5. Wool Marketing in Australia

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Learning objectives

At the end of this topic you should be able to:

- describe the Australian wool marketing system
- know factors that affect supply and demand in the wool market;
- understand the use and interpretation of supply and demand elasticities;
- appreciate how wool prices vary according to quality attributes and their levels; and
- understand how price and supply risk can be mitigated and the tools that are available to do this.

Key terms and concepts

Attributes, buffer stock scheme, elasticity, complements, forward contracts, options contracts, reserve price scheme, substitutes

Introduction to the topic

The aim of this unit is to provide you with some background on wool marketing and illustrate some of the tools that are used in wool market analysis. Development of a strong marketing strategy emanates from a thorough analysis of the underlying trends within each end use market. At the completion of this unit you should be able to describe the influence of the buffer stock scheme and reserve price scheme and the factors that influence the supply and demand for wool; you will have a good understanding of why wool markets must be separated into their end use properties to properly evaluate changes or marketing strategies; you will know how to interpret elasticities of demand and supply; and you will understand the methods that producers employ to mitigate market risk, including futures and options contracts.

5.1 Market background

The wool marketing system in Australia has an interesting history. The industry was regulated during the first and second world wars by the British Government and Australian wool producers were paid a fixed price per pound. Wool was an important input for military uniforms, blankets and insulation and, as such, all wool produced during war periods was sold for the war effort. The war periods created a strong demand for the fibre; however, prices were capped to assist with the war effort. The price that Britain paid for wool in the Second World War was 30 per cent below the price paid in the First World War, but producer costs had doubled between the wars (White, 1981). The last war that initiated a period of high prices was the Korean War. Since that war wool has had to compete with a range of natural fibres such as silk and cotton, and synthetic fibres such as rayon, acrylic, nylon and polyester which are much lighter than wool and less costly to produce. Cotton was preferred to wool for uniforms for troops in Vietnam due to the need for a lightweight fabric in the tropical environment.

In the latter half of the 20th century, the wool industry progressed from being partially supported to a competitive industry. Two marketing schemes were implemented in the early 1970s to assist producers who faced decreasing and volatile prices as the new substitutes for wool gained market share. The first arrangement was the Buffer Stock Scheme, which commenced in 1970, and the second was the Reserve Price Scheme, which was used to supplement the Buffer Stock Scheme in 1974. The purpose of these schemes was to minimise price variation for various grades of wool.

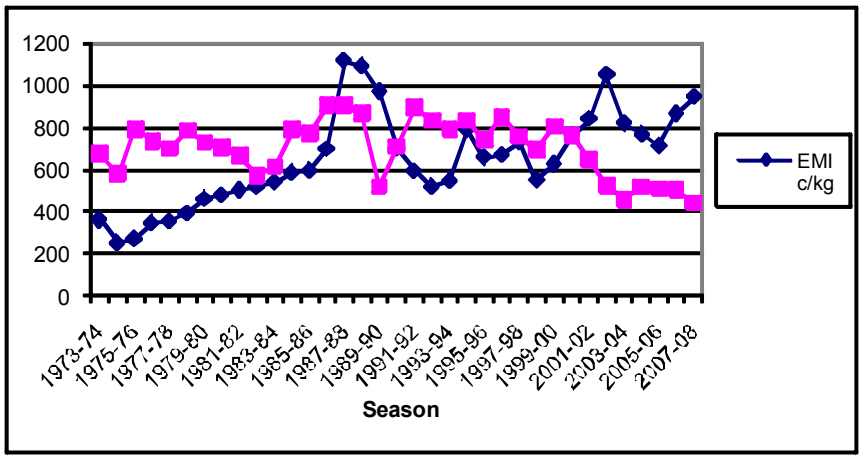
The Buffer Stock Scheme was designed to provide an even supply of each wool grade in each selling period, which would minimise price fluctuations due to an under- or over-supply of bales being offered. In a period of high volume the Wool Commission would buy bales of wool from the market and remove these to storage. Alternatively in periods of low volume the Wool Commission would sell bales onto the market from storage. By managing the quantity of wool available, the Commission could manage average prices in the market.

A more elaborate support scheme was introduced in 1974. The purpose of the Reserve Price Scheme was to buy or sell wool to maintain prices for various grades at or above a price level that was set by the Wool Board. The members of the Board were producers, industry representatives and a government representative. They set the price, referred to as the floor price, at the beginning of the wool-selling season each year. In this scheme, the Wool Commission would buy the wool if the price offered for a particular lot of wool fell below the floor price. If the price rose in subsequent sales, the Wool Commission would then sell the wool. The difference between the buying price and selling price would cover storage and handling costs plus management fees. The collapse of the Reserve Price Scheme was triggered in 1991 when the Board set the reserve price too high. The value of wool stocks purchased became excessive and the Australian Government withdrew its support for the Scheme, thus triggering the collapse in 1991. The resulting stockpile was sold by the Australian Wool Realisation Commission (AWRC) during the latter half of the 1990s using a variety of methods.

The end of the Buffer Stock Scheme and the Reserve Price Scheme has meant that farmers must now manage their own price and supply risk. Growers may set their own reserve prices at auction but they must also pay their own storage fees to brokers in the event that wool is withdrawn from sale.

The data portrayed in Figure 5.1 show the rise in wool prices during the period 1975 to 1990, as indicated by the Eastern Market Indicator (EMI), with the most dramatic rise being in the year 1989-1990. During this period the amount of wool sold also increased. According to demand theory, we expect the price to fall as quantity supplied increases, other things remaining unchanged, hinting that the reserve price was being set too high during this period. The dip in wool sold during 1991 and 1992 was due to the collapse of the wool market. Russia had ceased buying wool and this led to a reduction in demand, which caused the EMI to fall. From 1993 onward, the Australian Wool Realisation Commission sold the stockpile onto the market. The reduced prices being offered for wool at the time discouraged wool producers and the industry contracted. In the 2003-04 season there was a brief rise in the market due to shortages; however, the price rise was not sustained into the following season.

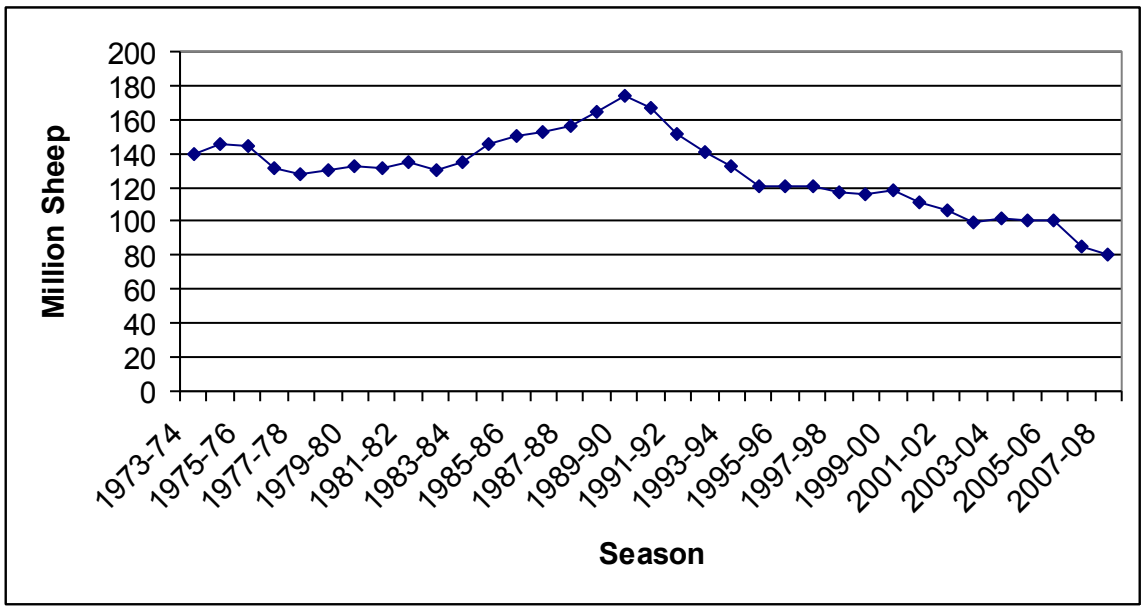
Figure 5.1 Eastern Market Indicator and wool quantity sold for the period 1973-2008. Source: Eastern Market Indicator (EMI) was obtained directly from ABARE data. Wool sold was calculated from wool production and closing stocks data produced by ABARE Australian Commodity Statistics 2009).



