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ON EVALUATING THE PRODUCER BENEFITS FROM PRICE STABILISATION

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Agricultural Economics
Discussion Paper 3/89

Paper presented to the Thirty-Third Annual Conference of the Australian Agricultural Economics Society, Lincoln College, Christchurch, New Zealand, 7-9 February 1989.

This work was supported by a grant from the Wool Research and Development Fund.

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Abstract

In this paper a new methodology for evaluating the producer benefits from price stabilisation is used to evaluate the Australian Wool Corporation's Reserve Price Scheme. One advantage of this methodology over that proposed by Newbery and Stiglitz (1981) is its more complex expected utility framework including explicit formulae to account for the guaranteed minimum price feature which is typical of price stabilisation schemes. Producer benefits estimated in this way are shown to be generally larger than previous estimates using the Newbery and Stiglitz methodology (Hinchy and Fisher 1988). These benefits are also compared with estimated costs of the Reserve Price Scheme.

Introduction

Hinchy and Fisher (1988) have estimated the producer benefits of price stabilisation in the Australian wool industry using an extension of the framework developed in Newbery and Stiglitz (1981). An essential feature of this framework is that price stabilisation is modelled "as if continuous intervention occurs over the range of prices" (p.12). This is in contrast to the actual operation of the Australian Wool Corporation's Reserve Price Scheme (RPS) which is based on the determination of some preset minimum level of price at which the Corporation will intervene to purchase wool, thereby guaranteeing for producers that they will receive at least this minimum price for their wool. As a consequence, Hinchy and Fisher are careful to point out: "The results of the present study, of course, cannot be interpreted as measuring the welfare gain from the minimum reserve price scheme" (p.11).

Recent research (Fraser 1988) has developed a new expected utility framework for evaluating the producer benefits from price intervention schemes, including formulae for explicitly characterising this minimum price feature which is typical of both price support and price stabilisation schemes. The aim of this paper is to present estimates of the producer benefits of wool price stabilisation which characterise the impact of the RPS using this new methodology.

The plan of the paper is as follows. Section 1 outlines the methodology of the analysis including the model of producer behaviour and the formulae used to represent the impact of the RPS. This section also outlines the data used in the estimation procedure. These data are based on price and income variability prevailing in the Australian wool industry before the introduction of the RPS (1974).

Section 2 presents estimates of producer benefits from the RPS calculated using the methodology and data outlined in section 1. These estimated benefits are then compared with the estimated benefits in Hinchy and Fisher (1988) and with estimates of the cost to producers of maintaining the RPS. Although (in keeping with Hinchy and Fisher's study) no supply response by producers to the RPS is allowed for in the estimation procedure, this comparison of benefits and costs nevertheless gives some indication of the circumstances in which producers will either gain or lose from the operating of the RPS.

Section 3 presents further estimates of producer benefits from the RPS based on an alternative data set and estimation procedure. In this case data are taken from the period after the introduction of the RPS, and the estimation procedure involves inverting the formulae outlined in section 1 to determine what level of price variability would have prevailed in the Australian wool industry in the absence of the RPS. Producer benefits can then be determined using the model outlined in section 1. Section 4 concludes the paper with a brief summary.

Section 1: The Methodology

The Model

The model of producer behaviour used in this paper is developed in Fraser (1984 1986). It assumes that the only input to production is the producer's own labour, ℓ, and that a single output is produced which is subject to multiplicative risk:

$$x = \theta f(\ell)$$

where:

$f(\ell)$ = planned output $[f'(\ell) > 0,\ f''(\ell) < 0]$

θ = multiplicative risk term $[E(\theta) = 1]$

x = uncertain actual output $[E(x) = \bar{x} = f(\ell)]$.

With price also uncertain, the producer's random income (y) is thus given by:

$$y = px$$

where:

p = uncertain price $[E(p) = \bar{p}]$

It is further assumed that the producer's utility is (additively) separable in income and leisure so that his objective is to maximise by choice of labour input:

$$E[U(px)] - w\ell \qquad (1)$$

where:

w = marginal disutility of labour

$U(px)$ = utility of random income $(U' > 0\ ,\ U'' \leq 0)$.

