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Relative economic value of wool processing parameters for New Zealand strong wool between 2003 and 2007

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ABSTRACT

Price trends for a total of 147,416 lots of wool in the strong wool segment of the New Zealand clip sold at auction between 1 July 2003 and 30 June 2007 were analysed by multiple regression analysis to determine the effect on price of five key characteristics known to affect wool processing performance. Changes in exchange rate were allowed for by covariance against the exchange rate of the US dollar on the day of the auction. The residual standard deviation within the data set was 20.4 c/kg clean. Mean values of the slope of the regression, or relative economic value, were 0.4 ± 0.2 c/kg clean/mm change in barbe length, -1.9 ± 0.9 c/kg clean/ μ m change in mean fibre diameter, 2.5 ± 0.5 c/kg clean/CIE Y value change in brightness, -5.0 ± 0.6 c/kg clean/CIE Y-Z value change in intensity of yellowness and -16.8 ± 3.0 c/kg clean/% change in vegetable matter contamination. These estimated values align closely with values estimated in 1991 for the New Zealand clip as a whole confirming that despite the significant changes that have occurred within the wool processing industry the economic significance of individual wool characteristics to wool processors have not changed.

Keywords: relative economic value; strong wool; wool characteristics.

INTRODUCTION

While the price of raw materials traded on a commodity market is dictated by supply and demand, the relative price between different consignments in the market will differ depending on the suitability of each consignment for a particular end-use in the industry concerned. Approximately 75% of the New Zealand clip is classified as strong wool suited for the production of interior textiles, specifically carpets. Past research has shown that the processing performance of strong wool is related to fibre diameter, fibre length, brightness, intensity of yellowing, wool bulk and vegetable matter contamination (Carnaby *et al.*, 1985). As each of these characteristics can be measured objectively it is possible to develop interrelationships between individual wool characteristics and wool price at different stages along the wool processing chain. Bulk however, is expensive to measure and few lots are tested. Price relationships applicable at the "farm gate" are of particular importance to individual wool growers to enable them to develop a breeding and management procedure to optimise the return from the sale of their wool clip.

With approximately 40% of the New Zealand wool clip sold by the grower at auction, 45% sold privately and 15% sold as slipe by meat processors after removing it from pelts (Meat and Wool New Zealand Economic Service, 2006), auction prices are a fair indication of the value of wool across the wool market as a whole.

To facilitate valuing lots of wool offered for sale by auction, representative subsamples of wool are drawn by the broker handling the sale from each lot

for measurement and display. The measurements are displayed on a "test certificate" attached to the display sample and included in the sale catalogue.

A comprehensive industry database involving a description of each lot of wool offered for auction has been maintained since the wool acquisition scheme operating during World War II. This database now includes data on the brand of the grower, the region where the wool was grown, the centre where the wool is sold, a description of the lot including its size, available objective measurements and a series of subjective assessments. The subjective assessments describe various attributes of the wool in relation to its potential scouring and/or processing performance. Following disestablishment of the New Zealand Wool Board in 2004 and the cessation of their collecting data for the industry database in April 2005, Wool Services International Ltd. has maintained the database since 1 July 2005. Wool auction sales are now held only in Napier and Christchurch.

Using data from the industry database, Maddever *et al.* (1991) analysed objective and subjective data describing lots of grower's wool sold at auction over the six wool selling seasons between 1 July 1984 and 30 June 1990 to derive estimates of the relative economic value (REV) of ten wool characteristics that affect wool processing performance. With major changes having taken place throughout the wool industry in recent years the analysis reported here was undertaken to determine whether the previously published (Maddever *et al.*, 1991) estimates of the REV's for the key wool characteristics still apply in the current wool market.

MATERIALS AND METHODS

Wool industry database

Data describing each lot of strong wool sold at auction between 1 July 2003 and 30 June 2007 were extracted from the wool industry database. Strong wool encompasses wool shorn from adult sheep that is coarser than 32 μm and wool shorn from lambs that is coarser than 27 μm where the lambs do not contain any Merino blood. These lots comprised approximately 88% of the wool sold by auction over this period (Meat and Wool New Zealand Economic Service, 2006). The extracted data involved the auction price expressed on a clean fibre weight basis (c/kg clean), objective measurements of mean fibre diameter (IWTO-28), CIE Y and Y-Z values (IWTO-56) and vegetable matter contamination (IWTO-19), and a subjective assessment of barbe length.

