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INCREASED DEMAND FOR WOOL APPAREL IN WESTERN EUROPEAN MARKETS: EFFECT ON AUSTRALIAN WOOL AUCTIONS

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EXECUTIVE SUMMARY

The need for marketing activities in retail markets for wool apparel is a current and re-occurring industry debate. This paper reports on the impact of these activities, as a change of demand for pure wool apparels at retail, on the price and quantity of raw wool cleared through Australian wool auctions.

The analysis uses a world wool trade model developed by the Department of Agriculture Western Australian and the University of Western Australia which tracks global flows of wool and wool products from production to retail in 10 regional markets.

The impact of demand is presented for selected wool garments in particular countries. The change in demand is applied as a shock to the equilibrium in the model. When the equilibrium is restored, changes in price and quantity at each processing stage and in each raw wool production region are simulated.

The base quantity, price and values of Australian wool sold at auction and the benefits to Australian wool producers measured as changes in the auction price and quantities due to a 10 per cent increase in demand are summarised in tables below.

Quantity, price and value of apparel wool* sold in Australia 2004-05 (ending June 2005)

Measure	All wool	< 19.5 micron
Starting quantity (t, clean)	229,371	87,434
Starting avg price (c/kg, clean)	806	931
Starting value ($million)	1,849	814

* Wool considered in the study was primarily fleece wool, used in apparel production (micron < 27.5 µm) with measured yield.

Change in quantity, price and value of greasy wool (clean weight) sales in Australia resulting from a 10 per cent increase in demand for men's and women's garments in Western Europe, and men's garments in USA (Based on 2004/05 prices)

Change	Western Europe				USA
	Men's wear		Women's wear		Men's wear
	All wool	< 19.5 m	All wool	< 19.5 m	All wool
Quantity increase (t, clean)	573	80	1351	894	105
Quantity increase (%)	0.3	0.1	0.6	1.0	0.1
Price increase (c/kg, clean)	12	11	22	34	2
Price increase (%)	1.5	1.2	2.7	3.7	0.2
Value increase ($ million)	32	11	62	38	6
Value increase (%)	1.7	1.4	3.4	4.7	0.3

The simulated results indicate that:

- Western Europe women's wear market is likely to generate a larger effect at Australian wool auction than the Western Europe men's wear.
- The effect on the Australian wool types depends on the retail market being targeted. For example women's wear is likely to have a stronger effect on the fine wool types.

- Demand changes in the USA men's wear market will have a small and possibly undetectable change in the Australian wool auction. Part of the USA market effect is due to the benefits to Australian wool growers being diluted by the use of Chinese fine wool in these products.

1. INTRODUCTION

Despite a four per cent growth in productivity over more than two decades (Islam, 2004), the Australian sheep industry has suffered from declining profitability because of a decline in the world wool price (Shafron *et al.* 2001). Since Australia is the worlds largest producer and exporter of raw wool, increased production and export of its wool is likely to have a negative influence on the wool price unless demand for wool products by end users increases.

The need for marketing activities in retail markets for wool apparel is a current and re-occurring industry debate. For example, IWTO meetings in Evian, France (2004) and Hobart, Australia (2005) focused discussions on the need to regain wool share of the Western European women's wear markets. The objective of these activities is to increase consumption of wool garments. However, it is unknown to what extent an increase in retail consumption will impact on the price of raw wool. To date there have been no attempts to investigate this question, perhaps due to a lack of a comprehensive analytical tool.

The aim of this study is to investigate the implications of increased demand for wool apparel in Western European markets, by applying the World Wool Model (WOOLMOD). WOOLMOD is a partial equilibrium model developed by the Department of Agriculture Western Australia (DAWA) in collaboration with the Economic Research Centre (ERC) of the University of Western Australia (UWA). The model development was partly funded by an Australia Research Council grant.

This report will focus on quantifying the effects of demand changes in Western European markets in men's and women's wear as identified in the IWTO discussions. Demand changes in men's wear in the USA have also been simulated, in response to presentations by Woolmark at the Federation of the Australian Wool Organization (FAWO) meeting held in Melbourne, 2005, which have focused the marketing debate on men's wear markets in the USA. The results from the USA target markets have been included in this report for comparison only.

The report continues as follows: section 2 briefly introduces the study method, the model (WOOLMOD) and the sources of data and parameters, section 3 describe the results, section 4 offers some discussion and section 5 includes some concluding comments.

2. METHOD

The results presented in this report are based on the application of the World Trade Model (WOOLMOD), to the Australian apparel wool supply profile (Wooldesk auction database) using a simulation of demand increase of retail wool apparel from IWTO's proposed marketing campaigns.

WOOLMOD was used to determine the percentage change in quantity and price of Australian wool sales resulting from an increased demand for women's and men's garments in Western European markets. As the structure of WOOLMOD was developed using 1995-96 trade data, it was necessary to apply the simulated percentage changes for volume, price and value to current data on the Australian wool clip. This data was prepared from DAWA's Wooldesk auction database using the 2004-2005 selling season results.

a. World Wool Model (WOOLMOD)

WOOLMOD is a comparative static partial equilibrium model of the world wool market. The structure of WOOLMOD is briefly described in Appendix A. A detail documentation of the model could be seen in Verikios (2004). The model can simulate the effect of different shocks in the markets, on wool production and wool trade between countries as it passes through the pipeline from raw wool to retail garment.

The model examines 9 apparel wool types classified on a diameter and hauteur basis from 8 wool producing regions, through the worsted and woollen processing pipelines into men's and women's apparel across 10 countries and regions. The full list of commodities in the model is shown in Appendix B.

The classification of wool types is shown in Table 1. These classifications are designed to cover all apparel wool types in the Australian wool clip. Wool with diameters of 28 µm or higher are expected to be used in interior applications, and so have been omitted from the model.

Treating wool as a heterogeneous product allows different wool types to be linked into specific wool processing pipelines and to specific retail garment segments.