It is shown in Fraser (1984) that using a Taylor series expansion (1) may be approximated by:

$$U(\bar{p}\bar{x}) + 0.5U''(\bar{p}\bar{x})\bar{x}^2(\sigma_p^2 + \sigma_\theta^2\bar{p}^2) - \sigma_{p\theta}\bar{x}\ U'(\bar{p}\bar{x})(R-1) - w\ell \qquad (2)$$

where:

σ_p^2 = variance of p

σ_θ^2 = variance of θ

$\sigma_{p\theta}$ = covariance of p,θ

$R = -U''(\bar{p}\bar{x})\bar{p}\bar{x}/U'(\bar{p}\bar{x})$ = the producer's coefficient of relative risk aversion (evaluated at $\bar{p},\bar{x}$).

Note from (2) that whether a covariance of a given sign contributes positively or negatively to utility depends on whether R exceeds or is less than unity.

Characterising Price Stabilisation

The type of price stabilisation scheme analysed here is that which involves the use of a buffer stock. In this case, an authority is established to buy stock at times of unusually low prices, and to sell this stock at times of unusually high prices. More specifically, on the basis of an expected price, a "floor price" is determined at which the authority guarantees to enter the market to buy, and a "ceiling price" at which the authority will sell. In this way, the overall variation of price is reduced. Note that the average level of price may also be altered by the operation of such a scheme. In particular, if the ceiling price is set relatively further from the expected level than is the floor price, then the average price will be raised by a process of stock accumulation (and vice versa).

Specific formulae for characterising the impact of such a price stabilisation scheme are listed below. A formal derivation of these formulae which involves "Winsorising" the price distribution is contained in Fraser (1988).

$$E(p_s) = F(p_f)p_f + [1-F(p_c)]p_c + [F(p_c)-F(p_f)]\epsilon_2 \quad (3)$$

$$\begin{aligned} Var(p_s) = & [F(p_c)-F(p_f)]\sigma_2^2 + F(p_f)[p_f-E(p_s)]^2 \\ & + [1-F(p_c)][p_c-E(p_s)]^2 \\ & + [F(p_c) - F(p_f)][\epsilon_2-E(p_s)]^2 \end{aligned} \quad (4)$$

$$\begin{aligned} Cov(p_s,x) = & \rho(\sigma_x/\sigma_p)\sigma_2^2[F(p_c)-F(p_f)] + \rho\sigma_x Z(p_f)(\epsilon_2-p_f) \\ & + \rho\sigma_x Z(p_c)(p_c-\epsilon_2) \end{aligned} \quad (5)$$

where:

p_f = floor price

p_c = ceiling price

$Z(p_f) = (1/\sqrt{2\pi})\exp\left[-0.5[(p_f-\bar{p})/\sigma_p]^2\right]$

$Z(p_c) = (1/\sqrt{2\pi})\exp\left[-0.5[(p_c-\bar{p})/\sigma_p]^2\right]$

$F(p_f)$ = cumulative probability of $p \le p_f$

$F(p_c)$ = cumulative probability of $p \le p_c$

$E(p_s)$ = expected stabilised price

$\epsilon_2 = \bar{p} + \sigma_p[Z(p_f) - Z(p_c)]/[F(p_c)-F(p_f)]$

$Var(p_s)$ = variance of the stabilised price

$Cov(p_s,x)$ = covariance of the stabilised price with output

ρ = correlation coefficient of the underlying joint normal distribution

$$\sigma_2^2 = \sigma_p^2\left\{1 + \left(\left[\frac{p_f - \bar{p}}{\sigma_p}\right]Z(p_f) - \left[\frac{p_c - \bar{p}}{\sigma_p}\right]Z(p_c)\right)\Big/\left(F(p_c - F(p_f)\right)\right.$$

$$\left. - \left([Z(p_f) - Z(p_c)]/[F(p_c) - F(p_f)]\right)^2\right\}$$

Note that the formula for $E(p_s)$ implicitly assumes that stock adjustments are used to absorb[1]:

(a) the effects of any differences in the elasticity of demand at times of buying and selling;

(b) the effects of any non-linearity in the demand curve.

