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THE MERINO EXPORT EMBARGO — A COMPARATIVE STATIC ANALYSIS

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The genetic changes which would occur in overseas flocks as a result of the export of merino rams from Australia are unknown. Even so, Australia recently relaxed the merino export embargo and may go further. A comparative static model is presented to assess changes in annual wool income resulting from increases in the supply of apparel wool emanating from possible levels of the genetic effect.

Introduction

In March, 1969, the relaxation of the merino export embargo was announced.[1] While the relaxation is limited to 300 rams in the first year, there is provision for annual review and the possibility remains that the embargo may be completely lifted. One implication behind the annual review is that if market conditions for wool are buoyant and prices satisfactory we could well expect further relaxation.

The current permissible level of ram exports is unlikely to have a noticeable effect on world wool supplies [1]. However, complete relaxation of the embargo emerges as a policy problem of some magnitude which requires a thorough analysis of the arguments for the relaxation of the ban.

The central propositions put forward for relaxation of the embargo run as follows:

'(a) The growing competition from synthetic fibres, a factor which did not apply when the embargo was imposed, makes it essential that both *quality and availability of apparel wool should be improved on a world-wide basis*, for otherwise wool's place could be taken by these other fibres. This has already occurred to some extent.

(b) The world demand for textile fibres is expanding faster than wool production and wool's share of the world fibre market is

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1 The details of the relaxation given in the announcement [2] are as follows:

(i) Export approvals will be issued only for merino rams that have been sold at public auction sales nominated by the State member associations of the Australian Association of Stud Merino Breeders.

(ii) The prohibition of the export of merino ewes and semen will be continued.

(iii) A prohibition will be placed on the export of fertilized merino ova.

(iv) Not more than 300 rams will be allowed to be exported in the first 12 months from the date on which the relaxation has been made effective.

(v) Conditions (i) and (iv) will be reviewed annually to the Australian Wool Industry Conference which will recommend to the Government any alterations it may consider desirable [2].

diminishing. There is a danger, therefore, that wool will become an insignificant raw material as compared with other textile fibres with the result that textile manufacturers will take little account of wool in planning their production. *Relaxing the embargo should help to counteract this trend by assisting to increase world production of good quality apparel wool*'. [2]

The first part of the argument suggests that quality improvements in world apparel wool arising from genetic changes will raise revenue in this sector of the world wool market. Certainly a quality change *per se* may well have this effect. However, the implication that increased supplies of apparel wool will increase revenue suggests either an elastic or positive price elasticity of demand for world apparel wool. Alternatively, the proponents of relaxation suggest that supply and demand are interdependent with increased supply shifting the demand curve outwards. The implication of this argument is that processors will tend to retool with flexible plant capable of processing wool or synthetics if suitable quality wools are not available. If supplies of quality wools are available processors will, according to this argument, retool with inflexible machinery. In the context of current textile technology this argument does not appear to be very strong. In this article no account is taken of demand shifts of any kind.

The net effect of the supply change in world apparel wools will have varying effects on world wool producers as a whole, on Australian woolgrowers, and on wool producers in 'the rest of the world'.

On the cost side, opponents of relaxation have argued that the price of flock rams will rise and thereby increase woolgrowers' costs.

With no change in the supply of stud rams it is likely that their price would rise as a result of increased demand following the entry of overseas buyers into the market. However, complete inelasticity of supply for stud rams is a very strong assumption which could only hold in the short run. Further, the demand for flock rams will be more elastic than the demand for stud rams which is derived from the former. Consequently, a given percentage reduction in the supply of stud rams for the home market will have a smaller effect on flock ram prices and on total costs at the flock level than at the stud level. However, a price increase only requires that supply is not perfectly elastic. While the available evidence [1, p. 5] suggests that the supply of stud rams is very elastic it is worthwhile to give some consideration to the effect of price increases on woolgrowers' costs.

On a 'typical' [3] [4] Australian sheep property total annual costs are approximately $30,000 and annual ram costs are approximately $1,750 which represents about 5% of total costs. A large change in the ram price of 20% will mean an increase in total costs of slightly over 1.1%. For a more feasible 10% change in flock ram prices the change in total costs is reduced to 0·6%.[2]

[2] The point at issue is not the accuracy of such calculation but their order of magnitude. Admittedly, these costs are an amalgam of the experience of farm consultants and some studies of actual farms and may not be truly representative, but any divergences are likely to have little effect on the change in total costs occasioned by higher ram prices and, in these estimates I have, if anything, erred on the side of overstating the size of the increase.

