AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

THE EFFECT OF BUYER COMPETITION ON PRICE DIFFERENTIALS BETWEEN AUSTRALIAN WOOL SELLING CENTRES

Phillip J. Hanson

Wool International
G.P.O. Box 4867
Melbourne 3001

A contributed paper to the 38th Annual Conference of the Australian Agricultural Economics Society, 7th to 11th February, Wellington

1. Introduction

The level of buyer concentration has been of interest to participants of the Australian wool industry for decades. The Philp report into the marketing of Australian wool in 1962 investigated buyer concentration and concluded: "The concentration of buying strength may not at present exert a significant depressing influence on the price paid for Australian wool. However, the present system of wool auctions does leave the woolgrower in a vulnerable position should further concentration occur" (Philp *et al*, 1962).

Woolgrowers are concerned about the pricing efficiency in the market for Australian wool due to perceived 'buyer power' depressing prices. The role and magnitude of this perceived 'buyer power' in affecting prices has not been quantified. One reason for this is that determining the price for a particular lot of wool is complex as many factors act simultaneously. Buyer competition is only one part of the many influences which determine price.

Given the overall demand and supply conditions, over 80 per cent of price variation can be explained by wool attributes and non-wool attributes (Stott, 1992 pers comm.). The remainder of the price variation is unexplained and assumed to be largely random. Although some research has focused on buyer behaviour (Vlastuin, 1988; Burns, 1984), little research has focused on the structure of the buying sector. A component of Stott's residual may not be random and may be related to buying strategies or the level of competition.

1.2 Objectives and Hypothesis

The effects of different levels of buyer concentration on price within the Price Leadership model of behaviour is analysed in an empirical framework. A significant amount of research has been undertaken into the general economic implications of price leadership, market structure and its influence on market performance. Much of this research pertains to Anti-Trust Laws aimed at curbing the anti-competitive behaviour associated with oligopolistic market structures (Pigassou, 1985; Scherer and Ross, 1991; Kirman and Scheller, 1990).

These studies are relevant to the Australian wool market because they provide a framework for understanding of buyer behaviour and are adapted to deal with the problem of 'large buyers' at Australian wool auctions.

The major objective of this study are to:

- quantify the level of buyer concentration/inequality in the Australian wool market;
- test the hypothesis that a high level of buyer concentration is indicative of collusion and an expression of market power;
- determine the effect this market power has on average prices; and
- determine the effect this market power has on the premiums and discounts on wool quality attributes and on marketing factors such a spatial discounts/premiums;

2. Price Leadership

A problem for cartels is the determination of price. If quality differences are minimal and preclude any lasting price differential between the products of two firms, some method of price setting is required which is both legal and acceptable. The fundamental problem facing firms aiming to maximise profit in an oligopolistic market structure is to devise a method of eliminating price competition between rival sellers (Markham, 1951). Communication is required between rival sellers so that price and output decisions are made that serve a common interest. Price leadership may be an effective method of achieving this aim.

Price leadership embodies a set of industry practices by which price changes are announced by a firm which is accepted as a leader by others. The latter firms follow the leader's initiatives. Models of price leadership have generally been summarised into two main types of price leadership, namely: (1) dominant firm; and (2) barometric (Thompson, 1975; Ono, 1982; Scherer and Ross, 1990; Markham 1951; Cohen and Cyert, 1975).

(a) Dominant Firm Price Leadership

'Dominant firm' price leadership which usually relates to the market structure where one firm accounts for a large share of total industry output and sets prices. Many small firms then form a 'competitive fringe' around the large firms with none producing a significantly large amount to be able to effect the price (Markham, 1951).

Firms in the competitive fringe act as 'price takers' as each firm regards its own demand schedule as perfectly elastic at the price set by the dominant firm and thus operate close to a situation of perfect competition. The dominant firm is the only agent able to influence price and does this by maximising profit subject to the constraints implied by a residual demand curve. After estimating the quantity the "competitive sector may supply at any price, the dominant firm sets the new price on the basis of it's knowledge of the (net) demand schedule" (Markham, 1951). Hence the large producer acts as a quasi monopolist with respect to the residual demand.

As noted by Markham (1951), "Price leadership in a dominant firm market is not simply a *modus operandi* designed to circumvent price competition among rival sellers, but is instead an inevitable consequence of the industry's structure".

(b) Barometric Price Leadership

Barometric price leadership is the case where a 'barometric' firm "commands adherence of rivals to his price only, because and to the extent that, his price reflects market conditions with tolerable promptness" (Stigler, 1947). Hence this model is "essentially competitive in effect, since the price leader is really lead by strong market forces of supply and demand and is a 'barometer' reflecting them" (Bain, 1960).

Especially for price decreases, a barometric price leader often assumes the role of formalising price changes that have already become common knowledge (Scherer and Ross, 1990). Barometric price leadership generally exists when there are several principal firms surrounded by a competitive fringe of firms. Hence the identity of the price leader may change frequently as the leader would be the first firm to announce new prices consistent with current market conditions (Thompson, 1975).

While barometric price leadership is often classified as 'competitive' price leadership (Markham, 1951), this may be an over generalisation when compared to what price may have been in an atomistically competitive market structure. For example, even when justified by demand conditions, price increases may not be sustainable unless there is a firm of considerable influence to provide a focus for the industry. Hence, because of the market structure, prices may be sustained at lower prices than the competitive level.

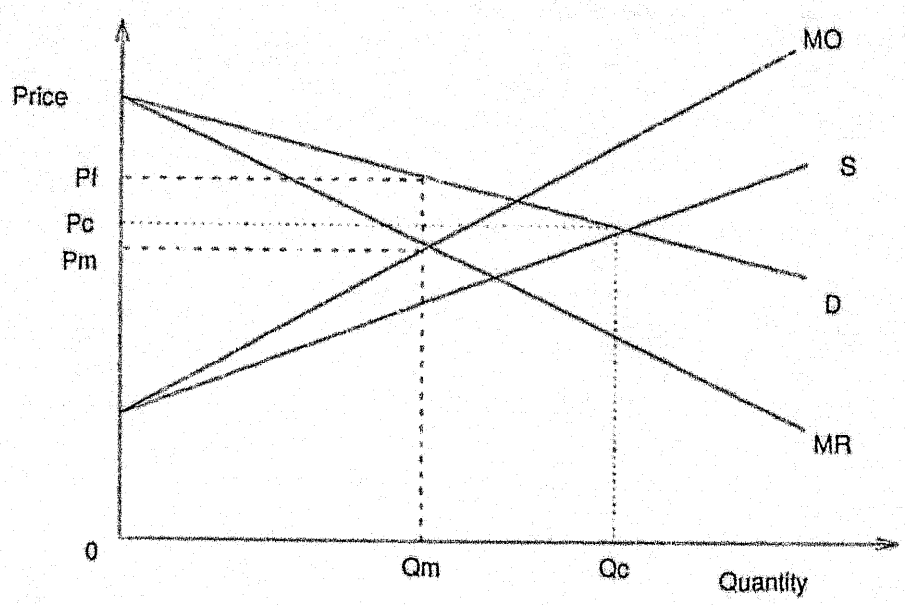
2.1 Price Leadership and Oligopsony

In comparison with the literature concerning oligopolistic theory, the theory concerning oligopsony (i.e. few large buyers) is scant. The major reason for this is that when compared to oligopolies, industries that are concentrated on the buying side are few. This is because most production is sold for personal consumption of which the number of individual buyers is very high. Only in the intermediate stage of processing raw products would a high concentration of buyers be expected.