This assumption means that the only scope for a producer to experience any "Transfer Benefit" (i.e. change in expected income) from the operation of the price stabilisation scheme is through its impact on the magnitude of the covariance between price and output. Nevertheless, the formula could be altered to take account of the mean price impact of these demand effects. Note also that if:

$$\bar{p} - p_f = p_c - \bar{p}$$

then the formulae simplify to:

$$E(p_s) = \bar{p} \qquad (3')$$

$$Var(p_s) = [F(p_c) - F(p_f)]\sigma_2^2 + 2F(p_f)(p_f - \bar{p})^2 \qquad (4')$$

$$Cov(p_s, x) = \rho(\sigma_x/\sigma_p)\sigma_2^2[F(p_c) - F(p_f)] + \rho\sigma_x Z(p_f)(p_c - p_f) \qquad (5')$$

Data Requirements

In order to be able to use (2) to evaluate a producer's benefit from price stabilisation, three broad types of information are required:

(a) a specification of the producer's risk aversion as characterised by his utility function;

(b) a specification of the producer's initial economic circumstances. This is taken in what follows to comprise[2]:

(i) $f(\ell)$

(ii) σ_p^2

(iii) σ_θ^2

(iv) $\sigma_{p\theta}$

(v) $\bar{p}$

(c) a specification of the floor price and ceiling at which the price stabilisation scheme operates.

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1. See Hinchy and Fisher (1988) for a discussion of how (a) and (b) can affect the mean price following stabilisation.

2. The assumption that w is constant for a producer means that its value can be deduced from the producer's first order condition. For details see Fraser (1988). See also note 3.

It is assumed that the producer's attitude to income risk can be adequately represented by the constant relative risk aversion function:

$$U(px) = px^{(1-R)}/(1-R)$$

In what follows, a range of values of R consistent with empirical estimates is considered (see Bond and Wonder 1980).

The specification of the producer's initial economic circumstances requires a mixture of assumptions and industry data. The already-simplified relationship between the producer's labour input and his output [$f(\ell)$] requires further simplification to a precise functional form. In what follows it is assumed that this form is given by:

$$\bar{x} = \ell^m$$

where the value of m is irrelevant since ℓ is given a positioning value equal to unity ($\bar{x} = 1$).[3] The producer's information about the relative size of σ_p^2, σ_θ^2 and $\sigma_{p\theta}$ is based on actual industry data which represents details of income variability in the Australian wool industry before the introduction of the RPS (1974) with the additional main assumption that the producer has rational expectations (ie, his beliefs about σ_p^2, σ_θ^2 and $\sigma_{p\theta}$ are correct). Specific details of the breakdown of the overall income variation in the Australian wool industry in this period are provided in Harris et al (1974). Using this breakdown, which is based on deviations about a linear trend and the following approximation[4]:

$$\sigma_y^2 = \bar{x}^2\sigma_p^2 + \bar{p}^2\sigma_x^2 + 2\bar{p}\bar{x}\,\sigma_{px}$$

and setting a positioning value for income variability of[5]:

$$\sigma_y^2 = 10$$

gives:

$$\bar{x}^2\,\sigma_p^2 = 12.4$$
$$\bar{p}^2\,\sigma_x^2 = 0.8$$
$$2\bar{p}\bar{x}\,\sigma_{px} = -3.2$$

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3. Note that for $\bar{x} = 1$ to represent optimal planned output over a range of values of R, the value of w must be (precisely) inversely related to the value of R. However, as the results are calculated in percentage change terms, this additional assumption concerning w is not felt to be particularly restrictive.

4. See Harris et al (1974) pp.304-305.

5. Recalling note 3, σ_y^2 would also vary over a range of values of R but for the setting of $\bar{x} = 1$ for all producers.

which, recalling that:

$$\ell = 1$$

gives:

$$\sigma_p^2 = 12.4 \ .$$

However, further specification of this breakdown requires an initial setting of $\bar{p}$. A positioning value of:

$$\bar{p} = 13$$

was chosen with a view to establishing an initial coefficient of variation (CV) of each of the random variables which corresponded closely to the actual industry values calculated by Harris et al (1974 p.302). With this initial setting:

$$\sigma_x^2 = \sigma_\theta^2 = 0.005$$

$$\sigma_{px} = \sigma_{p\theta} = -0.123$$

so that (with actual industry values in parenthesis):

$$CV_p = 27.1\% \ (29.9\%)$$

$$CV_x = 7.1\% \ (7.5\%)$$

$$CV_y = 24.6\% \ (23.4\%)$$

Note also that these initial settings give:

$$E(y) = \bar{p}\bar{x} + \sigma_{px} = 12.877$$

as the initial value of expected income.

