THE AUSTRALIAN JOURNAL OF AGRICULTURAL ECONOMICS

VOL. 24 APRIL 1980 NO. 1

ON THE HIDDEN REVENUE EFFECTS OF WOOL PRICE STABILISATION IN AUSTRALIA: INITIAL RESULTS

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A preliminary analysis of demand in eight major OECD wool-consuming countries is used to provide up-to-date estimates of price elasticities of demand for wool. Those elasticities are employed to calculate *ex ante* market prices, assuming no wool price stabilisation in Australia. The computed *ex ante* prices are used in a dynamic simulation to estimate demand and, hence, revenue from wool sales to the eight countries in the absence of reserve price operations in Australia. Based on the preferred semi-log demand curve, the variability of wool prices is estimated to have been reduced by 44 per cent, due to Australian intervention in the market up to 1977/78. However, price stabilisation is estimated to have lowered the revenue from Australian wool sales to the eight countries by $139m, or by 2 per cent, in the period up to 1977/78.

Introduction

Price stabilisation has been one of the major elements of Australia's wool marketing policies during the 1970s. As indicated in the review by Turnovsky (1978), the theoretical literature does not provide unequivocal guidance on the probable distribution of the gains from stabilisation between producers and consumers. In addition, the conclusions of the previous research on wool price stabilisation are largely indeterminate. The bulk of the work was done prior to the existence of Australia's price stabilisation arrangements for wool. Reflecting this, the research generally has been either theoretical or based upon assumed elasticities without direct estimates of elasticities in stock buying and selling periods. These points are illustrated variously in the work of Powell and Campbell (1962), Gruen (1964), Tisdell (1972) and Ward (1978).

Given all these factors, an attempt to measure empirically some of the hidden revenue effects of wool price stabilisation in Australia is reported in this paper. The analysis rests critically on the results of preliminary estimates of an aggregate wool demand function for major wool-using countries within the OECD region.

The eight major OECD wool-using countries included in the analysis are Japan, the USA, Belgium, the Federal Republic of Germany, France, Holland, Italy and the U.K. They account for nearly 45 per cent of total world consumption of raw wool and about 67 per cent of aggregate consumption in non-communist countries. The eight countries also account

* With the usual *caveat*, we are grateful for comments and suggestions made by Robert Bain, Dave Carland, Bill Curran, Geoff Miller, Bob Richardson and anonymous referees.

for 65 per cent of total world raw wool imports. More importantly in the context of this paper, the eight countries take some 70 per cent of Australia's raw wool exports.

Estimates of intertemporal movements in the demand elasticities for the eight countries were used to calculate the price impacts of market support purchases and sales by the AWC and its predecessor to the end of 1977/78. Those estimates were employed in a dynamic simulation of demand in the eight countries, assuming no price stabilisation in Australia. The difference between the intervention (*ex post*) and non-intervention (*ex ante*) streams of revenue (price times quantity) from sales to those countries was calculated. That difference indicates the extent of hidden revenue losses or gains over the period of the analysis from sales to those countries due to price stabilisation in Australia.

Theoretical Background

There is already an extensive literature on the profitability of buffer stockholding operations for wool and on the revenue and welfare effects of such schemes. Powell and Campbell (1962) and Gruen (1964) have distinguished between the profitability of a buffer stock scheme, from the administering authority's viewpoint, and the effects on producer/consumer surplus and revenue gains and losses. As demonstrated by Gruen, it is possible to operate such arrangements profitably without increasing producers' surplus. The only condition is that demand must be more price elastic when the stockholding authority is selling than when it is buying.

In a more general vein, the work of Waugh (1944) and Oi (1961) has been integrated by Massell (1969). He showed that, with linear functions, the source of price variability will determine whether there are gains or losses to producers, as measured by producers' surplus. In particular, producers will lose (gain) from price stabilisation if price variations are due to fluctuations in demand (supply). Alternatively, if price variations stem from both demand and supply fluctuations, the distribution of the gains from stabilisation will depend on the variability of supply and demand and on the slopes of the two curves. Tisdell (1972, 1973) and Chapman and Foley (1973) discussed cases in which there could be total revenue losses due to price stabilisation.

