WOOL-GROWER ADOPTION OF SALE BY SAMPLE

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Adoption levels of the innovation, sale of wool by sample, were less than complete but still increasing even after the innovation had been available for a number of years. A model that offers an explanation of the innovation process by individual growers is discussed and tested using econometric methods. The model is converted to testable form, given the data available, with the help of techniques used in studies of demand for travel. Variables found to have a significant influence on adoption levels include grower characteristics, which influence the profitability of innovation, and search variables such as contact with other growers and policies of wool brokers.

Introduction

The traditional method of selling wool in Australia has been to exhibit a sample of bales from each lot. Buyers assessed the value of a lot by inspecting the bales but without any objective measures of the characteristics of the wool. A recent innovation is 'sale by sample', where only a small sample of wool (approximately 8 kg), selected at random from each lot, is exhibited. Buyers of wool offered for sale by sample are given objective measures[1] of the yield, vegetable matter content and mean fibre diameter of the wool.[2]

Sale by sample became available in the 1971/72 selling season. Data on the proportions of wool sold by sample in Australian centres since 1973/74 are shown in Table 1. The data indicate that, even after the innovation had been available for a number of years, its adoption was incomplete but still increasing. The aim of this note is to report a test of a model that offers an explanation of this phenomenon in the diffusion of sale by sample.[3]

The decision of whether or not to adopt the innovation is ultimately that of the individual grower.[4] Accordingly, a model of the adoption process of a wool grower is outlined in the next section. Data available on adoption of sale by sample are discussed in the third section and this

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[1] The measures are made from a core of wool selected separately from the sample displayed.

[2] Wool is also sold by reduced showing where one bale from each lot is displayed with the set of objective measures. This method of sale is included here in 'sale by sample'.

[3] Observation and analysis of diffusion lags is not new; see, for example, Griliches (1957) and, more recently, Lindner and Pardey (1979).

[4] Discussion with brokers indicates there was no constraint in the areas considered below due to the capacity of coring and sampling machines. If such a constraint were binding, adoption levels would have been determined by investment in those machines.

TABLE 1
Wool Sold by Sample[a] *as a Percentage of Total Bales Sold*

Centre	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79
Brisbane	34.1	50.7	57.7	68.9	78.4	93.6
Sydney	10.5	25.0	45.5	50.2	64.1	74.0
Newcastle	4.8	23.4	38.0	41.0	52.2	66.5
Goulburn	5.5	18.6	42.7	42.7	52.0	64.6
Melbourne	12.7	33.8	46.5	50.1	75.3	84.6
Geelong	2.8	16.0	41.8	46.2	74.7	86.0
Albury	8.7	31.0	49.3	61.8	90.0	93.1
Portland	12.4	46.6	59.3	67.0	90.5	94.8
Adelaide	36.5	54.3	71.9	84.4	93.0	96.1
Fremantle	21.0	54.3	66.1	74.7	87.7	92.7
Albury	45.1	75.7	82.3	85.1	94.7	96.7
Tasmania	9.4	18.5	23.4	32.2	62.0	67.4

[a] All wool sold with a certificate.
Source: Australian Wool Corporation.

discussion is used to develop an appropriate test of the validity of the economic model. Results are presented in the fourth section.

Model

A model that provides an explanation of lags in the diffusion process and which concentrates on decision making by individual growers is that of Lindner and Pardey (1979). In the absence of perfect information, the grower may initially be unaware of the new selling method. A grower will become aware of the new method during a general search for new marketing methods. Once aware of a particular innovation, the grower may defer the terminal decision of adoption or rejection. The reason is that the grower will lack perfect information on the costs and benefits of the innovation. In that environment of uncertainty, a strategy of collecting information about the innovation from off-farm and on-farm sources and then making a final decision may be preferable to a terminal choice at the time of awareness.[5]

The observed adoption levels are, according to this view, the result of a combination of the time taken to reach a terminal decision and the outcome of that decision. A grower is likely to reach a terminal decision more quickly, the more time is spent searching in each decision-making period.[6] The following variables are likely to be determinants of the costs and benefits of search and, hence, the time spent searching:

(a) the density of settlement surrounding the grower;
(b) the number of meeting groups and grower organisations in the grower's area;

[5] This view implies a number of lags in the time from awareness to the terminal decision. Lindner and Pardey (1979) considered these lags separately but here they are lumped together as one lag.