Finally, in what follows the price stabilisation scheme is assumed to operate with a range of floor prices between 80 and 95 per cent of the mean price, and with a symmetrically set ceiling price so that $E(p_s) = \bar{p}$.

Section 2: Results

On the basis of the data, the formulae for the impact of a stabilisation scheme on the producer's uncertain conditions and the model of producer behaviour outlined in section 1, it is possible to estimate the welfare effects on individual producers of the introduction of a price stabilisation scheme for a range of price floors (and ceilings) and attitudes to risk.

Consider, initially, Table 1 which gives the impact of the scheme on the variance of price and the covariance of price with output for a range of price floors (with symmetrical ceilings). Clearly, the higher the price

Table 1

Impact of the Scheme on the Variance of Price and the Covariance of Price with Output

Floor Price (% of $\bar{p}$)	$Var(p_s)/\sigma_p^2$	$Cov(p_s,x)/\sigma_{px}$
80	0.342	0.539
90	0.110	0.288
95	0.031	0.147

floor, the greater is the reduction in price variability and covariability. Equation (2) shows that for values of R less than unity both of these changes result in this case in a favourable welfare impact. In particular, it indicates that even a risk neutral producer would benefit from the introduction of a price stabilisation scheme because the associated reduction in the magnitude of the negative covariance of price with output increases expected income.

Table 2

Producers' Willingness-to-pay for Price Stabilisation (Percentage of E(px))

$p_f/\bar{p}$	R					
	0	0.15	0.3	0.45	0.6	0.75
80%	0.435	0.730	1.017	1.297	1.569	1.833
90%	0.676	1.064	1.437	1.802	2.151	2.493
95%	0.815	1.219	1.615	2.004	2.369	2.726

These expectations are confirmed in the results presented in Table 2, which gives estimates of producer benefits from price stabilisation for a range of price floors and individual attitudes to risk in terms of a producer's willingness-to-pay (as a percentage of expected income) for those benefits. Specifically, it shows that a floor price equal to 80 per cent of $\bar{p}$ by reducing the magnitude of the negative covariance between price and output increases expected income by 0.435 per cent so that a risk neutral producer is willing to pay up to this amount for the scheme. However the scheme also reduces the variation of prices and so risk averse producers are willing to pay not only for the increase in expected income but also for the reduced variability of income. Table 2 shows that this extra willingness-to-pay increases with the risk aversion of the producer. For example, a producer with R = 0.15 is willing to pay 0.195 per cent of expected income (0.730 - 0.435) for the reduction in income variability whereas the producer with R = 0.75 is willing to pay 1.398 per cent. Finally, Table 2 shows that a producer's willingness to pay for price stabilisation increases with the level of the price floor because a higher price floor results in both a larger increase on expected income and a larger decrease in the variability of income.

In order to compare the results in Table 2 with those of Hinchy and Fisher (1988), note that the reduction in the standard deviation of price associated with a floor price which is 80 per cent of $\bar{p}$ (i.e. 42 per cent) is approximately equal to that (i.e. 44 per cent) estimated by Campbell, Gardiner and Haszler (1980) and used by Hinchy and Fisher to measure producer benefits from wool price stabilisation. In this case, Hinchy and Fisher estimate producer benefits from reduced income ("revenue") variability (i.e. the "Risk Benefit") to be 1.0 R (as a percentage of revenue).[6] A comparison of these results is given in Table 3. For a value of R = 0.15, the Hinchy and Fisher results imply a willingness-to-pay of 0.15 per cent for reduced income variability compared with the estimate of 0.295 per cent from Table 2. Similarly, for R = 0.75, the Hinchy and Fisher results imply a willingness-to-pay of 0.75 per cent compared with the estimate of 1.398 per cent from Table 2. In other words, not only are

Table 3
Producer Benefits from Reduced Income Variability:
Comparison with Hinchy and Fisher (1988)[a]
(Percentage)

	R					
	0	0.15	0.3	0.45	0.6	0.75
H&F[b]	0	0.15	0.30	0.45	0.60	0.75
$p_f/\bar{p}$=80%[c]	0	0.295	0.582	0.862	1.134	1.398
row(2)/row(1)•100	0	196.7	194.0	191.6	189.0	186.4

Notes: [a] Benefits as a percentage of expected income (revenue).