Note: KT = 1000 tonnes.

Figure 5.2 shows a 33 per cent rise in the Australian sheep flock during the period 1983-90 encouraged by high prices. The flock increased from 130 million to 178 million sheep during this period. Surprisingly it took four years for the sheep numbers to decrease back to the 130 million head level following the collapse of the Buffer Stock Scheme and the Reserve Price Scheme, which reinforces the idea that producers were optimistic about wool's prospects of returning to higher prices.

Figure 5.2 Australian sheep numbers in the period 1974 to 2008.
Source: Constructed from ABARE Australian Commodity Statistics (2009).



Approximately 75-85 per cent of greasy wool traded in Australia is sold at auction. Five per cent of wool is sold direct by contract or private sale and other wool is further processed and sold as tops or in some cases final products such as suits, jackets and skirts.

The Australian Wool Exchange (AWEX) is the body responsible for managing auctions on behalf of producers, selling agents, buyers and processors. Auctions are a low-cost method of selling wool and they provide transparent price signals to the market. The drawbacks of auctions are that they are infrequent and sale position has an impact on price. Wool lots are listed and sold sequentially at auction, and the position on the sale catalogue can affect prices that growers receive.

Wool can be auctioned by sample or by description. If wool is sold by sample then a random sample of wool is extracted by machine from some or all of the bales being offered in the lot. The grab samples from each bale are then amalgamated and placed in a display box where buyers can examine the wool prior to auction.

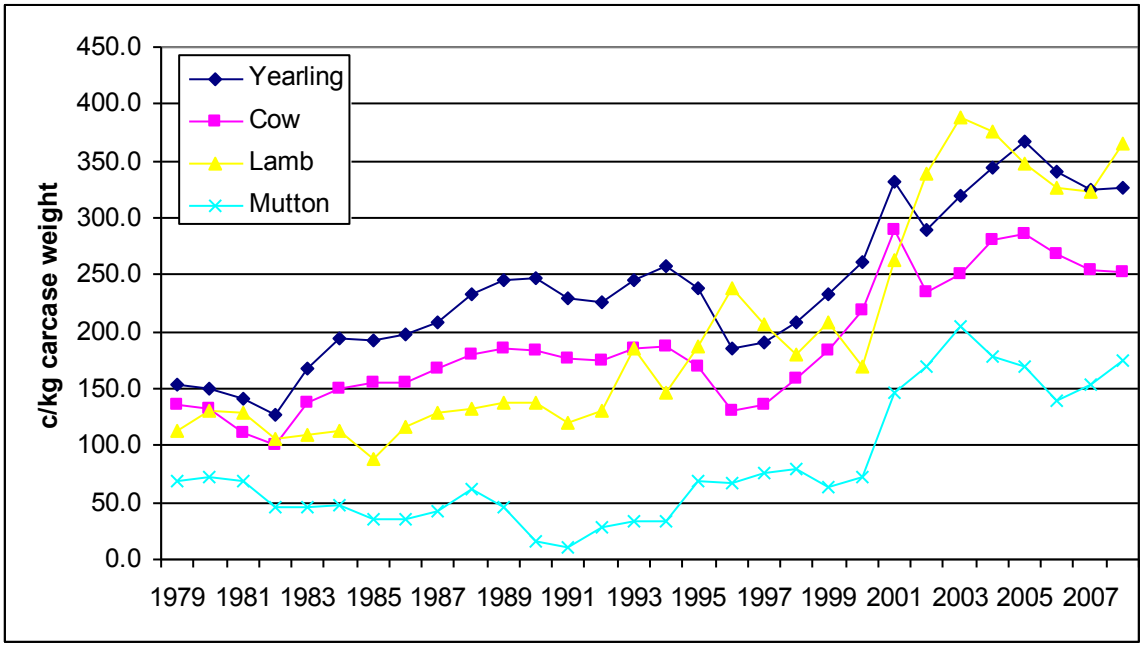
The most important change in wool marketing within Australia has been objective measurement of wool. Traditionally, sellers and buyers would 'type' wool and this type number would be used to estimate prices. The wool type was determined by scoring wool for visual fineness, length, strength, style, colour, yield and vegetable matter. The type number was thus subjective and the buyer or seller could disagree over the type determined. The introduction of objective measurement was to provide consistently measured information to both the buyer and seller.

Tisdell (1976) ranked, in decreasing order, yield, fibre diameter, vegetable matter, staple length, strength and position of break as the most important properties of worsted wools. Alternatively Teasdale (1988) argued that 'mean fibre diameter or fineness was the single most important property of wool and accounts for about 70% of the mean value of wool tops' (p. 49).

In some years, drought or a wet season will have an impact on the characteristics of wool. In a drought year the fibre diameter and yield could be reduced and the wool may become more tender if feed is not consistent for the whole growing season. There are several factors that may have an impact on price. Wool that is finer due to drought may be more valuable than wool that is broader. Wools with a lower yield may receive a price reduction and wools that are more tender will receive a price reduction. In a good season wool may become broader; the yield may increase; and there may be problems due to increased contamination from seed, burrs or shive due to the availability of additional feed supplies. In extremely wet seasons, wool sheep may suffer fleece rot or bacterial infections that may lead to dermatis. It is difficult for farmers to work out the effect of each of these changes in attributes of wool from year to year as they only receive one overall price. The above environmental factors need to be analysed with complex models due to the interactions that exist between the factors.

The supply of wool is also affected by the value of feed and the price of sheep and lambs. When lamb prices are high, farmers will sell merino lambs into the meat market and this will have an impact on the amount of hoggets wool available in the subsequent season. Similarly, when mutton prices are high producers will sell more wethers and cast-for-age ewes. This will have an impact on the total quantity of wool available from year to year. In the long run grain and cattle prices will also affect the supply of sheep and lambs that produce wool. After the 1991 wool market collapse, many producers switched to other enterprises such as cattle and many joined their merino ewes to terminal sires to breed first-cross or second-cross lambs as the prices for these products rose during the period 1991 to 2003 when wool incomes were decreasing or stagnant. The saleyard prices in cents per kilogram carcass weight are shown in Figure 5.3 for the period 1979 to June 2006.

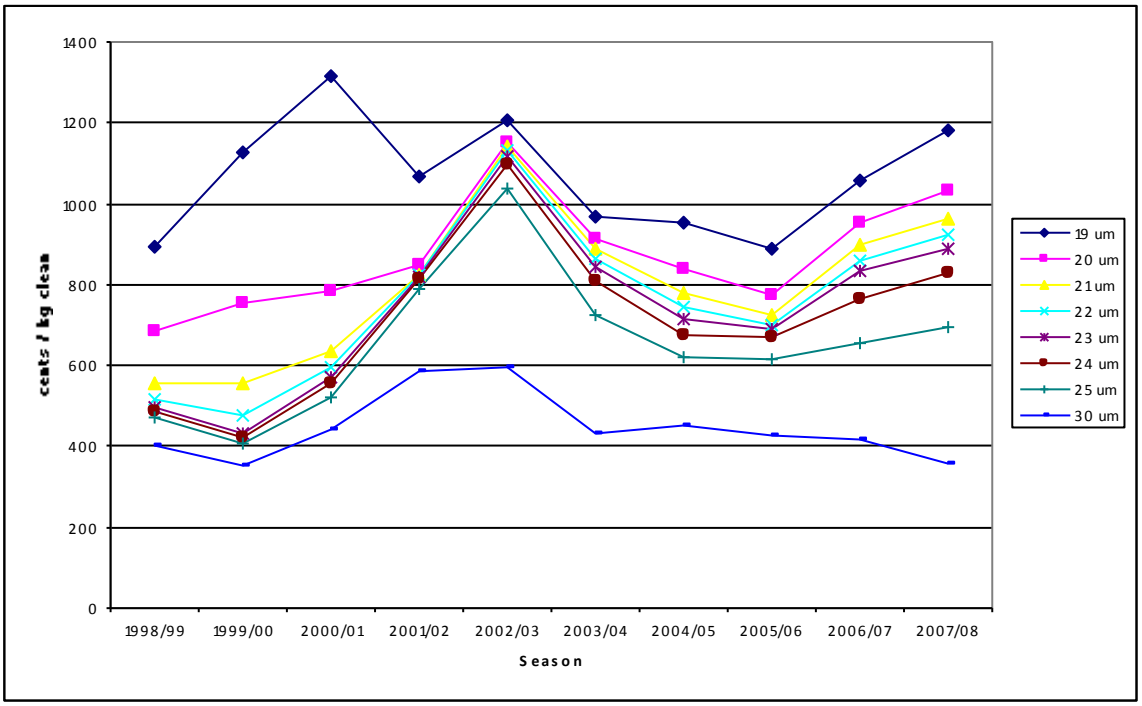
Figure 5.3 Saleyard prices of yearling beef, cows, lambs and mutton for the period 1979 to 2008. Source: Constructed from ABARE Australian Commodity Statistics (2009).



