SOME HIDDEN GAINS AND LOSSES OF A WOOL RESERVE SCHEME

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"Through the influence of Alfred Marshall economists have developed a fondness for certain dimensionless expressions called elasticity coefficients. On the whole it appears that their importance is not very great except possibly as a mental exercise for beginning students . . . Not only are elasticity expressions more or less useless but in more complicated systems they become an actual nuisance converting symmetrical expressions into asymmetrical ones . . ."
—P. A. Samuelson, "Foundations of Economic Analysis", pp. 125-6.

In January 1961 the Federal Government appointed a committee to investigate the merits of various marketing schemes for Australian Wool and in particular the merits of introducing a Reserve Price Scheme. The members of this committee were Sir Roslyn Philp, Mr. M. C. Butterfield and Mr. D. H. Merry. The Philp Committee, in its report (published February 1962), gave three main reasons for opposing the introduction of a Reserve Price Scheme. Briefly, these were:

(a) While fluctuations in wool prices are a disadvantage for wool in competition with synthetic fibres, the degree of price fluctuation which has occurred recently has not been the major factor responsible for the switch to fibres other than wool. The processors' choice between different fibres depends rather on two other factors namely the relative prices of wool and other fibres and secondly the qualities demanded by the consumer which are imparted to the final product by each fibre.

(b) The hidden losses or gains which result from a Reserve Price Scheme.

(c) The imperfections of the wool auction market are not sufficiently serious to warrant the adoption of a Reserve Price Scheme. Further the Committee was sceptical about the value of a Reserve Price Scheme in overcoming such market imperfections as do exist.

Here I want to deal, in the main, with argument (b)—i.e. the hidden losses and gains of a Reserve Price Scheme, though argument (c) is also dealt with to some extent, since some of the possible imperfections are also "hidden". The committee pointed out that while the accounts of the New Zealand Reserve Authority indicate that the costs of running the scheme have been less than the gross profit made by the New Zealand Wool Commission on its wool trading, neither the New Zealand nor the South African accounts disclose whether there have been hidden gains or losses which would affect the profit to growers overall. Under a reserve price scheme, the authority may make a profit whereas the returns to growers collectively may be lower than would have been obtained under a free auction system.[1] What

[1] *Report of the Wool Marketing Committee of Enquiry,* February 1962. Commonwealth Government Printer, Canberra, para. 343.

are these hidden gains and losses which result from the operation of a Reserve Price scheme? One way of showing them is by means of a simple Marshallian supply and demand diagram.

Figure 1 shows the situation we are discussing. Suppose that the quantity of wool to be sold in a certain period is given by the line *EQ*—i.e. we assume, in common with other writers on the subject, that the price realised has no effect in the short run on the quantity of wool offered by growers. Suppose further that the demand curve is given by the line D_1D_1. In the absence of a Reserve Price scheme the quantity *OQ* of wool is sold to buyers at an average price of Op_1. The gross returns to producers are given by the rectangle Op_1GQ.