There is, in addition, some flexibility in the percentage of rams in flocks and it seems reasonable to suggest that where this is at about 2·5% it could be reduced to 1·75% with safety but involving some small additional veterinary and management costs.

2. *A Simple Model*

In Figure 1 a simple comparative static model is presented to demonstrate the effect of a supply increase in world apparel wool supplies. The proportionate increase (Δ) in world wool supplies is assumed to result from an increase in the supply of apparel wool produced by non-Australian sources as a direct outcome of a unique genetic effect on production (δ) of imported Australian merinos.

The curve *DD* is a schedule of annual quantities of apparel wool demand by users of raw wool at various price level. *SS* is the short-run supply function assumed to be perfectly inelastic and representing the annual supply of apparel wool available from all sources prior to the relaxation of the merino ban. Both functions are presented as linear in logs. When other countries import merinos, supply increases in these countries by δ and on a world basis Δ, resulting in a new supply function S^*S^*.

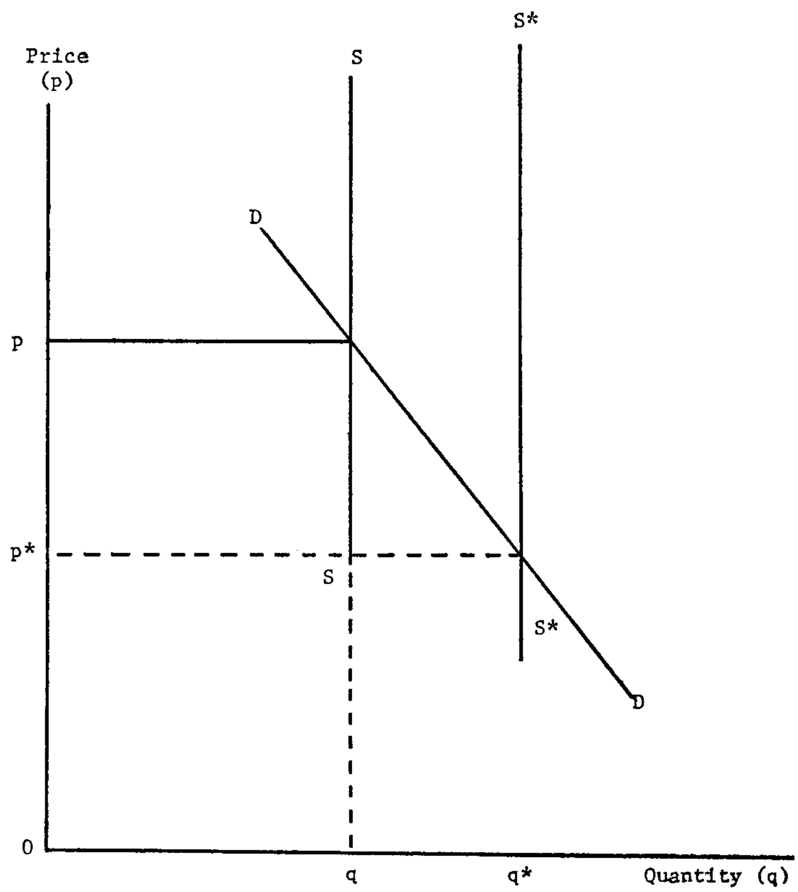

FIG. 1.—World apparel wool market with inelastic supply (logarithmic scales).

The demand function DD may be simply specified as

(2.1) $$q = \alpha p^{\eta}$$

where q is the quantity of world apparel wool sold at price p, α is some constant and η is the price elasticity of demand.

The revenue (R) derived from the quantity (q) of wool sold at price p is given by

(2.2) $$R = qp = (q/\alpha)^{1/\eta}q.$$

With a supply shift (an increase in apparel wool supplies) occasioned, in this case, by the genetic improvements afforded to woolgrowers in the rest of the world, revenue may be expected to change to R^*.

(2.3) $$R^* = (1 + \Delta)qp^* = [(1 + \Delta)q/\alpha]^{1/\eta}(1 + \Delta)q$$

where q, p and η are as before and Δ is the proportionate increase in the world supply of wool emanating from the genetic improvement in the flocks of non-Australian producers. Australian supply is assumed to be constant as between the initial period and the new period.