[b] Logarithmic trend price series--calculated as 1.0R.

[c] Entries calculated from Table 2 by subtracting 0.435.

6. Hinchy and Fisher calculate variability on the basis of deviations from a logarithmic trend, whereas Harris et al calculate variability on the basis of deviations from a linear trend. In addition, Hinchy and Fisher use data over the period 1953/54 to 1984/85 whereas Harris et al use data over the period 1949/50 to 1972/73.

the estimates of producer benefits from reduced income variability in Table 2 generally in excess of those of Hinchy and Fisher but also they are larger by almost 100 per cent. Although this conclusion could be interpreted as supporting the argument that Hinchy and Fisher's results underestimate the producer gains from wool price stabilisation because the Newbery and Stiglitz approach does not capture the benefits producers receive from having a guaranteed floor price, there is an alternative explanation stemming from the difference in time period between Hinchy and Fisher's data (1952/53 to 1984/85) and that of Harris et al (1949/50 to 1972/73). In particular, the Hinchy and Fisher data include a significant proportion of time during which the RPS was actually operating (i.e. post-1974). Therefore, it is perhaps not surprising that they estimate the coefficient of variation of price to be only 18.0 per cent compared with the 29.9 per cent estimated by Harris et al (27.1 per cent as used above) and that, as a consequence, their estimates of producer benefits are smaller than those estimated using the Harris et al data.[7]

In addition, note that the above comparisons only relate to the so-called "Risk Benefit" of price stabilisation. This is because the estimates of the so-called "Transfer Benefit" in Table 2 (i.e. the willingness-to-pay of the risk neutral producer) do not include any transfers which might arise from a change in the mean price brought about by the operations of the RPS. Note also that Hinchy and Fisher estimate the overall "Transfer Benefit" to be typically negative for the Australian wool industry.

Next, consider a comparison of the estimates of producer benefits from the RPS in Table 2 with some estimates of the cost of the RPS. Each year producers contribute a refundable levy of 5 per cent of their gross income to support the operations of the RPS. Although the timing of the refund is unspecified, it was, for example, recently announced (May 1988) that the contributions for the years 1981/82 and 1982/83 would be refunded during 1988/89. This refundable characteristic means that the cost to producers of contributing to the scheme can be approximated by the interest income forgone during the period between contribution and refund.

Table 4
Producer Cost of Price Stabilisation
(Percentage of E(px))

Interest Rate %	Years Until Refund				
	3	4	5	6	7
8	1.03	1.32	1.60	1.85	2.08
10	1.25	1.58	1.90	2.18	2.44
12	1.44	1.82	2.16	2.47	2.74

7. On p.9 Hinchy and Fisher note that "Since a buffer-stock scheme operated over the latter part of the data interval, any potential gains from price stabilisation may be slightly under-estimated relative to price variability in the absence of the scheme".

Table 4 gives some estimates of this cost (as a percentage of expected income) for a range of interest rates and years until refund.[8]

A comparison of Tables 2 and 4 shows that, in the absence of any unaccounted-for costs and benefits associated with the operation of the RPS, there is generally an even balance between a producer's willingness-to-pay for the scheme and its cost. In particular, Tables 2 and 4 show that an individual producer is more likely to view the scheme favourably the larger is his risk aversion and the level of the floor price, and the smaller is the interest rate and the period until refund. As a specific example, take the producer benefits of the RPS to be those applying for a floor price which is 90 per cent of $\bar{p}$ and take the relevant interest rate to be 12 per cent. In this case a producer with an attitude to risk represented by $R = 0.75$ would find the recent decision to refund 1981/82 and 1982/83 contributions during 1988/89 to imply for the former year of contribution a net cost of participation in the RPS and for the latter a net benefit ($2.47 < 2.493 < 2.74$). Note, however, that the evidence of Bond and Wonder (1980) suggests most Australian farmers have attitudes to risk consistent with $R < 0.45$.[9] If this is so, then for the same floor price and interest rate assumptions few farmers would see a refund delayed by even five years as resulting in a net benefit from participation in the RPS ($1.802 < 2.16$).

