Economic impact of phasing out the live sheep export trade

Dr Alistair Davey

March 2013
About the Author

Alistair Davey is a Principal in the Canberra office of the Sapere Research Group. Prior to becoming a consultant in May 2007, he spent 15 years working for the Australian Government in various roles, serving as the competition and microeconomic advisor to the Treasurer from March 1996 until June 1999, and working for the Australian Competition and Consumer Commission (ACCC) and the Australian Bureau of Agricultural and Research Economics (ABARE).

Alistair specialises in the economic analysis of trade practices, competition policy and regulatory instruments. He has advised prominent firms involved in the downstream petroleum industry, grocery retailing, credit/charge card issuance, agriculture and electricity generation, as well as various industry associations and Commonwealth and State government agencies.

Alistair holds a Masters degree in economics from the University of Melbourne and a professional doctorate from the Australian National University. Alistair has been published in refereed economic journals writing on competition law and petrol prices.

About Sapere Research Group Limited

Sapere Research Group is one of the largest expert consulting firms in Australasia and a leader in provision of independent economic, forensic accounting and public policy services. Sapere provides independent expert testimony, strategic advisory services, data analytics and other advice to Australasia’s private sector corporate clients, major law firms, government agencies, and regulatory bodies.

<table>
<thead>
<tr>
<th>Sydney</th>
<th>Canberra</th>
<th>Melbourne</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 14, 68 Pitt St</td>
<td>Unit 3, 97 Northbourne Ave</td>
<td>Level 2, 65 Southbank Boulevard</td>
</tr>
<tr>
<td>GPO Box 220</td>
<td>Turner ACT 2612</td>
<td>GPO Box 3179</td>
</tr>
<tr>
<td>NSW 2001</td>
<td>GPO Box 252</td>
<td>Melbourne, VIC 3001</td>
</tr>
<tr>
<td>Ph: +61 2 9234 0200</td>
<td>Canberra City, ACT 2601</td>
<td>Ph: +61 3 9626 4333</td>
</tr>
<tr>
<td>Fax: +61 2 9234 0201</td>
<td>Ph: +61 2 6267 2700</td>
<td>Fax: +61 3 9626 4231</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wellington</th>
<th>Auckland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 9, 1 Willeston St</td>
<td>Level 17, 3-5 Albert St</td>
</tr>
<tr>
<td>PO Box 587</td>
<td>PO Box 2475</td>
</tr>
<tr>
<td>Wellington 6140</td>
<td>Auckland 1140</td>
</tr>
<tr>
<td>Ph: +64 4 915 7590</td>
<td>Ph: +64 9 913 6240</td>
</tr>
<tr>
<td>Fax: +64 4 915 7596</td>
<td>Fax: +64 9 913 6241</td>
</tr>
</tbody>
</table>

For information on this report please contact:
Name: Dr Alistair Davey
Telephone: +61 2 6267 2705
Mobile: +61 (0) 4222 11110
Email: adavey@srgexpert.com
Contents

Executive summary .............................................................................................................................................. viii

1. Introduction ............................................................................................................................................. 1

2. Profile of the live sheep export trade ................................................................................................. 2
   2.1 Trends in the live sheep export trade ............................................................................................ 2
   2.2 Major live sheep export markets ................................................................................................. 3
   2.3 Security of demand ....................................................................................................................... 5
   2.4 Immediate prospects for the live sheep export trade ................................................................... 6

3. WA sheep flock and the sustainability of the live sheep export trade ............................................. 7
   3.1 Trends in the WA sheep flock ........................................................................................................ 7
   3.2 Sustainability of the live sheep export trade ............................................................................... 9

4. Capacity of WA meat processors ....................................................................................................... 10

5. Price impact of the live sheep export trade ....................................................................................... 13
   5.1 Perspectives on sale yard prices ................................................................................................. 13
   5.2 Centre for International Economics Study .................................................................................. 15
   5.3 Do live sheep exports underwrite farm gate prices? .................................................................. 17
   5.4 Do live sheep exports deliver a premium to sheep farmers? ..................................................... 19

6. Future prospects without the live sheep export trade .................................................................... 22

7. References .............................................................................................................................................. 25

Appendices

Appendix 1 : Incidents in Australia’s live sheep export trade................................................................. 32
Appendix 2 : Modelling sheep meat prices ............................................................................................ 36

Tables

Table 1 Estimated processing capacity of WA abattoirs to slaughter sheep per week ........................................... 10
Table 2 Augmented Dickey-Fuller (ADF) test with three specifications .................................................. 36
Table 3 OLS regression for equation (1) (HAC t-statistic probabilities in brackets) .................................. 37
Table 4 OLS regression for equation (2) (HAC t-statistic probabilities in brackets) .................................. 38
Table 5 Engle-Granger test of the residuals for equations (1) and (2) ....................................................... 39
Table 6 OLS regression for equation (3) (HAC t-statistic probabilities in brackets) .................................. 40
Table 7 OLS regression for equation (4) (HAC t-statistic probabilities in brackets) .................................. 41
Figures