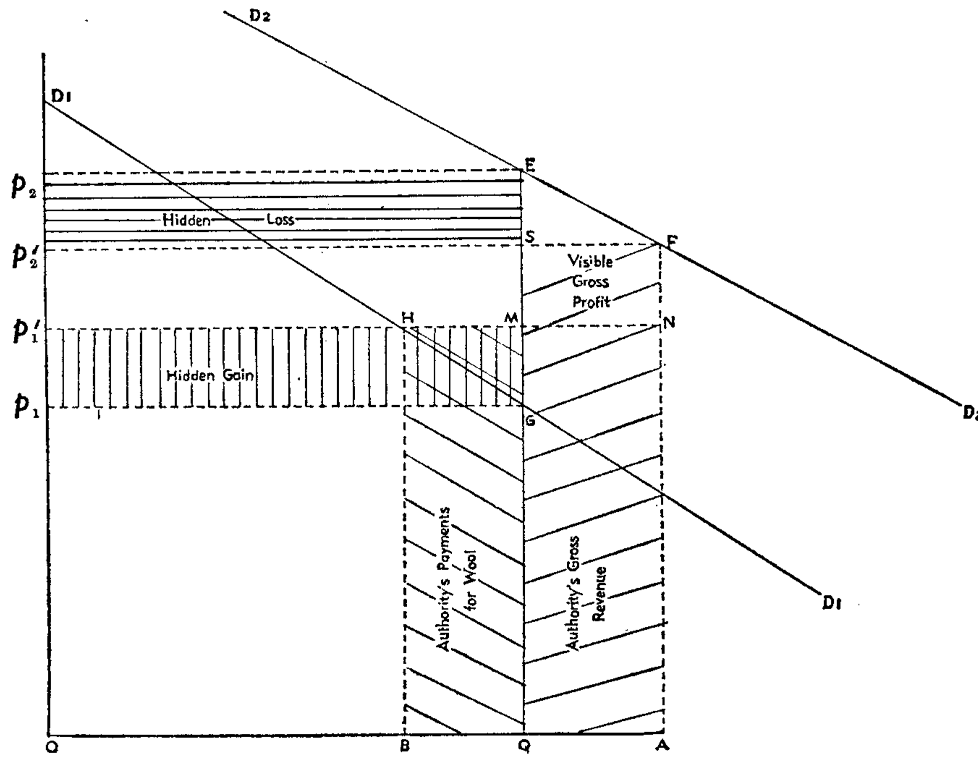

FIGURE 1

If a Reserve price scheme is operating during this period which buys, let us say *BQ* units of wool, the price to growers will be raised from p_1 to p_1'; and gross returns to growers will be given by the rectangle $Op_1'MQ$. Gross returns will be larger during this period; the increase being given by the rectangle $p_1p_1'MG$. It is obvious that this increase will depend on two factors: (i) the size of the Reserve Authority's purchase and (ii) the slope of the demand curve D_1D_1. This increase in returns is "hidden" in the sense that it would not appear in the accounts of a Reserve Authority.

Similarly during a second period when the Reserve Authority sells its stocks, growers will suffer hidden losses. Suppose that in the second period, when the Reserve Authority sells its stocks, growers' supply is again given by *EQ* and that the demand curve on this occasion is given by the line D_2D_2. In this case it can be shown—by reasoning parallel to that above—that growers will suffer a hidden loss equal to $p_2' p_2 ES$. The size of this loss will depend again on (i) the size of the Authority's sales and (ii) the slope of the demand curve D_2D_2.

In addition there will be the receipts and expenses of the Authority. The gross receipts of the Authority are given by the rectangle *QSFA* and their wool purchasing expenses by the rectangle *BHMQ* (In addition they will incur some storage and administrative costs).

The crucial question is, of course, whether the hidden gains are likely to be greater than, equal to, or smaller than the hidden losses. On this point, the committee was offered evidence by Professor K. O. Campbell. Campbell's submission has been published in a Monograph of the Department of Agricultural Economics, University of Sydney.[2] Another version of this argument has been presented in a paper by A. A. Powell and K. O. Campbell in the *Economic Record*.[3] The substance of the Powell-Campbell thesis is given in a series of tables showing the gains and losses resulting from a floor price scheme when different assumptions are made about the elasticities of demand during the purchase and disposal periods. Table 3 from this paper is reproduced below. It gives an illustration of the type of calculation undertaken by the authors—in this case of the hidden gains and losses of a scheme when the gross profit on wooltrading equals storage, administrative costs and interest on capital tied up.

Hidden Gains and Losses Resulting from the Floor Price Scheme, £Am.