Table 1. Apparel wool types and their classification used in WOOLMOD

		Fibre diameter (µm)		
		≤ 19.5 (D^-)	**19.6-23.5 (D)**	**23.6-27.5 (D^+)**
Hauteur (mm)	**< 56 (H^-)**	D^-H^-	DH^-	D^+H^-
	56-65 (H)	D^-H	DH	D^+H
	> 65 (H^+)	D^-H^+	DH^+	D^+H^+

Data on production, consumption and trade in raw wool and wool commodities were collected and compiled by the DAWA (in 1995-96) based on different sources of published statistics and expert opinion (Layman 1999). Subsequently, this data was made internally consistent and theoretically sound with updated economic parameters by Verikios (2004) in the WOOLMOD. This was done in collaboration with the Economic Research Centre at the University of Western Australia.

WOOLMOD assumes that in the short term, the production sector will not change the level of investment into land and capital in response to the demand change. It does allow for changes in labour usage and changes in the balance of on-farm enterprises in response to the demand changes. This constraint for fixed capital and land is applied to all processing sectors. Therefore this study examines only the short-run effects of changes in retail demand.

b. Australian wool supply profile

The weight, price and value of the Australian wool clip for the wool types described in Table 1 were prepared from the Wooldesk auction database using the 2004-2005 selling season (Table 2). Based on price and quantity, the value of wool was calculated for each sale lot. The average value and volume for the nine different wool categories were also calculated. The weight adjusted average price for each category of wool was calculated by dividing the average value by average volume. Panel A, B, and C of Table 2 describes the quantity, price and value of wool sold in Australia in 2004-2005.

Table 2. Quantity, price and value of apparel wool sold in Australia, 2004-2005 (12 months ending in June 2005)

A. Quantity sold (in tonnes, clean)

	Diameter (µm)			
Hauteur	**D-**	**D**	**D+**	**Total**
H-	23,794	9,348	61	33,203
H	43,325	39,103	1,140	83,567
H+	20,315	82,108	10,178	112,601
Total	87,434	130,559	11,379	229,371

B. Weighted average auction price (A¢/kg clean)

	Diameter (µm)			
Hauteur	**D-**	**D**	**D+**	**All**
H-	840	626	400	779
H	953	735	455	844
H+	993	757	614	786
All	931	741	597	806

C. Value of wool sold (A$m)

	Diameter (µm)			
Hauteur	**D-**	**D**	**D+**	**Total**
H-	200	59	0	259
H	413	287	5	705
H+	202	621	63	886
All	814	967	68	1,849

Note: H-: < 56 mm; H: 56-65 mm; and H+: > 65 mm;
D-: ≤ 19.5 µm, D: 19.6-23.5 µm; D+: 23.6-27.5 µm

Panel A of Table 2 shows that about 230 thousand tonnes of the nine types of raw wool (clean weight) was sold at auction in 2004-05 of which approximately one third (87 thousand tonnes) is in the finer D- diameter class (where diameter < 19.5 µm). The average price per kilogram of each wool type ranged between 993 to 400 cents, with an across type average of 806 cents and a total revenue of $1.8 billion.

The 3 x 3 table shows the weight, price and value of the Australian clip that will be affected by demand changes in apparel. Table 2 omits the high diameter lots over 28 µm and lots with no yield or clean price, and wool that entered the processing pipeline but was not sold at auction. Hence the total value for Table 2 is lower than the value of the total Australian clip. Table 2 is however a realistic estimate of the Australian clip that is consumed in the global apparel markets.

c. Simulation of demand change

A shock is first applied to WOOLMOD, which simulates a change in price and change in volume until a new equilibrium is reached, i.e. the demand and supply of all inputs and outputs in all markets become equal after the effects of the demand change have been absorbed by the wool pipeline and production sectors.

In this analysis, the shock - a stimulation of demand from marketing campaign - has been simulated by assuming a shift in the demand curve (of household apparel) to the right. The shift α_{ir} term is varied to model a range of increases in demand for wool apparel in the target markets (see the composition of household demand equation of WOOLMOD in Appendix C for more detail). Three demand shock simulations were run (a 10, 20 and 50 per cent uniform increase of α_{ir}) for the men's or women's wear garments detailed in Table 3.

The following four countries are considered as Western European markets where fine quality wool apparels are predominantly consumed:

- France
- Italy
- Germany; and
- United Kingdom.

The demand shock has been applied to men's and women's pure fine wool garments (Table 3) in the Western European markets mentioned above.

Table 3. End products in WOOLMOD upon which a demand shock has been applied

Men's	Women's
1. Men's worsted pure woven (56)	1. Women's worsted pure woven (63)
2. Men's worsted knitted (57)	2. Women's worsted knitted (64)
3. Men's woollen pure woven (59)	3. Women's woollen pure woven (66)
4. Men's woollen pure knitted (61)	4. Women's woollen pure knitted (68)

Note: The numbers in parenthesis correspond to the commodity numbers listed in Appendix B.

3. RESULTS

The price and quantity changes resulting from each level of demand shock are presented in percentage terms. These estimates are based on the data and parameters used in the model which is considered to represent a typical general flow of raw wool, wool textile and wool garments through processing pipelines (as shown in the Appendix A, Figure A1) and through bilateral trade in the model.

a. Model results

Table 4 and 5 show the percentage change in quantity and price of Australian wool sales resulting from an increased demand for women's and men's garments in Western European countries. Results for the three levels of demand shock (10, 20 and 50 per cent) are shown in panel A, B and C of each table.