Demand for wool fluctuates with changes in fashion and weather in Europe, Japan and the United States. Leaders in the fashion industry like to change styles from year to year and this may involve using less or more wool in the garments. Wool may be in fashion one year and out in another. Also, within the market, knitwear demand may move differently from apparel wear demand. Trends toward knitwear would favour broader micron wools and lamb's wool. Trends towards apparel would favour finer micron wools. Fashion designers are influenced by fabric costs, product differentiation and product wearability. Textile research has been aimed at making wool more appealing to fashion designers and campaigns such as wash-and-wear, wrinkle free, cool wool and sport wool have been employed. Fashion designers influence consumer demand as high fashion filters down to marketable fashions that in turn influence raw wool demand.

The demand for 19 micron (μm) wool increased in the period 1998 to 2000 at a faster rate than other micron bands. Since 2002-03 the premium for 19 micron wool has been eroded relative to the other micron groups. Alternatively, the 30 micron wool maintained its position relative to other micron bands until 2001 and then its relative value decreased to 2007-08. The gap between the 30 micron band and the 25 micron band closed during the 2004-05 season; however, it was relatively small and has since spread again. The reason for this difference is the large increase (approximately 100 kilo tonnes) in wool produced in China.

Figure 5.4 Eastern market indicator prices by micron group, 1988/89 to 2007/08. Source: Constructed from ABARE Australian Commodity Statistics (2009).



Cold winters in the northern hemisphere increase the demand for wool clothing. Unfortunately, the wool-processing pipeline is very long (6-9 months) and it is difficult to predict warm and cold winters. Buyers therefore work on buying raw wool volumes for average seasonal temperatures.

Other factors that influence wool demand are exchange rates and labour costs. Much of the early-stage textile industry of Western Europe has relocated to China where wool is processed into cloth or yarn and then exported to other countries for further processing. The finished product may then be sold in a third country.

The pie graph in Figure 5.5 shows the relative share of Australian wool purchased by China, Eastern Europe, the European Union, India and the United States in 1998/99. The major importers in that year were the European Union and China, importing 261 and 223 kilo tonnes respectively.

Figure 5.5 Wool import volumes in kilo tonnes by major destination markets, 1998/99. Source: Constructed from ABARE Australian Commodity Statistics (2006).

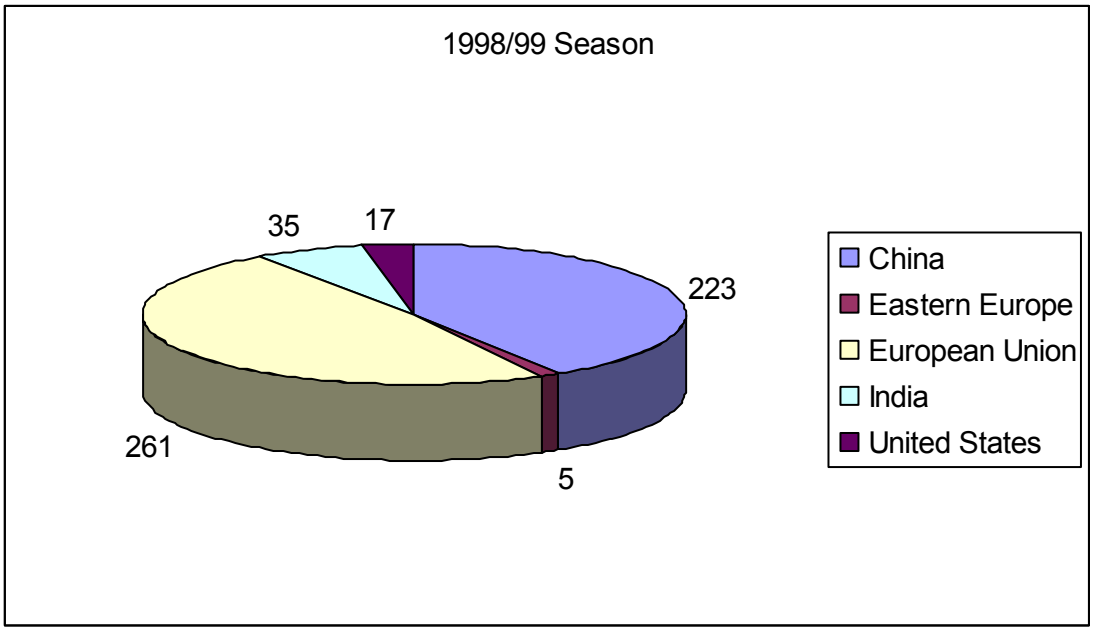
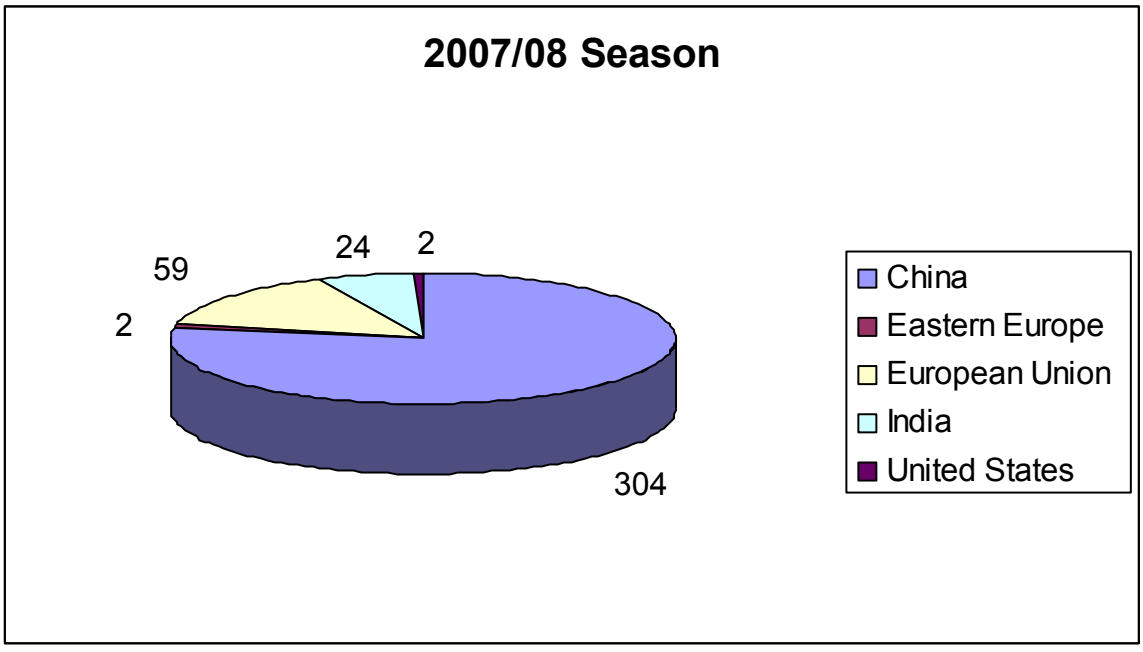


