

The Australian Wool Industry: A hedonic pricing analysis of the factors affecting price of wool

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- *To determine the **effect** of wool **attributes** and **global economic conditions** on the **price** per lot of Australian wool.*
- Provide growers with an insight into the key factors affecting demand for Australian wool
 - Help woolgrowers to adapt to changed market conditions
 - By identifying value of wool characteristics
 - ✓ Focus on those which attract premiums
 - ✓ Avoid those which accrue discounts

The model

- Hedonic pricing model based on inputs model of Ladd and Martin (1974).

- 4 log-linear models

Superfine	(< 18.5 micron)	358 289 observations
Fine	(18.5-20.5 micron)	422 007 observations
Medium	(20.5-23.5 micron)	375 664 observations
Broad	(23.5 +)	122 550 observations

- Dependent variable: Log of clean price
- Explanatory variables: Objectively measured characteristics
 - Qualitative attributes
 - Macroeconomic indicators
 - Geographic and time variables

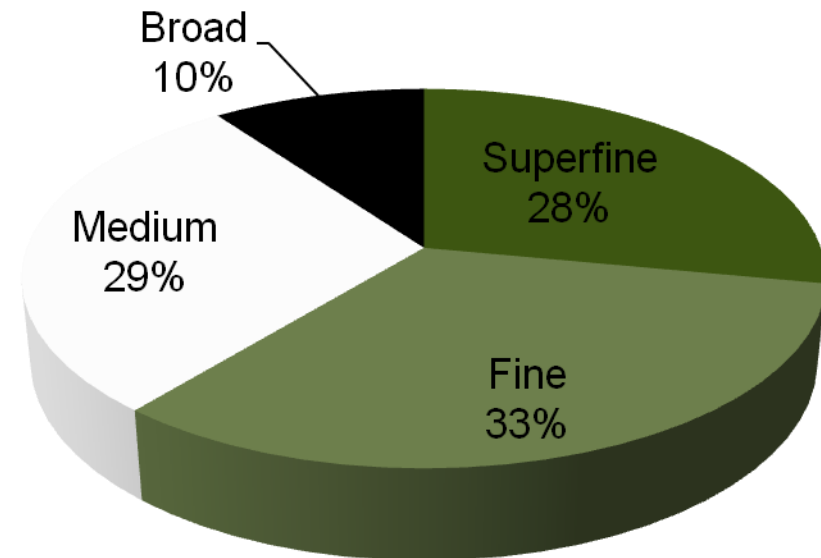
The Data

Wool Characteristics:

- Australian Wool Exchange (AWEX).

Global Influences:

- US GDP (Reserve Bank of Australia)
- Exchange rates (RBA)
- Cotton and Oil prices (International Monetary Fund)



Variables

Objectively Measured Characteristics:

- Fibre diameter
- Length
- Strength
- Midpoint breakage (POB)
- Total vegetable matter base

Macroeconomic Indicators:

- Exchange rates (\$A/\$US, \$A/Euro)
- GDP (US)
- World price of cotton
- World price oil (proxy for synthetics)

Qualitative Attributes:

- Style
- Type of vegetable matter
- Fleece contamination
- Breed
- Wool category
- Classing method
- Age (weaner or adult)

Geographic and Time Variables:

- Selling season/Year
- Location of sale

Table 1 Summary statistics

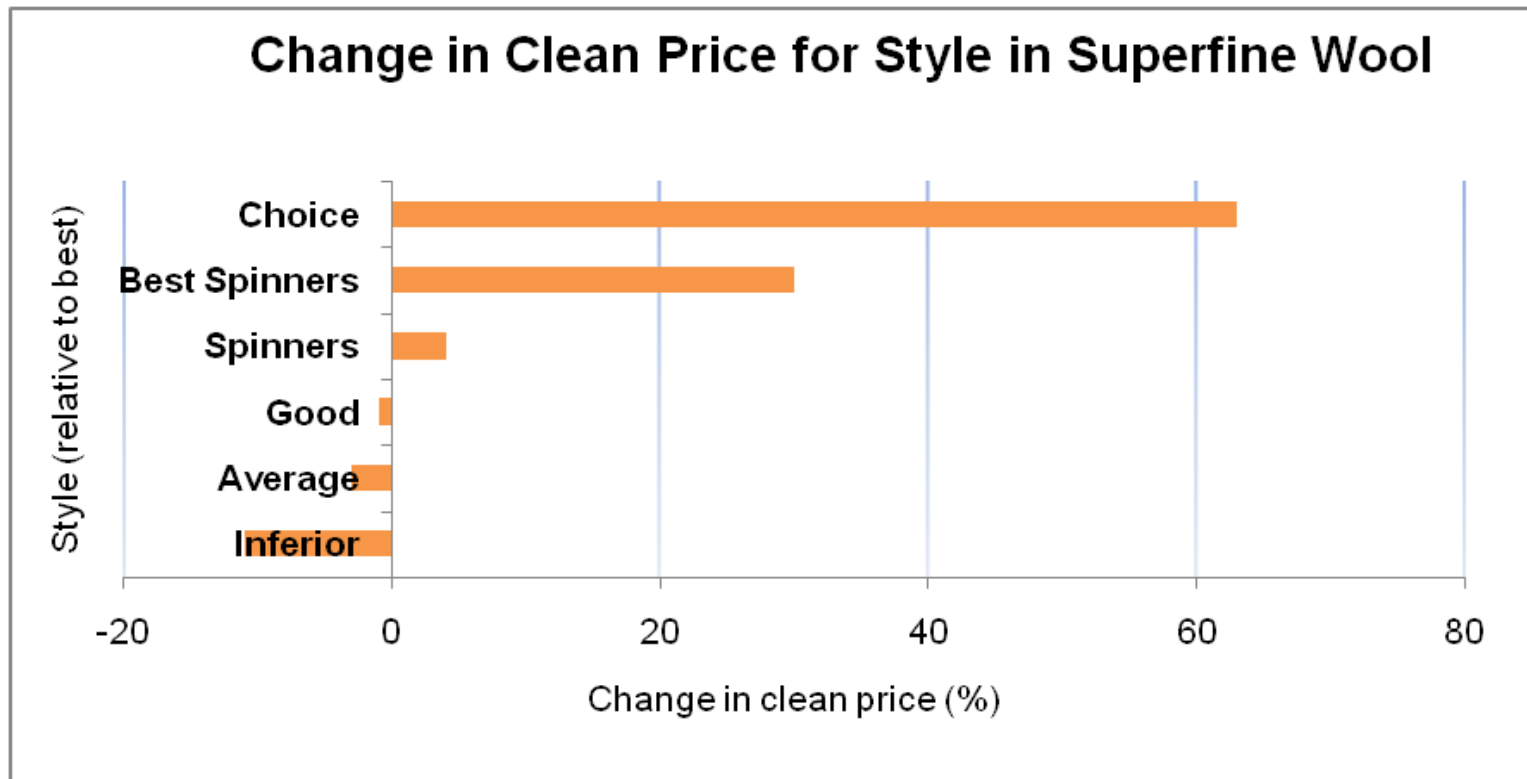
Model Statistics	Superfine	Fine	Medium	Broad
No. of Obs.	358 289	422 007	375 664	122 550
R ² (Adj.)	0.7746	0.8445	0.8398	0.9767
F-value	16863.94	26968.31	22903.74	10888.89
Pr > IFI	0.0000	0.0000	0.0000	0.0000
Root MSE	0.1258	0.0706	0.0617	0.1023

- Models are significant and largely explain variation in clean price.
- Signs and magnitudes of coefficients are consistent with previous studies (Beare and Meshios (1990), Gleeson *et al.* (1993), Ryan (2006) and Bruckback (2009)).
- Most variables significant.
- Most at the 1 per cent level.