Table 4. Percentage change in quantity and price of Australian wool sales from increased demand for women's garments in Western European countries

10% increase A.1 Quantity

	Diameter (µm)		
Hauteur	**D-**	**D**	**D+**
H-	-0.05	-0.17	-0.22
H	1.44	0.29	0.06
H+	1.39	0.37	0.18

A.2 Price

	Diameter (µm)		
Hauteur	**D-**	**D**	**D+**
H-	1.27	1.03	0.96
H	4.34	1.96	1.51
H+	4.26	2.13	1.76

20% increase B.1 Quantity

	Diameter (µm)		
Hauteur	**D-**	**D**	**D+**
H-	-0.10	-0.33	-0.43
H	2.78	0.55	0.12
H+	2.59	0.68	0.35

B.2 Price

	Diameter (µm)		
Hauteur	**D-**	**D**	**D+**
H-	2.49	2.01	1.88
H	8.52	3.8	2.94
H+	8.16	4.1	3.44

50% increase C.1 Quantity

	Diameter (µm)		
Hauteur	**D-**	**D**	**D+**
H-	-0.13	-0.63	-0.83
H	5.61	1.19	0.32
H+	4.99	1.41	0.79

C.2 Price

	Diameter (µm)		
Hauteur	**D-**	**D**	**D+**
H-	5.70	4.63	4.34
H	18.25	8.43	6.66
H+	16.94	8.99	7.69

Note: H-: < 56 mm; H: 56-65 mm; and H+: > 65 mm; D-: ≤ 19.5 µm, D: 19.6-23.5 µm; D+: 23.6-27.5 µm

Table 5. Percentage change in quantity and price of Australian wool sale from increased demand for men's garments in Western European countries

10% increase A.1 Quantity

	Diameter (µm)		
Hauteur	**D-**	**D**	**D+**
H-	-0.01	-0.08	-0.08
H	0.13	0.42	0.23
H+	0.13	0.37	0.29

A.2 Price

	Diameter (µm)		
Hauteur	**D-**	**D**	**D+**
H-	0.99	0.86	0.85
H	1.28	1.87	1.48
H+	1.27	1.77	1.6

20% increase B.1 Quantity

	Diameter (µm)		
Hauteur	**D-**	**D**	**D+**
H-	-0.02	-0.15	-0.15
H	0.26	0.80	0.44
H+	0.26	0.73	0.56

B.2 Price

	Diameter (µm)		
Hauteur	**D-**	**D**	**D+**
H-	1.95	1.69	1.67
H	2.52	3.64	2.90
H+	2.50	3.48	3.13

50% increase C.1 Quantity

	Diameter (µm)		
Hauteur	**D-**	**D**	**D+**
H-	-0.01	-0.31	-0.33
H	0.64	1.76	0.98
H+	0.64	1.67	1.21

C.2 Price

	Diameter (µm)		
Hauteur	**D-**	**D**	**D+**
H-	4.64	4.02	3.95
H	6.00	8.41	6.74
H+	5.98	8.20	7.21

Note: H-: < 56 mm; H: 56-65 mm; and H+: > 65 mm; D-: ≤ 19.5 µm, D: 19.6-23.5 µm; D+: 23.6-27.5 µm.

The results in Table 4 also show the percentage changes in price and quantity demanded for each of the 9 wool types.

For example the results in Table 4 show that a 10 per cent increase in the demand for the women's garments will increase the quantity of fine long wool (D-H+) demanded by processors at Australian auctions by 1.39 per cent, and increase the price paid at Australian auctions by 4.26 per cent (see panel A.1 and A.2).

For the same wool type, a 10 per cent change in demand for men's wear will generate smaller changes in price (0.13%) and quantity demanded (1.27%) at Australian wool auctions (see panel A.1 and A.2 of Table 5).

These results also indicate that the sale volume and price of raw wool changes more or less in a linear fashion as the demand for garments increases from 10 per cent to 50 per cent. Hence for the subsequent analysis the results for the 10 per cent shock is mainly used. Although the prices of all types of wool increase as a result of the demand shock, the sale volume for the shorter (H-: < 56 mm) wool decreases slightly for all diameter categories of wool for both the men's and women's garments.

It is interesting to note that change in the quantity of wool sales in the fine wool class (D-, where diameter is less than 19.5 μm) is almost 10 times greater in women's garments compared with men's garments, however there is only a 3 fold increase in price.

b. Impact on Australian wool supply profile

To understand the impact of these percentage changes on the Australian wool clip, it was necessary to apply the simulated percentage changes for volume, price and value to the Australian wool clip data (2004-05). The change in quantity, price and value of greasy wool (clean weight) sales in Australia resulting from a 10 per cent increase in demand for women's and men's garments in Western Europe are presented in Table 6 and 7.

Data in the first block of columns (base quantity, base price and base volume) in Table 6 and 7 are taken from Table 2. Data in the second block of columns shows the change in quantity, price and value above the base level; and data in the third block of columns shows the sum of the base level and the change level of quantity, price and value.

A 10 per cent increase in demand for Western Europe women's wear will result in an additional 1315 tonnes of wool demanded annually (in the short-run), combined with a predicted average price increase AUD 22 cents clean, worth an additional AUD 62 million (see totals in the last column of the second block for quantity, price and value in Table 6).

A 10 per cent increase in demand for Western Europe menswear will result in an additional 573 tonnes of wool demanded annually (in the short-run), combined with a price increase of AUD 12 cents clean, worth an additional AUD 32 million (see total in the last column of the second block for quantity, price and value in Table 7).

Table 6. Change in quantity, price and value on greasy wool (clean weight) sales in Australia resulting from a 10 per cent increase in demand for women's garments in Western Europe

Quantity	[1]Base quantity sold (tonnes)				[2]Change in quantity (tonnes)				[3]Quantity after simulation (tonnes)			
	Diameter (µm)				Diameter (µm)				Diameter (µm)			
[4]Hauteur	D-	D	D+	Total	D-	D	D+	Total	D-	D	D+	Total
H-	23,794	9,348	61	33,203	-12	-16	0	-28	23,782	9,332	61	33,175
H	43,325	39,103	1,140	83,567	624	113	1	738	43,949	39,217	1,140	84,305
H+	20,315	82,108	10,178	112,601	282	304	18	604	20,598	82,412	10,196	113,205
Total	**87,434**	**130,559**	**11,379**	**229,371**	**894**	**401**	**19**	**1315**	**88,328**	**130,961**	**11,397**	**230,686**

Notes: [1]From panel A of Table 3. [2] Quantity change is measured based on the base quantity and the corresponding entries in panel C.1 of Table 1. [3]Sum of the base and change in quantities. [4]H-: < 56 mm; H: 56-65 mm; and H+: > 65 mm. D-: ≤ 19.5 µm, D: 19.6-23.5 µm; D+: 23.6-27.5 µm.