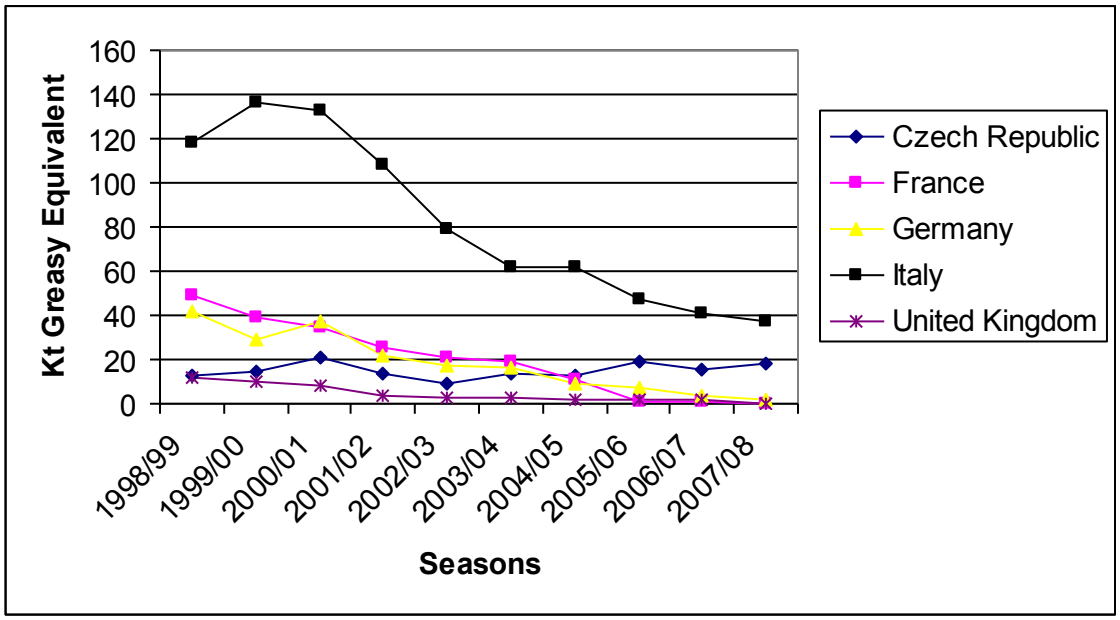
Figure 5.6 illustrates the rise of China's influence on Australian wool. In the 2007/09 season, China purchased approximately 304 kilo tonnes, which is a 36 per cent increase in volume over the 1998/99 volume. Notably, the European Union significantly reduced its purchases during the same period from 260 to 59 kilo tonnes. The largest reduction in imports was by Italy, which halved its imports. France and Germany also dramatically reduced their purchases of Australian wool during the past eight years from 1998/99 to 2007/08 as the early-stage processing facilities relocated to China. Raw wool imports to India fell by 31 per cent and for the United States they fell 89 per cent.

Figure 5.6 Wool import volumes in kilo tonnes by major destination markets, 2007/08. Source: Constructed from ABARE Australian Commodity Statistics (2009).



Import changes for the European Union are shown graphically in Figure 5.7 for the Czech Republic, France, Germany, Italy and the United Kingdom.

Figure 5.7 European Union wool imports between 1998/99 and 2007/08.
Source: Constructed from ABARE Australian Commodity Statistics (2009).



5.2 Demand and supply analysis

When making marketing decisions, it is important for producers to spend money on items that will increase their return to a greater extent than their costs. Recall the profit-maximising approach outlined in Topic 2 of increasing expenditure to the point where marginal revenue is equal to marginal cost. It is therefore vital that you know what is driving the various segments in the supply of wool and then to identify where marketing might have its greatest impact. When you apply economics to a marketing program, you can more easily make informed and justifiable decisions.

Farm planning and risk management are two key factors that ensure that farmers make informed decisions when purchasing farm inputs and when marketing farm outputs. Several government and private companies provide forecasts for input and output prices that can be used in farm decision making. The Australian Bureau of Agricultural and Resource Economics (ABARE) produces the most comprehensive reports on a wide range of crop and livestock activities. ABARE generally publishes its forecasts in late January or early February to provide industry decision makers with information on expected trends within the year.

ABARE has developed a world wool trade model. This model is reported in a publication that provides a very good overview of factors that impact on wool demand and supply (Connolly, 1992). Importantly, the model includes estimates of elasticities, which are explained in detail in the following section.

5.3 Elasticities

As described in Topic 2, elasticities indicate by how much quantity demanded or supplied will change with a one per cent increase in the price of a factor that is changed. Factors that change may include the demand or supply factors described above. The sign on an elasticity can be negative (-), constant (0) or positive (+), and these signs hold important clues as to the relationship between one factor and another.

Demand elasticities

As shown in Topic 2 for a price elasticity of demand, a negative sign means that an increase in price reduces the quantity demanded of a good. For a cross-price elasticity of demand, if the elasticity were to have a positive sign then this would imply that two goods are substitutes. That is, when the price of product 'a' decreases and therefore the quantity demanded of it increases, the demand for substitute product 'b' decreases. For example, margarine and butter are considered to be substitutes. The more margarine you use then the less butter you use. Alternatively, when the sign on the cross-price elasticity of demand is negative, then the relationship between the two goods is said to be complementary. That is, as you use more of one good you will also use more of the second good. Tea and milk have this type of complementary relationship. The more tea you drink the more milk you might use.

Table 5.1 shows own price elasticities for apparel wool demand in the United States and Japan and the elasticities for wool and wool blends, and knitting yarn in China. It is important to note the signs on the elasticities: they are all zero or negative. A negative sign implies that if the price of Australian wool were to rise, then demand in each of these markets would decrease. A price rise in Australia is initially more likely to cause demand in the United States (-0.14) to decrease more than the decrease in Japan (-0.07). But the long-term response in the United States market (-0.10) is less than the long-term response in Japan (-0.17). The greater response to price changes in Japan and the United States than in China would be expected because 70 per cent of the Australian wool clip is apparel wool. Alternatively, a price rise has a smaller impact on wool, wool blend and knitting yarn products used in China as these are typically produced using the broader micron wools that constitute approximately 25 per cent of Australian wool production.

Table 5.1 Price Elasticities of Retail Demand for Wool in the United States, Japan and China Relative to Australian Wool Prices. Source: Connolly (1992, p. 64).

	Price elasticity of demand for:			
Time lag	Apparel wool	Apparel wool	Wool blend	Knitting yarn
Years	United States	Japan	China	China
0	-0.14	-0.07	0.00	-0.04
1	-0.26	-0.14	-0.04	-0.05
2	-0.22	-0.15	-0.03	-0.06
3	-0.19	-0.16	-0.02	-0.06
4	-0.16	-0.16	-0.02	-0.06
5	-0.15	-0.16	-0.02	-0.06
Long term	-0.10	-0.17	-0.02	-0.06

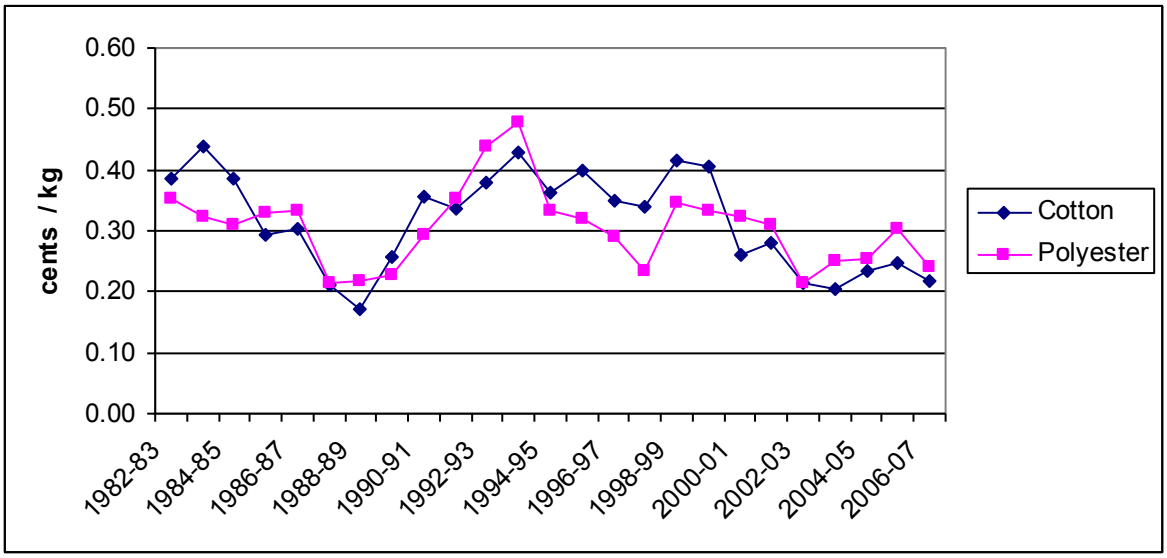
The price elasticities of demand shown in Table 5.1 illustrate how important it is to conduct price analysis by the end use of wool rather than raw wool. An in-depth market analysis would break the apparel wool market out into super fine apparel, fine apparel and apparel as these would be classified as different end use products. There are also many wool blend products available on the market and these might also be broken out as sub groups for market analysis.