Results: Objectively Measured Characteristics

Variable	Superfine			Fine			Medium			Broad		
	Parameter Estimate	t-ratio	p > t	Parameter Estimate	t-ratio	p > t	Parameter Estimate	t-ratio	p > t	Parameter Estimate	t-ratio	p > t
Objectively Measured Characteristics												
Micron	-1.9991	-260.00	0.00	-0.05	-40.37	0.00	-0.0984	-13.78	0.00	-0.2164	-87.39	0.00
Length	-0.0016	-3.98	0.00	0.0026	9.00	0.00	-0.0001	-0.33	0.74	-0.0031	-15.40	0.00
Strength	0.0711	126.30	0.00	0.0301	66.31	0.00	0.0065	18.70	0.00	0.0063	8.57	0.00
Micron*Micron	0.0248	257.30	0.00	(omitted)			0.0016	9.28	0.00	0.0024	62.40	0.00
Micron*Strength	-0.0044	-141.35	0.00	-0.0014	-60.58	0.00	-0.0001	-3.41	0.00	0.0000	1.52	0.13
Micron*Length	0.0000	1.40	0.16	-0.0002	-12.46	0.00	0.0000	-1.82	0.07	0.0000	1.16	0.25
Strength*Strength	0.0000	32.32	0.00	-0.0001	-65.95	0.00	-0.0001	-86.17	0.00	-0.0001	-20.95	0.00
Strength*Length	0.0000	30.20	0.00	0.0001	54.52	0.00	0.0000	39.29	0.00	0.0000	2.00	0.05

Results: Style for Superfine Wool

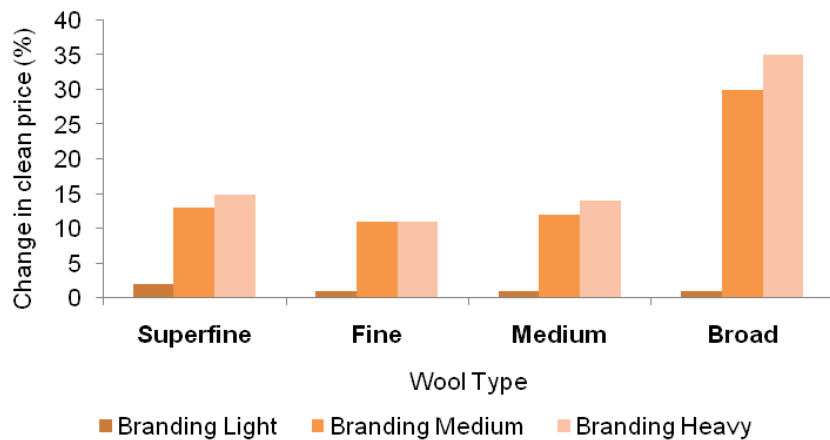


Results: Vegetable Matter and Fleece Contamination for fine wool

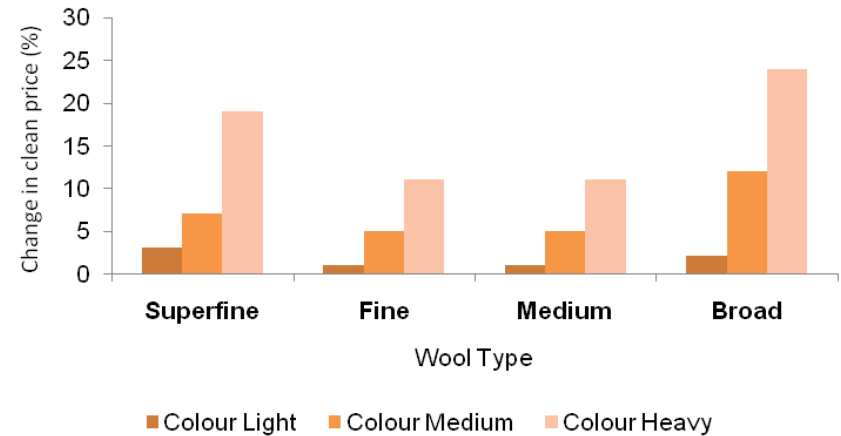
Variable	Fine		
	Parameter Estimate	t-ratio	p > t
Vegetable Matter Contamination*			
VMB	-0.0205	-129.51	0.00
VMB*burr	-0.0041	-24.56	0.00
VMB*seed	-0.0047	-17.73	0.00
VMB*shive	-0.0052	-29.80	0.00
VMB* noogoora	-0.0071	-17.91	0.00
VMB*boganflea	-0.0028	-9.07	0.00
Fleece Contamination			
Black pigment	-0.1016	-3.22	0.00
Darkstain	-0.0940	-32.55	0.00
Dermatitis L	-0.0312	-10.74	0.00
Dermatitis M	-0.0438	-6.76	0.00
Dermatitis H	-0.0650	-3.05	0.00
Kemp L	-0.0855	-6.18	0.00
Kemp M	-0.2655	-10.62	0.00
Mud L	-0.01	-1.21	0.227
Mud M	-0.1344	-11.08	0.00
Mud H	-0.2113	-5.98	0.00
Skin pieces L	-0.0219	-3.93	0.00
Skin pieces M	-0.2247	-30.86	0.00
Skin Pieces H	-0.2986	-51.81	0.00