Price	[1] Base auction price (A¢/kg clean)				[2] Change in price (A¢/kg clean)				[3] Price after simulation (A¢/kg clean)			
	Diameter (µm)				Diameter (µm)				Diameter (µm)			
[4]Hauteur	D-	D	D+	Total	D-	D	D+	Total	D-	D	D+	Total
H-	840	626	400	779	11	6	4	10	850	633	404	788
H	953	735	455	844	41	14	7	29	994	749	462	873
H+	993	757	614	786	42	16	11	21	1,036	773	625	807
Total	**931**	**741**	**597**	**806**	**34**	**15**	**10**	**22**	**965**	**756**	**608**	**829**

Notes: [1]From panel B of Table 3. [2]Price change is measured based on the base price and the corresponding entries in panel C.2 of Table 1. [3]Sum of the Base and Changed quantities. [4]H-: < 56 mm; H: 56-65 mm; and H+: > 65 mm. D-: ≤ 19.5 µm, D: 19.6-23.5 µm; D+: 23.6-27.5 µm.

Value	[1] Base value (A$m)				[2] Difference in value (A$m)				[3] Value after simulation (A$m)			
	Diameter (µm)				Diameter (µm)				Diameter (µm)			
[4]Hauteur	D-	D	D+	Total	D-	D	D+	Total	D-	D	D+	Total
H-	200	59	0	259	2	1	0	3	202	59	0	261
H	413	287	5	705	24	6	0	31	437	294	5	736
H+	202	621	63	886	12	16	1	28	213	637	64	914
Total	**814**	**967**	**68**	**1,849**	**38**	**23**	**1**	**62**	**852**	**990**	**69**	**1,911**

Notes: [1]Product of the base quantities and prices. [2]The difference between the values after simulation and the base values. [3]Product of the simulated quantities and prices. [4]H-: < 56 mm; H: 56-65 mm; and H+: > 65 mm. D-: ≤ 19.5 µm, D: 19.6-23.5 µm; D+: 23.6-27.5 µm.

Table 7. Change in quantity, price and value on greasy wool (clean weight) sales in Australia resulting from a 10 per cent increase in demand for men's garments in Western Europe

Quantity	[1] Base quantity sold (tonnes)				[2] Change in quantity (tonnes)				[3] Quantity after simulation (tonnes)			
	Diameter (µm)				Diameter (µm)				Diameter (µm)			
[4] Hauteur	D-	D	D+	Total	D-	D	D+	Total	D-	D	D+	Total
H-	23,794	9,348	61	33,203	-2	-7	0	-10	23,791	9,341	61	33,193
H	43,325	39,103	1,140	83,567	56	164	3	223	43,381	39,267	1,142	83,791
H+	20,315	82,108	10,178	112,601	26	304	30	360	20,342	82,412	10,207	112,960
Total	**87,434**	**130,559**	**11,379**	**229,371**	**80**	**461**	**32**	**573**	**87,514**	**131,020**	**11,411**	**229,944**

Notes: [1]From panel A of Table 3. [2]Quantity change is measured based on the base quantity and the corresponding entries in panel A.1 of Table 2. [3]Sum of the Base and Change in quantities.
[4]H-: < 56 mm; H: 56-65 mm; and H+: > 65 mm. D-: ≤ 19.5 µm, D: 19.6-23.5 µm; D+: 23.6-27.5 µm.

Price	[1] Base auction price (A¢/kg clean)				[2] Change in price (A¢/kg clean)				[3] Price after simulation (A¢/kg clean)			
	Diameter (µm)				Diameter (µm)				Diameter (µm)			
[4]Hauteur	D-	D	D+	Total	D-	D	D+	Total	D-	D	D+	Total
H-	840	626	400	779	8	5	3	8	848	631	404	786
H	953	735	455	844	12	14	7	13	965	749	462	857
H+	993	757	614	786	13	13	10	13	1,006	770	624	799
Total	**931**	**741**	**597**	**806**	**11**	**13**	**9**	**12**	**943**	**754**	**607**	**818**

Notes: [1]From panel B of Table 3. [2]Price change is measured based on the base price and the corresponding entries in panel A.2 of Table 2. [3]Sum of the Base and Changed quantities.
[4]H-: < 56 mm; H: 56-65 mm; and H+: > 65 mm. D-: ≤ 19.5 µm, D: 19.6-23.5 µm; D+: 23.6-27.5 µm.

Value	[1] Base value (A$m)				[2] Difference in value (A$m)				[3] Value after simulation (A$m)			
	Diameter (µm)				Diameter (µm)				Diameter (µm)			
[4]Hauteur	D-	D	D+	Total	D-	D	D+	Total	D-	D	D+	Total
H-	200	59	0	259	2	0	0	2	202	59	0	261
H	413	287	5	705	6	7	0	13	419	294	5	718
H+	202	621	63	886	3	13	1	17	205	635	64	903
Total	**814**	**967**	**68**	**1,849**	**11**	**20**	**1**	**32**	**825**	**987**	**69**	**1,882**

Notes: [1]Product of the base quantities and prices. [2]The difference between the values after simulation and the base values. [3]Product of the simulated quantities and prices. [4]H-: < 56 mm; H: 56-65 mm; and H+: > 65 mm. D-: ≤ 19.5 µm, D: 19.6-23.5 µm; D+: 23.6-27.5 µm.

As indicated from the simulated results in Table 4 and 5, repeated analyses with WOOLMOD for demand changes ranging from 10 per cent to 50 per cent show that the model response is essentially linear over that range. Hence the results from Table 1 and 2 can be adjusted accordingly to support discussion about demand changes up to 50 per cent in this market.