Consider, however, the argument that, with the floating of the Australian dollar and a generally acknowledged increase in the volatility of international markets, the historical level of underlying price uncertainty used to calculate the estimates of producer benefits from the RPS in Table 2 may well represent an underestimate of the current level. Bearing in mind that the coefficient of variation of price (CV_p) used in calculating the estimates in Table 2 is 27.1 per cent, and that at this level all producers with $R \leq 0.45$ find the cost of contributing to the RPS with interest rates at 10 per cent and a refund period of six years (2.18 per cent of expected income) in excess of the benefits, Table 5 presents estimates of the underlying CV_p required for benefits to equal costs for these producers.

Table 5 shows that the percentage increase in CV_p which equates

Table 5

CV_p Required to Equate Producer Benefits with 2.18 per cent of Expected Income (per cent)

$p_f/\bar{p}$	R			
	0	0.15	0.3	0.45
80 %	76.34	44.92	37.21	33.09
90 %	68.59	40.78	33.35	29.39
95 %	64.82	38.84	31.90	28.05

8. Note that nominal interest rates have been used on the assumption that only the nominal value of producer contributions is preserved in their refunds.

9. See Fraser (1988) regarding the representation of Bond and Wonder's results in terms of values of R.

benefits with costs is considerably smaller in magnitude than the required percentage increase in benefits. For example, for a floor price which is 80 per cent of $\bar{p}$, at R = 0 an increase in CV_p of 182 per cent (27.1 to 76.34) brings about the required 401 per cent (0.435 to 2.18) increase in benefits, while at R = 0.45 an increase in CV_p of only 22 per cent (27.1 to 33.09) brings about the required 68 per cent (1.297 to 2.18) increase in benefits. In addition, Table 5 shows that for the benchmark level of risk aversion of R = 0.3, the current level of underlying CV_p required for producer benefits to equal costs is not unreasonable--varying from 37.2 per cent down to only 31.9 per cent depending on the level of floor price. Therefore, even if there has only been a fairly moderate increase in the underlying level of price volatility in the Australian wool market in recent years, it seems likely that many more producers now perceive their benefits as exceeding the costs of contributing to the RPS.[10]

Section 3: Further Estimates of Producer Benefits

The estimates of producer benefits presented in the previous section were based on data relating to the Australian wool industry in the period prior to the introduction of the RPS.

As an alternative procedure, data can be taken from the period after the introduction of the RPS and the formulae outlined in section 1 can be inverted to determine what level of price variability would have prevailed in the Australian wool industry in the absence of the RPS. This alternative counterfactual can then be used with the model outlined in section 1 to estimate producer benefits from the RPS. More specifically, data on mean price, price floor, price ceiling and price variability with the RPS in operation can be substituted into equation (4′) to determine the unstabilised level of price variability (σ_p^2). Furthermore, on the assumption that the correlation coefficient between price and output is unchanged by the operation of the RPS, the covariance between output and price before and after price stabilisation can also be determined. A final assumption that the variability of output is unaffected by the operation of the RPS completes the data requirements for evaluating equation (2) with and without the RPS.

In what follows the mean "price" of wool is taken to be the yearly average of the Australian Wool Corporation's Market Indicator (MI).[11] Average MI ($\overline{MI}$) not only represents a useful aggregate benchmark for the average value of Australian wool, but also it is the expected value upon which the Australian Wool Corporation's aggregate measure of the price floor for wool for the coming year, the Minimum Reserve Price (MRP), is based. The ratio of these two aggregate statistics, MRP/$\overline{MI}$, thus represents a measure of $p_f/\bar{p}$ for the RPS.[12]

In an attempt to match MRP/$\overline{MI}$ as closely as possible to the hypothetical levels of $p_f/\bar{p}$ examined in section 2 (i.e. 80, 90 and 95 per

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10. That the estimate of actual CV_p in Harris et al (1974) is 29.9 per cent rather than the 27.1 per cent used here to calculate producer benefits provides additional strength to this conclusion.