Results: % reduction in price due to presence of Branding Fluid and Unscourable Colour

Effect of Branding Fluid on Price



Effect of Unscourable Colour on Price



Results: Macroeconomic Variables

- **Exchange Rates (\$A/Euro)** – consistent negative influence on clean price.
- **GDP US** – Positive relation with clean price for fine, medium and broad wools.
- **World Price of Cotton** - Consistent positive influence on clean price
 - Substitute.
- **World Price of Oil** (proxy for synthetics)
 - Negative Influence
 - Complement?
 - Why?

- **By estimating the value of wool attributes and controlling for global market conditions we have been able to contribute to the body of literature.**
 - **Characteristics**
 - **Macroeconomic factors.**
 - **Examine the longer term trend in demand.**

- **Usefulness of this study?**
 - **Reduced asymmetric information in the market place**

- **What should be the focus for woolgrowers wanting to improve market share?**

- **Demand side analysis only**

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Appendix I: Full Results (Superfine & Fine Wool)

Table 2 Results for superfine and fine models

Variable	Superfine			Fine			Variable	Superfine			Fine		
	Parameter Estimate	t-ratio	p > t	Parameter Estimate	t-ratio	p > t		Parameter Estimate	t-ratio	p > t	Parameter Estimate	t-ratio	p > t
Intercept	25.3192	216.27	0.00	7.5130	94.68	0.00	Age (relative to adult)						
Number of sales	0.0000	29.89	0.00	0.0000	13.39	0.00	Weener	-0.0296	-50.79	0.00	-0.0050	-9.55	0.00
Measured Attributes							Fleece Prep Type (relative to fleece)						
Micron	-1.9991	-260.00	0.00	-0.05	-40.37	0.00	Pieces	-0.0973	-4.44	0.00	-0.2296	-3.25	0.00
Length	-0.0016	-3.98	0.00	0.0026	9.00	0.00	Vegetable Matter Contamination*						
Strength	0.0711	126.30	0.00	0.0301	66.31	0.00	VMB	-0.0248	-72.42	0.00	-0.0205	-129.51	0.00
Micron*Micron	0.0248	257.30	0.00	(omitted)			VMB*burr	-0.0044	-10.62	0.00	-0.0041	-24.56	0.00
Micron*Strength	-0.0044	-141.35	0.00	-0.0014	-60.58	0.00	VMB*seed	-0.0065	-12.02	0.00	-0.0047	-17.73	0.00
Micron*Length	0.0000	1.40	0.16	-0.0002	-12.46	0.00	VMB*shive	-0.0056	-15.16	0.00	-0.0052	-29.80	0.00
Strength*Strength	0.0000	32.32	0.00	-0.0001	-65.95	0.00	VMB* noogoora	-0.0064	-4.00	0.00	-0.0071	-17.91	0.00
Strength*Length	0.0000	30.20	0.00	0.0001	54.52	0.00	VMB*boganflea	-0.0010	-0.82	0.41	-0.0028	-9.07	0.00
Length*Length	0.0000	-0.53	0.59	0.0000	-10.53	0.00	Fleece Contamination						
POB	0.0000	-43.58	0.00	-0.0003	-49.17	0.00	Black pigment	(omitted)			-0.1016	-3.22	0.00
Year of Sale (relative to 2004)							Branding L	-0.0177	-2.73	0.01	-0.0091	-4.56	0.00
2005	1.2022	35.89	0.00	-0.0116	-0.71	0.48	Branding M	-0.1319	-11.18	0.00	-0.1061	-27.04	0.00
2006	-1.5605	-79.80	0.00	-2.2763	-219.70	0.00	Branding H	-0.1451	-9.71	0.00	-0.1129	-22.34	0.00