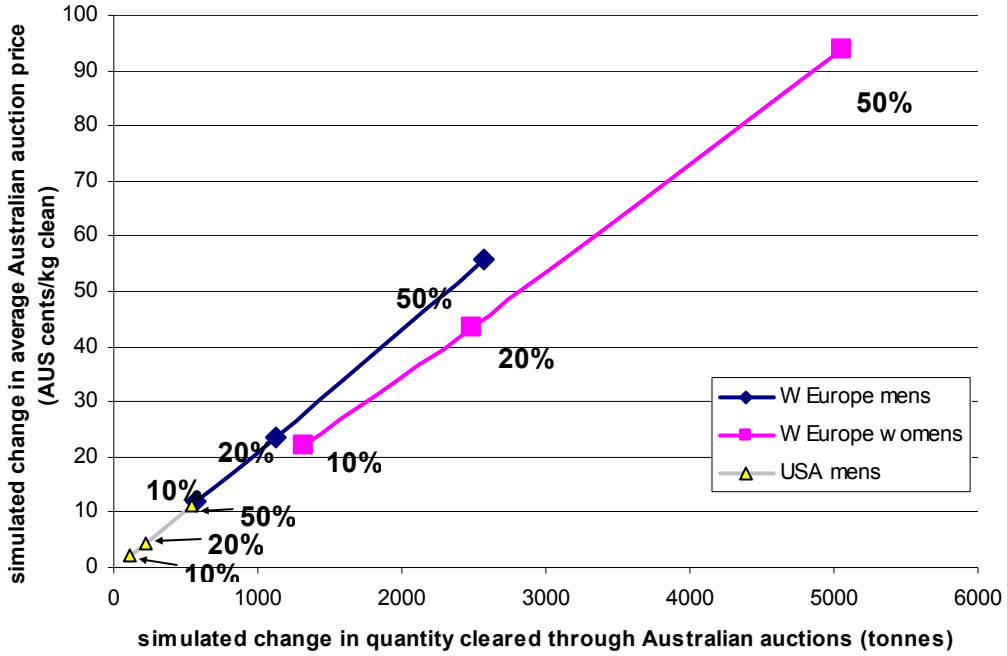

Figure 1. Effect of changes in demand in different market segments on Australian auction price and quantity.

A linear response is evident in Figure 1 where the simulated changes in price and quantity at the Australian auctions are presented. The demand changes have been estimated for the Western European markets, and for the USA/men's wear market. The extent of demand change is shown as percentage figures against the response lines.

It is evident from Figure 1, that the women's wear segment has a greater price and quantity response. The change in slope between Western European men's wear and women's wear could be partly driven by the response in women's worsted knitwear and its linkage to the fine medium length wool types (represented by the D-H wools in this model) at the Australian auction. The response by the men's wear market in this D-H segment is not strong.

c. Comparison with USA

A comparable analysis was undertaken for a demand shock in the USA pure wool men's wear worsted woven garments. This market segment includes the men's trouser market identified by Woolmark/Boston Consulting Group at FAWO's meeting held in Melbourne, 2005. The percentage changes in Western Europe (Table 8, a repeat of panel A.1 and A.2 of Table 5 above) can be compared with the USA results (Table 9) below.

Table 8. Percentage change in quantity and price of Australian wool sale from increased demand for men's garments in Western European countries

10% increase **A.1 Quantity** **A.2 Price**

	Diameter (μm)		
Hauteur	**D-**	**D**	**D+**
H-	-0.01	-0.08	-0.08
H	0.13	0.42	0.23
H+	0.13	0.37	0.29

	Diameter (μm)		
Hauteur	**D-**	**D**	**D+**
H-	0.99	0.86	0.85
H	1.28	1.87	1.48
H+	1.27	1.77	1.6

Note: H-: < 56 mm; H: 56-65 mm; and H+: > 65 mm; D-: ≤ 19.5 μm, D: 19.6-23.5 μm; D+: 23.6-27.5 μm.

Table 9. Percentage change in quantity and price of Australian wool sale from increased demand for Men's garments in USA

10% increase **A.1 Quantity** **A.2 Price**

	Diameter (μm)		
Hauteur	**D-**	**D**	**D+**
H-	0.05	0.03	0.01
H	0.01	0.07	0.05
H+	0.02	0.06	0.05

	Diameter (μm)		
Hauteur	**D-**	**D**	**D+**
H-	0.30	0.24	0.21
H	0.21	0.34	0.28
H+	0.22	0.32	0.29

Note: H-: < 56 mm; H: 56-65 mm; and H+: > 65 mm; D-: ≤ 19.5 μm, D: 19.6-23.5 μm; D+: 23.6-27.5 μm.

The proportional change in the Australian auction price and the quantity demanded is much lower when the demand shock is applied to this USA market. The price changes related to a 10 per cent USA demand shock are up to 0.34 per cent, compared to the Western Europe response of 1.87 per cent for the same wool type, over 5 times greater.

A 10 per cent increase in demand for USA/men's wear will result in an additional 105 tonnes of wool demanded annually (in the short-run), combined with a price increase of AUD 2 cents clean, worth an additional AUD 6 million (detail results for USA are not included in this report).

The simulation response for the USA/men's wear demand changes are also illustrated in Figure 1 above for comparison. The response is much lower than the Western European examples. In fact the simulated response to the 50 per cent demand increase in the USA market is smaller in both price and quantity change than the 10 per cent response in the Western Europe men's wear market.

Note this analysis has been undertaken for pure wool garments. Consideration of wool blend products will further dilute the Australian auction impact, as a proportion of the benefits from increased demand will have to be distributed to synthetic fibre suppliers.

4. DISCUSSION

Impact of demand change on wool quantity and price: Demand changes in men's wear and women's wear in Western Europe will have an impact on the Australian auction, both in terms of average price and in the volume of wool cleared through the auction. The selection of the target market (men's v women's) will also impact which market segment will experience the price and quantity changes. This effect is driven principally by the different wool requirements in the worsted knitting and worsted weaving sectors.

As mentioned previously, the model is a short-run partial equilibrium model and therefore the results are to be interpreted as the outcome of a new market equilibrium situation where, demand and supply of all inputs and outputs in all markets become equal after the initial shock in the demand change. Note also that in the short-run, no change takes place to the land or capital used in production but labour and other intermediate inputs change.