11. This average is calculated on the basis of the value of each sale's MI weighted by the number of bales sold as a proportion of total annual bales sold.

12. Note the continued assumption of rational expectations in the Australian wool industry in this case.

cent), the years 1984/85, 1985/86 and 1986/87 were chosen for analysis. Table 6 contains a summary of information relating to the Australian wool industry in those years, including the hypothetical variability of the MI (σ^2_{MI}) and its covariability with output (σ_{MIx}) in the absence of the RPS derived from the inversion of equation (4') and the assumptions of anunchanged correlation coefficient (ρ = -0.496) and variability of output (σ^2_x = 0.005) from the period prior to the introduction of the RPS. It can be seen from the values of $MRP/\overline{MI}$ in Table 6 that the years 1986/87, 1984/85 and 1985/86 correspond roughly to the ratios of 80, 90 and 95 per cent respectively. However, it can also be seen from Table 6 that the levels of unstabilised price variability differ markedly between the three years. This results in considerable differences in the hypothetical coefficients of variation ($\sigma_{MI}/\overline{MI}$) between the three years, whereas in the analysis of section 2 the coefficient of variation was uniform across the three $p_f/\bar{p}$ levels (27.1 per cent). As a consequence, it can be expected that the producer benefits from a higher ratio of price floor to mean price may not exceed those from a lower ratio because if the lower ratio is also associated with a much more variable price then it may in effect represent a more strongly interventionist pricing policy.

These expectations are confirmed in Table 7 which contains estimates of producer benefits in terms of willingness-to-pay (as a percentage of expected income) from the operations of the RPS in the three years. As Table 7 shows, the size of producer benefits is actually <u>inversely</u> related to the level of $MRP/\overline{MI}$, reflecting the dominance of the initial coefficient of variation of price in determining these benefits. In other words, it cannot be concluded that a higher level of MRP in relation to the expected level of MI is consistent with a higher level of producer benefits from the operation of the RPS because the underlying level of price variability is of fundamental importance in determining the size of benefits.

Finally, a comparison of Tables 2 and 7 shows that the estimated producer benefits using data from the period after the introduction of the RPS are considerably smaller than those estimated using data from the period prior to its introduction. Superficially, the explanation of this difference is that the underlying level of price variability (as measured by the coefficient of variation) has decreased markedly in recent years. But what has caused this marked decrease in underlying price variability? One possible explanation is that the <u>existence</u> of the RPS is itself sufficient to bring about a greater level of price stability--just knowing that the RPS will be brought into operation if price fluctuations become excessive may be enough to bring about a more stable marketing of wool. Accepting such an explanation means that the producer benefits from the operation of the RPS presented in this section underestimate the <u>actual</u> benefits because they do not include any measure of the benefits due to this "existence" effect of the RPS on price variability in the Australian wool industry.[13]

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13. Note that this conclusion also applies to the Hinchy and Fisher estimates because they are based on a data set which includes a significant period during which the RPS was in operation. Note also that recent research on exchange rate target zones has identified a similar phenomenon. Specifically, "the presence of a commitment by authorities to keep the exchange rate within a band tends to stabilise the movement of the exchange rate even inside that band" (Krugman 1987 p.22).

Table 6
Summary Information of the Australian Wool Industry
1984/87

	1984/85	1985/86	1986/87
MRP	470	500	508
$\overline{MI}$	525.57	532.76	621.22
MRP/$\overline{MI}$ (%)	89.43	93.85	81.77
$Var(MI_s)$[a]	943.02	82.15	4582.63
σ^2_{MI}	1130.69	82.30	6014.65
σ_{MIx}	-1.178	-0.318	-
$2.717\sigma_{MI}/\overline{MI}$ (%)	6.398	1.703	12.484

Source: ABARE.

Note: [a] Calculated as the weighted sum of squares of each sale's MI deviation from $\overline{MI}$, where the weights are the proportions of annual bales sold at each sale.

Table 7
Further Estimates of Producer Benefits from Price Stabilisation
Post-1974 Data
(Percentage of E(px))

MRP/$\overline{MI}$	R					
	0	0.15	0.3	0.45	0.6	0.7
81.8%	0.064	0.082	0.100	0.118	0.135	0.153
89.4%	0.022	0.024	0.026	0.028	0.030	0.031
93.9%[a]	0	0	0	0	0	0

Note: [a] All entries positive but less than 0.0005.