Wool substitutes

An in-depth market analysis should take account of substitute fibres and other factors that affect wool demand. Cotton, polyester and acrylic are each thought to be competitive with wool in the medium to fine micron range. When we calculate the elasticities for these other fibres, it can be shown that cotton and wool, and acrylic and wool are substitutes whereas polyester and wool are complements. Complement products are used in conjunction with wool in wool blends. The elasticities reveal that wool's main competitor is cotton and acrylic this may be seen in the sportswear markets, winter jackets or outer shell products that have replaced wool.

Figure 5.8 shows the relative price of wool (EMI) to cotton and polyester for the 26-year period 1982 to 2007. In the ten-year lead up to the end of the Reserve Price Scheme the price ratios of cotton to wool, and polyester to wool, decreased as the price of wool increased. Since 1993, wool has slowly become less cost competitive with cotton with the ratio falling from 0.42 to 0.2, which is one-fifth of the price of wool. The cotton industry has reduced its market price from 286 cents per kilogram in 1995 to 167cents per kilogram in 2004. Since then the cotton price has risen back to 188 cents in 2008. The ability to reduce costs has significantly increased the cotton industry's share of the world textile market. The wool industry needs to be price competitive in the middle micron range to compete with other fibres. Alternatively, wool has an opportunity to capture value in the lower micron market due to the unique textile properties of those wools.

Figure 5.8 Price ratio of wool relative to cotton and polyester, 1982-2007.
Source: Ratios calculated from ABARE Australian Commodity Statistics, various tables.



The relative price of "polyester to wool" has followed a similar trend to the "cotton to wool price" ratio. Both polyester and cotton are very cost competitive compared to wool. The price story is similar for Acrylic (Acrylonitrile).

The sign on the own price elasticity for wool shown in Table 5.2 is negative (-0.81). It implies that a one per cent increase in the price of wool will lead to a 0.81 per cent reduction in wool demand. The positive sign on the cross price elasticity of demand for cotton indicates that cotton is a substitute for wool. This implies that a one per cent price increase for cotton will increase wool demand (quantity) by 0.72 per cent. Alternatively the negative sign on the cross elasticity for polyester indicates that it is a complement for wool. Here a one per cent fall in the polyester price (reflecting an increase in supply of polyester) may increase wool demand by 0.04 per cent.

Table 5.2 Elasticity Estimates for Wool Substitutes. Source: Elasticities estimated from ABARE annual data 1990 to 2007, Australian Commodity Statistics.

Variable	Elasticity estimate
Price of wool	-0.81
Price of cotton	0.72
Price of polyester	-0.04 *
United States gross domestic product	0.14 *

* Not significant (this variable was not significant in this period of analysis; however, polyester and US GDP have been shown to be significant in analyses over longer timeframes.)

Table 5.2 contains two other important pieces of information. The first is the elasticity estimate for the Gross Domestic Product of the United States. This variable was used a proxy variable for average household income. The positive sign on this variable in Table 5.2 indicated, as expected, that as US GDP increases then so does the demand for wool. A one per cent increase in US GDP would cause demand for wool to increase by 0.14 per cent.

A major concern for the wool industry in developing marketing strategies concerns the elasticities of two variables that are not shown in Table 5.2. It would be interesting to have variables that reflect the competitive position of European processors and the textile preferences of European consumers, given that Europe was once the home of fashion. The competitive position of European processors in wool scouring and early-stage processing has deteriorated relative to that of Chinese processors, and much of this activity has been relocated to China. A significant negative elasticity would indicate the extent to which wool demand has declined in the European Union relative to other parts of the world. In particular, wool's main consumer base has shifted from Europe to North America.

Supply elasticities

Supply elasticities are also useful to determine the relationships between commodities. The own-price elasticity of supply of a farm product is normally positive. That is, as the price of a farm product increases, it pays the producer to supply a higher volume to the market in order to increase profit (see Topic 2). On the other hand, the supply elasticity with respect to input price is expected to be negative: as an input price increases, production becomes less profitable and the producer reduces the volume supplied to the market. A negative cross-price elasticity of supply indicates that two commodities such as wool and beef are substitutes and a positive elasticity indicates that two goods are complements, such as sheep and oats. Notice that the interpretation of cross price demand elasticities to determine complements and substitutes are reversed for supply elasticities.

The own-price elasticity of supply for wool, cross-price elasticities with respect to wheat, beef, lamb and mutton, and the elasticity of supply of wool with respect to input costs are shown in Table 5.3. The elasticities are reported for one, two, five and ten years and then the 'long term', which shows how the elasticity changes over time. It is important to realise that the effect of a price change will occur over a number of years. Short-term elasticities should be evaluated for short-term changes and long-term elasticities should be used for making long-term decisions.

The own-price elasticities of supply shown in Table 5.3 describe the expected positive supply response to wool price. That is, if the price of wool increased by one per cent then the quantity of wool supplied could be expected to increase by 0.10 per cent in the first year, 0.20 per cent in the second year and 0.62 per cent in the long term.

The negative sign on the wheat cross-price elasticity indicates that wool and wheat are substitutes. That is, if wheat prices increase then wool producers will increase their production of wheat at the expense of wool production over time. A one per cent rise in the wheat price would have no immediate impact on the quantity of wool supplied; however, over time the effect increases. The beef price elasticity is similar to the wheat elasticity in that the two products are substitutes; however, the response is highly inelastic at 0.04 in the long term. The reason for this is that beef production regions such as the eastern ranges in New South Wales and Queensland are not suitable for sheep production due to the problems of fleece rot and foot rot; hence, there will never be a 100 per cent substitution due to environmental restrictions. The substitution will likely take place in regions in the western slopes where first-cross or merino enterprises could be operated.

Table 5.3 Price Elasticity of Wool Production in Australia. Source: Connolly (1992, p. 13).

Time lags	Price elasticity with respect to:					
Years	Wool	Wheat	Beef	Lamb	Mutton	Farm inputs
0	+0.04	0.00	0.00	-0.01	0.00	-0.02
1	+0.10	-0.003	-0.01	-0.01	+0.01	-0.07
2	+0.20	-0.04	-0.02	0.00	+0.01	-0.13
5	+0.45	-0.19	-0.04	0.00	+0.02	-0.20
10	+0.56	-0.27	-0.04	+0.02	+0.03	-0.25
Long term	+0.62	-0.32	-0.04	+0.03	+0.04	-0.28

The lamb price elasticity shown in Table 5.3 is very interesting. The initial wool response is negative; however, the long run response is positive. We can rationalise this response in the following way. In the short term wool-producing lambs will be diverted to the meat industry and wool supply will decrease because lambs will be slaughtered prior to their first shearing. In the long run, however, producers will divert resources to increasing their ewe flocks and this increase in the ewe flock will lead to an increase in wool production. Hence, the price of lambs has a positive effect on the output of wool in the long run.

The mutton price elasticity in Table 5.3 is shown to be positive, which implies that wool and mutton are complements. When mutton prices increase then one might expect that abattoirs have access to fewer animals and this would imply that farmers are holding onto their animals rather than selling them for mutton, which would explain why wool output increases. Note, however, that the elasticities are very small in magnitude, indicating that lamb and mutton prices have only very small effects on wool production even in the long term.

The final column in Table 5.3 relates to farm input costs such as labour, fertiliser and pasture costs. The negative sign on the farm inputs indicates that producers grow and market less wool as farm costs rise. Notably, the effect of farm costs rising is stronger in the long run than in the short run; hence, farmers could be expected to shift toward enterprises that maximise their incomes and/or minimise their costs over time.

5.4 Valuing Wool Attributes

Wool prices vary due to demand factors as well as a range of different quality attributes and the level of attributes present. It is important from a marketing perspective to measure the value of attributes and the premiums or discounts that may be associated with different levels of the attributes. Discovering the value of attributes and their levels is not a simple task, as these must be estimated by using a technique known as hedonic price analysis. In short, the process relies upon regressing attributes on market prices for various lots of wool sold at auction. The following equation best represents the hedonic function.

$$Price_i = f (Z_i + e_i) \quad (1)$$

where Price is the clean price for the wool lot determined at auction; Z are attributes such as micron, length, vegetable matter and the i are the levels of the attributes for each lot of wool such as 18, 19, 20 microns. The final term, e_i, is the error term. By employing functions such as these, analysts are able to separate out the hedonic values for each attribute and their levels.

Some attributes of wool such as length, strength and micron increase or decrease in proportion to one another and therefore the analyst must be careful when estimating these types of attributes to include joint density functions in the model. Another problem that is often encountered with these models is that they are estimated over all micron categories rather than select bands (or bands for end use products) and this leads to biased estimates for quality parameters.