It is expected however that the first price changes after the start of the marketing campaign could be higher than these simulated, because the supply side to the auction will be unable to respond to the demand changes for some time. The model can not measure such immediate disequilibrium impacts.

Australian producers' capacity to meet additional demand: Australian wool producers have a limited capacity to supply, in the short-run, the additional quantity of wool that will be required due to increased demand resulting from the marketing campaign in the Western European market. If the marketing campaign has an extended life, then the producer options for increasing production can be expanded to include changes in land and capital (modelled as long term changes in production). Modelling the long term changes will require modification to WOOLMOD to allow effects such as movement of capital through and between economies.

Snapshot analysis: This analysis looked at the effect of achieving a 10 per cent increase in demand from a marketing campaign as a snapshot. No attempt is made in this study to examine the cost of regaining market share, the cost of gaining new market share or the rate of decay in demand after campaign has terminated.

Analysis of market segments: This report focused mainly on quantifying the effects of demand changes in Western European markets in men's and women's wear. The comparison with the USA results raises significant issues of the geographic (regional) differences, the fibre supply being used in the garments and the pipelines supplying them.

For example, the USA retail market has a significant supply of garments coming in from China, compared to the Western European markets. China is also a major supplier of raw wool in the DH category through its own domestic clip, and so will absorb a significant proportion of raw wool benefits from the success of the campaign in the USA. This result can be compared with Western Europe which does not have a significant raw wool industry, so the raw wool benefits will be strongly distributed from processing to the Australian suppliers.

Price impact of marketing campaign identifiable: Results of the simulation indicate that the changes in price resulting from a demand shift in Western Europe are reasonably large. For this reason, it is likely that the impact of this marketing campaign could be identified at auction in Australia. The simulation results suggest that the price change is unlikely to be uniform across wool types, and this pattern could be used to identify the demand change

effects compared to average price changes at auction resulting from other market effects, which would be expected to impact all apparel wool types.

Depending on the precision of the price analyses being employed, the same cannot be said of the simulations done for the USA men's wear campaign. These simulation results suggest a much smaller auction price response, and more uniform across wool types. These price changes could be difficult to identify from normal auction price fluctuations.

5. Conclusion

- Demand changes in wool apparel in Western Europe will have an impact, both in terms of increased average price and quantity of wool cleared through the Australian auction.
- Market selection will have a significant effect on the outcome in the Australian auctions, as illustrated by the comparative example of Western Europe and the USA.
- Differences between men's and women's wear marketing campaigns in Western Europe suggest that the size of the Australian auction response will be higher from women's wear campaigns.
- Repeated simulations suggest that demand increased from 10 per cent to 50 per cent is likely to have pro rata changes in the Australian wool auction.
- The effect on the Australian auction will not be uniform across all apparel wool types. The Western Europe example showed that marketing of women's wear will favour the finer wool types.
- The size and pattern of price changes from the simulation of Western Europe, could be used to monitor the impact of the demand shifts at retail at the Australian auction level.

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REFERENCES

Islam, N. (2004). 'An Analysis of Productivity Growth in Western Australian Agriculture', *Academia Economic Papers*, **32(3)**: 467-499.

Kopke, E., Stanton, J. and Islam, N. (2004). 'Compiling Data for a Global World Wool Model', R. Kingwell (ed.) Research Papers: Economic Services Group and Regional Economists, ISSN 1447-4980, ISBN 0-9750727-2-2, Western Australian Government - Department of Agriculture, pp. 6-22.

Layman, B. (1999). 'A Structural Model of the World Wool Market', Presented at the 43rd Annual Conference of the Australian Agricultural and Resource Economics Society, 20-22 January, Christchurch, New Zealand.

Shafron, W., Martin, P. Ashton, D. (2002). Profile of Australian Wool Producers: 1997-98 to 2000-01, Research Report 02.7, Australian Bureau of Agriculture and Resource Economics, Canberra.

Theil, H. and Clements K.W. (1987). Applied Demand Analysis: Results from System-Wide Approaches, Volume 7 of Series on Econometrics and Management Sciences, Ballinger Publishing Company, Cambridge, Massachusetts.

TWC (2002). Wool Fact File 2001/2002, The Woolmark Company. Melbourne.

Virikios, G. (2004). 'The Model of the World Wool Market' Discussion Paper 02-24, Economics Program, The University of Western Australia, Crowley. <http://www.ecom.uwa.edu.au/__data/page/49786/04_24_Verikios.pdf>

APPENDIX A: WOOLMOD in brief

Wool is treated as a heterogeneous commodity in the WOOLMOD by classifying in the nine categories in terms of diameter and hauteur.

A typical characteristic of the flow of these nine categories of raw wool from primary to final ends of the pipeline is provided in Figure A1. It shows that before it is finally consumed by households wool passes through a multistage production system. Wool and wool products are also traded through a number of countries before the final consumption. Therefore the regional pattern of output and exports at the primary end of the world wool market is not an indicative of the pattern of production and exports at the different production stages.

For example, at the spinning (or yarn) and later manufacturing stages the use of wool is concentrated in Western European countries (particularly Italy and the United Kingdom) and the Far East (particularly China). At the retailing stage Germany and France, as well as Italy and the United Kingdom, are important Western European consumers of wool, and Japan, as well as China, is important Far East consumer of wool (TWC, 2002). Thus to understand the effect of increased demand on wool garments on raw wool price this diverse regional pattern of production and trade in raw wool, wool textiles and wool garments should be taken into account in a comprehensive analytical framework. WOOLMOD provides such framework where the multistage nature of the production system through which wool passes as a heterogeneous commodity.

WOOLMOD divides the world wool market into ten geographical regions, representing all of the major raw wool and wool commodity producing and consuming regions of the World. This includes two regions of Australia given its unique status as both the largest single producer of greasy wool and the largest single exporter.

