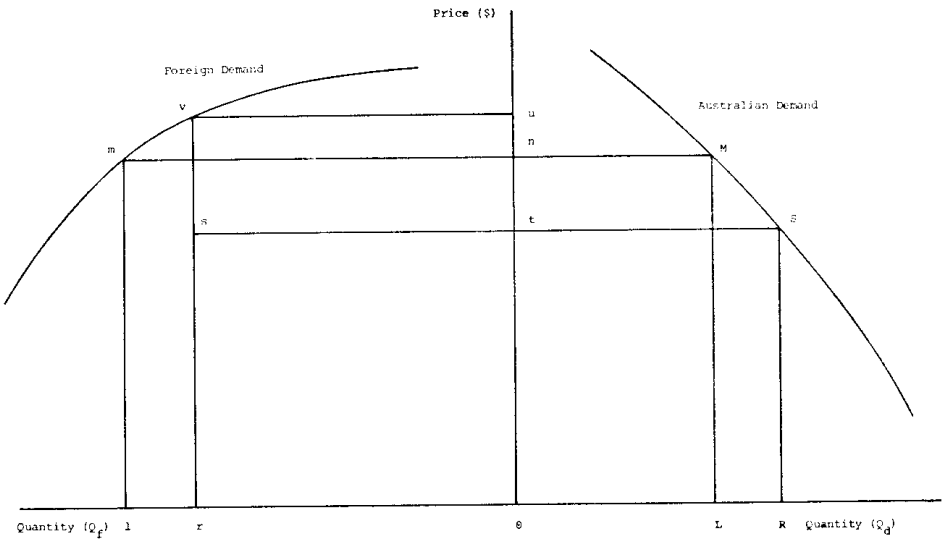

FIGURE 1—Trade diagram showing the effects of the export levy on beef and veal.

First, the situation where prices have reached the upper bound and the export levy is operative is evaluated. Despite the fact that different types of beef are sold on export and domestic markets, the supply of beef can be considered substitutable between these markets.[5] Hence, a rise in the price on one market relative to the other would cause shifts in the supply from one to the other.

In this case, when the export levy is operating, the analysis of Figure 1 is relevant. Before the introduction of the policy, the gross revenue from the market is represented by the sum of the rectangles *LMnO* and *lmnO*. Imposition of the levy would cause the export price to rise and export demand to fall. Given a particular level of production, some beef would be forced back on the domestic market, presumably lowering the price there. After arbitrage the tax per unit can be seen to be *ut* in Figure 1 and the producer gross revenue post-policy is *RStO* plus *rstO*. The levy (*tuvs*) enters the stabilization fund. In this case the export levy affects returns on both the export and domestic markets.[6]

The effect on the stability of producer revenue can be valuated only after consideration of the case when low prices prevail and the levy is applied to domestic sales. In Figure 2, the low price regime can be seen to be a result of a shift in the foreign demand curve for Australian beef. In this situation the policy has the effect of diverting beef which previously had been consumed at home onto the export market, thus depressing the export market price. Overseas consumers of Australian beef thus face lower prices than they would have faced

[5] The possibility of substitution between markets was confirmed by London [9].

[6] If there were no possibility of substitution between export and domestic markets because the beef sold abroad was of such a different quality that it could be considered a different product, then the same quantity of beef would be sent to each market both before and after the introduction of the policy. Hence, the export levy would be borne entirely by beef exporters.