Figure 1 Australian live sheep exports – 2001 to 2011 ('000) 2
Figure 2 WA, Victorian and South Australian live sheep exports – 2001 to 2011 3
Figure 3 Australian exports of live sheep 2011 4
Figure 4 Australian exports of live sheep from January 2012 to November 2012 4
Figure 5 WA sheep flock – 2001 to 2011 ('000) 7
Figure 6 Turn off rates for WA sheep flock – 2001 to 2011 ('000,000) 8
Figure 7 WA slaughtering of sheep – 1989-90 to 2011-12 (000’), 11
Figure 8 New South Wales and Western Australia sale yard prices for mutton, January 2002 to November 2012 (cents per kilogram (c/kg) carcase weight (cwt)) 18
Figure 9 New South Wales and Western Australia sale yard prices for heavy wethers, January 2002 to November 2012 (c/kg cwt) 19
Figure 10 Western Australia sale yard prices for live export wethers and non-live export heavy wethers, January 2002 to November 2012 (c/kg cwt) 20
Figure 11 Processed sheep meat imports by major live sheep import countries, Western Australian and Australian exports of processed sheep meat products to major live sheep import countries (tonnes) 22
Executive summary

- Although enjoying a recent peak in 2001, Australia’s live sheep exports have been trending downwards.
- The live sheep export trade has been predominantly comprised of sheep sourced from Western Australia. In 2011, live sheep exported from Western Australia made up almost 70 per cent of the Australian live sheep export trade (Australian Livestock Export Corporation, 2012). From January to November 2012, live sheep exported from Western Australia made up around 79 per cent of the Australian live sheep export trade (Australian Livestock Export Corporation, 2012).
- Australia’s markets for the export of live sheep are predominantly located in the Middle East and the surrounding region. In particular, some of the largest customers for Australian live sheep exports historically have been the six Arab states bordering the Persian Gulf and the Gulf of Oman: Saudi Arabia, the United Arab Emirates (UAE), Qatar, Kuwait, Bahrain and Oman which comprise the Gulf Cooperation Council (GCC). All six members of the GCC are heavily reliant on income generated from the sale of petroleum products to support their economies. The Middle East along with the surrounding region is often viewed as an unstable political region.
- While the need for security of demand has been pushed by petroleum exporting countries of the Middle East, they have not always been willing to extend security of demand when it has comes to receiving shipments of live sheep from Australia. Several Middle Eastern countries have proven to be fickle customers indeed for Australian live sheep exports.
- The Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) (Thompson, 2012, p. 91) is forecasting a decline of 22 per cent in live sheep exports in 2012-13 of around 2 million, following shipments of 2.6 million in 2011-12. ABARES lists several reasons for the decline in the live sheep export trade, including reduced demand from major exports in Kuwait and the UAE, trade disruption in other markets such as Bahrain, and a decrease in the number of sheep available for live export, particularly in Western Australia.
- The WA sheep flock is in trend decline, with the number of sheep falling by 50 per cent between 1998 and 2012.
  - Preliminary estimates show the WA sheep flock fell to 13.7 million as of June 2012. Back in 2009, the Department of Agriculture and Food Western Australia (DAFWA) (2009) was estimating a flock size of around 17 million in 2012.
- Given the trend decline in the Western Australian sheep flock, there has to be a question mark over the sustainability of the live sheep export trade.
- The live export trade has been one of the more significant reasons for excess capacity in the WA meat processing sector (Lindner, et al., 2004, p. 9). As a consequence of the live export trade, the WA meat processing sector has experienced lower levels of throughput and capacity utilisation than it would have in the absence of live export (Lindner, et al., 2004, p. 9).
- Sheep (including lamb and mutton) processing capacity for WA abattoirs is estimated conservatively at around 5.9 million sheep per annum.
• Since 2007-08 there has been a dramatic fall in the number of sheep being slaughtered/processed by WA abattoirs, which has fallen by over 50 per cent in the last five year period. Sheep processed in WA abattoirs has fallen by almost 2.7 million between 2007-08 and 2011-12 from around 5.1 million to less than 2.5 million.

• While there may be issues in relation to the availability of suitable labour, there exists sufficient spare physical processing capacity in Western Australia to absorb the entire Australian live sheep export trade as it currently stands.

• There are mixed views on the impact of the live sheep trade on sale yard prices for sheep. There are two main arguments used by supporters of the live sheep export trade:
  – The live sheep export trade underwrites the market; and
  – The live sheep export trade delivers a price premium to sheep farmers.

• The concept Law of One Price (LOP) relates to the impact of market arbitrage and trade on the prices of identical commodities that are exchanged in two or more different geographical markets (Persson, 2008). If the price of a product is different in two different markets, then an arbitrageur will purchase the asset in the cheaper market and sell it where prices are higher in order to earn a profit.
  – The LOP does not imply that prices in two separate geographical locations should be identical, just that any price differential should reflect transport and transaction costs. The LOP suggests that prices received by sheep producers in different regions of Australia should be similar.

• On the basis of visual as well as econometric evidence, the LOP applies to mutton and heavy wether prices in Australia and there is no support for the contention that the live sheep export trade somehow underwrites domestic sheep prices.

• There is evidence of a premium generated for farmers by selling heavy wethers to the live sheep export trade. This price premium is around 57 c/kg cwt in nominal terms on average which works out at just under $28 per head.

• The ability of live sheep exporters to pay a premium at sale yard auctions is probably related to livestock subsidies provided in recipient countries that in turn artificially increases demand for Australian live sheep exports. ABARE (Drum & Gunning-Trant, 2008, p. 15) has noted these subsidies are only available on animals slaughtered domestically and do not apply to sheep meat imports.