[6] More detailed models, on which this section is based, are presented in Lindner and Pardey (1979) and references therein.

(c) the grower's education level;
(d) the grower's age;
(e) the current level of marketing costs;
(f) the current scale of output; and
(g) the policy of the grower's broker on sale by sample.

Briefly, variables (a) to (c) enter the model because they all influence the cost of search: (a) and (b) are expected to vary inversely with search costs but the influence of (c) is ambiguous. The expected benefits of search will be determined by the probability of finding a new method, hypothesised to be influenced (ambiguously) by the age of the grower, the probability the new method will be profitable, which is likely to vary inversely with the current level of marketing costs, and the size of the profits, which depend positively on the current level of output. Finally, the length of the search will be influenced by the stochastic element of the information found and the grower's confidence in that information. These will be influenced, it is hypothesised, by the views of other information sources, particularly wool brokers.[7]

Once the grower decides to stop searching, the decision is whether or not to adopt the new method. In the case of sale by sample, the following additional variables are hypothesised to be important:

(h) average lot size;
(i) wool type;
(j) yield; and
(k) attitude to risk of price variation.

Average lot size. Selling costs faced by growers include warehousing charges and, in the case of sale by sample, coring and sampling charges. Also sale by sample could involve a loss on the value of the sample. Warehousing charges for wool sold by sample are less than those for wool sold traditionally. The Prices Justification Tribunal (PJT) has calculated that, as lot size increases, the extra charges due to sale by sample are gradually offset by lower warehousing charges (PJT 1978, p.55). Hence, average lot size, which depends on clip size, will influence the grower's decision.

Wool type. The willingness of growers to adopt sale by sample could also be influenced by the type of wool they sell. When wool was sold traditionally, price was determined by subjective assessments of its quality. One summary description of wool sold traditionally was the quality number which was largely based on crimps per inch. These quality numbers were found to explain 80 per cent of the variation in prices paid (BAE 1970, p.243). Hence, quality numbers are taken here to be an index of wool quality accepted under the traditional method. The problem is that the most important fibre characteristic in wool manufacture is fibre diameter and the inverse relation between fibre diameter and quality number is only about 48 per cent accurate over the whole clip (Jeffries 1972, p.11). The possibility therefore arises that wool with a high quality number will have relatively coarse fibres and the price paid for that wool when sold with objective measures will be less. There would be less price effect if buyers already knew of this poor relationship but, even if buyers

[7] A broker in favour of sale by sample need not reduce the time spent searching by a grower since the broker's information may conflict with other information already collected. Also brokers could reduce search costs by collating information for growers.

had made this allowance, some sellers might still expect lower prices and would then be unwilling to sell by sample. The relationship between quality number and fibre diameter becomes less exact the higher the quality number (Jeffries 1972, p.12). Hence, it might be expected that growers of so-called fine or super-fine wool (64s or higher) would be less willing to sell by sample.

On the other hand, growers of fine wools may have an incentive to sell by sample. When valuing under the present system, buyers take into account the possibility of having to meet claims from processors for incorrect description of fibre properties (BAE 1970, p.247). All buyers might then discount prices to offset this risk and these discounts are likely to vary inversely with the difficulty of assessing fibre characteristics. The fibre diameter of finer wools is more difficult to assess, mainly because of the poor relation between quality number and fibre diameter and, hence, the discount on these lots is likely to be higher. Introduction of sale by sample could then lead to higher unit prices for those wool types more difficult to assess. Hence, there are two opposing influences on adoption decisions by growers of fine wool and the net effect of wool type on adoption is uncertain.

Yield. Fibre diameter is not the only important characteristic—another is the yield of clean wool. The BAE (1970, p.224) reports that subjective yield estimates show greatest variability for lots with higher vegetable matter and dust content. Expecting a higher risk of mis-specification on these wools, buyers might discount their price. Growers of these wools would have a greater incentive to adopt sale by sample.