The ratio of world apparel wool revenue after the change (R^*) and the previous revenue (R) can now be specified as

(2.4) $$R^*/R = (1 + \Delta)(1 + \Delta)^{1/\eta}.$$

For an Australian share of the apparel wool market of 40% [11]

$$\Delta = (q^* - q)/q = .4 + .6(1 + \delta) - 1 = .6\delta$$

where δ is the proportionate change in the 'rest of the the world' supply of wool as defined previously, and

(2.5) $$R^*/R = (1 + .6\delta)(1 + .6\delta)^{1/\eta},$$

$(1 + .6\delta)$ may be termed the genetic effect

and

$(1 + .6\delta)^{1/\eta}$ the price effect.

Analogously, attention can be focused on Australia. In the following expressions the subscript $_A$ denotes Australia.

R_A = Australian revenue in period 1
R^*_A = Australian revenue in period 2

$$R_A = pq_A.$$

Since Australian supply is assumed constant

$$R^*_A = p^*q_A$$

(2.6) $$R^*_A/R_A = p^*/p = (1 + .6\delta)^{1/\eta}.$$

Note from (2.2) and (2.3)

$$p^*/p = [q(1 + \Delta)/\alpha]^{1/\eta}/(q/\alpha)^{1/\eta} = (1 + .6\delta)^{1/\eta}$$

and for countries other than Australia, denoted by the subscript $_O$,

$$R_O^*/R_O = p^*q_O^*/pq_O$$

(2.7) $$R_O^*/R_O = (1 + .6\delta)^{1/\eta}(1 + \delta).$$

3. *A More General Model*

The absence of any supply response to changing prices is a strong assumption which may be relaxed to make the model more general.

Figure 2 shows the more general situation where some allowance for price elasticity of supply is made. The revenue ratio R^*/R can still be derived as before. However, it is necessary to introduce supply explicitly into the system to determine the new equilibrium when the genetic improvement in flocks outside Australia takes effect.

The supply function S_1S_1, an aggregate of the supply response in Australia and the rest of the world, takes the form

(3.1) $$q_S = \beta_A p^\gamma + \beta_o p^\gamma = p^\gamma \, (\beta_A + \beta_o)$$

where β_A and β_o are supply constants. The price elasticity of supply (γ) is assumed uniform as between Australia and the rest of the world and constant as between periods before and after the introduction of the genetic shift in the supply of overseas producers.

As before, the static demand function, DD, may be represented by

(3.2) $$q_D = \alpha p^\eta.$$

For market clearance at the original equilibrium

(3.3) $$q_D = q_S = q.$$

Hence at equilibrium from (3.1) and (3.2)

$$\alpha p^\eta = p^\gamma \, (\beta_A + \beta_o)$$

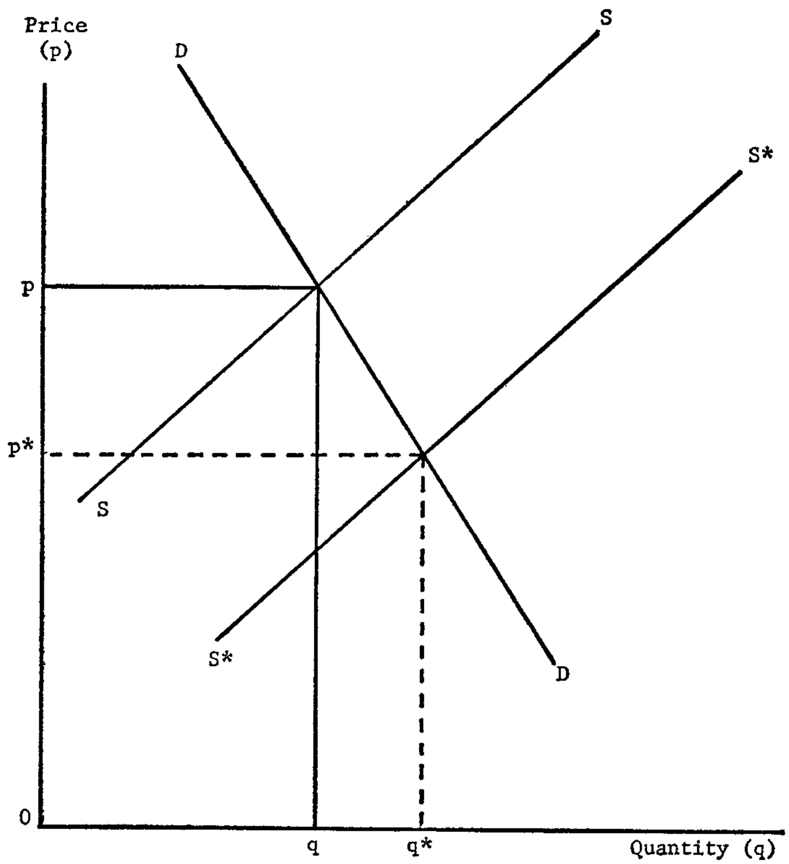

FIG. 2—World apparel wool market with elastic supply (logarithmic scales).