(a) Monopsonistic Price Determination

Consider a market structure where supply of the commodity comes from a perfectly competitive industry. The supply curve for these firms is represented as S (Figure 1). Because it is likely that there are many final consumers, the demand schedule facing the monopsonistic firm buying intermediate products is a derived demand (D), or the marginal value of the input to the buying firm. In a competitive situation the input is purchased up to the point where the price of the input equals the value of the marginal product. That is, price would be at Pc and the buying firms would buy 0Qc.

Figure 1 Price Determination in Monopsonistic Market Structures



However, if the buyer is a monopsonist, the buyer would recognise that the more input it seeks to buyer, the higher its purchase price will be. It therefore sees the marginal cost of its purchases it terms of the marginal outlay curve (MO), which is lies above the supply function.

If the monopsonist also has monopoly power in its output market, then the more output it sells, the lower the price received from the output and the lower the average value derived from the input. Hence the benefit from purchasing input depends on the marginal revenue curve (MR). To maximise profits, the monopsonist offers a price of Pm which encourages sufficient supply such that the marginal outlay equates with the marginal revenue. The resulting equilibrium

reduces the demand for the input (Qc to Qm), reduces the price paid (Pc to Pm) compared with the competitive equilibrium and increases the price to the final consumer to Pf.

(b) Oligopsonistic Price Leadership

When facing a reasonably inelastic supply, large buyers would aim to maximise profits by minimising the price paid for the commodity while maximising the revenue from the resale of the commodity. If the industry structure contained a monopsonist only, the monopsonist would set prices so that sufficient supply was encouraged to maximise the firm's profits. However, a buyer in a competitive market structure may find that prices are higher than the profit maximisation equilibrium for a monopsonist, and would stop purchasing when price equals average value product. That is, when the marginal value product equals zero. Hence, an oligopsonist who by virtue of the size of purchases, or lower cost structure, would find price leadership attractive because prices could then be set at a lower level than the equilibrium of a perfectly competitive market could enjoy profits similar to (but not as large) an monopsonist.

Consider a price leading oligopsonist who has determined the purchasing pattern of the competitive fringe at given prices. The oligopsonist is then able to determine the residual derived demand for its purchases. Competitive price determination would set prices above the profit maximising equilibrium. However, if a major firm restrained purchases and hence prices were lowered to an optimal price level, prices could be maintained at this level because other firms, on seeing this action, would not pay more than this level.

Price rises would occur if the derived demand curve moves outwards. That is, the average net value product curve moves out. Hence the equilibrium between marginal outlay and marginal revenue is such that it is more profitable to increase the amount of input bought. If the price leader does not increase price then another firm, reacting to the changed demand and supply conditions, would act as the price leader and increase its market share (i.e. barometric price leadership). Thus, to secure more input, the price paid by the price leader would rise to a level where marginal outlays are again in equilibrium with marginal revenue.

Alternatively, as in barometric price leadership of oligopolistic firms, if the frequency of higher paid purchases increases to such a level that the price leading firm begins to lose market share (in its output market), then the firm is forced to bid prices up to levels that the rest of the market accept as satisfactory. The other major buyers would follow suit to maintain market share. Hence the fringe, seeing this action, would also have to follow and increase their prices. This would reduce their profits.

Hence price leadership actions in an oligopsonistic market structure have the effect of reducing the price paid and the amount bought compared to a competitive market, as the price set by the price leader to maximise profits is less than what would be paid where only normal profits are achieved.

Price leadership as outlined for the oligopolistic market structure is also relevant to the oligopsonistic market structure as the price leader by his actions enable profits to be increased by his influence on the market to the detriment of competitive suppliers.

2.2 Adaptation of Price Leadership Models to the Australian Wool Market

The Australian wool market is comprised of many small buyers who are 'price takers' and some large buyers who purchase over one third of the offering. Consider the following model where it is assumed that large buying firms have some cost advantages resulting from their size.

(1) $\pi_L = D_L(V-P) - k_L(D_L)$

(2) $\pi_{si} = D_{si}(V-P) - k_{si}(D_{si})$

(3) $V = v(D_L + \Sigma_i D_{si})$

(4) $P = g(S)$

(5) $S = D_L + \Sigma_i D_{si}$

where

π_L	=	profit for large middleman
π_{si}	=	profit for small middleman
D_L	=	quantity purchased by large middleman
D_{si}	=	quantity purchased by small middleman
V	=	marginal value of wool to processor
P	=	auction price received by grower
S	=	wool supply
$k_i(.)(i = L \text{ or } S)$	=	cost of buying wool and selling to processors

The first two equations are the profit functions for big and small middlemen. Profits are constrained by the derived demand for the wool. That is, the processors' valuation of the wool (equation 3) and by the amount a wool producer will supply at a given price, which is, the producer's valuation (equation 4). Hence equations 3 and 4 are the inverse demand and supply functions respectively. If there is no storage, then market clearing requires that total demand equals total supply, equation 5.

To determine the relationship between large middlemen and prices in the short-run the simplifying assumption is made that supply is inelastic and equation 3 and 4 are replaced by:

(6) $S^* = D_L + \Sigma_i D_{si}$

where S* is a constant.

In order to establish a profit maximising equilibrium for small middlemen, first order conditions are established when the rate of change in profit per unit of quantity purchased equals zero. The first order conditions for the small middleman, from equation 2 are:

(7) $$\frac{d\pi_{si}}{dD_{si}} = V - P - k_s'(D_{si}) = 0$$

and this equation may be solved to obtain P, the auction price for wool:

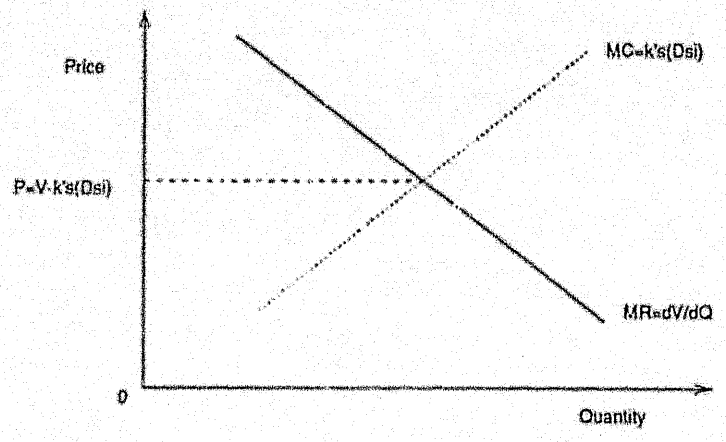
(8) $P = V - k_s'(D_{si})$

Substituting equation 3;

(9) $P = v(D_L + \Sigma_i D_{si}) - k_s'(D_{si})$

Hence equation 9 states that the equilibrium price for small middlemen is equal to the processors' valuation of the wool minus the marginal costs associated with the purchase of the wool by the small middlemen. This relationship would hold regardless of the activity of large middlemen providing costs faced by small middlemen are increasing (Figure 2).