Two-Year Transactions Cycle: 5 per cent of the Clip Acquired

Elasticity of Demand during Disposal Period	Elasticity of Demand during the Purchase Period							
	—0·5	—0·7	—0·9	—1·0	—1·1	—1·5	—3·0	—10·0
—0·5	—6·2	—14·8	—19·7	—21·4	—22·8	—26·7	—32·0	—35·8
—0·7	+4·9	—3·7	—8·6	—10·3	—11·8	—15·6	—20·9	—24·7
—0·9	+10·9	+2·3	—2·6	—4·3	—5·7	—9·6	—14·9	—18·7
—1·0	+13·0	+4·4	—0·5	—2·2	—3·6	—7·5	—12·8	—16·6
—1·1	+14·7	+6·1	+1·2	—0·5	—2·0	—5·8	—11·1	—14·9
—1·5	+19·2	+10·6	+5·7	+4·0	+2·5	—1·3	—6·6	—10·4
—3·0	+25·3	+16·7	+11·8	+10·1	+8·6	+4·8	—0·6	—4·4
—10·0	+29·5	+20·9	+16·0	+14·3	+12·8	+9·0	+3·7	—0·1

The authors then argue that very little is known about the likely magnitude of demand reactions during periods of high and low prices. The conclusion drawn is: "in other words the scheme becomes a lottery with say 10% of the Australian Wool cheque or about 5% of Australian export income as stakes".[4] This conclusion is echoed by the Committee: "there are certainly no grounds for the assumption that a reserve price scheme would result in a profit to growers. All that can be said with certainty is that the result would be unpredictable".[5]

[2] K. O. Campbell and R. M. Parish, "Some Observations on Suggested Modifications of the Wool Marketing System in Australia" (Statements submitted to the Wool Marketing Committee of Enquiry), Department of Agricultural Economics, University of Sydney, September 1961.

[3] A. A. Powell and K. O. Campbell, "Revenue Implications of a Buffer Stock Scheme with an Uncertain Demand Schedule", *Economic Record,* September 1962.

[4] A. A. Powell and K. O. Campbell, *op cit.* p. 382.

[5] Philp Committee *Report,* para 347.

This is a powerful argument in favour of a searching economic examination of the two Reserve schemes in operation in South Africa and New Zealand to estimate the probable size of the hidden gains and losses. It is not a very logical argument *against* a reserve price scheme because no action (i.e. non-adoption of a Reserve Price Scheme) will also produce an uncertain outcome. Thus we can reverse the Powell-Campbell tables by substituting plusses for minuses and minuses for plusses. The tables then give us the hidden losses and gains which result from *not* adopting a floor price scheme.[6]

In other words the decision to take no action is also a decision which will produce an uncertain (lottery-type) outcome. In the absence of conclusive evidence as to whether a Reserve Price scheme raises the overall returns to growers one might then be more influenced by other criteria in favour or against a scheme. On the negative side the fact that the implementation of the scheme will involve growers and perhaps governments in some capital outlays might be regarded as important. On the other hand, on the positive side it might be argued as the committee did, in fact, point out "that many growers would prefer to suffer the reduction in price which might result at higher levels from the selling operations of the authority in order to gain an assured minimum return during periods of poor demand and low prices".[7]

The Philp Committee seemed to be aware of the doubtful logical validity of the uncertainty argument. They went further and placed some stress on the fact that all entries on the diagonal of the Table above (i.e. Table 3 of the Powell-Campbell article and Table I of the Campbell submission) were negative. They pointed out that the experts they consulted "agreed that, if the industry as a whole (the authority and the growers) is to profit from the scheme, it is *essential* that the reactions of the market be more favourable to growers during the selling operations of the authority than during its buying operations. Or as economists put it, it is essential that the elasticity of demand be higher during the selling operations than during the buying operations"[8] (my italics).

The overall gains and losses from the operation of a scheme depend on

(i) the demand reactions during the purchase and sale periods;
(ii) the movement in free auction prices between the purchase and sale periods (i.e. the demand "shifters") and
(iii) storage costs.