Attitude to risk of price variation. Sale by sample is likely to reduce the dispersion of evaluations of wool and hence will lower the dispersion of the prices paid (BAE 1970, p.246). This reduction in price variability will be more attractive to risk-averse growers so the level of adoption is likely to be higher in areas where there are more risk-averse growers.

The validity of the model was tested here by asking whether the eleven variables (a) to (k) listed above could significantly explain variations in observed adoption levels.

Data and Testing Method

Data on the adoption decisions of individual growers were not available, so the test of the model of the adoption process had to be based on available data on adoption levels by groups of growers. The method used was to choose a year arbitrarily and to compare adoption levels between grower groups.[8] The year chosen was 1973/74 and the grower groups were defined according to the Australian Wool Corporation's (AWC) woolgrowing areas.[9] The significance of the variables (a) to (k) in explaining the variation in adoption levels was testing using regression. The rest of this section describes the regression model under the three headings of functional form, estimation problems, and explanatory variables.

[8] An alternative would have been to use time series data and apply a technique like that of Griliches (1957) but it was judged that the seven annual observations available were not sufficient to obtain a reliable characterisation of the diffusion process in terms of Griliches's summary curves.

[9] Selling centres could have been used instead but grower location and, hence, characteristics are easier to identify when areas are used.

Functional form

As noted above, observed adoption levels will depend on variables which influence the outcome of the final decision and the speed with which growers move to a terminal decision. To assist the derivation of the functional form the following simplification was made. It was assumed that all growers simultaneously reached the final decision of whether or not to adopt. Search aspects can be introduced again at a later stage. In this form, the grower's choice can be modelled like a binary choice problem familiar in models of transport demand.[10] Such models lead to a statement that the probability of adoption by grower i (P_i) can be written as a function of grower characteristics (x) as in (1)

(1) $$P_i = H(x).$$

Equation (1) applies to the individual but an aggregate model is required so as to be consistent with the aggregate data available. If x is distributed according to $f(x)$ then the expected group level of adoption (P), equal to the proportion of adopters in the group, would be

(2) $$P = \int_{-\infty}^{\infty} H(x) f(x) dx.$$

A complication is that data on the number of adopters in each region were not available so P could not be calculated. Data available referred to numbers of bales sold by users of sale by sample. A problem in using bales sold by the new method as a measure of adoption levels is that bales sold is another measure of clip size which, through its influence on average lot size, is a relevant grower characteristic. Assume then that x in (2) is wool clip, then the expected output by adopters (W) would be

(3) $$W = \int_{-\infty}^{\infty} x H(x) f(x) dx.$$

Equation (3) was the model estimated.

Equation (3) can be used to check the appropriateness of different functional forms for the regression equation. It is evident that specifying W as a linear function of characteristic means is not likely to be appropriate. Also variables are likely to enter the equation multiplicatively and the shape of the distribution of the characteristics, for example, reflected in the variance, will also influence W.[11]

[10] See, for example, Domencich and McFadden (1975).

[11] For example, say

$$H(x) = a + bx,$$

then

$$W = a\bar{x} + b\bar{x}^2 + \mathrm{bV[x]}$$

where $V[x]$ is the variance of x. The problem is more complicated if two factors are relevant. E.g. say the functions are $f(x,s)$ and $G(x,s)$ where

$$G(x,s) = a + bx + cs + dxs,$$

then, over the region of x and s,

$$W = \int\int (ax + bx^2 + cxs + dx^2 s) f(x,s) ds\, dx.$$

Assume that w and s are independently distributed, then

$$W = (a + cE(s))E[x] + (b + dE[s])(E[X])^2 + (b + dE[s])\, V[x]$$

so that $E[s]$ enters the model multiplicatively. Note that the form of the regression equation is independent of the form of $f(.)$.