• However, there is question mark over the ability of GCC states to maintain food subsidies over the medium and longer term given emerging budgetary pressures.
  – The sustainability of food subsidies is further called into question given population growth of at least 20 per cent across the GCC region is expected to occur between 2010 and 2020.
  – The future of such food subsidies is also heavily dependent on future prices of petroleum products.

• The trend increase in consumption of processed sheep meat products in the Middle East coupled with a trend decline in processed sheep meat exports from Western Australia to the Middle East suggests there are export opportunities available for mutton redirected away from the live sheep export trade.

• The cessation of the live sheep export trade would see sheep farmers selling heavy wethers lose the premium they currently receive at sale yard auctions when they sell to
live sheep exporters. On this basis, these sheep farmers would be materially worse-off. However, WA sheep farmers on average earn the bulk of their income from cropping.
1. Introduction

This report has been commissioned by the World Society for the Protection of Animals (WSPA) to examine the cost and benefits of increasing the amount of sheep processed in Australia, up to and including the amount that would otherwise be directed towards the live sheep export trade. In other words, the report examines the economic impact of the phasing out of the live sheep export trade. As the live sheep export trade is dominated by sheep supplied by sheep producers in Western Australia (WA), this report is primarily focuses on the economic impact of phasing out the live sheep export trade on WA sheep producers and meat processors.

The structure of this report is set out as follows:

• Profile of the live sheep export trade;
• The WA sheep flock and the sustainability of the live sheep export trade;
• Capacity of WA sheep meat processors;
• An analysis of the price impact of the live sheep export trade on WA sheep producers; and
• Future prospects without the live sheep export trade.

The views and opinions expressed in this report are strictly those of the author.
2. Profile of the live sheep export trade

2.1 Trends in the live sheep export trade

Although enjoying a recent peak in 2001 following the resumption of exports to Saudi Arabian, Australia’s live sheep exports have been trending downwards as outlined in Figure 1 below.

Figure 1 Australian live sheep exports – 2001 to 2011 (‘000)

![Australian live sheep exports graph]

Source: Australian Bureau of Statistics (2012)

As can be seen in Figure 2 below, the live sheep export trade has been predominantly comprised of sheep sourced from Western Australia. In 2011, live sheep exported from Western Australia made up almost 70 per cent of the Australian live sheep export trade (Australian Livestock Export Corporation, 2012). From January to November 2012, live sheep exported from Western Australia made up around 79 per cent of the Australian live sheep export trade (Australian Livestock Export Corporation, 2012).
2.2 Major live sheep export markets

Australia’s markets for the export of live sheep are predominantly located in the Middle East and the surrounding region, as outlined in Figure 3 and Figure 4 below. In particular, some of the largest customers for Australian live sheep exports historically have been the six Arab states bordering the Persian Gulf and the Gulf of Oman: Saudi Arabia, the United Arab Emirates (UAE), Qatar, Kuwait, Bahrain and Oman. These six states comprise the Gulf Cooperation Council (GCC) which is an economic union similar to the European Economic Union. All six members of the GCC are heavily reliant on income generated from the sale of petroleum products to support their economies.
The Middle East along with the surrounding region is often viewed as an unstable political region. It has been the scene of numerous international wars, civil wars and revolutions. This instability continues with the advent of the Arab Spring that has seen demonstrations, protests and civil wars erupt across the region. The Arab Spring has resulted in the overthrow of regimes in Tunisia, Egypt, Libya and Yemen as well as an ongoing civil war in Syria. There have also been protests across several countries in the region, including Bahrain, Jordan, Kuwait, Oman and Saudi Arabia. According to a publication by the Washington DC think tank the Center for Strategic and International Studies (CSIS) (Cordesman & Yarosh, 2012):
... the “Arab spring” is likely to involve a decade of more of political, economic, and social unrest. The causes of unrest are deep, complex, and involve structural problems in governance, demographics, and economics. None can be solved in a few months or years... Even the most successful nations... still face major challenges over the next decade. Others must fight their way out of problems that have brought them close to the edge of becoming “failed states.”

2.3 Security of demand

Within the literature on energy security and food security there has usually been an emphasis placed on the availability of supplies. However, in discussing energy security the World Bank (2005, p. 3) has commented the precise meaning will vary by country. In relation to energy producing and exporting nations, the World Bank has observed that concerns regarding energy security would focus on the security of energy demand and the need to protect export revenues.

The Secretary General of the Organisation of Petroleum Exporting Countries (OPEC), Abdalla Salem El-Badri (2008), has argued that energy security should be reciprocal with security of demand being as important to producers, as security of supply is to consumers. Security of demand has been defined by OPEC in terms of steady and predictable demand (Hamel, 2006, p. 27). The need for security of demand has predicated on the need to avoid or minimise investment risk (Hamel, 2006, p. 30).

Half of OPEC’s membership is made up of Middle Eastern countries Iran, Iraq, Kuwait, Qatar, Saudi Arabia, and the UAE. Four of these countries, Kuwait, Qatar, Saudi Arabia and UAE have been recipients of Australian live sheep exports.

While the need for security of demand has been pushed by petroleum exporting countries of the Middle East through OPEC, they have not always been willing to extend security of demand when it has comes to receiving shipments of live sheep from Australia. Several Middle Eastern countries have proven to be extremely fickle customers for Australian live sheep exports. Problems encountered by Australian live sheep export shipments to the region are outlined in Appendix 1. However, no apparent problems have been encountered in exporting chilled and frozen sheep meat products to the Middle East and surrounding region.