Figure 2 **Price Equilibrium for Small Middleman**



To consider the effect of large middlemen on price, the derivative of equation 9 is taken with respect to D_L. Because S* is assumed to be a constant hence from equation 6,

$$\frac{d(D_L+\Sigma_i D_{si})}{dD_L}=0 \quad \text{thus;} \quad \frac{dv(D_L+\Sigma_i D_{si})}{dD_L}=0 \quad \text{and hence;}$$

$$(10) \qquad \frac{dP}{dD_L}=0-\frac{k_s^{'}(D_{si})}{dD_L}$$

Again under the assumption of inelastic supply (equation 6), purchases by large middlemen have a one for one inverse relationship on the purchases by small middlemen and thus, $dD_l/dD_{si}=-1$. The latter expression allows the second right hand side term in equation 10 to be simplified:

$$(11) \qquad \frac{dk_s^{'}(D_{si})}{dD_L}=-\frac{dk_s^{'}(D_{si})}{dD_{si}}=-k^{''}(D_{si})$$

Marginal costs faced by small middlemen would represent a 'U shaped' curve. Initially marginal productivity of inputs would increase, and hence marginal costs would fall. However marginal costs ultimately rise as the availability of inputs start to decline. If small firms are price takers and operate on the declining part of the marginal costs curve, there would be unexploited profits. However, in a competitive market no unexploited profit opportunities can exist. Hence all firms in a competitive market would expand output until marginal costs were increasing. Hence $k''(D_{si}) > 0$.

Thus substituting equation 11 into equation 10 and from the assumption of increasing marginal costs discussed in the paragraph above, it follows:

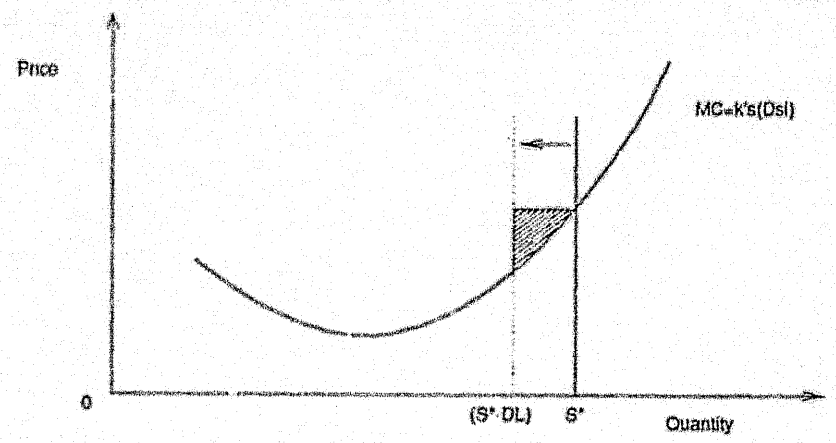
$$(12) \qquad \frac{dP}{dD_L} = \frac{k_s'(D_{si})}{dD_{si}} > 0$$

We conclude that with constant supply large middleman activity drives up auction prices.

The reason for this is that because supply is constant in the short run, increased (reduced) activity by a large middleman reduces (increases) through-put by small middlemen. The latter then face lower (higher) marginal costs and thus can bid higher (lower) at auction.

Purchases by the large middleman are equal to D_L. Thus purchases made by small middlemen decrease from S* to (S^*-D_L) (Figure 3). The shaded area represents a reduction in costs. Hence small middlemen faced with reduced marginal costs bid more in a competitive manner for an additional unit then they would have previously.

Figure 3 Small Middlemen Cost Savings



This equation shows the effect of large middleman purchases on the marginal costs of small middlemen. An increase in purchases by large middlemen (D_L) effects middleman gross revenue (V-P) which in turn effects the incentives for small middlemen and hence the amount of wool they buy. This in turn effects small middlemen' marginal costs.

2.3 Summary

Price leadership is usually associated with either firms of large size, or firms that have some comparative advantage in terms of cost structure.

Large firms dominate many of the sub-markets for wool in Australia with some markets being very highly concentrated. Hence the price leadership model may be appropriate to the Australian wool market with large wool exporters setting prices and with smaller buyers acting as price takers in a competitive fringe.

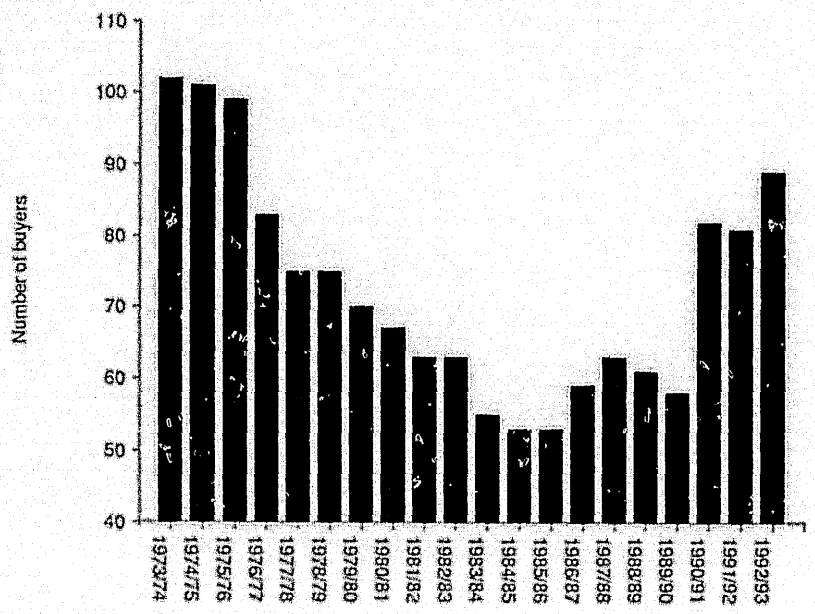
The influence of large buyers in their role as price leaders on prices is ambiguous. If supply is inelastic, large buyer activity may have a positive influence on prices by decreasing the purchases of small buyers which allows small buyers to bid higher as their marginal costs are lower. However, when supply is elastic, the direction of the influence is unclear and the resulting influence depends on the relative elasticities of demand and supply.

3. Concentration in the Australian Wool Market

3.1 Number of buyers

The number of exporters recorded by the ACWE as buying wool has fallen over the past 19 years (Figure 4). In 1974/75 a total of 101 buyers was recorded. This compares with 58 buyers in 1988/89. In the last two years there has been a reversal in this trend and the total number of buyers has increased to 81 in 1990/91, 82 in 1991/92 and 89 in 1992/93. A listing of buyers active in 1992/93 is presented in Appendix A. The reduction in the number of buyers before the removal of the RPS may be related to the trend towards firm offer contracts which would reduce the viability of small, specialised buyers.