Equation (3) was derived by assuming that all growers simultaneously reached the final decision stage but it can be amended to incorporate the influence of search variables. For example, if search is continuing, the adoption decision will have been deferred. After further evaluation the innovation may be adopted. This implies that the parameters of the probability function (1) change over time. The temporal change in parameters could be related to the amount of information that is available and to search variables such as education levels. Hence, this simple model could be consistent with changing adoption levels over time in the region.

If the parameters of the function for probability of adoption change over time, they could do so at different rates between regions. Then when a snapshot is taken of the adoption process, the parameters and adoption levels will vary between regions. The change in parameters will be related to search variables. For example, consider a search variable that is constant over all growers in a region, such as the number of grower meeting groups. Then consider two growers who, otherwise identical, live in different regions. The grower in the area with the larger number of meeting groups is more likely to have adopted the innovation.[12]

The conclusions in this section are, first, that W, the number of bales sold by sample, is the appropriate dependent variable; second, a linear function linking W and explanatory variables is not likely to be appropriate; and third, the shape of the distribution of grower characteristics can also influence W.

Estimation problems

In the sample used, the variance of adoption levels is likely to fall as the level increases since the characteristics of the innovation would be more widely and confidently known. This implies that the variance of the disturbances of the regression equation would be heteroscedastic. In that case, ordinary least squares (OLS) estimates are no longer best linear estimates and estimates of their variances are also biased so that the standard significance tests no longer apply (Kmenta 1971, pp.249-56).

Another problem is that some variables are likely to enter the equation multiplicatively. Ignoring these interactions could lead to unstable coefficients which would bias coefficient estimates, even leading to the erroneous exclusion of a variable.

Given these statistical problems, an ideal estimation procedure would be to include all interaction terms in the equation, test for heteroscedasticity and, if necessary, transform the data so that the disturbances are homoscedastic, and then delete any insignificant variables. This procedure was not adopted because the number of observations was insufficient. The procedure used was to define a number of sets of interaction and other terms, to include each set in a basic linear equation and to test the significance of the set by an F test (Kmenta 1971,

[12] The influence of search variables on the functional form can be illustrated as follows. Let m, a constant within each region, be the search variable and w be the only relevant characteristic, then let

$$H(w,m) = a + (b + cm)w$$

so that, from (3),

$$W = a\bar{w} + (b + cm)E[w^2].$$

p.370). A final equation, including the significant sets was tested for heteroscedasticity. If the homoscedasticity hypothesis were accepted, insignificant terms could be excluded from the equation. If not, the data would have to be transformed and once the homoscedasticity hypothesis was not rejected, insignificant variables could be deleted.

One criticism of the estimation procedure used is that heteroscedasticity will affect *F* as well as *t* tests. Therefore, the heteroscedasticity of the equations including different sets of interaction terms should be tested before the *F* test is applied. This procedure was not applied here because of the large number of sets of interaction terms and, hence, the time involved.

Explanatory variables

The variables that could be included in the regression equation are now considered. Detailed definitions, data sources and notation are included in the Appendix. Data were not available by woolgrowing area for two variables, education levels and attitude to risk, so these variables had to be excluded. Of the remainder, variables (d) to (j) were distributed over the population while (a) and (b) were constants. Variable (b) was measured by the number of meeting groups in the area (denoted by *MEET*). Variable (a), settlement density, was proxied by the average size of holdings (*FARM*). Discussion of equation (3) suggested that not only the mean but also the variance of variables (d) to (j) should be included in the regression equation. This was possible only for the age distribution, variable (d), where the mean and variance are denoted by *MAGE* and *VAGE*, and output, variable (f) denoted by *MF* and *VF*, respectively. Mean yield (*YIELD*) and mean average lot size, variable (h), (*ALOT*) were included. The other variables were proxied, in the case of the current level of marketing costs, variable (e), by average distance to store (*DIST*), broker policies, variable (g), by broker shares[13] of wool sold, and wool type, variable (c), by dummies for wool quality (*DQ*) and sheep breeds (*DB*). The dependent variable was the number of bales sold by sample (*W*). The estimated equation thus specified that *W* was a function of the variables *FARM, MEET, MAGE, VAGE, DIST, MF, VF, ALOT, DB, DQ* and *YIELD* and broker shares. This equation was estimated using data from 46 woolgrowing areas in South Australia and Victoria.