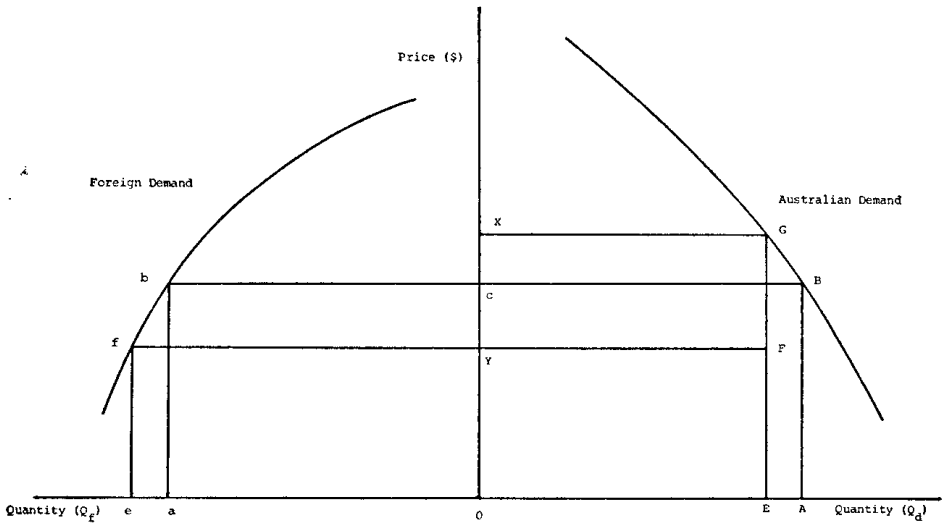

FIGURE 2—Trade diagram showing the effects of the domestic levy on beef and veal.

without the policy. Gross producer revenue before the introduction of the domestic levy is represented by the sum of the rectangular areas *ABcO* and *abcO*. After the levy is introduced, producers receive *EFYO* plus *efYO* plus some levy repayments. The domestic levy is *FGXY*.

Stability of Producer Revenue

The range of total producer revenue before and after the buffer fund is introduced can be evaluated to provide an indication, by comparison, of the effect of the policy on the instability of revenue. The range of producer revenue before the introduction is the difference between (*LMnO* + *lmnO*) and (*ABcO* + *abcO*). The range after the policy's introduction cannot be directly evaluated, because it depends on the method by which the funds collected from the export and domestic levies are distributed. Assuming that all the funds collected from these levies are distributed to producers when beef prices are low, then the range of gross revenue with the policy is (*RStO* + *rstO*) minus (*EFYO* + *efYO* + *FGXY* + *tuvs*). The most likely results of the scheme on the range of producer revenue are shown in Table 2. The use of various levels of supply and price elasticity of demand provides some indication of the sensitivity of the results.

The immediate observation from comparing best and worst possible outcomes is that there is a high possibility of the variability of gross revenue in the production sector being reduced as a result of the buffer fund policy. However, it should be noted that the outcome labelled 'worst' has quite a high probability of occurrence. Further analysis indicated that, even if the foreign demand curve was perfectly inelastic in the low price position,[7] the range of revenue over the cycle would still be significantly reduced by the policy.

[7] It has been argued that this is the current situation because there seems to be no potential for expanding export markets at any price.

TABLE 2

Range of Gross Revenue with and without the Buffer Fund Policy Given Various Levels of Supply and Various Price Elasticities of Demand ($ million)

	Production (Mt carcase weight)		
	1·5	1·7	1·9
No policy	375·0	425·0	475·0
Worst range with policy[a]	237·5	268·8	298·9
Best range with policy[b]	105·0	119·0	133·0

[a] In this case, the elasticities of demand were —1·00, —0·25 and —1·25 for the foreign demand curve high price, foreign demand curve low price and domestic demand curve all prices situations, respectively.

[b] Here, the elasticities of demand were —2·00, —1·00 and —0·75 for the foreign demand curve high price, foreign demand curve low price and domestic demand curve all prices situations, respectively.

Two important questions remain unanswered. First, although returns to the production sector would seem to be stabilized under the policy outlined, this does not guarantee that such stability would filter through the marketing chain to beef farmers. Space does not permit a review of this subject here but the existing evidence suggests that such stability would, in fact, be transmitted to farmers.[8]

The second question, which will be treated in more detail, relates to the costs involved in providing the above stability of gross revenue.

Costs to Producers

Although stability of gross revenue is likely to be achieved by the introduction of the buffer fund policy, it seems probable that this will only occur given some reduction in total revenue in the production sector. The situation is shown in Table 3, which indicates the expected change in total revenue as a result of the policy over two consecutive years in which high prices, requiring an export levy, and low prices, requiring a domestic levy, each occur 50 per cent of the time. Costs relating to administration of the policy are not included.

These results indicate that, although some reduction in total revenue might be expected as a result of the buffer fund policy, the percentage change in the short run would probably be small. Longer-term effects are more difficult to predict but it may be that, given the stabilizing effect on consumer prices, mentioned in the following section, the scheme may actually have a long-run beneficial effect on total revenue.