Figure 4 Number of Wool Exporters - 1973/74 to 1992/93



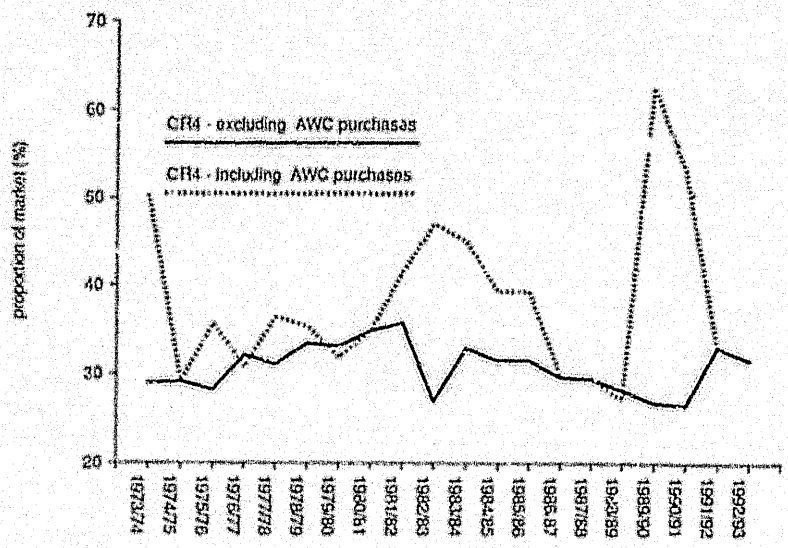
The reduction in the number of buyers, would cause a reduction in the number of independent voices in the auction room, and hence, would have contributed to a reduction in competition. Whilst this reduction is small in an aggregate sense, it may have had a significant impact for specialised markets in certain selling centres where competition was already limited.

3.2 Concentration Ratio

(a) Without the AWC

The Australian wool market has been dominated by a few major buyers for many years. Over the past 20 years, the largest 4 buyers (excluding the AWC) have bought approximately 30 per cent of the total amount of wool sold every year (Figure 5). The top eight buyers have consistently bought just under 50 per cent of the total amount of wool sold.

Figure 5 Concentration Ratios of the Australian Wool Buying Sector



During the last decade there has been a slight decrease in the CR4 value, especially as purchases by the AWC increased during 1989/90 and 1990/91. During 1991/92 the trend in the decreasing value of the CR4 was reversed. The primarily reason for this was the absence of the AWC from the market after the cessation of the RPS. The CR4 increased from 26.6 per cent in 1990/91 to 32 per cent of the total sold in 1992/93. However, the increased concentration was restricted to increased purchases by the four largest buyers as the CR8 fell from 50 per cent in 1990/91 to 48.7 per cent in 1992/93. That is, the share bought by buyers ranked 5th to 8th actually fell.

Almost three quarters of the increase in the CR4 value between 1990/91 and 1992/93 was due to increased purchases by Itoch C & Co. Itoch C & Co. increased market share in 1992/93 to purchase 10.6 per cent of the total wool sold from 7.5 per cent in 1990/91.

While no significant trend in the concentration of the buying sector of the Australian wool market is observable during the existence of the RPS, concentration had increased significantly during the 1960s. In 1960/61 the largest four buyers purchased 16.4 per cent (Philp *et al*, 1962). By 1973/4 the CR4 had risen to 28.9 per cent of the market.

(b) Concentration Ratio and the AWC

Throughout the existence of the RPS, the AWC bought significant amounts of wool at auction when prices were at floor price levels with the aim of reselling the wool privately when prices improved. The amount of wool bought per year varied between zero per cent to around 50 per cent of the total amount sold (Figure 5). The AWC has been the largest buyer 9 times in the past 19 years and one of the largest 3 buyers 14 times in the past 19 years.

The AWC was a significant buyer during the early 1970s, between 1983/84 and 1985/86 and most significantly between 1989/90 and 1990/91. The CR4 including the AWC over the past 19 years has ranged from 28 per cent to 63 per cent. The CR8 has varied from 45 per cent to 75 per cent of the market. The level of AWC purchases depended on the level of overall prices compared to the floor price. Hence changes in the concentration ratios including the AWC

purchases reflects changes in the level of prices compared to the floor price and is not indicative of changes in the structure of the buying sector.

As a large buyer, the AWC may have had a significant effect on the level of market competition. The AWC, as a large buyer, may have acted as a countervailing power against other major buyers since it purchased wool with the aim of supporting prices. This was, of course, in stark contrast to other major buyers which were aiming to secure the lowest possible price for wool. Thus, the AWC is likely to have reduced the effectiveness with which large buyers could influence price levels. Hence, this may have limited the development of collusive buyer behaviour between other large buyers.

3.3 Summary

The structure of a market is important in determining the level of competition in the market. Further, an examination of market structure helps to identify how firms interact and how well the market performs in setting prices.

The Australian wool buying sector is highly concentrated and has been that way over the last two decades. During this time the largest four buyers consistently bought around 30 per cent of the annual trade purchases.

Apart from concentration ratio, other aspects of market structure were also studied (see Hanson 1993). It can be shown that there has been some change in the structure of the buying sector with respect to the remainder of the buying sector with the market share of buyers which are ranked between the top 10 per cent to 40 per cent of buyers. Thus the market share of the small buyers (the remaining 60 per cent of buyers) has decreased over the past two decades.

The ranking of buyers over the past fifteen years has been very stable. Spearman correlation coefficients over this time show a high degree of correlation (with a significance level of 5 per cent or greater). However Spearman coefficients of the mid 1970s compared with later years are not significant indicating that significant changes to the market structure occurred in the early 1970s and has been stable since.

Change in the pattern of entry and exits from the wool exporting industry was restricted to small buyers purchasing less than 10,000 bales per annum. While there was a high number of firms entering and leaving this purchase category, change in firm identity was very limited in higher purchases categories which may be caused by some barrier to entry at this level.

In summary, the buying sector of the Australian wool market is highly concentrated with a few buyers purchasing a large proportion of the total amount of wool sold. However, there is a large number of independent firms operating in the market. It appears that a large proportion of buyers can operate profitably with limited turnover. This structure has been very stable over the past two decades. Similarly, the ranking of the major firms has also been very stable. While there appears to be little restriction to entry or exit of small buyers, there is little evidence of change amongst the largest wool exporting companies.

4. An Econometric Model of Price Leadership

Modelling the specific influence of large buyers on prices would help to confirm the existence of price leadership in the Australian wool market as opposed to collusive behaviour. Such a model would also help to identify the relative importance of the price leadership activity in setting the price for particular lots of wool.

4.1 Methodology and Data

The technique used to estimate a hedonic model of wool prices from value determining attributes is regression analysis. Regression analysis, using the Ordinary Least Squares estimator, provides a method of estimating relationships among variables, that is, it summarises the linear dependence between variables.

By making the initial assumptions that prices are a linear function of the observable characteristics of a lot, a general hedonic model for wool price is;

$$(1) \qquad P_i = a_0 + \sum_{k=1}^{n} a_k X_{ik} + \mu_i$$

where P_i = the clean price per kg for lot i
a_0 = a constant term
a_k = the value or 'implicit price' of an additional unit of the characteristic k
X_{ik} = the amount of the *kth* characteristics of lot i
u_i = is the error term

From the previous research, the major value determining characteristics of wool lots sold at auction are;

- mean fibre diameter;
- vegetable matter content;
- length;
- strength;
- style; and
- colour.