Angel, Beare and Zwart (1990) estimated a model for wool diameter (micron), length, and vegetable matter for auction sales in Australia and New Zealand for the 1986-87 selling season. The average diameter of all wool lots in their study was 24.2 micron for Australia and 24.1 for New Zealand. The vegetable matter percentage was 1.4 for Australia and 0.6 for New Zealand and the length in millimetres was 95.4 for Australia and 64.8 for New Zealand.

The function estimated by Angel, Beare and Zwart (1990) was used to produce the response surfaces shown in the following three figures. Figure 5.9 shows the wool length from 120 mm down to 30 mm on the horizontal axis. The micron level is shown on the Z-axis and the price is shown on the Y-axis. The response surface is high in the rear left corner where the micron level is 18 and the wool length is 120 mm. The value of these types of wool was $14.38 per kilogram. Moving from left to right the price response surface declines and is at its lowest point for the short 30 millimetres and 30-micron wool. The value of these wools was only $5.85 per kilogram. The response surface enables you to compare two attributes and map all price points for the levels of each attribute. By analysing the response surface you can see that a 22-micron 90 mm wool would be valued at approximately $10.20 per kilogram. In practice one would use a table to show the combinations of prices where there are more than two attributes being considered.

Figure 5.9 Price response surface for wool micron and length.
Source: Angel, Beare and Zwart (1990, p. 74) calculated from Model 3.

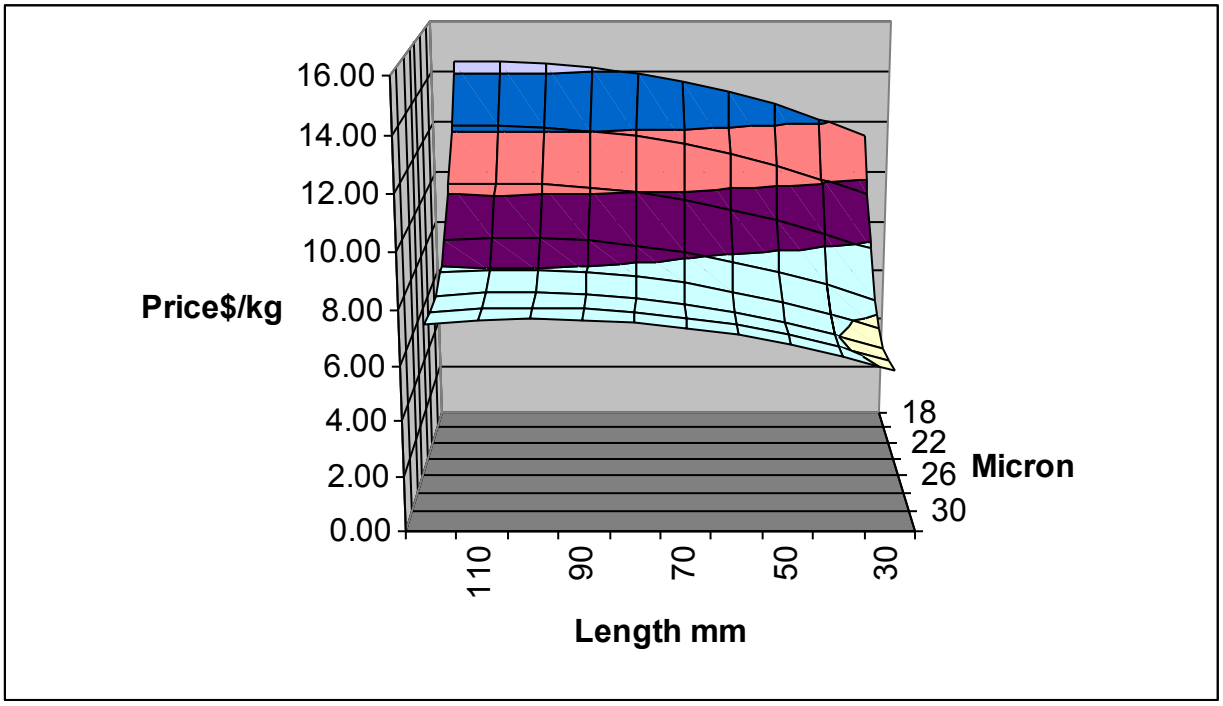


Figure 5.10 shows the effect of vegetable matter percentage on prices for each micron category. From this figure it is simple to see that vegetable matter content affects finer micron wool more than it affects broader micron wools. It is also obvious that the effect of micron on prices was far greater then the effect of vegetable matter on prices.

Figure 5.10 Price response surface for wool micron and vegetable matter percentage.
Source: Angel, Beare and Zwart (1990, p. 74), calculated from Model 3.

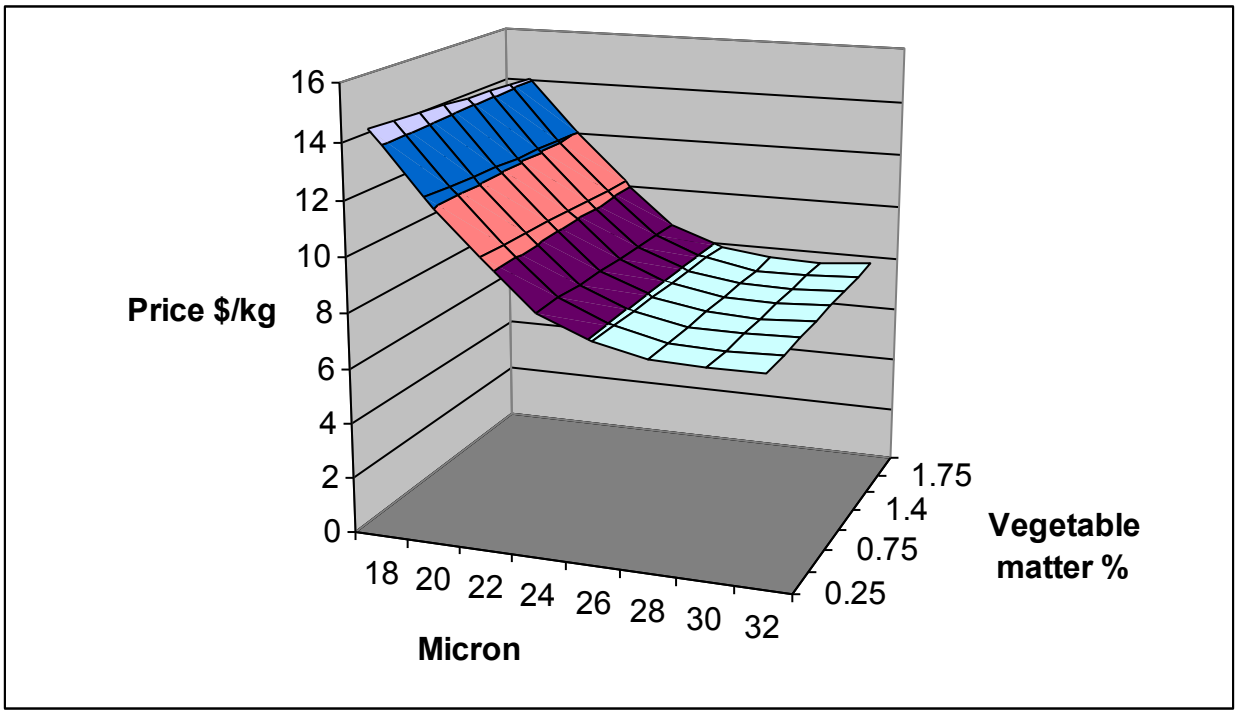
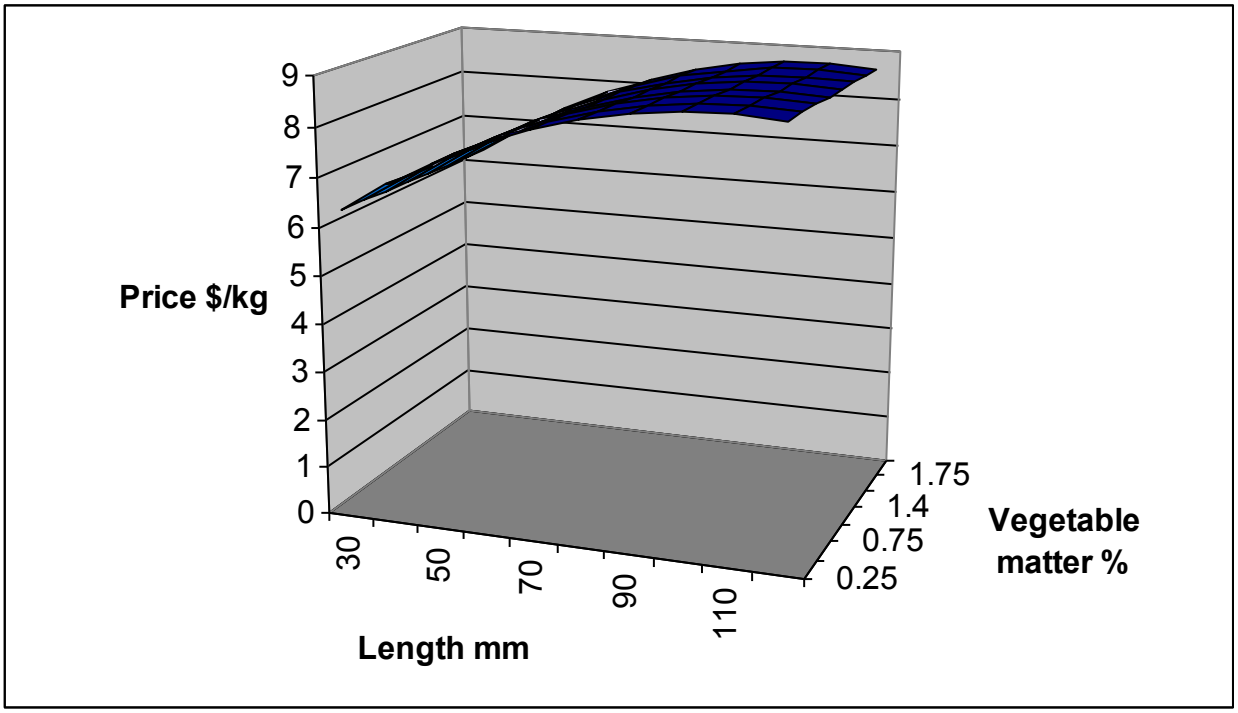