2007	0.3913	22.10	0.00	0.3274	35.26	0.00	Dags L	(omitted)			-0.0599	-3.18	0.00
2008	-0.6086	-47.64	0.00	-0.9627	-149.92	0.00	Darkstain	-0.1323	-17.51	0.00	-0.0940	-32.55	0.00
2009	-0.3663	-20.26	0.00	-0.5536	-59.45	0.00	Dermatitis L	(omitted)			-0.0312	-10.74	0.00
National Wool							Dermatitis M	(omitted)			-0.0438	-6.76	0.00
Declaration	0.0271	11.38	0.00	-0.0045	-3.03	0.00	Dermatitis H	(omitted)			-0.0650	-3.05	0.00
Sale Location (relative to Melbourne)							Jowls L	(omitted)			-0.0703	-1.72	0.09
Newcastle	0.0030	3.16	0.00	0.0137	24.98	0.00	Kemp L	(omitted)			-0.0855	-6.18	0.00
Sydney	0.0125	22.42	0.00	0.0021	7.32	0.00	Kemp M	(omitted)			-0.2655	-10.62	0.00
Freemantle	0.0060	6.19	0.00	-0.0028	-8.40	0.00	Mud L	(omitted)			-0.01	-1.21	0.227
Launceston	-0.0445	-25.23	0.00	0.0002	0.16	0.87	Mud M	(omitted)			-0.1344	-11.08	0.00
Classing Method (relative to "classed grower lot")							Mud H	(omitted)			-0.2113	-5.98	0.00
Other grower lot	-0.0055	-1.89	0.06	-0.0203	-17.43	0.00	Shanks L	(omitted)			-0.0901	-10.75	0.00
Classed bulk lot	-0.0266	-10.02	0.00	-0.0343	-36.40	0.00	Skin pieces L	-0.0167	-1.38	0.17	-0.0219	-3.93	0.00
Other bulk lot	-0.0449	-23.72	0.00	-0.0392	-54.37	0.00	Skin pieces M	-0.3047	-13.65	0.00	-0.2247	-30.86	0.00
Interlotted	-0.0421	-12.81	0.00	-0.0405	-37.68	0.00	Skin Pieces H	-0.3120	-16.37	0.00	-0.2986	-51.81	0.00
Matched lots	-0.0511	-9.88	0.00	-0.0428	-22.20	0.00	Soft cott L	0.0294	0.62	0.54	(omitted)		
Breed Group (relative to Merino)							Soft cott M	-0.3526	-2.80	0.01	(omitted)		
Australian superfine	0.1386	118.15	0.00	0.1156	17.26	0.00	Sweat/Frib	(omitted)			-0.0025	-1.40	0.16
Wool Category (relative to fleece)							Waterstain L	-0.0758	-3.07	0.00	-0.0143	-4.37	0.00
Pieces	-0.0125	-0.57	0.57	0.1399	1.98	0.05	Waterstain M	(omitted)			-0.0634	-7.72	0.00
Bellies	(omitted)			0.3484	2.21	0.03	Waterstain H	(omitted)			-0.0408	-1.63	0.10
Style (relative to best)							Macroeconomic Variables						
Choice	0.6338	86.61	0.00	0.0013	0.02	0.99	05*LagExRateUS	-1.6235	-36.27	0.00	-0.0428	-1.95	0.05
Best spinners	0.2975	70.85	0.00	0.2711	8.58	0.00	06*LagExRateUS	2.2540	89.81	0.00	3.1385	237.26	0.00
Spinners	0.0432	37.14	0.00	0.0105	7.50	0.00	07*LagExRateUS	-0.1160	-6.01	0.00	-0.0575	-5.69	0.00
Good	-0.0082	-15.96	0.00	0.0026	8.55	0.00	08*LagExRateUS	0.9835	64.59	0.00	1.3425	175.83	0.00
Average	-0.0323	-23.33	0.00	-0.0159	-30.57	0.00	09*LagExRateUS	0.5517	26.63	0.00	0.8185	76.94	0.00
Inferior	-0.1066	-21.22	0.00	-0.0748	-41.32	0.00	LagExRate Euro	-0.2258	-10.65	0.00	-0.1364	-12.92	0.00
Colour (relative to good)							LagGDP US	-0.0152	-31.66	0.00	0.0043	18.03	0.00
Unscourable L	-0.0319	-34.82	0.00	-0.0142	-37.44	0.00	Lag WP Cotton	0.0021	67.87	0.00	0.0021	146.90	0.00
Unscourable M	-0.0663	-14.60	0.00	-0.0490	-31.42	0	Lag WP Oil	-0.0008	-17.03	0.00	-0.0037	-156.00	0.00
Unscourable H	-0.1935	-3.44	0.00	-0.1107	-7.19	0.00							