This is, in fact, pointed out in Professor Campbell's submission[9]. In other words, if (ii) is positive and large enough, it can outweigh any hidden losses resulting from (i). Furthermore, numerical examples are given in Campbell's submission (Table 3) and in the Powell-Campbell article (Table 5) of net gains to growers when the elasticity

[6] I am indebted to Prof. R. M. Parish for first pointing out to me the weakness of the uncertainty argument. This argument has also been challenged on slightly different grounds by Neil Swan. *Economic Monograph No. 249,* New South Wales Branch, Economics Society of Australia and New Zealand, p. 5.

[7] *Loc. cit.* para 349.

[8] *Loc. cit.* para 346.

[9] K. O. Campbell and R. M. Parish, *op. cit.* p. 9.

of demand is the same during the purchase period and the disposal period (elasticities of $-3 \cdot 0$ and $-10 \cdot 0$ in the respective tables). This table examines the situation where the buying-in price is 50d. and the selling price is 70d. It may be argued that such a big margin is unlikely to be achieved in practice. Thus the New Zealand scheme has not, on average, been able to achieve a gross margin between buying and selling prices of 10d. let alone 20d. i.e. it may still be that in all practically significant cases there will be overall losses if the reactions of the market are not more favourable to growers during the selling period than during the buying period.

However, the greater prevalence of hidden losses rather than hidden gains in the Powell-Campbell calculations is produced entirely by the use of elasticities as the unit of measurement of demand reactions. If we use slopes of the demand curves (i.e. ordinary derivatives instead of logarithmetic derivatives) the assymetry of hidden gains and losses disappears and all entries on the diagonal of the Table above become zero.

This point can be shown easily by reference to Figure 1. If the slopes of the two demand curves D_1D_1 and D_2D_2 are the same over the relevant range, the price-raising effect of buying x million lbs. of wool will be numerically equal to the price depressing effect of selling the same quantity of wool. In other words, $p_1p_1'MG$ in Figure 1 will equal $p_2'p_2ES$. The reason why different results are obtained with elasticities is, of course, that an identical slope at points E and G on the two demand curves in Figure 1 implies a (numerically) higher elasticity at point E compared with point G.

If $\dfrac{dx}{dp_1} = \dfrac{dx}{dp_2}$

then $\dfrac{dx}{dp_1} \cdot \dfrac{p_1}{x} < \dfrac{dx}{dp_2} \cdot \dfrac{p_2}{x}$ if $p_2 > p_1$

However there is no reason to regard elasticities as a more "fundamental" unit than slopes in this case. The overall gains or losses of the Reserve Price Scheme will then be measured by the visible net gains or losses of the Authority. If there are no visible net gains or losses equality of slopes or "market reactions" leads to neither overall gains or losses.

There are two other hidden revenue implications of a reserve price scheme which are not mentioned in the Powell-Campbell discussion of the revenue implications of a buffer stock scheme. These are: (1) One way in which a Reserve Price scheme differs from a Buffer Stock scheme is that Reserve Authorities—at least the South African and New Zealand Authorities—do not attempt to obtain their stocks at the lowest price possible. In both countries each lot of wool is given a valuation by the Authority; if the Authority is called on to bid, it will bid only once, at its valuation. Suppose the bid in the auction room for a given lot stops at 40d. and the Authority has a reserve price of 42d. on the lot. A normal buffer stock organisation, trying to minimise its cost and maximise its (visible) profit, should bid $40\frac{1}{4}$d. and be willing to go to 42d. There will be occasions when the Reserve Authority will pay more for its stocks than a buffer stock organization would. In other words some of the visible gains of a buffer stock scheme become hidden in a reserve price scheme.

(2) Secondly there is the phenomenon of bidding in the auction room starting again once the Authority has put in its bid. The following figures from the 1960-61 Annual Report of the South African Wool Commission illustrate the point:

Total South African offering (1960-61)	1,045,333	bales	(100%)
Reserve Price declared on	392,212	,,	(37·5%)
Sold or declared not sold to Commission	118,726	,,	(11·4%)
Taken over by trade at Reserve Price	98,716	,,	(9·4%)
Taken over by trade at higher price	174,770	,,	(16·7%)

(*Source:* Die Wolboer, February, 1962).