The model represents all the major stages of production from the sheep farm through to retail garments, and it does so by treating raw wool and wool commodities as heterogeneous. The broad regional sectors include a sheep industry, scouring industries (of which there are nine), carbonizing industries (three), worsted top making industries (six), yarn or spinning industries (five), fabric or weaving industries (six), wholesale garment making industries (12) and retail garment making industries (14). In total, there are 56 individual industrial sectors producing 70 commodities. Thus, the model distinguishes 560 separate industries and around 38,000 separate commodities in total.

Each region in WOOLMOD is linked via international trade in wool and wool commodities, which is depicted on a bilateral basis. Thus, one of the major features of the framework is the combination of (i) all the major wool and wool products producing and consuming regions of the World; (ii) all the major stages of production from the sheep farm through to retail garments; and (iii) international trade in wool and wool commodities; into a single analytical framework. The second major feature is the unprecedented degree of industry and commodity detail in representing the World wool market.

The model is partial equilibrium with a particular industry focus - wool and wool commodity producing industries. However, unlike previous wool models, it uses applied general equilibrium techniques to develop a differentiated treatment (in terms of regions, trade and commodities) of the wool industry.

At the core of the WOOLMOD are input demands and commodity supplies by industries; commodity demands by households; bilateral trade demands for intermediate inputs, inventory demands, and assumption about price systems and wage relativities.

This is a short-run model where it only allows for the short-run effects of changes in exogenous variable, i.e. simulations can only be conducted within an environment where industry capital stocks are fixed and can not change. In other words, land and capital are considered as fixed but firms can change their output-mix in response to exogenous changes.

The basic data on production, consumption and trade in raw wool and wool-products commodities were collected and compiled by the Department of Agriculture Western Australia in 1995-96, based on different sources of published statistics and expert opinion (Layman, 1999). Subsequently, this data was made internally consistent and theoretically sound with updated economic parameters by Verikios (2004) in the WOOLMOD. This was done in collaboration with the Economic Research Centre at the University of Western Australia.

Output from the model may not be perfect due to assumptions made and limitations of the model data base. Since the original database was developed in 1995-96, the world wool market structure has changed. In collaboration with the ERC at the UWA efforts have been made to develop and make the WOOLMOD as realistic as possible based on the original database. Results at the detailed disaggregated levels may not be as robust as results for the aggregated level.

WOOLMOD takes account of complex and diverse regional patterns of output and exports of primary and end products of wool. Hence, in interpreting the effects of increased demand on wool garments in different market segments these diverse patterns of production and trade in raw wool, wool textiles and wool garments need to be taken into consideration.

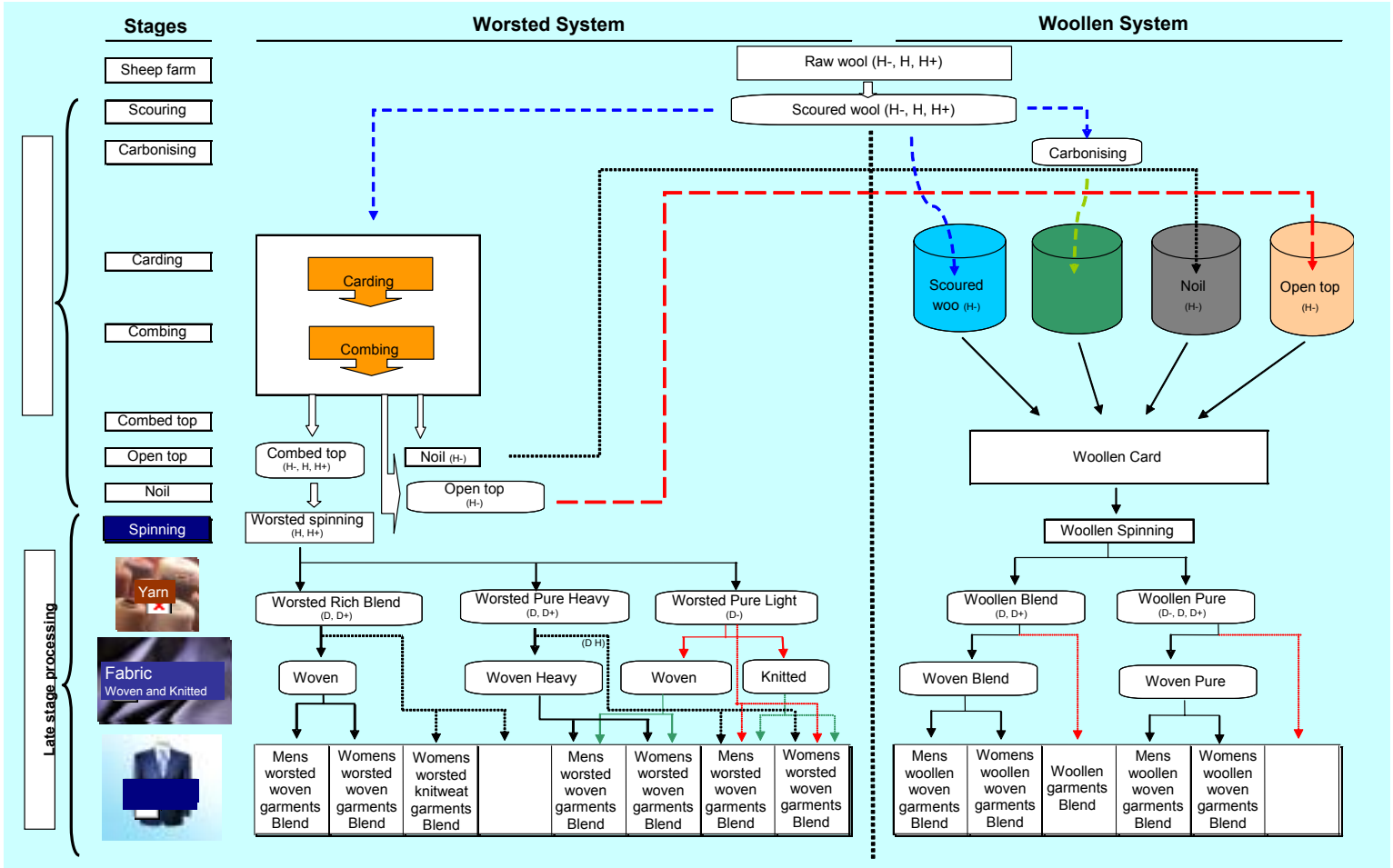

Figure A1. A typical flow of heterogeneous raw wool fibre through the woollen and worsted processing pipelines.