* Scale measure: L = light M = medium H = heavy



Appendix II: Full Results (Medium & Broad Wool)

Table 3 Results for medium and broad models

Variable	Medium			Broad			Variable	Medium			Broad		
	Parameter Estimate	t-ratio	p > t	Parameter Estimate	t-ratio	p > t		Parameter Estimate	t-ratio	p > t	Parameter Estimate	t-ratio	p > t
Intercept	7.5760	81.42	0.00	12.3864	96.25	0.00	Vegetable Matter Contamination*						
Number of sales	0.0000	2.08	0.04	-0.0001	-6.29	0.00	VMB	-0.0182	-101.82	0.00	-0.0327	-80.70	0.00
Measured Attributes							VMB*burr	-0.0035	-19.33	0.00	-0.0041	-9.05	0.00
Micron	-0.0984	-13.78	0.00	-0.2164	-87.39	0.00	VMB*seed	-0.0046	-16.52	0.00	-0.0036	-4.63	0.00
Length	-0.0001	-0.33	0.74	-0.0031	-15.40	0.00	VMB*shive	-0.0035	-16.57	0.00	0.0008	1.57	0.12
Strength	0.0065	18.70	0.00	0.0063	8.57	0.00	VMB* noogoora	-0.0065	-15.82	0.00	-0.0074	-4.03	0.00
Micron*Micron	0.0016	9.28	0.00	0.0024	62.40	0.00	VMB*boganfleat	-0.0029	-8.16	0.00	0.0090	2.38	0.02
Micron*Strength	-0.0001	-3.41	0.00	0.0000	1.52	0.13	VMB*moit	-0.0037	-8.77	0.00	0.0105	2.73	0.01
Micron*Length	0.0000	-1.82	0.07	0.0000	1.16	0.25	Fleece Contamination						
Strength*Strength	-0.0001	-86.17	0.00	-0.0001	-20.95	0.00	Black pigment	-0.0592	-1.66	0.10	-0.0225	-0.22	0.83
Strength*Length	0.0000	39.29	0.00	0.0000	2.00	0.05	Branding L	-0.0060	-4.65	0.00	-0.0121	-2.94	0.00
Length*Length	0.0000	-9.01	0.00	0.0000	10.45	0.00	Branding M	-0.1166	-32.01	0.00	-0.2969	-24.24	0.00
POB	-0.0002	-50.22	0.00	0.0000	-0.88	0.38	Branding H	-0.1387	-31.65	0.00	-0.3499	-34.93	0.00
Year of Sale (relative to 2004)							Dags L	-0.0596	-3.05	0.00	-0.1504	-3.60	0.00
2005	-1.0202	-69.25	0.00	-0.2901	-6.03	0.00	Darkstain	-0.1072	-36.03	0.00	-0.0938	-12.69	0.00
2006	-2.1230	-214.43	0.00	-0.5707	-20.72	0.00	Dermatitis L	-0.0234	-6.97	0.00	-0.0119	-0.31	0.76
2007	0.2492	28.28	0.00	0.5861	24.47	0.00	Dermatitis M	-0.0596	-6.56	0.00	(omitted)		
2008	-1.1827	-196.04	0.00	-0.1201	-6.99	0.00	Dermatitis H	-0.1296	-3.64	0.00	(omitted)		
2009	-0.7128	-78.82	0.00	0.1535	6.18	0.00	Jowls L	-0.0178	-0.50	0.62	(omitted)		
National Wool Declaration	-0.0161	-11.93	0.00	0.0391	9.65	0.00	Kemp L	-0.0345	-2.37	0.02	-0.0553	-7.82	0.00
Sale Location (relative to Melbourne)							Kemp M	(omitted)			-0.2148	-8.13	0.00
Newcastle	-0.0006	-0.73	0.46	0.0096	4.62	0.00	Mud L	-0.0466	-3.99	0.00	(omitted)		
Sydney	0.0008	2.69	0.01	0.0034	4.12	0.00	Mud M	-0.1042	-7.54	0.00	(omitted)		