The objective measurement procedures were all undertaken by one of the two IWTO-licensed (International Wool Textile Organisation), industry approved wool test houses in New Zealand.

Barbe length is a subjective assessment of the likely mean fibre length after carding. The estimated value takes account of the perceived fibre tensile strength with the barbe length being less than the mean staple length.

Wool type classification

To take account of the potential effect of different end-uses on wool price, data for lamb wool, which is inherently finer and softer than adult wool, were analysed separately from wool shorn from adult sheep. Similarly data for wool grown on the main body region were analysed separately from data for shorter often discoloured wool grown on other regions over the body. Each lot was allocated a type classification according to the following criteria, namely

- Adult fleece: Body wool derived from adult sheep.
- Adult oddments: Oddments derived from adult sheep.
- Lamb fleece: Body wool derived from lambs.
- Lamb oddments: Oddment wool derived from lambs.
- Other: Wool that did not fit the four main classifications.

Lots classified as "Other" were not analysed.

Statistical analysis

Data related to lots that were "passed-in" at auction or contained apparent recording errors were discarded from the analysis. With the bulk of the New Zealand wool clip traded in US\$ the exchange rate between the NZ\$ and the US\$ was used to adjust for currency fluctuations.

The variation in clean wool auction price associated with each of the key wool characteristics that affect processing performance was analysed

using restricted maximum likelihood (REML) procedures in Genstat (Payne *et al.*, 2007). Fixed effects included in the model were season, wool type classification, sale location, region where grown by sale location interaction, assessed barbe length and measured mean fibre diameter, CIE Y and Y-Z values, and vegetable matter contamination, and their interactions with the region where grown and sale location, as well as the currency value of the US\$, and its interaction with region where grown and sale location. The random effects included in the model were the region where grown and sale location along with interaction of these with the fixed effects. The analysis was similar to a standard regression analysis while modelling the correlations between individual lot values to give larger and more realistic estimates of the standard errors of the estimated coefficients.

The regression coefficient, or slope, of the relationship of auction price regressed on each of the adjusted key wool characteristics, can be deemed an estimate of the REV of each characteristic, independent of the interrelationship with the other characteristics included in the model. Each estimated REV was expressed as the change in clean auction price (c/kg clean) per unit change in the specified characteristic.

RESULTS

The supply of wool types onto the wool market is seasonal. An indicator wool price is routinely estimated for each sale as the average price of each segment of the New Zealand clip if the whole clip had been sold at that sale. The mean indicator wool price for the strong wool segment of the New Zealand clip during the period of the study was 376 c/kg clean.

A total of 149,900 lots of wool within the strong wool segment of the New Zealand clip were sold at auction during the four wool selling seasons between 1 July 2003 and 30 June 2007 (Table 1). Forty nine percent of the lots were sold in Napier and 50.1% of the lots were sold in Christchurch with equivalent amounts of wool of each type sold in each centre related to the farming practices in the two islands.

Analyses of between lot differences treated each lot as an independent entity with no account being taken of interrelationships between lots within an individual clip. The result was that while the trends in objective characteristics present within most clips were evident between the mean values of each wool type, the effects barely attained statistical significance on account of the large variation within the four wool types (Table 2). A comparison of the mean values showed lamb wool was shorter, finer, brighter and less yellow than wool shorn from adult

TABLE 1: Number of lots of each wool type classification sold at auction during each season between 1 July 2003 and 30 June 2007.

Season	Adult		Lamb		Other	Season subtotal
	Fleece	Oddments	Fleece	Oddments		
2003/04	24,675	6,989	6,644	1,225	392	39,925
2004/05	19,402	6,035	4,955	962	434	31,788
2005/06	23,537	7,225	6,388	1,226	844	39,220
2006/07	23,926	6,918	6,138	1,171	814	38,967
Total	91,540	27,167	24,125	4,584	2,484	149,900
Proportion (%)	61.1	18.1	16.1	3.1	1.6	100.0

TABLE 2: Mean ± standard deviation (SD) and pooled standard error of difference (SED) for the key characteristics of processing significance of lots of strong wool recorded in the wool industry auction sale database for sales between 1 July 2003 and 30 June 2007 within each wool type classification group.