Results

The three steps in the estimation procedure were (a) test for the significance of sets of extra variables including interaction terms to find the best functional form, (b) test the heteroscedasticity hypothesis and (c) delete insignificant variables to obtain the final equation. The results are discussed under these headings.

Functional form

The sets of extra variables tested are listed in Table 2. In cases (1) to (4) the interacting variable was multiplied by the grower characteristic variables (*MF, VF, MAGE, VAGE, YIELD* and *ALOT*) so six inter-

[13] Care was taken to avoid a perfect correlation between the sum of the broker share variables in each state and the constant term.

TABLE 2

Testing the Significance of Sets of Interaction Terms

Case	Set[a]	*F*
(1)	*MEET*	16.13***
(2)	*DQ*	0.16
(3)	*PV*	3.25**
(4)	*DS*	6.36***
(5)	Squares	4.74**
(6)	Flock	2.69**
(7)	*MEET + DS*	2.37*
(8)	*DS + MEET*	7.03***
(9)	*MEET + PV*	1.10
(10)	*MEET* + Squares	1.80
(11)	*MEET* + Flock	1.93

[a] See text for definition of these sets.
* Significant at 10 per cent level.
** Significant at 5 per cent level.
*** Significant at 1 per cent level.

action terms were added to the linear equation. The first case tested the contribution of the set of interaction terms involving *MEET* and the second tested the hypothesis that the wool quality dummy influenced the coefficients on the characteristic variables as well as the constant term. The third case tested the influence of the state of sale of the wool and the fourth tested the influence of its state of origin. The former, represented by the proportion of wool sold in Victoria (*PV*) set, could reflect the influence of an interstate difference in general broker attitudes to sale by sample. The state of origin set (DS) was equivalent to a test of interactive effects via average lot size (*ALOT*) since *ALOT* was higher in South Australian areas than in Victoria. The fifth case[14], called the squares set, included the squares of the characteristics *MF, VF* and *YIELD*. The sixth case, called the flock set, included interaction effects between the flock variables *MF, VF* and $(VF)^2$ with *MAGE, YIELD* and *ALOT* (nine variables in this set). According to the *F* test, in all cases except the second, the sets of variables added significantly to the regression sum of squares.

It could have been that the sets of interaction terms were not mutually exclusive so to test which combination was significant it would have been necessary to test 20 pairs of sets.[15] A shorter version of this approach was adopted. First, it was assumed that either the *MEET* set or the *DS* set or both should be in the estimated equation because of the greater confidence in the significance of their contribution. Then the significance of each given the other was tested (cases (7) and (8) in Table 2). While the *MEET* set added significantly to the *DS* set, the latter only made a significant contribution to the *MEET* set at the 10 per cent level. Hence, it was presumed that only the *MEET* set should be in the equation. The next step was to test the contribution of the other significant sets (cases

[14] Cases (5) and (6) were suggested by the model in footnote 11.

[15] For example, both the significance of the *PV* set given the *MEET* set and the *MEET* set given the *PV* set would have to be tested.

(9), (10), (11)) given the *MEET* set. None of these were significant. Therefore, the final functional form is a linear equation plus six terms representing the interaction of *MEET* with *MF, VF, ALOT, MAGE, VAGE, YIELD* (a total of 27 explanatory variables).

Heteroscedasticity

Applying the Breusch-Pagan (1979) test, the null hypothesis of homoscedastic errors was accepted at the 25 per cent level.[16] Since the trial and error search for a transformation that could reduce this significance level can be time consuming and since there are other significant estimation problems, such as possible mis-specification of the functional form and multicollinearity, particularly between interaction and original variables, no attempt was made to find a transformation.