Subsequently, the theoretical analysis has been extended to nonlinear systems. In particular, Turnovsky (1974, 1976) has shown that, for multiplicative and additive disturbances (shifts in the demand and supply schedules), nonlinear supply and demand systems can produce welfare results different from those obtained from linear models. More recently, Campbell and Carland (1978) have extended the nonlinear analysis to a semi-log demand/supply system with additive disturbances. They show that the linear results also apply in the semi-log case with demand instability, that is, in the case of a demand function essentially the same as the preferred form presented in this paper. However, Campbell and Carland also indicate that, compared to the linear case, a switching of the losses/gains, could occur if the buffer stock authority were stabilising for supply variations.

It has been shown by Motha et al. (1975) that, over the period 1960/61 to 1972/73, the variability of Australian wool prices[1] was 3.7 times greater than the variability of Australian wool production. This suggests that demand fluctuations are the major source of variance in wool prices. This inference is supported by the fact that the coefficient of variation of annual world wool production (a supply shifter) was only 4 per cent over the period 1965/66 to 1977/78, while that for a quarterly index of fluctuations in economic activity (a wool demand shifter) was 31 per cent. Further evidence is provided by the relative success obtained by Hussey (1972) and Dalton and Taylor (1975) in using explicit demand shift variables in price projection equations. In the case of wool, therefore, demand shifts appear to be the major source of price variance.

Even the latter result and the Campbell and Carland conclusions combined with the preferred functional form presented in this paper do not, as Edwards (1979, p. 4) said, provide wool policy analysts with '. . . instant enlightenment in the theory of price stabilisation'. The reason is that, in addition to all the factors mentioned previously, the effects of price stabilisation on producers also depend on producers' attitudes to risk, on its effects on private storage and on the way producers form their price expectations. Presumably, the method by which wool processors form expectations is also relevant.

The possibility of producer gains from wool price stabilisation has been raised in two recent studies. Ward (1978) reached the judgment that there had been net revenue gains to growers from the market support activities of the AWC over the period 1974/75 to 1977/78. However, he assumed constant elasticities between buying and selling periods. This is thought to be a restrictive assumption. In addition, Ward does not appear to have specified a functional form for his analysis. Brook et al. (1978) concluded that producers would achieve revenue gains from wool price stabilisation. However, their conclusions were based on a linear supply and demand system, the theoretical relevance of which is questioned later. Also, they implied that, on an annual basis, supply was more variable than demand. But this conclusion does not appear to be consistent with the evidence presented in this paper and Brook et al. made no effort to examine explicitly the demand and supply shifters.

Assumptions and Methodology

Given a completely disaggregated model of the world wool market, calculations of the hidden revenue effects of stabilisation would be based upon direct estimates of the price elasticity of demand for Australian wool and of the relevent flexibility. Since up-to-date estimates of these parameters were not available, a more limited procedure was employed. Briefly, it was assumed that the estimated quarter-by-quarter own-price elasticities of demand for wool in the eight countries equalled the aggregate world elasticities. The reciprocals of the elasticities were used as estimators of price flexibilities which, together with data for net changes in AWC stocks, were employed to calculate the price effects of the Corporation's market interventions. That is:

$$(1) \qquad PW_{ea} = PW_{ep} - PW_{ep} f \Delta QS/QS$$

[1] The 'price' series used in the analysis were the unit gross values of production derived by dividing the total value of the clip by production.

where PW = price of wool, while *ea* and *ep* stand for *ex ante* and *ex post*, respectively;
f = price flexibility;
ΔQS = net change in AWC stocks;
QS = total world wool production.

Finally, the computed *ex ante* prices were used in dynamic simulations of the eight-country demand for wool over the period 1971:I to 1978:II, assuming no price stabilisation in Australia. The results of the analysis are necessarily dependent on the estimated demand models and on a number of simplifying assumptions.

The demand functions used

The demand functions used in this analysis were based on a preliminary single equation model of the aggregate demand for wool at the mill level in the eight main OECD wool-using countries. The model was based on the assumption that wool is an homogeneous commodity, and it was estimated using quarterly data over the period 1965:IV to 1978:II.