Characteristic	Adult		Lamb		Pooled SED	Probability of difference between types
	Fleece	Oddments	Fleece	Oddments		
Barbe length (mm)	94 ± 17	70 ± 18	66 ± 12	49 ± 8	9	<0.001
Mean fibre diameter (µm)	36.5 ± 2.6	36.2 ± 2.4	30.1 ± 1.3	29.2 ± 1.1	1.9	0.019
CIE Y value	63.4 ± 2.3	57.4 ± 4.1	66.0 ± 2.0	59.3 ± 3.4	2.7	0.098
CIE Y-Z value	2.3 ± 1.9	6.4 ± 2.5	0.9 ± 1.2	4.8 ± 1.9	1.7	0.098
Vegetable matter contamination (%)	0.14 ± 0.21	0.20 ± 0.24	0.10 ± 0.16	0.21 ± 0.27	0.04	0.110

sheep. Oddment wool was shorter and duller with a higher intensity of yellowing and more vegetable matter contamination than fleece wool. The observed differences between the mean values were of processing significance (Hunter, 1980).

The estimated REV for each of the key wool characteristics within each of the wool type classifications, are given in Table 3. Estimates of the REV for mean fibre diameter of lamb fleece were significantly greater than estimates of the REV for the other three type classifications that were not significantly different. In the case of CIE Y-Z the REV for lamb oddments was significantly greater than the value for adult oddments with the other estimates not being significantly different. There was no significant difference between the estimated REVs of the other three analysed characteristics within each type classification or between the REVs estimated for each selling centre or season. All REV estimates were significantly greater than zero.

DISCUSSION

Barbe length is a major factor dictating the processing route used to produce a yarn and the subsequent performance of the end-product. Although barbe length is subjectively assessed, its wide range results in only a slight variation between assessors. The related measurement of staple length can be readily checked with a ruler.

A traditional, seven-stage, subjective assessment of the “potential scourability” of a parcel of wool has been an attribute defined as style. While this characteristic is primarily an assessment of the intensity of yellowing evaluated in the greasy state, the presence of foreign material such as vegetable matter, dust, mud and soot from a bush-burn, is also considered. Some of these contaminants abrade the fibre cuticle reducing the brightness of the fibres independently of a yellow discolouration. Potentially the continuous CIE reflectance values measured on a laboratory-cleaned sample, provide a superior

TABLE 3: Regression coefficients (REV) (c/kg clean/unit change in the characteristic) and associated standard errors at a mean indicator price of 376 c/kg clean, for the relationship between clean auction price (c/kg clean) and the key characteristics of processing significance of lots of strong wool recorded in the wool industry auction sale database for sales between 1 July 2003 and 30 June 2007 within each wool type classification group and across the strong wool segment as a whole. SED = Standard error of difference; SEM = Standard error of mean.

Characteristic	Adult		Lamb		Pooled SED	Probability of difference between types	Mean across types	SEM	Probability of difference from zero
	Fleece	Oddments	Fleece	Oddments					
Barbe length (mm)	0.1	0.6	1.2	0.5	0.5	0.200	0.4	0.2	0.016
Mean fibre diameter (µm)	-3.2	-1.4	-8.6	-2.0	1.9	0.018	-1.9	0.9	0.042
CIE Y value	2.2	3.4	1.4	2.2	1.6	0.593	2.5	0.5	<0.001
CIE Y-Z value	-6.1	-3.1	-4.4	-7.1	1.2	0.015	-5.0	0.6	<0.001
Vegetable matter contamination (%)	-4.7	-14.2	-14.5	-20.4	6.3	0.153	-16.8	3.0	<0.001

TABLE 4: Comparison of average REVs (c/kg clean/unit change in the characteristic) published by Maddever *et al.* (1991) converted to an average price of 376 c/kg clean and the present study (Table 3).