4.2 Results

(a) Results of Regression without Buyer Concentration Variables (Model A)

The regression model was found to explain 83.1 per cent of total price variation (adjusted R^2). Of the 47 variables used in the regression, only two were found to be insignificant at the 1 per cent level of significance. Given the size of the data set, the large period analysed, and the variation in price which occurred during this period, the model was thought to be acceptable compared to other hedonic models of wool prices in the literature.

The results confirm with previous studies with regard to the sign associated with different wool attributes and their magnitude. Of major importance in determining price is the average micron diameter of the lot of wool (see Appendix B). As expected, the sign for the micron term is negative which confirms the premiums for fine wool compared to coarser wool.

Discounts/premiums due to selling centre range compared to Melbourne from premiums of 8 cents/kg (1.4 per cent) for wool sold at Newcastle, to a discounts of 18.5 cent/kg (3.3 per cent) for wool sold at Launceston. With the exception of Brisbane, wool sold in the northern region selling centres exhibited a premium relative to Melbourne. No significant difference was observed for the Geelong selling centre relative to Melbourne. A discount of 8.7 cents/kg (1.5 per cent) was observed for wool sold at Fremantle compared to Melbourne.

These results are comparable with previous analysis carried out for the second half of 1991/92 (Stott 1993, pers comm) (Table 1). While the results for the second half 1991/92 were

estimated from a slightly different model using staple measured wool only, it appears that the differences in prices for lots of wool sold at different locations have been reduced. With the exception of Launceston, the pattern of centre premium and discounts are similar.

Table 1 Centre Price Differentials Relative to Melbourne (c/kg clean)

Sale centre	*1991/92 * second half*	*Discount relative to average price*	*1992/93 first half*	*Discount relative to average price*
Adelaide	-5.3	-0.92%	-3.1	-0.55%
Brisbane	-5.5	-0.96%	-10.1	-1.79%
Fremantle	-17.5	-3.04%	-8.8	-1.56%
Geelong	-4.5	-0.78%	ns	-
Goulburn	2.4	0.42%	6.2	1.10%
Launceston	20.4	3.55%	-18.5	-3.29%
Newcastle	19.6	3.41%	8.2	1.46%
Sydney	6.1	1.06%	2.4	0.43%
Ave. Price (c/kg clean)	575		563	

(* Stott 1993, personal communication)

The discounts for Adelaide and Brisbane are similar, while the premiums for Sydney and Newcastle have been reduced by around 60 precent. Similarly, the discount observed for Fremantle relative to Melbourne have been reduced by almost 50 per cent. The large premium observed for Launceston in the second half 1991/92 was reversed in the first half 1992/93, by a similar magnitude. While the results for Launceston and Goulburn are statistically significant, because these centres sell infrequently, the model may not separate the centre and week effects sufficiently, thus this would make the results less reliable.

Fibre diameter (56 per cent of price variation) is the most significant attribute affecting clean price. The other main attributes are: strength (16 per cent), vegetable matter content (12 per cent) and length (five per cent). Centre effects contribute around five per cent of price variation, while factors such as style, colour and staple measurement each contribute around three per cent of total price variation.

(b) Model Results with Concentration Variables (Model B)

Herfindahl Index (H-index), and the concentration ratio (CR4) were calculated for each selling centre for each of the 20 weeks during the first half of 1992/93. Results from the regression model adjusted for buyer concentration using H-index are presented in Appendix B. The overall adjusted R^2 improved slightly from 83.1 per cent to 83.3 per cent of the total price variation explained by the model.

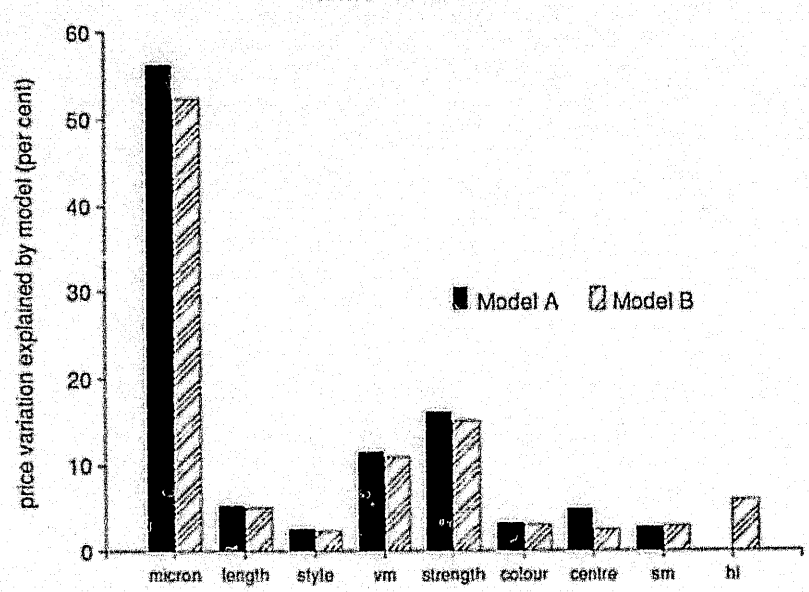
In summary, H-index was found to be a significant explanator of price. A positive relationship was found between price and the H-index. This result suggests that as market inequality increases, prices rise. This suggests that as the buying sector assumes a structure where fewer buyers are active, buyers are not acting collusively to depress price. Rather, increased buyer concentration may be reducing through-put by small buyers, and hence putting pressure on them to increase their price limits. This is consistent with the theoretical results of the price leadership model.

4.3 Comparison of Results

(a) Variation in wool attribute coefficients

A comparison between models with and without the H-index variable is presented graphically in Figure 7. For discussion purposes the model without the H-index term will be identified as model A, whilst the model with the H-index variable will be identified as model B. The most important difference between models A and B is the contribution of micron and centre variables to overall price variation.

Figure 7 Relative Importance of Value Determining Attributes - Models A and B



It was observed that the selling centre variables explain less of the total price variation in model B than in model A. Model A shows that the average centre influence contributed around 4.5 per cent to total price variation. However, in model B it was found that the average selling centre influence is around 2.5 per cent of the total price variation. Hence approximately 50 per cent of the premium/discount due to centre differences may be due to differences in buyer shares per selling centre. The difference in H-index per centre is reflected in the coefficient for the H-index variable in model B.

The second major difference between the determination of attribute importance between the two models is that of micron. In model A, micron explained 56 per cent of total price variation. In model B, micron explains 52 per cent of total variation.

(b) Variation in selling centre coefficients

Generally the absolute size of the discounts and premiums for selling centres increased in model B compared to model A (Table 2). That is, centres which had a discount relative to Melbourne in model A exhibited a larger discount in model B. Conversely, centres which exhibited a premium in model A exhibited a larger premium compared to Melbourne in model B.