The time between the purchase of wool at auction and the sale of finished goods to consumers is about one year (AWC 1973). If the initial design and styling stages are included as well, the total processing span may extend to two years (NEDO 1976). Also, the greasy wool bought at auction in a particular quarter would not enter mill consumption until about one period later, due to the shipping time involved (Bell 1978). Because of these dynamic elements in the wool market, mills cannot know with certainty the final demand for their products when buying raw wool. It was postulated, therefore, that auction purchases are determined initially by expected levels of demand (QDW^* – based upon past mill consumption) and by the prices of wool (PW) and man-made fibres (PS). It was hypothesised also that, while mills generally process their raw wool through to top or yarn stage, actual levels of consumption are influenced by current economic conditions ($DFWW$). Based on these considerations, the theoretical model took the following general form:

$$QDW = f(PW_{-i}, PS_{-i}, DFWW, QDW^*) \tag{2}$$

$$QDW^* = \sum_{i=1}^{n} W_{-i}\ QDW_{-i} \tag{3}$$

where W_{-i} are the relevant weights for QDW_{-i}.

Because mill consumption (QDW), not auction demand, was the dependent variable, the wool and man-made fibre prices were lagged one quarter. Three dummy variables were also introduced to account for one-off occurrences over the estimation period. Detailed specifications for the dummy and other variables used are provided in Table 1.

Because the true nature of the demand function was not known, linear, semi-log and log-linear versions were estimated. Of these, the semi-log specification is the preferred one.

There are compelling microeconomic reasons for rejecting a linear aggregate demand curve for the wool textile industry. The industry consists

TABLE 1

Notation Used in Estimated Demand Model

Notation	Definition	Units/comments
QDW	Mill consumption of raw wool in the eight major OECD wool-consuming countries—seasonally adjusted	kt
*QDW**	Planned mill consumption	$\sum_{i=1}^{3} QDW_{-i} . W_i$ $W_1 = 0.57$ $W_2 = 0.29$ $W_3 = 0.14$
PW	Australian clean wool price indicator specified as the quarterly average of Australian greasy prices converted to clean equivalents by adjusting for seasonal variations and changes in yield	Ac/kg converted to an index in terms of currencies of major OECD wool-using countries
PS	U.S. man-made fibre price, defined as the reported average market price for 1.5 denier polyester staple for cotton blending	USc/lb converted to index form as for *PW*
DFWW	Wool-trade weighted diffusion index of economic activity in the six major OECD wool-consuming countries	Weights derived from average Australian exports
*D*1	Dummy variable to take account of the U.K. dock strike in 1968/69	*D*1 = 1 in 1968:IV; 1 in 1969:I; zero elsewhere
*D*2	Dummy variable to take account of the Australian storemen and packers' strike	*D*2 = −1.0 in 1976:II; 0.5 in 1976:III; 2.0 in 1976:IV
*D*3	Dummy variable to allow for effects of the Japanese worsted spinners' cartel	*D*3 = 1 in 1977:III; zero elsewhere

of a number of firms operating under different scale and efficiency conditions. For the aggregate demand function to be linear, each individual firm's demand curve would need to be linear and identical in both intercept and slope. Such a restrictive condition, imposing equally limiting constraints on the production functions of wool-processing firms, is considered unrealistic. Also, the assumption of constant elasticities (the log-linear model) over widely fluctuating economic conditions in the wool textile industry is considered naîve.

By contrast, the semi-log specification does not imply the same restrictive conditions. Moreover, it allows for price threshold effects, which have been suggested by S. F. Harris (personal communication 1971) and discussed by McKenzie et al. (1969). The price threshold assumption rests on the hypothesis that mills substitute between fibres mainly in response to significant shifts in price relativities. Despite the theoretical preference for the semi-log version, when the different variance of the dependent variable of each equation was taken into account, the residual sums of squares from the three equations were not significantly different (Rao and Miller 1971, pp. 108-11).[2]

[2] We are grateful to Bruce Whittingham for drawing this test to our attention.

The construction of QDW^* posed two empirical problems. The precise nature of the lag was not known and there were no prior estimates of its length. It was expected, nevertheless, that a naîve type of expectations formulation would be appropriate, with mills giving most weight to their most recent levels of throughput. For the preferred semi-log model, the weights were obtained by testing a generalised Pascal distribution (Kmenta 1971, pp. 487-92). These distributions allow for geometrically declining weights as well as inverted-V shapes. After some testing, it was found that a type of simple geometric lag over three quarters gave the 'best' results. The estimated weights are specified in Table 1. The same lag length and weights were used in the linear and log-linear equations. The estimated equations are presented in Table 2.