It appears that of the 400,000 bales on which the South African Commission had to declare its reserve price, almost half were in lots on which the auction started again after the declaration of the reserve by the Commission. It is known that similar resumption of bidding after the Reserve Authority has made its price known occurs in New Zealand though the Commission there has not so far extracted similar statistics of the proportions. The phenomenon of the resumption of bidding is rather inexplicable in terms of orthodox competitive theory. One possible explanation is that the trade wanted to find out the Commission's reserve on different lots and therefore refrained from bidding in the first instance. This seems unlikely to apply to such a large proportion of the offering. A second possibililty which seems to me also unlikely is large-scale collusion which is broken by an independent bidding agent. This seems to me unlikely since—if large-scale collusion can be organised—it should not be too difficult to frame a set of rules which prevent the disruption of such collusion by a single bid from an independent agency. A third possible explanation is that buyers may be willing to pay more for a given parcel of wool if the purchaser knows that his competitors have to pay a similar price. Presumably the most direct price competition each processor faces is from colleagues purchasing and using the same raw material. The existence of a floor price may make buyers (or their colleagues) willing to bid somewhat more for lots when they are secure in the knowledge that rivals have to pay similar prices. A fourth explanation depends on the likely actions of commission buyers. Suppose a dealer has the instruction to buy a unit of wool at a price $p \leqslant r$ within n days. If he buys at a price of p $<r$ he obtains a premium $(r-p).u$. If he cannot buy at a price $p \leqslant r$ he incurs a penalty—say v. The premium would be partly a cash payment in the form of a commission and partly in terms of likely future business and similarly in the case of the penalty v.

How much should the buyer offer for a unit of wool at the first sale at time t_o? This will depend on the probable distribution of prices between t_o and t_n—the last day on which he can buy wool for delivery under the order. The optimal purchasing policy—given this system of rewards and penalties—depends on the probability distribution of future prices. A reserve price authority—by its bidding—will affect this probability distribution and hence may affect the prices which commission buyers are willing to offer. It can be shown that the price which the dealer is willing to bid (S_t) will rise gradually as he approaches the last day (when $S_t = \gamma$). A proof of this is given in the Appendix.[10] Hence a commission buyer may revise the price which

[10] I am indebted to Professor John Harsanyi of the University of California, Berkeley for this exercise.

he is willing to offer on a lot when the Reserve Authority's bidding changes his price expectations for the near future.

Such price increases may of course affect present or future demand for wool from processors. On the other hand in as far as wool is being bought by merchants or speculators, part of the profit arising from such merchanting transactions can be obtained by growers with the existence of a Reserve Price Authority.

APPENDIX

Optimal Purchasing Policy

Assumptions

Suppose a dealer has the instruction to buy one unit of wool at a price $p \leqslant r$ within n days. If he buys at a price $p < r$ he obtains a premium $(r - p).\ u$. If he cannot buy at an acceptable price he has to pay the penalty v.

Let the price at the t-th day be p_t. Let $F(\pi)$ be the probability that $p_t < \pi$ (i.e. F is the probability distribution function for p_t). Let $f(\pi) = \dfrac{dF(\pi)}{d\pi}$ be the probability density function corresponding to F.

For the sake of simplicity we assume a rectangular distribution between the limits a and $b = a + d$, so that

$$F(\pi) = \begin{cases} 0 \text{ if } \pi < a \\ \dfrac{\pi - a}{d} \text{ if } a \leqslant \pi \leqslant b \\ 1 \text{ if } \pi > b \end{cases} \qquad f(\pi) = \begin{cases} 0 \text{ if } \pi < a \\ \dfrac{1}{d} \text{ if } a \leqslant \pi \leqslant b \\ 0 \text{ if } \pi > b \end{cases}$$

Of course, we must assume that $r \geqslant a$, otherwise the dealer could never make a purchase.