The distribution of these costs among producers should also be considered. If export proportions remain as in the recent past then a large percentage of the export levy would be paid by producers in Queensland, whilst the domestic levy would chiefly be paid by producers in other States. To the extent that all funds are eventually paid out to all producers, there will be no redistributive effects because the export

[8] See, for example, Griffith [7] and Bureau of Agricultural Economics [2].

TABLE 3

Expected Change in Total Annual Returns with Introduction of the Buffer Fund Policy ($ million)

	Production (Mt carcase weight)		
	1·5	1·7	1·9
Worst change with policy[a]	−55·9	−63·2	−70·7
Best change with policy[b]	−46·4	−52·6	−58·8

[a] Elasticities as in footnote [a] of Table 2.
[b] Elasticities as in footnote [b] of Table 2.

and domestic levies are designed to be about equal. If, however, as is suggested in a later section of this paper, the funds from the export levy are paid out in full, then there will be a redistribution effect from producers dependent on the export market to those dependent on the domestic market. However, this effect will be comparatively small.

Effects on Australian Consumers and Taxpayers

Apart from costs within the producing sector, other costs of ensuring greater stability of producer prices need to be assessed. Consumers and taxpayers are other groups to be considered within Australia.

The range of consumer prices in the model fell from 25 c/kg to around 15 c/kg as a result of the policy. This reduction in consumer price variability must necessarily result when the buffer fund policy is operative, because consumer prices are raised when they are relatively low and lowered when they are relatively high. This increased consumer price stability may have a long-run effect of expanding beef consumption.

In order to assess whether total benefits to consumers as a result of the scheme are positive, the consumers' surplus measure was em-

TABLE 4

Expected Change in the Level of Australian Consumers' Surplus with the Introduction of the Buffer Fund Policy ($ million)

	Production (Mt carcase weight)		
	1·5	1·7	1·9
Worst outcome[a]	−0·6	−0·7	−0·8
Best outcome[b]	+66·7	+75·3	+84·1

[a] In this case, the elasticities of demand were −1·25, −0·75 and −1·00 for the domestic demand curve high price, domestic demand curve low price and foreign demand curve all prices situations, respectively.
[b] Here, the elasticities of demand were −0·75 and −1·25 for domestic demand curves at low and high prices, respectively; and −2·00 and −0·25 for foreign demand curves at high and low prices, respectively.

ployed.[9] The effects of the policy on consumers' surplus are shown in Table 4.

From 81 observations obtained by varying the demand elasticity, only one turned out to have a negative effect on consumers' surplus at each level of supply. The most probable outcome would be a small net benefit to Australian consumers as a result of the buffer fund operation. This result occurs because the loss of consumers' surplus caused by the raising of consumer prices at the low end of the price scale is more than offset by the consumers' surplus gain caused by price falls at the upper-price end, when beef is forced back onto the domestic market by the export levy.

The buffer fund policy should have no effect on taxpayers. It is designed to be self-financing. However, if the scheme was commenced under low price circumstances, with more funds distributed than collected, then some form of initial loan would be required. A loss to taxpayers would only then occur if prices did not return to high enough levels to operate the export levy.

Effects on Foreign Consumers

The effects of the proposed scheme on foreign purchasers of Australian beef may be one of the most important elements from the viewpoint of political feasibility. Export prices would be destabilized. The imposition of an export levy when beef prices are high forces them higher. In addition, when low prices prevail, the domestic levy on beef consumption has the effect of an export subsidy. Foreign governments may find these aspects unsatisfactory and may introduce retaliatory trade restrictions.

Using the approach of the preceding section it is possible to measure the effects of the buffer fund policy on foreign consumers' surplus accruing from the purchase of Australian beef (see Table 5).

The implication seems to be that the policy will probably have an almost neutral effect on foreign consumers' surplus given a complete cycle of high and low prices.

TABLE 5

Expected Change in the Level of Foreign Consumers' Surplus with the Introduction of the Buffer Fund Policy ($ million)

	Production (Mt carcase weight)		
	1·5	1·7	1·9
Worst outcome[a]	−19·3	−22·0	−24·5
Best outcome[b]	+46·9	+53·2	+59·5

[a] Elasticities as in footnote [a] of Table 4.