In all the equations, the signs of all coefficients are as suggested by theory. The models simulate well and analysis of the roots of the characteristic equations indicates they are stable. The correlograms suggested the presence of autocorrelation.[3] Accordingly, the equations were corrected for first-order autoregressive disturbances using an iterative Cochrane-Orcutt procedure (Pagan 1974) which appears to have overcome the problem.

The mean own-price elasticity of demand for wool estimated from the semi-log equation is -0.12. The cross elasticity with respect to prices of man-made fibres is $+0.08$. These estimates indicate that mill demand is price inelastic in the short run, a result which is in line with the estimates of Horner (1952), Philpott (1955) Donald, Lowenstein and Simon (1963), Emmery (1967), Witherell (1967), Duane (1973), Smallhorn (1973) and Gardiner (1975). The comparable elasticities from the linear and log-linear models are given in Table 3. The estimated period-by-period elasticities show some upward trend and, on inspection, demand was found to be generally more elastic in times of low demand and more inelastic in times of high demand.

TABLE 2

Summary of Results[a]

Model	Const.	PW_{-1}	PS_{-1}	$DFWW$	QDW^*	ϱ	R^2	s.e.
Linear	48.84 (3.51)	−0.10 (4.92)	0.23 (2.29)	0.57 (3.30	0.67 (9.59)	−0.44 (2.79)	0.96	5.81
Log-linear[b]	1.89 (5.18)	−0.13 (5.66)	0.07 (2.59)	0.14 (5.25)	0.63 (10.08)	−0.37 (2.35)	0.97	0.03
Semi-log[b]	101.90 (2.77)	−21.88 (4.56)	14.21 (2.65)	0.63 (3.49)	0.66 (8.85)	−0.44 (2.74)	0.96	5.93

[a] t values in parentheses; DW is not shown because it is an inappropriate test for this form of model; the results for $D1$ to $D3$ were similar and are not shown; estimation period 1965:IV to 1978:II.

[b] For the log-linear model, all variables in ln except $D1$ to $D3$; for the semi-log function, PW and PS in ln.

[3] The Durbin-Watson statistic does not provide an appropriate test with lagged dependent variables and it was felt that the h statistic would also be unsuitable due to the nature of the lag used.

TABLE 3

Comparison of Elasticities: Three Functions

Functional form	Elasticity[a]			
	Own-price *PW*	Cross-price *PS*	Economic activity *DFWW*	Expected demand *QDW**
Linear	−0.11	0.07	0.10	0.68
Semi-log	−0.12	0.08	0.12	0.66
Log-linear	−0.13	0.07	0.14	0.63
	(0.02)	(0.03)	(0.03)	(0.06)

[a] At the means of the data. Figures in parentheses are standard errors relevant to the log-linear coefficients.

Three attempts were made to verify the latter result because it is critical in estimating the *ex ante* prices and, hence, the net hidden revenue gains and losses. First, the preferred equation was estimated using data for 1970:IV to 1978:II. Second, a dummy variable was introduced to allow for changes in the coefficient on *PW* between buying and selling periods. Third, the data from 1970 to 1978 were partitioned to derive completely separate functions for buying and selling periods. The first two estimations indicated that the coefficients are generally stable, with that on *PW* highly stable. In the latter case, all the estimated coefficients on *PW* lie within the range plus and minus one standard error of the mean coefficient on *PW* in the full sample function. All the tests confirmed the judgmental conclusion, based on the whole-period equation, that the own-price elasticity is numerically higher in periods of low demand and vice versa. Based on the elasticity estimates in Table 4, the use of some form of partitioned function probably would have resulted in lower estimates of the hidden revenue gains than those obtained from the whole-period equation, with estimates of the losses largely unchanged.

Major assumptions

The analysis rests on five major assumptions. In terms of the computations outlined in this paper, the two critical ones are that the estimated eight-country elasticities equal the 'world' elasticities and that the reciprocals of the elasticities equal the price flexibilities.