In commenting on the Middle East, the Department of Agriculture and Food Western Australia (DAFWA) (2010, p. 27) has observed:

Security issues and political instability in some parts of the region are affecting the development of long-term businesses.

---

1 Energy security has been defined as the adequate, reliable and affordable supply of energy to support the functioning of the economy and social development (Australian Government, 2009, p. 5). Food security has been defined as when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (Food and Agriculture Organization of the United Nations, World Food Programme, International Fund for Agricultural Development, 2012, p. 57).
In discussing the live sheep export trade, the Chief Executive Officer of the Australian Livestock Exporters’ Council (ALEC) Alison Penfold (2012) highlighted that one of the challenges faced was the political stability in the relevant markets and the possibility of force majeure events.2

2.4 Immediate prospects for the live sheep export trade

The Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) (Thompson, 2012, p. 91) is forecasting a decline of 22 per cent in live sheep exports in 2012-13 of around 2 million, following shipments of 2.6 million in 2011-12. ABARES lists several reasons for the decline in the live sheep export trade, including reduced demand from major export markets in Kuwait and the UAE, trade disruption in other markets such as Bahrain, and a decrease in the number of sheep available for live export, particularly in Western Australia. Similarly, according to Meat & Livestock Australia Ltd (MLA) live sheep exports will remain low (McRae, 2012a).

According to DAFWA (2012e) key live export markets in the Middle East and Turkey coming under pressure from Africa and Eastern Europe. Similarly, ABARES has commented:

... competition in many of Australia’s key markets has increased in recent years, because of increasing shipments from African and Eastern European exporters. (Deards & Thompson, 2012)

2 Force majeure is a coercion which cannot be resisted; a superior force. A circumstance beyond the control of a party to a contract, which enables that party to escape liability for failing to perform the contract as a result of the circumstance. It may include human acts (such as war, strikes, machinery breakdowns) as well as natural acts (such as storms or earthquakes). (Nygh & Butt, 1998, p. 181)
3. **WA sheep flock and the sustainability of the live sheep export trade**

3.1 **Trends in the WA sheep flock**

The WA sheep flock is in trend decline, with the number of sheep falling by 50 per cent between 1998 and 2012 as outlined in Figure 5 below.

**Figure 5 WA sheep flock – 2001 to 2011 (’000)**

![Graph showing the decline in WA sheep flock from 2001 to 2011](image)


MLA (McRae, 2012, p. 7) correctly predicted in its mid-year update on Australian sheep:

*At an estimated 13.7 million head for 30 June 2012, the WA sheep flock is at its lowest level since 1954, and has fallen by over 10 million head since 2000.*

Back in 2004 when the WA sheep flock was around 25 million, the Ministerial Taskforce (Lindner, et al., 2004, p. 14) on the meat processing sector in WA warned:

*... the size of the sheep flock in WA has fallen to a level that some would suggest is critically low for a viable future.*

According to the livestock industry of Western Australia back in 2008:

*Industry leaders predict that within twenty years, Western Australia will become a net importer of food, with the red meat industry a prime industry target for food imports.*

(Pastoralists and Graziers Association and Western Australian Farmers Federation, 2008, p. 5)
In March 2012 DAFWA (2012) and the Sheep Industry Leadership Council3 established the More Sheep Initiative to address the critical issue of the decline in the Western Australian sheep flock:

The State’s sheep flock has dropped from 25 million to 14.5 million in six years – a level not experienced since the 1950s. Sheep numbers are at a tipping point where unless they are increased immediately Western Australia could lose markets, capacity and profitability.

According to the WA Minister for Agriculture and Food, Terry Redman (2012):

It is clear to industry that sheep numbers are precariously balanced with insufficient supply to meet demand and allow for flock rebuilding, risking a loss of processing capacity and markets as well.

Earlier this year DAFWA (2012a) contended:

Processors and live exporters require a bare minimum of 5.6 million sheep per year. This level of turn off is unsustainable from the current flock at current average marking rates. Also this is the level of turn off over the last couple of years, and still the flock declines, highlighting the unsustainability of the current situation.4

In 2011-12, it is estimated the turn-off rate for the Western Australian sheep flock was 4.4 million (Curtis, 2012). Recent annual turn off rates for the Western Australian sheep flock are provided in Figure 6 below.

Figure 6 Turn off rates for WA sheep flock – 2001 to 2011 (‘000,000)

---

3 The Sheep Industry Leadership Council was established in 2011 to develop and promote a shared vision for the Western Australian sheep industry. The council has broad representation across all sectors of the industry.

4 This figure of 5.6 million sheep is composed of 3.3 million for processors and 2.3 million for the live export trade (Curtis & Hardy, 2012).
In discussing a sheep industry forum in Katanning in November 2012, DAFWA (2012b) was estimating the size of the WA sheep flock had grown slightly as of June 2012:

> Department senior research officer Kimbal Curtis told the forum the WA sheep flock had grown slightly to an estimated 14.9 million head as of June this year, an annual increase of six per cent.

However, cause for optimism that the WA sheep flock had arrested the trend decline would seem to have been short-lived with the release of the Principal Agricultural Commodities publication by the Australian Bureau of Statistics (ABS) (2012a) that provided preliminary estimates of the WA sheep flock falling to 13.7 million as of June 2012. Back in 2009, DAFWA (2009) was estimating a flock size of around 17 million in 2012.