[b] Elasticities as in footnote [b] of Table 4.

[9] The disadvantages of the use of this measure, pointed out especially by Mishan [11] and Currie, Murphy and Schmitz [4], are noted but this appeared to be the only means of estimating consumer benefits.

Policy Evaluation over the Period from 1973/74 to 1976/77

Further evaluation of this policy was carried out using an extension of the model of the beef market described in the previous sections. This model was applied to events over the period from June 1973 to March 1977 in an attempt to discover the probable effects of a buffer fund policy had it been operating during this period. It seems extremely unlikely that the policy would have been introduced at a time when prices were rising during 1973 but it is still considered that there is some value in comparing what actually occurred with what would have happened if the policy had been previously adopted. The period analysed is a convenient one because of the price instability which occurred during it. No supply response effects of the policy are considered. In addition, the scheme could have many different administrative details. Thus, there is is no reason why the price bounds should be 120 c/kg and 145 c/kg.[10]

TABLE 6

Average Retail Price Sydney (c/kg)

Quarter	Actual[a]	With policy	
		Most damped[b]	Least damped[c]
1973–2	134·5	134·5	134·5
–3	145·6	145·6	145·6
–4	154·1	142·2[d]	146·3[d]
1974–1	162·5	149·9[d]	154·2[d]
–2	160·7	149·2[d]	153·8[d]
–3	139·9	129·9[d]	133·9[d]
–4	121·3	121·3	121·3
1975–1	113·5	113·5	113·5
–2	117·7	123·8[e]	119·4[e]
–3	116·1	122·5[e]	117·7[e]
–4	118·9	125·4[e]	120·7[e]
1976–1	124·1	130·9[e]	126·0[e]
–2	123·9	123·9	123·9
–3	126·5	126·5	126·5
–4	130·0	130·0	130·0
1977–1	127·9	127·9	127·9

[a] Source: [13].

[b] In this case, the elasticities of demand were —2·00, —1·00 and —0·75 for the foreign demand curve high price, foreign demand curve low price, and domestic demand curve all prices situations, respectively.

[c] Here, the elasticities of demand were —1·00, —0·25 and —1·25 for the foreign demand curve high price, foreign demand curve low price and domestic demand curve all prices, respectively.

[d] Export levy in operation.

[e] Domestic levy in operation.

[10] It is further assumed that the buffer fund authority is prepared for a price slump having a duration of two years. Therefore, the whole of the domestic levy plus one-eighth of the fund available from accumulated export levies is passed back each quarter of a low price period.

Table 6 shows the actual domestic retail price of beef, quarter by quarter, and the price that would have been observed if the buffer fund policy, with 10 per cent domestic and export levies, had been in operation. Once again the results are shown for different levels of price elasticity of demand. A similar comparison for one set of demand elasticities is shown in Figure 3.

The policy would have had the following effects. In the third quarter of 1973 the average retail price rose above 145 c/kg and the export levy would have been implemented in the following quarter. This 10 per cent levy on exports would have continued until the end of the third quarter of 1974 when prices dropped below the upper bound.