Given that there are no recent estimates of demand elasticities for the world, the revenue estimates in the preferred semi-log case were parametrised for different estimates of price impacts based on varying the elasticities used. 'Higher' and 'lower' bounds of the eight-country and, given the assumptions, the world elasticities were obtained by taking a range on the coefficient on *PW* equal to its mean value plus and minus three standard errors. As a result, the alternative revenue computations were based upon differing price impacts derived from assumed world elasticity sets with means ranging from a 'low' −0.04, to a 'mean' −0.12, to a 'high' −0.20. This range almost covers Duane's elasticity of −0.22 for the 'rest of the world' other than the USA. This parametrisation can be interpreted alternatively as providing approximate

TABLE 4

Coefficients on PW and Buying and Selling Elasticities[a]

Form of model/ estimation period	Coefficient on *PW*			Elasticity[b]		
	Buying	Selling	Mean[c]	Buying	Selling	Mean[c]
Semi-log						
– 1965:IV to 1978:II	na	na	– 21.88 (4.79)	– 0.14	– 0.13	– 0.12
– 1970:IV to 1978:II	na	na	– 24.28 (2.36)	– 0.15	– 0.14	– 0.15
– 1970:IV to 1978:II Slope dummy	– 25.27 (2.32)	– 24.34	na	– 0.16	– 0.14	na
– 1970:IV to 1978:II Buying	– 30.56 (2.54)	na	na	– 0.19	na	na
– 1970:IV to 1978:II Selling	na	– 23.05 (3.87)	na	na	– 0.13	na
Linear						
– 1965:IV to 1978:II	na	na	– 0.10 (0.02)	– 0.14	– 0.13	– 0.11
Log-linear						
– 1965:IV to 1978:II	na	na	– 0.13 (0.03)	na	na	– 0.13

[a] 'Buying' and 'selling' refer to periods of net purchases and sales, respectively, by the AWC. Figures in parentheses are standard errors.
[b] Computed at data means.
[c] Mean over entire estimation period.
na not applicable.

confidence bounds for the price stabilisation and hidden revenue estimates for the 'mean' world elasticity set derived directly from the mean value of the coefficient on *PW* in the eight-country equation.[4].

Because the Wool Corporation's activities result in movements along the demand curve at any particular time, arc and not point elasticities/flexibilities should be used to derive the estimates of *ex ante* prices. This presented no problems for the log-linear model and arc elasticities/flexibilities were estimated in the semi-log case. However, this was not possible for the linear function. In the latter instance, therefore, the simulations tend to overstate hidden revenue gains and understate losses from sales to the eight countries.

Meinken, Rojko and King (1956) argued that the reciprocal of the elasticity equals the price flexibility only if there are no cross-price effects. However, Houck (1965) demonstrated that the smaller the cross effects, the closer will be the estimates of elasticities (flexibilities) derived from taking the reciprocal of equation estimates of flexibilities

[4] It would have been possible to derive estimates of the relevant Australian elasticities and flexibilities using market shares. However, the calculation of price impacts would have changed and would effectively have cancelled out the former computation. Consequently, the more direct approach described was used.

(elasticities). That is, with cross effects, the reciprocal of the elasticity is the lower bound estimator of the flexibility.

Because of the small cross effects estimated in all the equations, it is likely that any bias will be small, though the degree of this could be time variant. Note that, based on work by Buse (1958), Colman and Miah (1973) discussed situations in which the inverses of flexibilities and elasticities may not be biased estimates of each other.

Three other assumptions underlie the analysis. These are that, on a global basis, price stabilisation has not shifted the supply function nor resulted in significant movements along it; has not shifted the demand curve; and has not caused any significant change in stockholding by the trade. At this stage it is impossible to confirm or reject these three assumptions conclusively. Given the first assumption, no allowance has been made for variations in supply due to the differences between the *ex ante* and *ex post* wool prices.

If price stabilisation has reduced commercial stockholding, both the estimates of the price stabilising and net hidden revenue effects of Australia's reserve price operations will be overstated. Although the mean stock/consumption ratio has fallen since 1970/71, the decline could be due as much to increased costs of stockholding (e.g. interest rates) as to the existence of buffer stocks in Australia. Moreover, the correlation between quarterly commercial stocks and consumption is a high +0.9, and the variance of the ratio is small (1965:IV to 1978:II mean of 0.78 and variance 0.004). Consequently, it appears that the transactions motive has been a major reason for holding stocks.