Final equation

An attempt was made to avoid incorrectly deleting variables because of their collinearity with other regressors. Collinearity was measured by the R^2 from a regression of an explanator on the rest of the variables in the equation. Initially only variables insignificant at the 10 per cent level and whose collinearity with other regressors was the lowest in the group of insignificant variables were excluded. Also the exclusion of a variable was influenced by the confidence of the expectation they should be significant: for example, a broker share variable would be excluded before *DQ* or *DB*, even if the collinearity measure were equal for all three. Also an interaction term would be dropped before an original variable when both had a similar collinearity measure. By this process, the final equation, reported in Table 3 was obtained.

Estimated coefficients in Table 3 are all significantly different from zero at least at the 10 per cent level. The R^2 of the estimated equation is 0.98 so the 14 variables included explain a high proportion of the variance of the dependent variable (*W*).

Of the eleven variables discussed above, those found insignificant were average age (MAGE) and wool type (*DQ* and *DB*). While average age was excluded, the variance of the age distribution was included. The total effect of a change in *VAGE*, allowing for an interaction effect at the mean of *MEET*, was positive. This result indicates that age and adoption levels are positively related. The lack of significance of the wool type variables could reflect the two opposite effects of wool type on adoption levels, discussed above. *MF* in Table 3 has an unexpected sign which could be the result of correlation between *MF* and other variables in the equation.[17] Also, *VF* has the sign expected which is inconsistent with the sign on *MF*. The variable *DIST* also has an unexpected sign; an explanation of this result is that *DIST* is a poor proxy for the current level of marketing costs and could be acting as a proxy for other variables, such as wool type or grower density. The signs on the variables *FARM* and *ALOT* were as expected and the effect of a change in *YIELD*, via an interaction with *MEET*, was negative as expected. The total effect of a

[16] The test statistic, distributed as χ^2 with 26 degrees of freedom, was 19.1 and the critical values were 17.3 at 10 per cent and 20.8 at 25 per cent.

[17] The coefficient of determination from the regression of *MF* on the other 13 variables was 0.93. It should also be noted that *MF* is not the only highly correlated variable.

TABLE 3
Final Equation[a]

Variable	Coefficient	*t* value
MF	−0.001	2.79***
VF[b]	0.37	3.25***
FARM	−0.14	3.02***
MEET	−2.00	5.49***
DIST	0.01	4.72***
ALOT[c]	2.54	3.54***
VAGE[d]	−0.24	3.74***
DENNYS	−7.94	3.70***
BF	−28.72	4.53***
ES	7.57	1.53*
VAGE. MEET[e]	0.004	8.12***
VF. MEET[e]	0.09	7.38***
ALOT. MEET[e]	0.23	8.82***
YIELD. MEET[e]	−0.01	2.49***

[a] $R^2 = 0.98$, $F_{14,32} = 119.72$.

[b] $\partial W/\partial(VF) = 1.79$ (calculated at the mean of *MEET*).

[c] $\partial W/\partial(ALOT) = 6.63$ (calculated at the mean of *MEET*).

[d] $\partial W/\partial(VAGE) = 0.04$ (calculated at the mean of *MEET*).

[e] $\partial W/\partial(MEET) = 0.74$ (calculated at the means of interacting variables).

* Significant at 10 per cent level.

*** Significant at 1 per cent level.

change in *MEET* was positive as expected. The other significant variables were the broker shares. The results suggest that Elders-GM clients in South Australia were more likely to sell by sample while Bennett and Fisher clients were less likely to do so.

In summary, the econometric results are that most variables hypothesised to be important influences on adoption levels are significant and have the signs expected. These results and the significant explanatory power of the equation do not lead to the rejection of the model. These results are qualified by the problems of multicollinearity, which could have led to erroneous exclusion of variables and by the low level of confidence that the residuals are homoscedastic. Also, while some effort was made to test a variety of functional forms, the estimated equation could be mis-specified.

Conclusion

The main result of the work reported here is that, noting the qualifications to the econometric results in the last section, variables suggested by a model of the adoption process of individual growers can explain a significant part of the variation in bales sold by sample. Significant variables include both grower characteristics and search variables, such as contact with other growers and wool broker policies. The implication of the model is that observed adoption levels, varying over time, will be influenced by the information search activities of growers and by growers' final decisions on whether or not to adopt the new method. Finally, while this work may indicate something about the adoption process, it does not imply an affirmative answer to the question of whether the diffusion process should be hastened by public action. Such action can be justified only by a comparison of the benefits of raising adoption levels and the costs of achieving those increases, where the benefits could be derived from a comparison of predicted adoption levels, in the absence of any public intervention, and some concept of an 'optimal' set of adoption levels over time.