1. If the dealer waits till the n-th (= last) day, he must accept any price $p_n \leqslant r$. There is a probability $F(r)$ that he can make a deal, and a probability $[1 - F(r)]$ that he cannot make a deal and will get the negative profit $-v$.

Hence the expected value of his profit will be

$$w_m = \int_a^r (r - \pi)\, uf(\pi)\, d\pi - [1 - F(r)]v$$

2. If the dealer has made no deal in the first $(t - 1)$ days, at the t-th day he may follow the policy of making a deal if the price $p_t \leqslant s_t$, where s_t is an appropriately chosen constant — while making no deal on that day if $p_t > s_t$. There is a probability $F(s_t)$ that he can make a deal on the t-th day and a probability $[1 - F(s_t)]$ that he cannot. Let w_{t+1} be the expected value of his profit if he cannot make a deal on the t-th day.

Then at the beginning of the t-th day the expected value of his profit will be

$$\begin{aligned} w_t &= \int_a^{s_t} (r - \pi)\frac{u}{d}\, d\,\pi + [1 - F(s_t)]\, w_{t+1} \\ &= [(r - a)^2 - (r - s_t)^2]\frac{u}{2d} + \left[1 - \frac{s_t - a}{d}\right] w_{t+1} \\ &= [(r - a)^2 - (r - s_t)^2]\frac{u}{2d} + \frac{b - s_t}{d} w_{t+1} \end{aligned}$$

The optimal value of s_t will be the one which maximizes w_t subject to $s_t \leqslant r$.

Case A. If $w_{t+1} \geqslant 0$ this requires $-(s_t - r)\frac{u}{d} - \frac{w_{t+1}}{d} = 0$

3. Hence $s_t = r - \frac{w_{t+1}}{u}$.

Case B. If $w_{t+1} < 0$ then the maximum is reached when $s_t = r$
In what follows I am assuming that Case A applies, i.e. $w_{t+1} \geqslant 0$ and $s_t = r - \frac{w_{t+1}}{u}$.

If this value of s_t is chosen then

$$4.\ w_t = (r-a)^2 \frac{u}{2d} - \frac{w_{t+1}^2}{2ud} + \frac{bw_{t+1}}{d} - \frac{rw_{t+1}}{d} + \frac{w_{t+1}^2}{ud}$$

$$= (r-a)^2 \frac{u}{d} + \frac{(b-r)\, w_{t+1}}{d} + \frac{w_{t+1}^2}{2ud}$$

$$= \frac{(r-a)^2 u^2 - 2(r-a)\, u\, w_{t+1} + w_{t+1}^2}{2ud} + \frac{(b-a)w_{t+1}}{d}$$

$$= [(r-a)\, u - w_{t+1}]^2 + w_{t+1}$$

From 3. $w_{t+1} = (r - s_t)\, u$

Substituting in 4.

$$5.\ w_t = \frac{(s_t - a)^2}{2d}\, u + (r - s_t)\, u$$

We can now write 3. in the form

$$s_{t-1} = r - \frac{w_t}{u}$$

By 5.

$$6.\ s_{t-1} = r - \frac{(s_t - a)^2}{2d} - r - s_t)$$

$$= s_t - \frac{(s_t - a)^2}{2d}$$

6. is a recursive relationship by which s_{t-1} can be computed from s_t, using equation 1. or 2. and 3. as the starting point, to compute s_{n-1}.

6. is a first-order quadratic difference equation with 1. or 2. as the initial condition.

Note s_t will depend on a — i.e. the lowest price likely to be reached in the auction room. Hence, if a is changed by the bidding procedure of a Reserve Authority this will change the optimum price s_t which a buyer should go to on any single day. By 6. $s_{t-1} < s_t$ as one would expect. If n (the number of days available) is very large, s_t tends to a because we obtain the limit of s_t by making $s_{t-1} = s_t$, which gives $s_t = a$. We can write $s_n = r$ (because r is the limit price on the last day). Hence as we move backwards from the n-th day, s_t decreases from r towards a, without ever reaching a.