Price stabilisation might be expected to shift the demand curve outwards if wool processors are risk averse. This type of result has been argued by the AWC (1973) in relation to interfibre competition. But merchant topmakers have existed to provide arbitrage in the wool industry. Also, the stabilisation of prices tends to destabilise the throughput levels of mills (Ward 1978) which might tend to shift demand backwards. Whether the net effect of these sorts of factors is positive or negative for demand is unknown. In any case, the demand equations all tend to simulate well, apparently without any need for explicit measures of price variability. Moreover, the intercepts and the coefficients on PW in the whole period and Australian price stabilisation period estimates of the preferred semi-log demand function are stable. This suggests that, if price stabilisation has shifted the demand curve, the movement has probably been small.

Judging by Australian data, the failure to allow for short-run supply effects would also not influence the results greatly. Work by Dalton and Lee (1975) and by Reynolds and Gardiner (1979) indicates that price variability has not been a significant supply shifter, at least given the measures of variability used. Moreover, the research by these authors and that by Powell and Gruen (1967) and Malecky (1971) indicates that wool supply is price inelastic on an annual basis. It would be particularly so on a quarterly basis. If wool supply is elastic in either the short or long run, failure to allow for supply changes would probably tend to magnify the estimates of the net hidden effects of price stabilisataion. As indicated previously, however, the outcome would also depend on the nature of the supply curve and on the way in which wool growers form price expectations.

Simulation Results

The actual and *ex ante* prices, in Australian dollars, are presented in Figure 1 for the semi-log case. It is clear that market intervention was successful in restraining the level of prices during the boom of 1972/73 and held up the market during 1970/71 and 1974/75, particularly in the latter season. During the period 1970:IV to 1978:II, the operations of the AWC and its predecessor are estimated to have resulted in a 44 per cent decrease in the overall variability of auction prices as indicated by the coefficients of variation computed for the actual and nonintervention price series derived from the semi-log function. The simulation under high world price elasticities results in an estimated reduction of 22 per cent in price variability due to market intervention. As indicated previously, the latter simulation can be interpreted as providing an approximate confidence bound for the estimate obtained from using the mean value of the coefficient on *PW* in the semi-log function. The price variability and net revenue effects calculated from the various functions are shown in Table 5.

The lower bound elasticity estimates of the revenue effects due to stabilisation are not presented in Table 5. Use of these elasticities resulted in some negative *ex ante* price estimates (see equation (1)) suggesting that the world elasticity has not been so low.

The revenue effects of the AWC's market intervention were assessed by comparing the simulated eight-country demand under nonintervention prices with an historical simulation over the period 1970:IV to 1978:II which was used as a control solution. The revenue effect was computed as the difference between the alternative streams of the values of wool consumed by the eight countries. The net effects on Australian sales were obtained by simply summing the same proportions of the estimated total losses and gains as the shares of Australian exports to the eight countries in their consumption. Data on their consumption of Australian wool are not available.

TABLE 5

Effects of Wool Market Intervention in Australia

	Changes due to stabilisation				
		Hidden revenue			
Form of model	Price variability[a]	Total sales	Australian sales	Mean price[b]	Mean quantity[b]
	%	$Am	$Am	c/kg clean	kt clean
Semi-log:					
– medium[c]	–44	–199	–139	3	–7
– high[c]	–22	–93	–65	1	–3
Linear	–51	261	182	3	–1
Log-linear	–50	–113	–79	10	–12

[a] Percentage differences between coefficients of variation.
[b] Quarterly.
[c] Medium and high refer to the own-price elasticity sets used to compute price impacts. Note that the hidden revenue totals are derived from seasonally unadjusted values for *QDW*.

FIGURE 1 — Price Impacts of Market Intervention.

In the semi-log case, the estimated net hidden revenue loss essentially arises from the fact that the price elasticities employed in the analysis are higher and lower, respectively, in periods of low and high demand. The converse applies to the flexibilities used. For the semi-log function, the revenue losses shown in Table 5 would probably be lower bound estimates. The reciprocal of the elasticity is a lower bound estimator of the flexibility. As is evident in the table, the higher the flexibility on average, the greater the calculated revenue losses. An average annual discount rate of 30 per cent would have been required to equalise the two streams of revenue in the 'medium' elasticity case. In that instance, the net hidden revenue loss to Australian sales is computed at $139m. This is equivalent to about 2 per cent of the value of the *ex ante* revenue stream from sales to the eight countries up to 1977/78.