Section 4: Conclusion

In this paper a new methodology for evaluating producer benefits from price stabilisation has been used to estimate producer benefits from the Australian Wool Corporation's Reserve Price Scheme (RPS). One advantage of this methodology over that proposed by Newbery and Stiglitz (1981) is its more complex expected utility framework including explicit formulae to account for the guaranteed minimum price feature which is typical of price stabilisation schemes. The estimates of producer benefits from wool price stabilisation presented in section 2 of this paper are almost 100 per cent higher than those of Hinchy and Fisher (1988) estimated using the Newbery and Stiglitz framework. Although this discrepancy may be due to the latter's omission of the guaranteed minimum price feature, an alternative explanation can be based on a difference in the two data sets used to generate the estimates.

A comparison of these benefits with the costs of refundable contributions to the operation of the RPS showed, however, that the net value of participation in the RPS is evenly balanced, with small changes in the magnitudes of several parameters being capable of altering a net cost to a net benefit. In particular, an individual producer is more likely to find participation in the RPS of net benefit the higher is the level of the floor price and his aversion to risk, and the lower is the opportunity cost of contributions and the time period until contributions are refunded. Moreover, if as seems likely the current level of underlying price uncertainty in the Australian wool market exceeds the historical level used here to calculate producer benefits, then many more producers than indicated by the results in section 2 would now view participation in the RPS as a net benefit.

The estimates of producer benefits presented in section 2 were based on data relating to activity in the Australian wool industry prior to the introduction of the RPS (1974). In section 3 an alternative procedure was outlined in which data taken from the period after the introduction of the RPS were combined with inverted forms of the formulae outlined in section 1 to determine what level of price variability would have prevailed in the absence of the RPS. Estimates of producer benefits calculated using this alternative procedure were shown to be considerably smaller than those of section 2. It was suggested that this difference may be due to the failure of the alternative procedure to take account of the stabilising effect of the RPS on prices which occurs simply because of the existence of the RPS. If this explanation is accepted, then the estimates of producer benefits presented in section 3 must be considered unreliable.

One area in which the estimates of section 2 may also be considered unreliable is that in evaluating producer benefits from price stabilisation no account has been taken of any supply response to the scheme. Because any supply response to price stabilisation will typically be in the same direction as the welfare effect, and because any consequent price change will be in the opposite direction (unless demand is perfectly elastic), the estimates of section 2 should be interpreted as (absolute) upper bounds to estimates in which supply response has been allowed for. The clarification of the relationship between these two types of estimated producer benefits from price stabilisation is a subject for further research.

References

Bond, G. and Wonder, B. (1980) "Risk attitudes amongst Australian farmers", Australian Journal of Agricultural Economics 24:16-34.

Campbell, R., Gardiner, B. and Haszler, H. (1980) "On the hidden revenue effects of wool price stabilisation in Australia: initial results", Australian Journal of Agricultural Economics 24:1-15.

Fraser, R.W. (1984) "Risk aversion and covariances in agriculture: a note", Journal of Agricultural Economics 35:269-271.

Fraser, R.W. (1986) "Supply responses, risk aversion and covariances in agriculture", Australian Journal of Agricultural Economics 30:153-156.

Fraser, R.W. (1988) "A method for evaluating supply response to price underwriting", Australian Journal of Agricultural Economics (forthcoming).

Harris, S., Crawford, J.G., Gruen, F.H. and Honan, N.D. (1974) Rural Policy in Australia. A Report to the Prime Minister by a Working Group. Canberra, AGPS.

Hinchy, M. and Fisher, B. (1988) "Benefits from price stabilisation to producers and processors: the Australian buffer-stock scheme for wool", American Journal of Agricultural Economics (forthcoming).

Krugman, P.R. (1987) "Trigger Strategies and Price Dynamics in Equity and Foreign Exchange Markets", NBER Working Paper No.2459.

Newbery, D.M.G. and Stiglitz, J.E. (1981) The Theory of Commodity Price Stabilisation. Oxford, Clarendon Press.