and

$$(3.4) \qquad p = (1/\alpha)^{1/(\eta-\gamma)} (\beta_A + \beta_o)^{1/(\eta-\gamma)}.$$

So that multiplying by $q_D = \alpha p^\eta$ annual revenue in the first period is given by

$$(3.5) \qquad R = (1/\alpha)^{(1+\gamma)/(\eta-\gamma)} (\beta_A + \beta_o)^{(1+\eta)/(\eta-\gamma)}.$$

Similarly for the new period annual revenue can be expressed as

$$R^* = (1/\alpha)^{(1+\gamma)/(\eta-\gamma)} [\beta_A + \beta_o (1 + \delta)]^{(1+\eta)/(\eta-\gamma)}$$

and

$$(3.6) \qquad R^*/R = (1 + .6\delta)^{(1+\eta)/(\eta-\gamma)}.$$

Again, the separate revenue effects for Australia and other producers can be shown.

For *Australia*:

$$(3.7) \qquad R^*_A/R_A = (1 + .6\delta)^{1/(\eta-\gamma)} (1 + .6\delta)^{\gamma/(\eta-\gamma)}$$

and for *Other Producers*:

$$(3.8) \qquad R^*_o/R_o = (1 + .6\delta)^{1/(\eta-\gamma)} (1 + \delta) (1 + .6\delta)^{\gamma/(\eta-\gamma)}.$$

4. *Results and Conclusions*

Under a range of conditions of supply and demand which can be specified given various levels of increase in the supply of apparel wools from the rest of the world induced by a *genetic effect* arising from the export of merino rams to the world as a whole, Australia and the rest of the world face varying changes in their wool revenue. These changes depend on the variables specified in the model.

The choice of the values of the economic parameters is based on several studies by economists [5, 6, 7, 8, 10, 11, 12]. The likely range for the world price elasticity of demand is from —0·3 to —0·7. The higher end of the range expresses a belief that synthetics are increasingly substituting for wool in a wide range of end uses. Values for the supply elasticity are shown for a range from 0 to 1·0. I am unable to guess at the genetic effects and have included a range from zero to an 8% increase in supply of apparel wools by wool producers outside Australia.

Table 1 shows results for some values of the variables which cover the 'likely' range.[3]

The results indicate a more unfavourable outcome for Australia where the world wool price elasticity of demand and supply are low. Gains to

[3] A range of elasticities is presented here. Their subjective justification comes from the sources cited which cover a variety of lengths of run and markets. The general conceptual apparatus presented by Campbell [7] suggests a low price elasticity of supply and leads me to limit the supply elasticity to 1·0 or below. Empirical estimates derived or quoted by Horner [6], Gruen, Ward and Powell [5] and Powell and Gruen [11] all confirm a low price elasticity of supply between 0·05 and 0·3 depending on the length of run. The demand elasticity estimates range through —0·27 to —4·0 in the B.A.E. study [12], —0·4 to —0·5 by Horner [6], —0·33 to —0·5 for the French textile industry in a French study quoted by Gruen [8] and for the U.S.A. —0·56 by Ferguson and Polasek [10].