Characteristic	Maddever <i>et al.</i> (1991) data		Present study
	450 c/kg clean	376 c/kg clean	376 c/kg clean
Barbe length (mm)	0.3	0.3	0.4 ± 0.2
Mean fibre diameter (µm)	-0.48 ^a	-0.40 ^a	-1.9 ± 0.9
CIE Y value (brightness)	4.1	3.4	2.5 ± 0.5
CIE Y-Z value (yellowness)	-6.5	-5.4	-5.0 ± 0.6
Vegetable matter contamination (%)	-24.3	-20.3	-16.8 ± 3.0

^a Restricted to wools in the 34 to 35 µm range.

indicator of scourability than a seven-stage subjective assessment of a greasy sample.

Table 4 summarises the estimated REVs published by Maddever *et al.* (1991) at an average wool price of 450 c/kg clean and after adjustment to an average price of 376 c/kg clean as occurred during this study. Included in the table is the mean “across type” REV calculated in this study and an estimate of the standard error of the mean. These data show a close agreement between the REVs derived by the two different analyses, with the possible exception of the value for mean fibre diameter.

Though the relationship between wool auction price and the restricted mean fibre diameter range in this study was not significantly curvilinear, plots of wool auction price against mean fibre diameter for wools finer than 30 µm are known to be significantly curvilinear reflecting the different, higher value, end-use for finer type wools (Maddever *et al.*, 1991). Fine, soft handling lamb fleece is better suited for production of a higher price knitting yarn than a carpet yarn resulting in a higher REV for mean fibre diameter for lamb fleece. The magnitude of the estimated REV for mean fibre diameter in the strong wool segment should be contrasted with a value of 293 c/kg clean/µm change reported by Maddever *et al.* (1991) for high value 20 µm apparel wool.

Individual wool characteristics are strongly correlated with each other and closely related to on-farm management procedures. For wool growers to be able to utilize these data to optimise their net returns, the REV for each characteristic must be considered in relation to the change in that characteristic, and the characteristics with which it is associated, which result from a change in a particular practice. While it is possible to easily change the barbe length through changing the frequency of shearing thereby also changing the CIE Y and CIE Y-Z values, it may be difficult to reduce the vegetable matter contamination in a line of wool by 0.1% by a simple change in sheep management. Attempting to change the fibre diameter profile of a

strong wool clip for the sake of changing fibre diameter alone is uneconomic.

The similarity in magnitude of the recalculated REVs provides validation for the robustness of the different analytical procedures. While there have been significant structural changes within the wool processing industry over the last two decades there have been no significant developments in processing technology and the economic significance of individual wool characteristics to wool processors have not changed.

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REFERENCES

- Carnaby, G.A.; Maddever, D.C.; Ford, A.M. 1985: Computer blending of wool. *Wool technology and sheep breeding* **XXXIII (II)**: 56-63.
- Hunter, L. 1980: The effect of wool fibre properties on processing performance and yarn and fabric properties. In: *Proceedings of the International Wool Textile Research Conference*, Pretoria, South Africa. Volume 1, p. 133.
- IWTO-19. 2006: Determination of wool base and vegetable matter of core samples of raw wool. International Wool Textile Organisation, Brussels, Belgium.
- IWTO-28. 2000: Determination by the airflow method of the mean fibre diameter of core samples of raw wool. International Wool Textile Organisation, Brussels, Belgium.
- IWTO-56. 2007: Method for the measurement of colour of raw wool. International Wool Textile Organisation, Brussels, Belgium.
- Maddever, D.C.; Carnaby, G.A.; Ross, D.A. 1991: Relative economic values of wool processing parameters. *Proceedings of the New Zealand Society of Animal Production* **51**: 333-337.
- Meat and Wool New Zealand Economic Service. 2006: Compendium of New Zealand farm production statistics. Meat and Wool New Zealand Economic Service, Wellington, New Zealand. Publication number P06005, pp. 27.
- NZS8707. 1984: Method for the measurement of colour in wool. Standards Association of New Zealand, Wellington, New Zealand.
- Payne, R.W.; Murray, D.A.; Harding, S.A.; Baird, D.B.; Soutar, D.M. 2007: GenStat for Windows, 10th Edition. Introduction. VSN International Ltd., Hemel Hempsted, Hertfordshire, UK