### 3.2 Sustainability of the live sheep export trade

Given the trend decline in the Western Australian sheep flock, there has to be a question mark over the sustainability of the live sheep export trade. According to DAFWA’s Kimbal Curtis (2009) “as the majority of live sheep exports have been sourced out of Western Australia, the decline in the Western Australian flock must soon impact on that sector of the industry”. Earlier this year, DAFWA (2012c) commented:

> Processors and exporters are currently unable to source sufficient sheep to operate their investments (abattoirs, boats, etc) efficiently. At a time when demand is rising, there are insufficient sheep to meet export and domestic consumption without further eroding the flock.

Similarly, MLA (McRae, 2012, p. 23) commented in its mid-year update on Australian sheep:

> With the vast majority of Australia’s live sheep trade sourced out of WA, the ongoing decline forecast for the WA sheep flock will continue to place supply pressure upon the trade... With the WA sheep flock estimated to be at a 60-year low as at June 2012, exporters may be forced to look east for any additional supplies...
4. Capacity of WA meat processors

According to the 2004 WA Meat Processing Taskforce, the live export trade has been one of the more significant reasons for excess capacity in the WA meat processing sector (Lindner, et al., 2004, p. 9). As a consequence of the live export trade, the WA meat processing sector has experienced lower levels of throughput and capacity utilisation than it would have in the absence of live export (Lindner, et al., 2004, p. 9).

In 2002, it was estimated that the underutilisation of WA meat processing capacity for sheep was in the order of 55 per cent (Lindner, et al., 2004, p. 19). A survey of the WA major meat processing facilities in 2011 found the level of utilisation was around 59 per cent (Kingwell, et al., 2011, p. 42).

Based on a partial survey conducted by DAFWA (Kingwell, et al., 2011, p. 42) of the major meat processing facilities, there appears to be processing capacity for at least around 4.9 million sheep (including lamb and mutton) per annum. Supplementing the DAFWA material, sheep processing capacity for WA abattoirs is estimated conservatively at around 5.9 million sheep per annum and is outlined in Table 1 below.

<table>
<thead>
<tr>
<th>Abattoir</th>
<th>Capacity units per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fletchers (Narikup)</td>
<td>45,000</td>
</tr>
<tr>
<td>WAMMCO (Katanning)</td>
<td>20,000</td>
</tr>
<tr>
<td>V&amp;V Walsh (Bunbury)</td>
<td>17,500</td>
</tr>
<tr>
<td>Beaufort River Meats (Beaufort River via Woodanilling)</td>
<td>12,500</td>
</tr>
<tr>
<td>Hillside (Narogin)</td>
<td>7,500</td>
</tr>
<tr>
<td>Shark Lake (Esperence)</td>
<td>6,000</td>
</tr>
<tr>
<td>Goodchild (Australind)</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>Total</strong>                                         <strong>113,500</strong></td>
<td></td>
</tr>
</tbody>
</table>


Note: Includes both lamb and mutton.
According to the Western Australian Meat Industry Authority (2012a), there are a number of other abattoirs that process sheep meat that includes:

- Geraldton Meat Exports Pty Ltd, Moonyoonooka;
- TE Cullen & Sons, Coolgardie;
- Dardanup Butchering Company, Picton;
- Windmill Meats, Corrigin;
- Hagan Bros, Greenough;
- Great Eastern Abattoir, Tammin;
- BJ & JA Haslam, Hyden; and
- Kellerberrin Butchery, Kellerberrin.

Since 2007-08 there has been a dramatic fall in the number of sheep being slaughtered/processed by WA abattoirs, which has fallen by over 50 per cent in the last five year period. As outlined in Figure 7 below, sheep processed in Western Australian abattoirs has fallen by almost 2.7 million between 2007-08 and 2011-12 from around 5.1 million to less than 2.5 million.

**Figure 7 WA slaughtering of sheep – 1989-90 to 2011-12 (000’s)**

![Graph showing slaughtering of sheep from 1989-90 to 2011-12](image)

**Source:** ABS (2012b)

Note: The ABS categorise lambs separately to sheep. However, no such distinction has been made here between lambs and sheep with lambs included as part of the number of sheep slaughtered.

The processing of sheep (lamb and mutton) for export fell from around 2.9 million in 2010-11 to around 2.2 million in 2011-12, while the processing of sheep for the domestic market fell from 467,000 in 2010-11 to 371,000 in 2011-12 (Western Australian Meat Industry Authority, 2012, p. 22).

The major WA abattoir for mutton production is Fletchers at Narrikup, near Albany while the major abattoir for lamb is in Katanning and is managed by Western Australian Meat Marketing Cooperative Limited (WAMMCo) which is a producer-owned and controlled as a
cooperative (Department of Agriculture and Food Western Australia, 2009, p. 19). Both processors have previously expressed concerns about WA sheep supply (Department of Agriculture and Food Western Australia, 2009, p. 19).

While there may be issues in relation to the availability of suitable labour, there exists sufficient spare physical processing capacity in Western Australia to absorb the entire Australian live sheep export trade as it currently stands.
5. Price impact of the live sheep export trade

5.1 Perspectives on sale yard prices

There are mixed views on the impact of the live sheep trade on sale yard prices for sheep.

In its 2009 review of the live sheep export trade, ACIL Tasman (2009, p. 12) contended that overall, there was unlikely to be a dramatic or sustained impact on the price of mutton or lamb in Australia if the live export market could no longer be accessed by Australian producers. This assumption has been roundly criticised in several quarters. In a report commissioned by the Australian Livestock Export Corporation (LiveCorp) and MLA, the Centre for International Economics (CIE) (2011, p. 15) commented:

In our view, the ACIL Tasman study is underpinned by a highly optimistic outlook on the potential for the lamb and mutton industry to maintain current prices. That is, the study does not allow for an additional fall in prices beyond current market differentials between live export and processing markets.