Table 2 Comparison of Selling Centre Coefficients Between Models
First Half 1992/93

Centre	*Model A*	*Model B*	*H-index**
(relative to Melbourne)			
Fremantle	-8.8	-10.3	0.076
Sydney	2.4	5.6	0.058
Brisbane	-10.3	-9.8	0.063
Adelaide	-3.1	-11.2	0.097
Newcastle	8.2	15.6	0.049
Geelong	ns	-1.5	0.077
Goulburn	6.2	3.8	0.077
Launceston	-18.5	34.3	0.091
Melbourne			0.077

ns not significant
* Average for first half 1992/93

Thus it seems likely that the centre coefficient in model A is influenced by:

- a positive relationship between price and H-index; and
- that H-index is related to selling centre.

Because different centres have different H-index values, it follows that centre variables would be related to prices because price is related to the H-index. Hence price differences between centres are likely to be influenced by the different buying structures as reflected in different H-index values.

The change in the coefficient of the centre variables between models is mixed. Four groups were identified:

(1) At Fremantle, Adelaide and Geelong which recorded negative coefficients in model A, the coefficient of the centre variable was a larger negative value when the H-index was included separately (model B).

(2) At Sydney and Newcastle which recorded positive centre coefficients in model A, larger positive coefficients were observed in model B.

(3) The negative coefficient for the Brisbane centre variable in model A was less in model B and the positive centre coefficient for Goulburn in model A was a smaller positive in model B.

(4) A large negative coefficient was identified for the Launceston centre variable in model A while a large positive coefficient for the centre variable was observed in model b.

Consider the group 1 and group 4 selling centres, an example of which is Adelaide. This centre had the highest H-index value during the first half of the 1992/93 season. The variable coefficient for Adelaide in model A was -3.1 cents/kg clean. However, in model B the coefficient was -11.2 cent/kg clean. When the positive effect of the H-index/price relationship was removed from the model A centre coefficient a more accurate indication of the centre discount is observed in model B. Hence the discount due to spatial effects which may affect price due to factors such as buyer attendance costs, composition of offering, timing of sales in other centres and other factors, are higher than previously identified.

A similar, but converse explanation may be appropriate for the group 2 type centres. These centres have significantly lower buyer concentration compared to the Melbourne selling centre. Hence when the H-index is separately modelled, the H-index/centre/price interaction which in this case would be reducing the centre coefficient because concentration is lower than compared to the Melbourne centre, would be removed from the coefficient values for these selling centres and hence the centre coefficients in model B would rise. Thus the centre premium for type 2 centres rise in model B compared to model A because the lower H-index value for these centres relative to Melbourne would have a negative influence on the centre coefficients in model A.

The result for the Type 3 centres is unclear. The centre coefficients for Brisbane is similar between models, while the Goulburn centre coefficient is smaller in model B. These results may indicate that buyer concentration is not as important in these centres compared to other centres.

4.4 Price Leadership and model results

A significant positive relationship was observed between average price and the Herfindahl index. This relationship is due to several factors.

(a) Buyer costs

As concluded from the theoretical model in section 2, if supply is inelastic (or in the short term), a positive relationship between price and buyer concentration would be expected. This result is due to the fall in marginal costs incurred by small buyers as the amount purchased by large buyers increases. Thus, lower marginal costs faced by small buyers, causes increased bidding in a competitive 'sub' market between small buyers for the remaining lots of wool. Hence the competitive behaviour of small buyers faced with lower marginal costs would increase prices.

Also the largest buyers are Japanese. Japanese exporting firms such as C.Itoch, Kanematsu, Marubeni and Nissho-Iwai, were the major buyers over the last decade. Many of these firms are associated with early stage processing firms, and because of the this vertical integration, may bid higher at auction then otherwise as profits made in the processing sector may offset losses in the buying side of their operations.

(b) Demand

Increased H-index is a reflection of increased purchases by the few large buyers, which in turn increases the inequality of market shares. Increased purchases by large buyers may be a reflection of increased demand from clients. As the large buyers, by definition, purchase a significant amount of the wool offered, increased demand would be reflected in increased orders to the large exporters. Hence as their orders increased, their share of the market increases. Bidding competitively against each other to fill their orders or to increase market share, large buyers would push prices up to match changes in demand conditions.

(c) Price Leadership Behaviour

A positive relationship between price and H-index is indicative of a price leadership pattern. If large buyers increase purchases, small buyers recognising that prices are generally higher, will bid competitively for wool at this new higher price which is set by the large buyers. As 'price takers' small buyers can either enforce price changes as

set by large buyers or stop purchasing. As identified earlier, a decrease in marginal costs will encourage small buyers to 'meet-the-market' and pay the higher prices to fill client orders.

If orders to large buyers fall, prices will also tend to ease. Small buyers recognising the decline in purchases from large buyers would not purchase at the previously high levels and would reduce buying limits and hence amplify the price fall.

Hence while large buyers do have a significant effect on prices their actions and subsequent influence on prices may be amplified by small buyers through a barometric price leadership model of behaviour in an attempt to maximise profits by minimising costs.

5 Summary

A hedonic multi-attribute model was developed to identify the sources of price variation that could be attributed to wool attributes and other non-wool attributes. From this model discounts and premiums for different centres were identified which are similar in magnitude and sign to previous research. The model was then modified to identify how buyer concentration affects price and to quantify the magnitude of the effect.

Buyer concentration was found to have a positive affect on price. This is consistent with the conclusions of the theoretical model. Two observations were made with the introduction of a H-index variable into the regression model. Firstly, the contribution of micron and centre variable to overall price variation was reduced with the H-index explaining around 6 per cent of total price variation. Secondly, the centre coefficients for different individual centres were affected by generally increasing the absolute magnitude of the centre coefficients.

Because different centres have different average H-index values, with the introduction of the H-index variable, means that the centre coefficient more accurately represents the relative centre premium/discount due to spatial effects rather than due to concentration effects. Hence the overall proportion of price variation explained by the centre coefficient was reduced with the introduction of the H-index variable. It was calculated that around 50 per cent of the difference between centres in model A was explained by buyer concentration in model B.

The positive relationship observed between H-index and prices was found to be consistent with *a priori* knowledge of the relationships between large buyer and small buyer marginal costs, buyer concentration and overall market demand and buyer concentration and price leadership behaviour.

5.1 Policy Implications

From the current research, it is apparent that buyer concentration is not a price depressing factor in the market for Australian wool. In the current market structure, high concentration actually increases prices as market information may be more obvious to market participants with price setting being aided via a price leadership model of behaviour. Hence development of wool markets should focus on improving the quality of information to market participants and reducing price risk. An important aspect therefore is the reduction in excessive price variation. Further, viable Futures and Options markets would provide a mechanism to help reduce overall risk. Thus by utilising these marketing tools, bidding at auction would be less risky and this would attract more buyers to the market.

As the current research does not identify any market inefficiencies created by a concentration of buyer market shares, action under the trade practices act or antitrust laws is not required. However, the present role of the wool exporter may undergo a significant change over the next few years as the wool industry adjusts to the 'free' market environment.

The RPS, while beneficial to wool growers by supporting price levels and reducing price variation, was also beneficial to wool exporters/buyers. This was because the RPS reduced the need for private stockholding which is required to meet short term needs of buyers' clients. Similarly, with the reduction in price variation, there was less need and indeed, less scope, for exporters to engage in arbitrage activities. Hence the activity of 'merchanting', or buying when prices were low to fill potential orders, has not featured as a major wool exporter activity.