Figure 5.11 shows the price response surface between wool length and vegetable matter percentage. There is a twist in the response surface near the wool length of 60 mm. The discount for vegetable matter percentage in short wool is shown to be greater than the discount for vegetable matter for long wool. The reason for the difference is again related to the end use of the product. Here carding wools or short wools go into a different vegetable matter removal process than the longer combing wools.

Figure 5.11 Price response surface for wool length and vegetable matter percentage. Source: Angel, Beare and Zwart (1990, p. 74) calculated from Model 3.



Figures 5.9 to 5.11 show the relationships between three different wool attributes, namely micron, length and vegetable matter content. In practice, the model would need to be more comprehensive to properly represent the range of prices that one observes in the market. Other attributes that could be included are wool strength, position of break, wool tip damage, colour, softness, coefficient of variation of fibre length, yield and the presence of brands or stain. There are also other factors such as position within sale, sale day, sale month and sale location that could be examined for price premiums or discounts (Ryan, Nolan and Ahmadi-Esfahani, 2007).

5.5 Market Risk Management

Managing supply or price variation is difficult as by definition risk comes from variability in inputs, outputs and prices. When assessing risk the first step is to examine the risk profile of an input, output or price. Risk management is covered in detail in Topic 8, so only brief notes are provided in this topic with emphasis on market risk management.

Statistically we can locate the minimum, maximum, mean, median, variance and standard deviation (S.D.) of the price series to assist in decision-making. These summary statistics are reported in Table 5.4 for the micron categories for the period 2000 to 2006. For example, if we examine the 19 micron EMI we can see that it has a high, low and average value.

It is obvious from Table 5.4 that price decreases as micron increases. The next item to notice is how close the median is to the mean. A small difference between these two values would indicate a normal distribution while a large difference may indicate a skewed distribution either to the low or high end. Skewness is also a measure or the symmetry of prices around their means. This would indicate the possibility of a downward or upward bias in the price distribution. The next item to consider is the variance or standard deviation (recall that the variance is the square of the standard deviation). If a producer wanted to minimise their risk then they would choose to produce wool in a

micron range that had the smallest variance or standard deviation. From the options shown in Table 5.4, a producer of 20 micron wool faces a less risky market environment than one who produces 19 or 21 micron wool, which have higher variances.

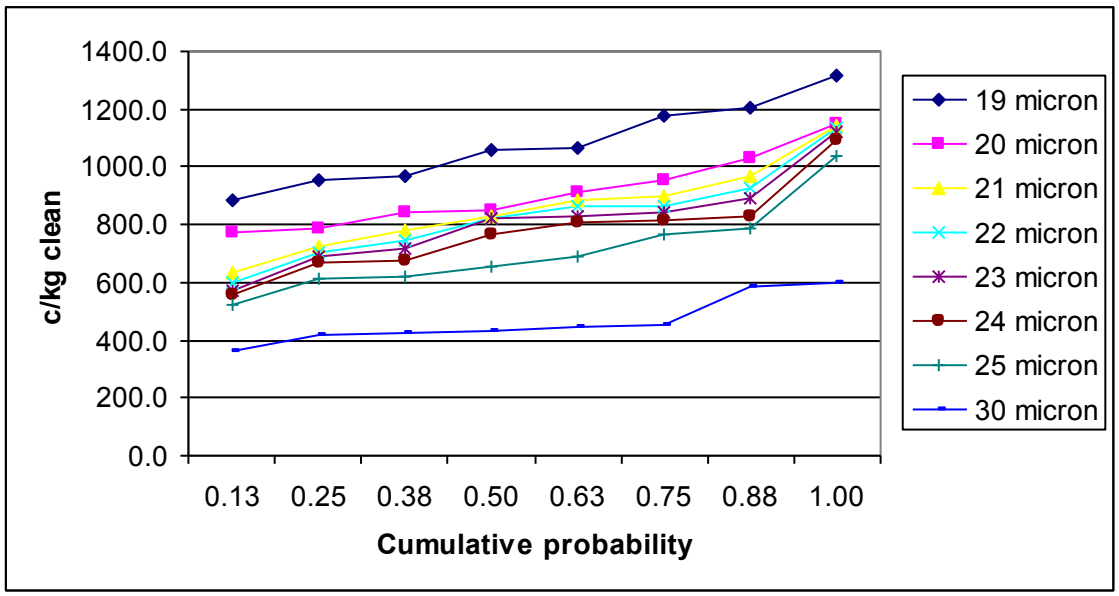
Table 5.4 Summary Statistics by Micron Category for the Period 2000-2008.
Source: ABARE, Australian Commodity Statistics (2009).

	Low	High	Mean	Median	Skew	Variance	S.D.
19 micron	888.0	1315.0	1079.0	1062.5	0.36	21146.78	145.42
20 micron	776.0	1150.9	912.8	881.7	0.88	16787.57	129.57
21 micron	637.0	1143.0	857.6	856.9	0.55	24238.15	155.69
22 micron	597.0	1133.9	831.2	842.5	0.59	25964.07	161.13
23 micron	570.0	1119.3	809.7	826.0	0.62	26405.16	162.50
24 micron	554.0	1096.2	776.7	788.7	0.91	25613.38	160.04
25 micron	521.0	1035.7	711.8	674.5	1.29	24447.71	156.36
30 micron	359.0	595.6	463.4	437.5	0.91	6922.93	83.20
EMI	713.3	1049.0	845.4	830.5	0.90	11810.10	108.67
WMI	691.7	1051.2	841.0	828.6	0.78	13015.83	114.09

Another useful technique to assess risk is to construct a cumulative probability graph. The graph is constructed by organising the data in ascending order and assigning probabilities to each observation. The usefulness of Table 5.4 is that you can then assign probabilities to various price levels. Note that there is an important assumption that past data are a reflection of future data sample space. In the wool industry this assumption may not be valid due the level of structural change within the industry.

Examine Figure 5.12 and note that the probabilities on the X axis range from 0 per cent to 100 per cent. The price in cents per kilogram is shown on the Y axis. For the 19 micron price series we can say that there is a 50 per cent probability of the price being less than 1052 cents. This point is identified by ruling a vertical line at the 50 per cent level and then reading the value from the Y axis. Similarly there is a 75 per cent probability of the 19-micron price being less than 1180 cents per kilogram. We can also use the fact that the sum of the probability is 100 per cent and therefore subtract the probability from 100 to identify the probability of making more than a particular value. Again for the 19-micron category we know that there is a 75 per cent probability of the price being less than 1180 cents per kilogram, but we also know that there is a 25 per cent probability of the price going above 1180 cents (100-75=25). The data also inform us that there is a 100 per cent probability of making less than 1315 cents per kilogram and a zero probability of earning more than this. Remember that these outcomes are based on the data that are available and that the six annual observations used for this analysis may not be reliable for forecasts due to the small sample size and the amount of structural change within the industry.