Similarly, DAFWA (Kingwell, et al., 2011, p. 9) has commented:

... ACIL-Tasman made assumptions that led to their finding that cessation of the live trade would have little impact on farm businesses. They made the bold assumption that lamb and mutton prices would not change as a result of the closure of the export trade and so, of course, there is little surprise in their study's conclusion of little impact on farm businesses of closure of the live trade.

Another view is that the live sheep export trade underwrites sheep sale yard prices. According to Dunkeld sheep farmer Craig Oliver:

The live export trade is really critical to underpinning sheep and mutton prices. We have got an increasingly limited number of processors in the country competing on livestock. When the live export trade is functioning well you see a lot of competition in the market and prices improve. (Willingham, 2012)

Similarly, the Sheepmeat Council of Australia (n.d) has commented:

The live export trade also underpins sheep prices received throughout the domestic markets in Australia.

It has also been claimed competition between the live export trade and the meat processing sector has had the effect of pushing up sheep sale yard prices, which in turn has delivered a price premium to sheep farmers.

According to the 2004 WA Meat Processing Taskforce the live export trade increases prices that West Australian meat processors have to pay for livestock (Lindner, et al., 2004, p. 2). In the event of the cessation of the live export trade, DAFWA (Kingwell, et al., 2011, p. 37) has asserted that:
The reduced competition for purchasing sheep would place downward pressure on the sheep prices, therefore reducing margins for producers...

In 2008, the Australian Bureau of Agricultural and Resource Economics (ABARE) commented:

If Australia were to restrict live exports it is likely that there would be significant regional economic effects, particularly on ... the sheep industry of Western Australia. It is generally accepted that there would not be a 100 per cent transfer of the industry from live animal sales to their meat equivalent, despite the potential that currently exists for sheep meat. This would result in a loss of farm income to producers currently specialised in the trade of live animals. (Drum & Gunning-Trant, 2008, p. 25)

In the absence of the live sheep export trade, CIE (2011, p. 6) has contended that farm gate returns would be lower because of the lower demand for livestock and the higher transport costs involved in transporting animals to the alternative markets. CIE (2011, p. 13) has asserted there is price premium received for sheep sold into the live export trade throughout Australia, citing a research report published by MLA in support of this claim. This MLA commissioned research report commented:

The most obvious benefit for producers of involvement in the live export trade is the price premium they receive. For sheep producers, the price of shippers has averaged around $50 per head over the last few years. The same sheep sold on the domestic market would average around $25 per head, perhaps even less. (Clarke, Morison, & Yates, 2007, p. 89)

Similarly, the 2004 WA Meat Processing Taskforce (Lindner, et al., 2004, p. 16) observed that higher prices were received in terms of $/head for sheep heading for the live export trade as compared to those to be processed domestically.

On the other hand, it been suggested that international commodity prices could have a major impact on sheep prices. According to Freshlogic (2008, p. 51)

... returns to the lamb production and processing sector are strongly influenced by world trade, through prices demanded by overseas customers. Domestic market consumption is relatively static, and subject to price competition from other red and white meats.

According to the National Farmers’ Federation (2008, p. 9):

Global agricultural commodity prices – With Australian agriculture exporting 70% of all domestic production, the prices attained on global markets are a key determinant of their end price.

It would appear that supporters of the live sheep export trade depend on two main arguments:

1. The live sheep export trade underwrites the market; and
2. The live sheep export trade delivers a price premium to sheep farmers.

Both of these claims will be examined in subsections 5.3 and 5.4.
5.2 Centre for International Economics Study

The Centre for International Economics (CIE) (2011) undertook an assessment of the impact of the cessation of the live sheep export trade based on the average impact over the period from 2005-06 to 2008-09. In aggregate it found that:

- sheep farmers would be $119 million worse off;
- live sheep exporters would be $30 million worse off; and
- meat processors would be $38 million better off.

The CIE found that on average farm gate returns for lamb would fall by 7.6 per cent while for mutton they would fall by 17.6 per cent.

However, the CIE study is predicated on a number of underlying assumptions that are highly contestable.

In relation to WA sheep, it was assumed the dramatic fall in farm gate prices for older sheep was a function of the additional transport costs that would be incurred due to a shortage of processing capacity in Western Australia – which would substantially reduce the average farm gate return to WA sheep producers (Centre for International Economics, 2011, p. 7).

However, given the dramatic decline in the number of sheep being slaughtered/processed by WA abattoirs, which has fallen by over 100 per cent in a five year period between 2007-08 and 2011-12, this assumption of additional transport costs incurred due to a shortage of processing capacity appears no longer to be valid. As outlined in section 4 above, there exists sufficient spare processing capacity in Western Australia to absorb the entire Australian live sheep trade as it currently stands.

Another key assumption made by CIE (2011, p. 10) was that the impact of farm gate price reductions would be sustained due to the lack of viable alternatives at the farm level. More specifically, CIE (2011, p. 11) claimed the prospect for land conversion in WA sheep enterprises was particularly limited given this region produced a high portion of the sheep going to the live export market.