It seems that the wool exporter may have responded more to incoming orders for wool rather than to price changes in the market. However, in the future, the 'middlemen' of the wool industry may assume a more active role in the market by an increase in opportunistic purchasing without covering orders.

Thus following this scenario, it is open to conjecture as to what influence large exporters will have on wool prices when more sophisticated purchasing activities and strategies have evolved to cope with the free wool market. The analysis relates to a period soon after the removal of the RPS. It therefore relates to a market which is very immature and still evolving. Nevertheless, the analysis has shown that large buyers have a significant effect of price levels. Although no serious distortions of the wool market were identified due to the activity of large buyers, the conclusions of the study may relate to an era soon to be past, and different results may be found when the market matures.

Because of the unique market structure of the wool market there is potential for distortions to occur in segments of the wool market. For example, if concentration was to reach a critically high level, such that there were no small buyers to offset the action of large buyers, some market intervention may be required.

Hence it is not enough to assume that because a market now exits which is free of intervention, that an efficient and competitive market will evolve. Therefore it is necessary to continue to monitor the influence of large middlemen with respect to the efficiency of price determination in the Australian wool market.

REFERENCES

Australian Council Of Wool Exporters (1992), 'Annual Purchases of Wool'. 1991/92 and previous issues.

Bain, J. (1960), 'Price Leaders, Barometers, and Kinks', *The Journal of Business* 33 (3), 193-205.

Burns, P. (1984), *Modelling Wool Auction Markets.* Paper presented at the 28nd Annual Conference of the Australian Agricultural Economics Society, University of Sydney 1984.

Cohen, K. and Cyert, R. (1975), *Theory of the Firm - Resource Allocation in a Market Economy*, Second Edition Prentice-Hall, Inc Englewood Cliffs, New Jersey.

Hanson, P. (1993), 'Buyer Power in the Australian Wool Market: Implications for price and Selling Centre Efficiency'. Masters Dissertation. University of New England.

Kirman, A. and Scheller, N. (1990), 'Price Leadership and Discrimination in the European Car Market', *The Journal of Industrial Economics*, 39 (1), 69-91.

Markham, J. (1951), 'The Nature and Significance of Price Leadership', *The Economic Review* 41 (1), 891-905.

Ono, Y. (1982), 'Price Leadership: A Theoretical Analysis', *Economica* 49 (1), 11-20.

Philp, R., Butterfield, M.C. and Merry, D.H. (1962), *Report of the Wool Marketing Committee of Enquiry*, Commonwealth Government Printer, Canberra.

Pigasson, P. (1985), 'Oligopoly and Antitust Law: A Comparison of United States, European Community, West German, and French Law', *Journal Of International Law and Economics* 19 (1), 633-740.

Scherer F.M. and Ross D.R. (1990), *Industrial Market Structure and Economic Performance*, Houghton Mifflin Company.

Simmons, P. (1980), 'Determination of Grade Prices for Wool', *Review of Marketing and Agricultural Economics* 48 (1), 37-46.

Stigler, G. (1947), 'The Kinky Oligopoly Demand Curve and Rigid Prices', *Journal of Political Economy* 55 (1), 432-449.

Thompson, A. A. (1973), *Economics of the Firm*, Prentice Hall, Inc. Englewood Cliffs, New Jersey.

Vlastuin, C. (1988), *The Efficiency of Price Discovery at Wool Auctions.* Paper presented at the 32nd Annual Conference of the Australian Agricultural Economics Society, La Trobe University, 9-11th February 1988.

Australian Council of Wool Exporters

HEAD OFFICE

APPENDIX A

NTM:235/93 15 JULY 1993

A M E N D E D

AUCTION PURCHASES FOR AUSTRALIA
1 JULY 1992 TO 30 JUNE 1993

* Southern Region figures adjusted

BUYER	NORTHERN REGION	SOUTHERN REGION *	WESTERN REGION	AUST TOTAL
ABBOTT WOOL PTY LTD		2858		2858
ACE WOOL TRADER			946	946
ALEX S H & SON PTY LTD		29056		29056
ANTI WOOL SERVICES			18511	18511
ASSOCIATED WOOL EXPORTERS PTY LTD	18038	11020		62919
AUSTRALIAN WOOL FIBRE EXPORTS			724	724
AUSTRALIAN FINE WOOLLENS			58	58
AUSTRALIAN WOOL EXPORTS PTY LTD	5932	31126	11226	51684
BAYL B		679		679
BELGRAF D PTY LTD	11207			11207
BETTA WOOLS	255			255
BIDCH & BEDREVS PTY LTD	16032	47406	37973	101411
BOOTH HILL & MIR PTY LTD	80551	42951	22280	145787
CABLE BRIGHT & PTY LTD	1550			1550
CAMDEN WOOLS PTY LTD		299		299
CHELSEA WOOLS			199	199
CITY WOOL CENTRE	317	194		511
COMPAGNIE d'INDUSTRIA de LANES	12315	41819	16507	117641
DEVAGRA WOOL PTY LTD	71788	36191	38601	146575
DAEIL TEXTILE INDUSTRIAL CO LTD		16978		16978
DALGETY INTERNATIONAL TRADING	31657	36776		90473
DARSON H SONS & CO (AUST) PTY LTD	12621	11057	5116	28791
de TEUTEV HAROLD PTY LTD	3405			3405
DESPLECHIN PTY LTD	875			875
DEVEREUX J B & CO	3			3
DEWAVRIN SEGARD A PTY LTD	35041	46381	33119	114547
DEWEZ J R & CO PTY LTD	3293			3293
DIXON WOOLS (AUST) PTY LTD		5511		5511
DYSON WOOLS			117	117
FIBRES (AUST) PTY LTD	1070			1070
FOX & LILLIE (AUST) PTY LTD	6037	14045		30082
FUJIKOSHI		53		53
GARADON PTY LTD		3489		3489
GEDGE A S (AUST) PTY LTD	57294	50346		107640
GEORGESON & CO PTY LTD			1427	1427
GLOBAL			1670	1670
GORDON TECHNICAL COLLEGE		6		6
GRIST ALAN (WOOL) PTY LTD			27869	27869
HAVICE C P		8		8
HUGHES F W PTY LTD	44450			44450
ITOCHU AUSTRALIA LTD	143973	168895	89932	402800
KANEMATSU AUSTRALIA LTD	98390	149884	70869	319143
KREGLINGER (AUST) PTY LTD	2096	26266	10807	39169
LAYCOCK IAN PTY LTD	59583	23020	11870	94473
LEMPHERE (AUST) PTY LTD	71465	60905		132370