Figure 5.12 Cumulative probabilities for various micron categories. Source: Constructed from ABARE Australian Commodity Statistics (2000 - 2006).



Wool producers have a number of alternative strategies available to them to minimise market risk. They can store wool and release it onto the market when prices increase. The cost of this strategy is that the value of the wool is not earning interest while it is in the shed and the producer may have to borrow carry-on finance. The second strategy is to sell their wool and place the money in a managed deposit scheme, which attracts interest, but the money is not taxed on entry and can be called upon in periods where income falls. Producers may consider purchasing a forward contract to deliver wool at a certain date in the future for a fixed price. The contract is a legally binding agreement to deliver wool at the agreed date. Another strategy is to sell a futures contract (called a short position). The producer can choose to deliver the wool or buy the contract back. A more refined risk management tool is to use options contracts. The options contract provides the producer with an opportunity to purchase a futures contract at a fixed price if the cash market falls. If the price rises then the producer does not need to purchase the contract and can let the option on the contract expire. These last two tools are now discussed in more detail.

Wool futures contracts

The Sydney Futures Exchange (SFE) offers futures contracts for lots of 2500 kg of wool for settlement during February, April, June, August, October and December up to 18 months ahead. There are three different contracts available to producers: fine wool (19 micron, 2500 kg clean), broad wool (23 micron, 2500 kg clean) and greasy wool (21 micron, 2500 kg greasy). A producer would select the contract that more closely resembles their wool type. All prices are bid in cents per kilogram clean weight and trading ceases on the third Thursday of the month when the contract is due to be settled.

To understand contract trading you need to realise that there are two markets. One is the physical market where lots or lines of wool are bought and sold. This physical market sets the market indicator price and is controlled by AWEX. Alternatively, the futures market does not trade wool; it trades paper (contracts) with the right either to buy or sell wool at a particular price. The SFE controls this market, which is a subsidiary of the Australian Stock Exchange. The price difference between a futures contract price and the physical market price is called basis. The basis changes over time and typically narrows as contracts draw nearer to their expiry dates.

To sell a contract in May 2009 a producer would examine the market prices for wool at present and determine how they thought price might move in the future. The closing quote for the 19 micron indicator for 5th May 2009 was 1023 cents per kilogram clean (AWEX, 2007). The producer would then examine the settlement price summary (SFE, 2009) and compare that with their forecast. If the producer shears their sheep in July then they would consider a contract date of August 09 and beyond. The SFE price summary has been replicated in Table 5.5. From that summary the producer can see that the forward price for 19 micron August 2009 contract is 990 cents per

kilogram. Therefore, they would compare the August 09 settlement price with their expectations of the market price in August.

If the producer purchased the "sell" contract then they would be guaranteed this price, 990 cents, for each contracted lot for that settlement month excluding interest, broker fees and charges. The opening basis in May is 1023 – 990 = 33 cents.

Table 5.5 Sydney Futures Exchange Settlement Price Summary
Source: Sydney Futures Exchange week ending (5 May 2009).

5 May 2009	Fine wool	Broad wool	Greasy wool
Expiry month	19 micron	23 micron	21 micron
Jun-09	995	730	822
Aug-09	990	730	824
Oct-09	990	730	821
Dec-09	990	730	821
Feb-10	990	730	849

The value of SFE contracts price tends to follow the physical market price. In the event that the physical market price (AWEX) fell to 950 c/kg in August then the producer would sell their wool in the physical market for that price (a loss of 73 cents). You need a buy contact to cancel out a sell contract. The sell contract was valued at 990 at purchase in May and by August a buy contract may be worth 920. The producer would make 990 – 920 = 70 cents on the contract exchange.

In this scenario the producer wins 70 cents on the SFE contracts but makes a loss of 73 cents in the physical market. The net effect is that the producer was able to lock in a price close to 990 cents.

In the event that the physical market price rose from 1023 to 1050 then the producer would make 27 cents on the physical market but lose a similar amount when exchanging contract on the futures contracts. That is, they would need to pay more to buy out their original sell contract. The net effect is that the same price, 990 cents, is locked in.

Options contracts

An options contract is a contract that a producer can buy which provides one-way protection. Producers have to pay a premium to buy the options contract. The benefit of managing downside risk comes at a small cost. The cost of the premium depends on the expectation that the market will increase or decrease, time to maturity and interest rates. Typically a producer wants to insure against a loss so they would seek downward protection. A producer can buy the right to sell a SFE futures contract at a fixed price. Let's say they want to lock in 1025 cents per kilogram. If the AWEX physical market falls to 950 c/kg then the producer would exercise the contract (This means they use it.) They would sell the contract for 1025 c/kg and make 75 c/kg on the trade minus the premium. They would sell their wool in the physical market for 950 c/kg and make a 75 c/kg loss. Hence the gain on the options market equals the loss in the physical market minus the premium.

If the AWEX market price becomes higher and moves to 1100 c/kg then the producer does not have to exercise the option (This means they do not use it.) They simply throw the option in the bin and sell their wool in the physical market for 1100 and take the 75 c/kg gain minus the premium. Similarly, if the AWEX market price went to 1200 c/kg the producer would simply sell their wool in the physical market and make the 175 c/kg gain. But they still have to pay the premium. This is the benefit of using options. They protect against downside risk but allow the producer to capture any increase in market prices. The costs of the contract are worthwhile for producers who have to meet certain income targets such as those with regular debts to repay or those who are risk-averse.

Readings

There are no readings for this topic.

Summary

The purpose of this topic is to provide you with an overview of some of the tools that are used to analyse the wool market. It is important that markets for wool are examined by their end use properties. Analysts also need to understand the impact that other industries have on wool markets. The beef and lamb industry cause changes in the available resources that can be used for wool production. Similarly, the cotton and acrylic fibre industries have an impact on the demand side for wool and affect a range of micron bands.

For wool to compete in the middle micron market, it needs to be cost competitive with fibres such as cotton and acrylic. Fine wool appears to have sustained a market niche. The market for broad micron wools is likely to decline as China and Eastern European countries have over-supplied that market.

Producers have several risk management strategies available to them, and those who are risk-averse can use forward contracts, wool futures contracts or options contracts to manage their risks. The uptake of these tools has been slowed by the fact that risk management was provided by the Reserve Price Scheme until 1990 and producers did not have to learn how to mitigate their risk under that marketing arrangement.

Summary Slides are available on CD

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Glossary of terms

Apparel wool	Wool that is used for suits and clothing made from cloth
Auctions	A call bidding process, which commences at a low price and increases to the final bid price
AWEX	Australian Wool Exchange
Buffer stock scheme	Scheme established to control wool quantities available for auction with the objective to restrict price variation
Complements	Goods that complement each other in production or consumption
Eastern Market Indicator (EMI)	A weighted average of auction prices across various wool types sold in Eastern Australian wool-selling centres for a specific day or week
Floor price	The price below which the Wool Commission would enter the market and buy wool

Futures contracts	Contracts that are bought and sold on the Sydney Futures Exchange for specific quantities of wool with specific micron and type traits that can be exchanged for a fixed price in the future
Knitting yarn	Wool that is used in making wool products with several plies such as pullovers, tweed or blankets
Objective measurement	Measurement of wool fibres using standardised and calibrated equipment for fibre length, diameter, strength, colour and clean wool yield
Options contracts	A contract that a producer may or may not exercise to purchase a futures contract for a specific price at a particular date
Price elasticity	The elasticity shows the percentage change in the quantity of good 1 for a one per cent change in the price in good 2
Reserve price scheme	A scheme devised to supplement the buffer stock scheme which had the specific aim to control prices above a fixed price level set by a controlling board at the commencement of each wool selling season
Settlement price	The price at which a futures or options contract is exchanged through the Sydney Futures Exchange
Substitutes	Goods that compete for resources in supply or for the consumer's dollar in demand
Wool blends	Fibres that are composed of wool with polyester, cotton or some other fibre typically to add durability and strength, such as in socks
Worsted wools	Wools that are used in men's and women's apparel clothing