In regard to most WA sheep producers, as well as Australian sheep producers in general, the CIE assumption appears not to be particularly robust. The majority of both wool and sheep meat production in Australia occurs on mixed enterprise farms, particularly on mixed livestock–crops industry farms (Australian Bureau of Agriculture and Resource Economics and Sciences, 2012a, p. 7). According to a joint publication by the Sheep CRC and DAFWA:

_The sheep enterprise on a farm may not always compare favourably in income with alternative enterprises, notably cropping... (Hall, Ferguson, Curnow, & Thompson, 2011)_

In relation to the decline in the WA sheep flock, the 2004 WA Meat Processing Taskforce (Lindner, et al., 2004, p. 14) observed:

_... competition from cropping and other enterprises in traditional sheep areas has seen the supply of stock stifled._

ABARES which examined the financial performance of farms that sold 200 or more lambs for slaughter across Australia, found WA sheep producers involved in the live sheep export trade generated most of their income from cropping:
Almost all producers who mostly sold lambs for live export were in Western Australia. These farms had the largest sheep flocks, on average, but derived the smallest percentage of receipts from the sale of sheep and lambs of any group. Receipts for these farms were predominantly derived from the sale of grain. (Martin P., 2012)

According to DAFWA (Kingwell, et al., 2011, p. 37):

Sheep numbers in W.A would probably decline further in response to lower prices. However the response by industry participants depends on a number of factors; the alternative options for producers would have to yield more profits than the margins generated by sheep production. The regions in W.A most vulnerable to the cessation of the live sheep trade are the Great Southern region (lower and upper) and the Midland region. These regions are medium to high rainfall areas, where the reliance on sheep income is higher because only 40% to 60% of farm area, on average, is cropped compared to the Central and South Eastern regions, where 70% or more of farm area is cropped.

DAFWA (Kingwell, et al., 2011, p. 37) goes on to observe that conversion from sheep farming to cropping has occurred and that further conversion is still possible:

Associated with the reduction in the sheep population has been conversion of land to cropping. Further conversion is possible.

DAFWA (2012d) has highlighted the shift from sheep production across to cropping that has already occurred in WA:

A period of low sheep and wool prices combined with the perception of greater profitability from cropping has seen the enterprise mix across the state shift away from grazing sheep.

DAFWA (Kingwell, et al., 2011, pp. 10-11) has also identified several limitations and potential deficiencies in the CIE study, including highlighting that because processing is input and labour intensive relative to farm-level animal production, the economy-wide economic consequences of the cessation in live animal export trade may be far less than indicated in the partial analysis conducted by CIE.

DAFWA (Kingwell, et al., 2011, pp. 42-43) has undertaken its own assessment of the economy-wide implications arising from the cessation of the live sheep export trade using a computable general equilibrium for the Western Australian economy. According to DAFWA:

... the economy-wide impacts are relatively minor, causing small percentage changes in the state’s gross state product (GSP), employment, export values and the CPI. (Kingwell, et al., 2011, p. 42)

However, it should be noted that DAFWA (Kingwell, et al., 2011, p. 43) also commented that the main impacts of any reduction or cessation in the export of live sheep are likely to be felt most strongly within the sheep supply chain and that any reduction or cessation of the live trade in sheep is liable to impose significant adjustment costs on particular farm and pastoral businesses in particular regions.
5.3 Do live sheep exports underwrite farm gate prices?

DAFWA (2012f) has claimed that even if WA sheep farmers don’t produce more sheep, sheep prices will probably edge downward anyway because:

- Supply is increasing elsewhere. Following drought breaking rains in eastern Australia, producers are retaining more sheep and marking rates are higher producing more lambs.
- Loss of markets may occur through product substitution. Other proteins replacing sheep meat, synthetics replacing wool and domestically imported sheep meat replacing WA lamb.

Given the potential impact of sheep supply elsewhere on WA sheep prices, it would appear that even DAFWA is sceptical of claims that the live sheep export underwrites WA sheep farm gate prices.

The concept Law of One Price (LOP) relates to the impact of market arbitrage and trade on the prices of identical commodities that are exchanged in two or more different geographical markets (Persson, 2008). In an efficient market there must be, in effect, only one price of such commodities regardless of where they are traded. If the price of a product is different in two different markets, then an arbitrageur will purchase the asset in the cheaper market and sell it where prices are higher in order to earn a profit.

The LOP does not imply that prices in two separate geographical locations should be identical, just that any price differential should reflect transport and transaction costs.

According to Lamont and Thaler (2003, p. 201), the logic as to why the law of one price must hold is simple: if the same asset is selling for two different prices simultaneously, then arbitrageurs will step in, correct the situation and make themselves a tidy profit at the same time. Despite the inherent logic surrounding the LOP, many studies fail to find significant support for the LOP in commodity markets (Pippenger & Phillips, 2008, p. 915). However, Pippenger and Phillips (2008, p. 924), conclude that once pitfalls in previous studies are accounted for, there is no empirical evidence that would lead them to reject the law of one price in commodity markets.\(^5\)

The LOP suggests that prices received by sheep producers in different regions of Australia should be similar. As a test of this general proposition, monthly WA sale yard indicator prices for mutton with its very high exposure to the live sheep export trade, have been compared to those in New South Wales. New South Wales has virtually no exposure to the live sheep export trade so live sheep export prices should have little bearing on sale yard prices in that state. Rather than being a market for sheep in general, it should be noted that the live sheep export trade is more specifically a market for heavy wethers.\(^6\) As a further test

---

\(^5\) According to Pippenger and Phillips (2008), those pitfalls are (1) using retail prices, (2) omitting transportation costs, (3) ignoring time, and (4) not using identical products.