BUYER	NORTHERN	SOUTHERN	WESTERN	TOTAL
MARCOM PTY LTD			2191	2191
MARLSTON COLLEGE		108		108
MARLEM AUSTRALIA LTD	53100	95220	33102	181432
MEREDITH WOOL CO PTY LTD		236		236
MITCHELL G H & SONS AUSTRALIA PTY LTD		95623	41683	110306
MODANO AUSTRALIA PTY LTD	48708	59745	29871	138324
MONTGOMERY WOOL		373		373
MOREPEX	2	874		876
MORRIS P J WOOLS PTY LTD		3211	11140	14351
NEW ENGLAND WOOL PTY LTD	6159			6159
NEWING PHILLIP L PTY LTD	9313			9313
NISSHO IWAI AUSTRALIA LTD	61752	104230	44975	210957
NORFOLK WOOL TRADERS PTY LTD			13919	13919
O'BRIEN P J WOOL PTY LTD			4112	4112
PATTERSON A & F WOOL PTY LTD	7526			7526
PEYWOOL		29		29
PETERS WOOL TRADING PTY LTD		455		455
PIVOME WOOL EXPORT (AUST) PTY LTD	22381	27494	7600	57477
PRINCOST HART (AUST) PTY LTD	85417	80867	98014	264298
QUEENS WOOL		2086		2086
QUAD WOOL SERVICES			2137	2137
REDMONE & CO	17812	4766		46578
RUTHERN WOOLS			2906	2906
SCHAEFER S & CO	20260	614		20874
SCOTT WOOL			228	228
SOUTH HEAD P LTD	6489	5441	412	12346
SOUTHERN WOOL TRADERS		207		207
STANDARD WOOL (AUST) PTY LTD	45469	37074	55047	137590
STARCO PTY LTD	21662	22408	2969	47039
SUBIAC TECHNICAL COLLEGE	198			198
STERLING SORTING CO PTY LTD			25695	25695
TECHWOOL TRADING PTY LTD		14474		14474
TEVELMEY (AUST) PTY LTD		17		17
TRAVIS		1		1
TOLLIOVIE (AUST) PTY LTD	5			5
UNILAV AUSTRALIA PTY LTD	28009	13287	5629	41925
VIVIANE (PTY) LIMITED	21710	29674	24133	75517
WOOL PTY LTD		517		517
WHITEHEAD & CO	1696			1696
WOOL BROKERING SERVICES		11023		11023
WOOL TECH GAMCESTON		119		119
WOOL TECH MARKETING PTY LTD		99		99
WRIGHT & BRUCE (QLD) PTY LTD	14616			14616
YUDO WOOL (AUSTRALIA)	2465			2465
	1357620	1566260	861245	3785125

Appendix B: Results of Regression Analysis

Model A

Variable	Parameter estimate	Standard Error	T statistic	Significance level
Intercept	7809.49	89.89	86.88	**
MICR	-687.34	9.27	-74.1	**
MRTN	16.34	0.24	68.37	**
M205	-7.49	0.68	-10.96	**
M225	-11.13	0.91	-12.27	**
M230	25.44	1.2	21.13	**
M240	-12.53	1.83	-6.86	**
Length (relative to a length)				
b length	-2.74	0.19	-13.92	**
c length	-15.53	0.35	-44.83	**
Style (relative to good topmaking)				
best	4.4	0.23	19.25	**
avtm	-6.92	0.46	-14.9	**
Vegetable matter				
vm	-8.55	0.09	-90.44	**
Strength (relative to sound wool)				
W1	-15.75	0.23	-68.34	**
W2	-43.74	0.32	-135.68	**
V	-54.94	0.94	-58.33	**
Colour (relative to clean colour)				
H1	-10.76	0.37	29.04	**
H2	-21.26	1.18	-17.99	**
H3	-46.45	11.83	-3.93	**
Additional measurement (relative to no additional measurement)				
sm	4.88	0.19	25.09	**
Centre (relative to Melbourne)				
fre	-8.8	0.34	-25.67	**
syd	2.41	0.39	6.22	**
brl	-13.17	0.46	-22.03	**
ade	-3.06	0.47	-6.57	**
new	8.24	0.51	16.2	**
gel	0.35	0.46	0.76	ns
gou	6.16	0.64	9.69	**
lau	-18.51	1.05	-17.68	**
Week (relative to week 23)				
wk4	43.64	0.58	75.13	**
wk5	33.53	0.61	49.77	**
wk6	33.56	0.52	64.83	**
wk7	47.25	0.65	72.38	
wk8	35.52	0.49	75.17	**
wk9	45.78	0.49	92.76	**
wk10	51.58	0.51	101.4	**
wk11	44.56	0.49	90.8	**
wk12	25.21	0.51	55.86	**
wk13	30.79	0.52	58.87	**
wk14	38.48	0.52	75.05	**
wk15	27.21	0.51	52.9	**
wk16	5.46	0.58	9.454	**
wk17	-7.62	0.49	-15.65	**
wk18	-9.16	0.51	-17.79	**
wk19	1.14	0.63	1.824	*
wk20	14.04	0.53	26.43	**
wk21	33.12	0.48	69.71	**
wk22	41.2	0.61	67.65	**

Model B

Variable	Parameter estimate	Standard Error	T statistic	Significance level
Intercept	8047.84	92.97	86.56	**
MICR	-715.85	9.6	-74.55	**
MRTN	17.11	0.25	69.13	**
M205	-10.48	0.71	-14.63	**
M225	-12.04	0.95	-12.65	**
M230	26.56	1.26	21.14	**
M240	-13.5	1.88	-7.199	**
Length (relative to a length)				
b length	-2.713	0.21	-13.05	**
c length	-15.66	0.36	-43.25	**
Style (relative to good topmaking)				
best	4.32	0.24	17.82	**
avtm	-7.14	0.48	-14.94	**
Vegetable matter				
vm	-8.72	0.1	88.14	**
Strength (relative to sound wool)				
W1	-15.45	0.24	-64.49	**
W2	-43.16	0.33	-128.94	**
V	-53.74	0.97	-55.13	**
Colour (relative to clean colour)				
H1	-10.96	0.4	-27.74	**
H2	-20.78	1.25	-16.61	**
H3	-47.8	11.59	-4.13	**
Additional measurement (relative to no additional measurement)				
sm	4.93	0.21	24.05	**
Centre (relative to Melbourne)				
fre	-10.38	0.39	26.59	**
syd	5.64	0.48	11.65	**
brl	-9.8	0.49	-20.1	**
ade	-11.17	0.57	-19.45	**
new	15.58	0.67	23.36	**
gel	-1.52	0.55	-2.74	**
gou	3.88	0.96	4.022	**
lau	-34.31	1.27	-26.87	**
Week (relative to week 23)				
wk4	41.06	0.68	60.01	**
wk5	31.22	0.69	45.06	**
wk6	26.64	0.69	38.63	**
wk7	42.57	0.73	58.59	**
wk8	36.11	0.57	63.48	**
wk9	42.67	0.75	56.78	**
wk10	49.88	0.58	85.98	**
wk11	42.05	0.62	68.36	**
wk12	25.99	0.61	42.92	**
wk13	27.4	0.66	41.46	**
wk14	38.26	0.65	59.19	**
wk15	19.03	0.67	28.2	**
wk16	4.86	0.69	7.05	**
wk17	-7.13	0.55	-12.89	**
wk18	-15.1	0.68	-22.22	**
wk19	-5.8	0.75	-7.74	**
wk20	6.49	0.81	7.99	**
wk21	0.32	0.61	49.45	**
wk22	40.83	0.69	59.08	**
H-index	297.07	13.94	21.31	**