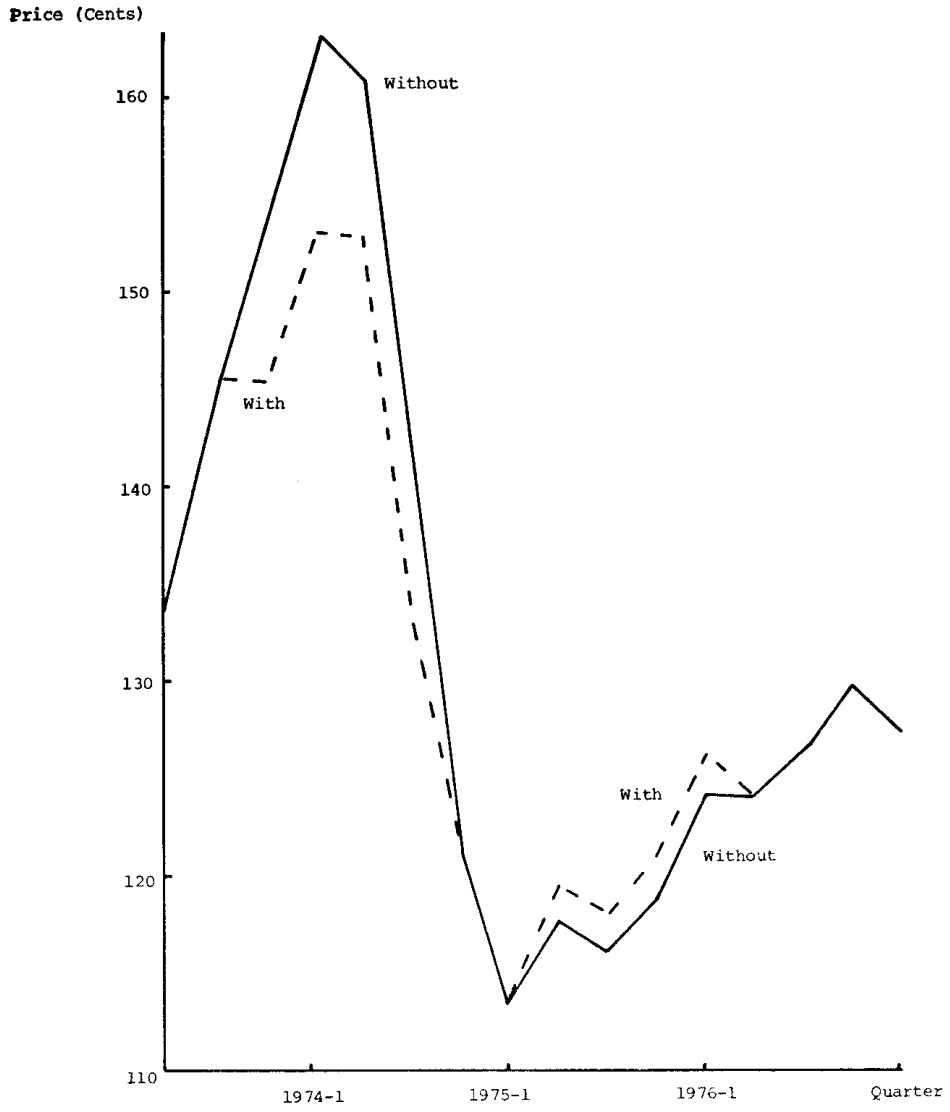

FIGURE 3—Quarterly average retail prices with and without the buffer fund policy. (Demand elasticities are —1·00 for the domestic curve over all prices, and —1·00 and —0·25 for the foreign curve at high and low prices, respectively.)

The lower bound of 120 c/kg was reached in the first quarter of 1975 and the domestic levy would have operated from the second quarter until the end of the first quarter of 1976. During the period when the domestic levy was activated, levy proceeds would have been distributed from the stabilization fund.

From Table 6 it is clear that some stabilizing effect on prices at the retail level would have been achieved. The effects on the stability of gross producer revenue cannot be directly observed because different levels of production between the high and low price period give a distorted view. However, a comparison of the range of revenue per kilogram passed back to the production sector with and without the policy is possible. This comparison is shown in Table 7, which also contains estimates of the effect of the scheme in terms of the reduction in production sector revenue, and of the effects on consumers' surpluses at home and overseas occurring when the policy is imposed on the 1974 to 1976 simulated market. These results seem to confirm the findings of the previous sections.

A further very important statistic is revealed by this analysis. If, in the low price position, annual gross revenue with the policy operating is compared with annual gross revenue without the policy, the increase as a result of the policy is around 1·5 ± 2·0 per cent. Such a rather minimal increase must cast considerable doubt on the effectiveness of this policy in alleviating a low income problem.

This situation arises because of the inelastic nature of the demand curves for beef when its price is low. Indeed, it might be questioned whether some policy other than a buffer fund scheme could be more successful in overcoming a low income problem in such circumstances. For example, a policy whereby the Government purchased beef and destroyed it, or by other means prevented its sale on the commercial market, would improve total returns to the beef industry.