Freemantle	-0.0064	-21.64	0.00	-0.0622	-35.25	0.00	Mud H	-0.0319	-1.86	0.06	(omitted)		
Launceston	0.0115	5.32	0.00	-0.0243	-4.84	0.00	Shanks L	-0.1318	-27.43	0.00	-0.0430	-7.52	0.00
Classing Method (relative to "classed grower lot")							Shanks M	-0.8501	-30.80	0.00	-0.2079	-9.95	0.00
Other grower lot	-0.0147	-15.66	0.00	-0.0223	-12.49	0.00	Shanks H	(omitted)			-1.4654	-20.26	0.00
Classed bulk lot	-0.0333	-33.30	0.00	-0.0398	-22.59	0.00	Skin pieces L	-0.0223	-4.20	0.00	0.0179	0.46	0.64
Other bulk lot	-0.0370	-54.13	0.00	-0.0414	-28.39	0.00	Skin pieces M	-0.2215	-19.49	0.00	-0.0710	-0.69	0.49
Interlotted	-0.0353	-39.12	0.00	-0.0417	-21.73	0.00	Skin Pieces H	-0.2994	-36.06	0.00	(omitted)		
Matched lots	-0.0390	-21.33	0.00	-0.0584	-5.61	0.00	Soft cott L	-0.0121	-0.48	0.63	-0.1431	-1.81	0.07
Breed Group (relative to Merino)							Soft cott M	(omitted)			(omitted)		
Crossbred	-0.1291	-2.09	0.04	-0.0794	-28.01	0.00	Sweat/Frib L	-0.0021	-1.65	0.10	-0.0240	-9.46	0.00
Downs	(omitted)			-0.1876	-2.90	0.00	Sweat/Frib M	-0.0715	-2.01	0.05	-0.0297	-1.00	0.32
Wool Category (relative to fleece)							Waterstain L	-0.0115	-3.79	0.00	-0.0236	-1.51	0.13
Pieces	-0.0056	-0.13	0.90	-0.1553	-1.52	0.13	Waterstain M	-0.0714	-9.95	0.00	-0.1128	-4.68	0.00
Bellies	0.1350	1.26	0.21	(omitted)			Waterstain H	-0.0984	-3.57	0.00	(omitted)		
Style (relative to best)							Macroeconomic Variables						
Spinners	-0.0063	-2.25	0.03	0.0082	0.41	0.68	05*LagExRateUS	1.3638	69.21	0.00	0.4262	6.65	0.00
Good	0.0064	19.27	0.00	0.0180	19.34	0.00	06*LagExRateUS	3.0158	238.54	0.00	0.8962	25.34	0.00
Average	-0.0064	-14.57	0.00	0.0063	4.51	0.00	07*LagExRateUS	0.1100	11.48	0.00	-0.5243	-20.20	0.00
Inferior	-0.0545	-39.96	0.00	-0.0166	-3.05	0.00	08*LagExRateUS	1.7254	238.25	0.00	0.2832	14.14	0.00
Colour (relative to good)							09*LagExRateUS	1.1189	107.59	0.00	-0.1079	-3.83	0.00
Unscourable L	-0.0099	-28.43	0.00	-0.0222	-26.29	0.00	LagExRate Euro	-0.0503	-5.05	0.00	0.1777	6.22	0.00
Unscourable M	-0.0464	-34.98	0.00	-0.1178	-52.18	0.00	LagGDP US	0.0042	18.93	0.00	-0.0201	-30.94	0.00
Unscourable H	-0.1127	-10.81	0.00	-0.2428	-18.21	0.00	Lag WP Cotton	0.0023	172.80	0.00	0.0012	30.85	0.00
Age (relative to adult)							Lag WP Oil	-0.0055	-246.96	0.00	-0.0009	-13.71	0.00
Weener	-0.0082	-7.62	0.00	-0.0029	-0.22	0.83							
Fleece Prep Type (relative to fleece)													
Pieces	-0.0961	-2.20	0.03	0.0515	0.50	0.62							

* Scale measure: L = light M = medium H = heavy