TABLE 1

Annual Effect on Wool Revenue of Relaxation of the Merino Export Embargo

Expressed as the Ratio of Annual Revenue after the Genetic Effect Changes World Supplies (R^*) to the Annual Revenue in the Previous Period (R)

% Change in wool supplies the rest of the world (δ)	*The World*		*Australia*		*The Rest of the World*	
	$\gamma = 0$					
	$\eta = -0\cdot3$	$\eta = -0\cdot7$	$\eta = -0\cdot3$	$\eta = -0\cdot7$	$\eta = -0\cdot3$	$\eta = -0\cdot7$
½	0·993	0·999	0·990	0·996	0·995	1·001
1	0·986	0·997	0·980	0·991	0·990	1·001
2	0·973	0·995	0·961	0·983	0·980	1·003
3	0·959	0·992	0·942	0·975	0·970	1·004
4	0·946	0·990	0·924	0·967	0·961	1·005
5	0·933	0·987	0·906	0·959	0·951	1·006
6	0·921	0·985	0·889	0·951	0·942	1·008
7	0·908	0·982	0·872	0·943	0·933	1·009
8	0·896	0·980	0·855	0·935	0·924	1·010
	$\gamma = 0\cdot3$					
	$\eta = -0\cdot3$	$\eta = -0\cdot7$	$\eta = -0\cdot3$	$\eta = -0\cdot7$	$\eta = -0\cdot3$	$\eta = -0\cdot7$
½	0·997	0·999	0·994	0·996	0·998	1·001
1	0·993	0·998	0·987	0·992	0·997	1·002
2	0·986	0·996	0·974	0·985	0·994	1·004
3	0·979	0·995	0·962	0·977	0·991	1·006
4	0·973	0·993	0·950	0·970	0·988	1·008
5	0·966	0·991	0·938	0·962	0·985	1·010
6	0·960	0·989	0·926	0·955	0·982	1·012
7	0·953	0·988	0·915	0·948	0·979	1·014
8	0·947	0·986	0·903	0·941	0·976	1·016
	$\gamma = 1\cdot0$					
	$\eta = -0\cdot3$	$\eta = -0\cdot7$	$\eta = -0\cdot3$	$\eta = -0\cdot7$	$\eta = -0\cdot3$	$\eta = -0\cdot7$
½	0·998	0·999	0·995	0·996	1·000	1·001
1	0·997	0·999	0·990	0·993	1·001	1·003
2	0·994	0·998	0·982	0·986	1·001	1·006
3	0·990	0·997	0·972	0·979	1·002	1·009
4	0·987	0·996	0·964	0·972	1·003	1·011
5	0·984	0·995	0·956	0·965	1·003	1·014
6	0·981	0·994	0·947	0·959	1·004	1·017
7	0·978	0·993	0·939	0·953	1·004	1·019
8	0·975	0·992	0·930	0·946	1·005	1·022

the rest of the world emerge when the supply elasticity (γ) is zero and the price elasticity of demand (η) is $-0\cdot7$. As supply elasticity increases gains to the rest of the world increase.

At all levels, the proportionate revenue changes for the world as a whole, Australia and the 'rest of the world' are sensitive to changes in the genetic effect (δ), but are more pronounced for Australia.

From arguments in the literature cited and from common sense I would suggest that the most useful results to consider are those where the price elasticity of demand (η) is $-0{\cdot}7$ and the price elasticity of supply is $1{\cdot}0$.

If there is any truth in the suggestion that the Australian merino possesses unique transferrable genetic characteristics then, using these likely values, it would seem sensible to preserve Australia's monopoly as indicated by the high order genetic effects where Australia loses about 5% of its annual wool income. If, however, the genetic effects are slight as shown by an increase in other producers supply, of say, 0·05% or lower, then Australia may well gain on balance through ram sales by exploiting the ill-founded cupidity of her neighbours. At least we have a bench-mark on which to base a decision once the genetic effect is known and we are able to assess benefits such as ram sales.

If, as has been suggested [8], lifting the embargo is a political counter to induce Argentina to join the I.W.S. and swell promotion funds, then promotion could have an additional burden to carry in recouping Australian losses or even, for some values of the parameters, world and other countries' foregone revenue. Presumably, Australia's woolgrowing counterparts will be grateful for any annual income transfer, however slight.

The model can be modified to take account of a quantity change in particular quality groups—the specific micro values of γ and η may be harder to come by but we may be able to suggest their order and the direction of change from the more aggregative values. In any case, they are equally capable of empirical determination.

With demand for total fibres expanding through time perhaps the genetic effect can be absorbed without reduction in world and Australian wool revenue. The model abstracts from such changes and from supply changes other than the genetic effect. The rate of supply expansion emanating from other sources in apparel wool production by the rest of the world would have to be lower than it would have been in the absence of the genetic changes for wool revenue to remain unimpaired.

The comparative static nature of the model limits the degree to which we can take account of behaviour in the 'real world'. However, it does point to the importance of the genetic effect (δ) which remains a critical parameter to be determined by the geneticists.

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