Conclusions

A buffer fund policy for beef and its effects have been outlined and several conclusions can be summarized. It was shown by the analysis

TABLE 7

Effects of the Buffer Fund Policy over the Period 1973/74 to 1976/77

	Without policy	With policy[a]
Range of annual average returns per kg to the production sector between high and low price regimes (c/kg)	34·9	25·0 ± 2·5
Reduction in production sector revenue ($ million)	0	25·1 ± 36·4
Australian consumers' surplus gain ($ million)	0	26·0 ± 34·3
Foreign consumers' surplus gain ($ million)	0	21·6 ± 33·2

[a] Mid-point estimates and range.

that the policy would probably reduce the range of gross revenue expected by the production sector. The costs of this increased stability would involve a loss of less than 5 per cent of total revenue to the production sector. Despite this increased stability effect, it was also shown that the policy would only slightly improve producers' revenue when low prices prevail. Therefore the merits of this policy for alleviating a low income problem seem questionable.

In addition, the model results indicate that a small net benefit would be expected for Australian beef consumers, together with increased consumer price stability. Foreign consumers would be almost unaffected by the policy over a complete cycle of high and low prices, though prices for Australian beef experienced by them would tend to fluctuate more widely than would be the case without the policy. However, a major international problem of the scheme would be the emotive connotations surrounding the words export subsidy and export levy which may detract from its political feasibility.

References

[1] Australian Meat Board, *Annual Report* (various issues).
[2] Bureau of Agricultural Economics, *The Australian Beef Cattle Industry: Submissions to Industries Assistance Commission Inquiry*, Industry Economics Monograph Number 13, Canberra, 1975.
[3] Cameron, B. J. Marketing Reforms in the Beef Industry, Australian Cattlemen's Council mimeographed paper, Canberra, 1975.
[4] Currie, J. M., J. A. Murphy and A. Schmitz, 'The Concept of Economic Surplus and Its Use in Economic Analysis', *Economic Journal* 81 (324): 741-99, 1971.
[5] Dean, G. W. and N. R. Collins, 'Trade and Welfare Effects of E.E.C. Tariff Policy: A case Study of Oranges', *Journal of Farm Economics* 48 (4): 826-46, 1966.
[6] Freebairn, J. W. and F. H. Gruen, 'Marketing Australian Beef and Export Diversification Schemes', *Australian Journal of Agricultural Economics* 21 (1): 26-39, 1977.
[7] Griffith, G. R., 'Sydney Meat Marketing Margins—An Econometric Analysis', *Review of Marketing and Agricultural Economics*, 42 (4): 223-39, 1974.
[8] Gruen, F. H., *et al.*, *Long Term Projections of Agricultural Supply and Demand—Australia 1965 to 1980*, Monash University, Melbourne, 1967.
[9] London, M., Australian Meat Board, Personal Communication.
[10] Main, G. W., R. G. Reynolds and G. M. White, 'Quantity-Price Relationships in the Australian Retail Meat Market', *Quarterly Review of Agricultural Economics* 29 (3): 193-211, 1976.
[11] Mishan, E. J., 'A Survey of Welfare Economics, 1939-59', *Economic Journal*, 70 (278): 197-265, 1960.
[12] Motha, G., T. C. Sheales and M. M. Saad, 'Fluctuations in Australian Rural Production and Prices—Some Implications for Support Policies', *Quarterly Review of Agricultural Economics* 28 (1): 38-48, 1975.
[13] New South Wales Department of Agriculture, Division of Marketing and Economics, *Commodity Bulletin* (various issues).
[14] O'Sullivan, M. H., 'Problems with Elasticity Estimates Applied to Beef Consumption, Australia 1973-1976', paper presented to the Australian Agricultural Economics Society Annual Conference, Brisbane, 1977.
[15] Parton, K. A., 'A Note on Domestic Levy Policy for Beef', *Review of Marketing and Agricultural Economics* 45 (1 and 2): 45-50, 1977.
[16] Queensland Department of Primary Industries, *Proposed Beef Stabilization Scheme*, Brisbane, 1975.
[17] Samuelson, P. A., 'Spatial Price Equilibrium and Linear Programming', *American Economic Review* 42 (3): 283-303, 1952.

[18] Throsby, C. D., 'A Quarterly Econometric Model of the Australian Beef Industry', *Economic Record*, 50: 199-217, 1974.
[19] Tweeten, L. G. and F. H. Tyner, 'The Utility Concept of Net Social Cost —A Criterion for Public Policy' *Agricultural Economics Research*, 18 (2): 33-42, 1966.