Based on work by Gruen (1964), the net hidden revenue loss calculated for the log-linear (constant elasticity) model is somewhat surprising, especially as about 0.9 million bales were still in stock at the end of that period. The computed loss results from the fact that supply was not constant over the period and from the dynamics of the model. The net gains calculated with the linear model reflect the fact that the estimated flexibilities have a strong downward trend, from as high as -19 in the early 1970s to around -4 to -6 in 1977/78. In the linear case, a negative *ex ante* price was computed in 1971:IV (set at zero for the simulations), certainly magnifying the revenue gain due to stabilisation in that period. As stated before, the gains and losses in the linear case tend to be overstated and understated, respectively, due to the failure to use arc flexibilities.

Reserve price operations are estimated, for the semi-log model again, to have had three other effects. As suggested by Ward (1978), market intervention, while stabilising prices, has destabilised consumption. The coefficient of variation of consumption in the control/intervention situation is computed to be 1.1 per cent higher than in the 'medium' world elasticity/flexibility case with no intervention. Market intervention, in the 'medium' case again, is also estimated to have reduced average quarterly wool consumption by 4 per cent and raised the average price by 1 per cent. However, given the limiting assumptions which underpin the estimates, these changes are too small to be considered significant.

Concluding Comments

There are two major conclusions arising from the analysis presented in this paper. The first is that the Australian buffer stock/reserve price operations have reduced the variability of auction prices. The second is that, most probably, this reduced price variability has been won at a net cost to revenues from wool sales. The net revenue losses calculated from the nonlinear models will have been magnified by the sale of the 0.9 million bales still held by the AWC in June 1978. It is also probable that the hidden revenue loss from those sales will have offset the gains to the end of 1977/78 estimated from the linear function. The price stabilisation activities in Australia have also resulted in net operating costs amounting to $91m over the 1974/75 to 1977/78 period (see, for example, Ward 1978). This net cost is the result of larger operating charges (interest, storage) outweighing wool trading surpluses (selling price minus purchase price). The Corporation's operating profit of $24m in 1978/79 (AWC 1979) has not offset this net cost.

The analysis in this paper has been confined to price stabilisation in Australia and to the effects of this on wool revenues from a group of eight major OECD wool-using countries. Price stabilisation schemes also exist in New Zealand and South Africa. In those countries, reserve prices have been adjusted broadly in line with the movements of reserves in Australia and their marketing authorities have been net buyers and sellers in roughly the same periods as have the authorities in Australia. It seems reasonable to assume, therefore, that, if price stabilisation activities in these two other major exporting countries had been taken into account, the estimated reduction in price variability would have been greater than that due to the operations in Australia alone. The estimates of net hidden revenue effects would have been affected also. In addition, it is possible that there have been net 'hidden' losses from sales to countries other than the eight considered here.

In interpreting these results, it must be recognised that the analysis has limitations. Moreover, it has focused on only two aspects of price stabilisation, namely price stability and hidden revenue effects. As discussed by Harris et al. (1974), price stabilisation can have other effects. These centre on efficiency, equity and welfare issues. For example, price stabilisation policies can shield producers from dramatic and short-term falls in demand and prices. Adjustments to such short-run situations can be inefficient in the longer term for individual producers as well as for the wider community. This possibility has, in fact, been recognised by legislative action, such as emergency assistance to wool growers in 1970/71. However, if price stabilisation has beneficial effects of this nature, any net hidden revenue losses could work in the opposite direction, though not necessarily in such an obvious way.

Price variability can also lead to capital rationing on both sides of the credit market. In addition, price stabilisation may result in greater equity between producers who sell at different times. Finally, risk-averse producers would probably be prepared to pay for price stability. In the latter context, the issue for wool growers, and the wider community, is whether the insurance premiums potentially paid for price stabilisation are warranted by the price risk cover purchased and by any other benefits which may arise.

It is in the latter area that this paper is seen as making its main contribution. In a field where few quantitative estimates of the effects of wool price stabilisation based on the actual performance of such schemes are available, an attempt has been made to provide such estimates. Those estimates suggest that Australia's reserve price schemes have stabilised prices but that this result has probably been achieved at a net cost to sales revenue.

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