APPENDIX

Data and Definition of Variables

(A.1) $ALOT$ = average lot size

Average lot size was calculated by dividing the total number of bales offered from each area by the total number of lots. The data were obtained from computer tapes containing sale catalogue information supplied by the AWC.

(A.2) DB = dummy for sheep bred where
$DB = 1$ if only merino wool was offered by growers in the area,
$= 0$ otherwise.

DQ = dummy for wool quality where
$DQ = 1$ if the wool quality number was typically greater than or equal to 64,
$= 0$ otherwise.

The raw data used to develop DB and DQ were provided by officers of the AWC and are based on their subjective judgments.

(A.3) $MAGE$ = mean age of the population at 30 June 1971.
$VAGE$ = variance of the age distribution at 30 June 1971.

Victorian data were collected from 1971 census data. Local government areas corresponding to each woolgrowing area were found by comparing maps of the two sets of areas. An age distribution for each woolgrowing area was then found by combining data from each local government area. Only District Councils and Shires were included. Data on the age distribution in South Australian areas other than numbers 1 to 3 were found in the same way. The first three areas are outside local government areas and an age distribution was developed using unpublished collectors' district data provided by the Australian Bureau of Statistics (ABS).

(A.4) MF = mean flock size.
VF = variance of the distribution of flock size.

The South Australian data were obtained from 1973/74 rural censuses. The data provided by the local ABS office are available by Statistical Divisions and Subdivisions. The areas corresponding to each woolgrowing area were found by comparing maps of the two sets of areas. There is frequently an overlap so some census data appear in more than one woolgrowing area. The data from woolgrowing area 2 in South Australia are an average of the data for areas 1 and 3.

Mean flock sizes in Victoria were found using data on the number of holdings with sheep and the number of sheep shorn by county in 1973/74 provided by the Victorian ABS office. The only year for which a distribution of flock size in Victoria could be developed using the method applied to South Australian data was 1976/77. The variance of flock size estimated for this year was assumed to also apply to 1973/74.

(A.5) *YIELD* = average yield of greasy wool.

YIELD is a weighted average of the yields of greasy wool sold in different selling centres from each woolgrowing area. The weights are the proportion of bales sold in each centre. The source of the data was *Wool Sale Statistics*, Statistical Analysis 4A, 1973/74 season, published by the AWC in Melbourne.

(A.6) *FARM* = average size of holdings.

Victorian data on the area and number of holdings were obtained from the Victorian ABS Office. S.A. data were obtained from the S.A. Office of the ABS.

(A.7) *DIST* = average distance to store.

DIST was formed by choosing a major town in each woolgrowing area closest to the most popular wool-selling centre. A weighted average of the road distances to each centre used was calculated by using the proportion of bales sold in each centre as the weights.

(A.8) *MEET* = number of meeting groups of grower organisations in the area.

The grower organisations included in S.A. were the Agricultural Bureau (branches currently operating), United Farmers and Graziers (branches operating in 1974) and the Stockowners Association (1972). In Victoria, the organisations included the Graziers Association of Victoria (branches currently operating) and the Victorian Farmers Union (current branches).

(A.9) Broker Variables.

AML	= A.M.L.
BF	= Bennett and Fisher
DAL	= Dalgety
DENNYS	= Dennys Lascelles
ES	= E.S.G.M. (S.A.)
EV	= E.S.G.M. (Vic.)
ESTATE	= Australian Estates
FG	= Farmers and Graziers
SFS	= Southern Farmers (S.A.)
SFV	= Southern Farmers (Vic.)

Data on market shares, measured by the proportion of bales sold by the broker, were obtained from AWC tapes.

(A.10) *W* = number of bales sold by certificate in the 1973/74 season.

Data were obtained from AWC tapes.

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