Source: Kopke *et al*. (2004).

APPENDIX B: List of commodities in WOOLMOD

1. Sheep meat	36. Woollen pure yarn
2. Greasy wool D-H-[a]	37. Worsted blend woven fabric
3. Greasy wool DH-[b]	38. Worsted pure lightweight woven fabric
4. Greasy wool D+H-[c]	39. Worsted pure heavyweight woven fabric
5. Greasy wool D-H[d]	40. Worsted knitted fabric
6. Greasy wool DH[e]	41. Woollen blend woven fabric
7. Greasy wool D+H[f]	42. Woollen pure woven fabric
8. Greasy wool D-H+[g]	43. Wholesale men's worsted woven garments (blend)
9. Greasy wool DH+[h]	44. Wholesale men's worsted woven garments (pure)
10. Greasy wool D+H+[i]	45. Wholesale men's worsted knitted garments
11. Scoured wool D-H-[a]	46. Wholesale men's woollen woven garments (blend)
12. Scoured wool DH-[b]	47. Wholesale men's woollen woven garments (pure)
13. Scoured wool D+H-[c]	48. Wholesale women's worsted woven garments (blend)
14. Scoured wool D-H[d]	49. Wholesale women's worsted woven garments (pure)
15. Scoured wool DH[e]	50. Wholesale women's worsted knitted garments
16. Scoured wool D+H[f]	51. Wholesale women's woollen woven garments (blend)
17. Scoured wool D-H+[g]	52. Wholesale women's woollen woven garments (pure)
18. Scoured wool DH+[h]	53. Wholesale woollen knitted garments (blend)
19. Scoured wool D+H+[i]	54. Wholesale woollen knitted garments (pure)
20. Carbonised wool D-H-[a]	55. Retail men's worsted woven garments (blend)
21. Carbonised wool DH-[b]	56. Retail men's worsted woven garments (pure)
22. Carbonised wool D+H-[c]	57. Retail men's worsted knitted garments
23. Worsted top D-H[d]	58. Retail men's woollen woven garments (blend)
24. Worsted top DH[g]	59. Retail men's woollen woven garments (pure)
25. Worsted top D+H[f]	60. Retail men's woollen knitted garments (blend)
26. Worsted top D-H+[g]	61. Retail men's woollen knitted garments (pure)
27. Worsted top DH+ [h]	62. Retail women's worsted woven garments (blend)
28. Worsted top D+H+[i]	63. Retail women's worsted woven garments (pure)
29. Noil D-HH+[J]	64. Retail women's worsted knitted garments
30. Noil DHH+[k]	65. Retail women's woollen woven garments (blend)
31. Noil D+HH+[L]	66. Retail women's woollen woven garments (pure)
32. Worsted blend yarn	67. Retail women's woollen knitted garments (blend)
33. Worsted pure lightweight yam	68. Retail women's woollen knitted garments (pure)
34. Worsted pure heavyweight yarn	69. Synthetics
35. Woollen blend yarn	70. Other inputs

[a]Diameter ≤ 19.5 µm; hauteur < 56 mm. [b]Diameter 19.6-23.5 µm; hauteur < 56 mm. [c]Diameter 23.6-27.5 µm; hauteur < 56 mm. [d]Diameter ≤ 19.5 µm; hauteur 56-65 mm. [e]Diameter 19.6-23.5 µm; hauteur 56-65 mm. [f]Diameter 23.6-27.5 µm; hauteur 56-65 mm. [g]Diameter ≤ 19.5 µm; hauteur > 65 mm; [h]Diameter 19.6-23.5 µm; hauteur > 65 mm. [I]Diameter 23.6-27.5 µm; hauteur > 65 mm. [J]Diameter ≤ 19.5 µm; hauteur > 56 mm. [k]Diameter 19.6-23.5 µm; hauteur > 56 mm; [l]Diameter 23.6-27.5 µm; hauteur > 56 mm.

Source: Verikios (2004).

APPENDIX C: Description of demand shock

The household demand equations for commodities in the model (as specified in Equations (1)) are used to simulate the model. The representative household for each region is assumed to consume two classes of goods: (i) the fourteen retail garments; and (ii) sheep meat. Retail garments are further separated into two groups: (a) seven men's retail garments and (b) seven women's retail garments. Thus the demand for individual commodities in Equation (1) has the characteristics of conditional demand equations where the additive nature of utility function is applied to groups of goods rather than individual goods which is known as block-independent preferences (see Theil and Clements, 1987 and Verikios, 2004).

The household demand equation:

$$x_{ir} = \frac{\theta_{ir}}{\theta_{gr}} \frac{W_{gr}}{W_{ir}} x_{gr} + \phi \frac{\theta_{ir}}{W_{ir}} (p_{ir} - p'_{gr}) + \alpha_{ir}, \quad i \in S_g, i = 1,...,k; g = 1,...G, r = 1,...,c. \quad (1)$$

where:

$x,$ is house hold consumption of good i in region r;

θ_{ir} is the marginal budget share for household consumption of commodity i in region r;

θ_{gr} is the marginal budget share of consumption of commodity group g in region r;

W_{gr} is the budget share for household consumption of commodity group g in region r;

W_{ir} is the(unconditional) budget share for household consumption of commodity i in region r;

x_{gr} household consumption quantity of commodity group g in region r;

ϕ is the reciprocal of the income elasticity;

p_{ir} is the household price of commodity i in region r;

p'_{gr} if the Frisch price index of commodity group g for household consumption in region r;

and

α_{ir} is the shift term for household consumption demand for commodity i in region r.

The shift term α_{ir} is used to simulate the model for increased demand for wool apparels.