\(^6\) A wether is a castrated male sheep with no 'ram like' characteristics and with more than two permanent teeth. A heavy wether is categorised as a wether above 24 kg.
of the LOP, monthly WA sale yard indicator prices for heavy wethers have been compared to those in New South Wales. The results are presented in Figure 8 and Figure 9 below.

**Figure 8** New South Wales and Western Australia sale yard prices for mutton, January 2002 to November 2012 (cents per kilogram (c/kg) carcass weight (cwt))

Source: Data supplied by Meat and Livestock Australia
Figure 9 New South Wales and Western Australia sale yard prices for heavy wethers, January 2002 to November 2012 (c/kg cwt)

Source: Data supplied by Meat and Livestock Australia

Figure 8 and Figure 9 suggest a close relationship between sale yard prices in Western Australia and New South Wales and suggests that the LOP holds.

As a further test of the LOP for both mutton and heavy wethers, Western Australian prices have been modelled as a function of New South Wales prices using the Engle and Granger two step error correction model. Further details are provided in Appendix 2. For both mutton and heavy wethers statistically valid relationships have been established.

On the basis of visual as well as econometric evidence, it is concluded that the LOP applies to mutton and heavy wether prices in Australia and thus there is no support for the contention that live export sheep trade somehow underwrites domestic sheep prices.

5.4 Do live sheep exports deliver a premium to sheep farmers?

The proposition as to whether the live sheep exports delivers a premium to sheep WA sheep farmers has been tested by comparing live export wether prices with non-live export heavy wether prices. The results are presented in Figure 10 below.
The fact that the price of live sheep export wethers is generally above the line for non-export heavy wethers suggests there is in fact a premium generated for farmers by selling heavy wethers to the live sheep export trade. In the months in which data for both time series is directly comparable, this price premium is around 57 c/kg cwt in nominal terms on average. Based on the weight of export sheep (Australian Bureau of Statistics, 2012), the premium comes works out at just under $28 per head on average in nominal terms.

The ability of live sheep exporters to pay a premium at sale yard auctions is probably related to livestock subsidies provided in recipient countries that in turn artificially increases demand for Australian live sheep exports. According to the owner and proprietor of major meat processing company Fletcher International Exports, Roger Fletcher:

*The only reason why the trade existed is because it was heavily subsidised by their governments.* (Clancy, 2013)

ABARE (Drum & Gunning-Trant, 2008, p. 15) has noted these subsidies are only available on animals slaughtered domestically and do not apply to sheep meat imports.

Bahrain set aside in the order of $126 million (based on current exchange rates) in meat subsidies in 2012 (Rafique, 2012). Kuwait is currently providing a subsidy of almost $54 per head (based on current exchange rates) on sheep (Arab Times, 2012). Based on Australian live sheep exports to Kuwait for 2012 until November, this represents a subsidy in the order
of around $35 million. In the first nine months of 2011 Qatar provided a subsidy of around $76 million (based on current exchange rates) to Mawashi (2011), the Qatar Meat and Livestock Company.

Food subsidies are widespread across the Middle East and provided as a form of social protection (Ahmed, 2011). According to Masood Ahmed (2011), Director of the International Monetary Fund’s Middle East and Central Asia Department:

Price subsidies enjoyed by all are typically poorly targeted, so they are not the most cost-effective way to provide social protection.

There is question mark over the ability of GCC states to maintain food subsidies over the medium and longer term given emerging budgetary pressures. Staff of the International Monetary Fund (2012, p. 19) have warned:

In terms of fiscal policy, the strong state of the GCC economies means that the pace of government spending growth can be scaled down from recent highs. While expansionary fiscal policies helped the region weather the global financial crisis, given the healthy economic expansion currently underway, the need for continued fiscal stimulus is diminishing. Most GCC countries should therefore plan to reduce the growth rate in government expenditure in the period ahead, with a view to gradually lowering the ratio of their non-oil deficits to non-oil GDP. This would help ensure long-term sustainability given the prospect of budgets moving into deficit over the medium term.

According to the International Monetary Fund (2012, p. 17):

In the GCC, the expansionary fiscal stance has been appropriate, given the need to support non-oil growth, the absence of signs of overheating, and, in many cases, the buildup of fiscal buffers and international reserves. However, given the sustained rise in non-oil primary deficits, analysis indicates that many GCC countries are spending at levels inconsistent with intergenerational equity ...

The sustainability of food subsidies is further called into question given population growth of at least 20 per cent across the GCC region is expected to occur between 2010 and 2020.7

The future of such food subsidies is also heavily dependent on future prices of petroleum products.

---

7 Based on the United Nations medium variant population projections for the GCC region.
http://esa.un.org/wpp/unpp/panel_population.htm
6. Future prospects without the live sheep export trade

With the cessation of the live sheep export trade, a critical question is whether there is the opportunity to redirect sheep previously directed towards the live sheep export trade into markets for processed sheep meat products. One obvious set of markets are major live sheep import countries in the Middle East. Major live sheep import countries have significantly increased their consumption of processed sheep meat products (including mutton and lamb). While Australian exports of processed sheep meat products to the Middle East have expanded to meet this growing demand, the share of this market serviced by WA sheep farmers has been in decline since 2009, which is outlined in Figure 11 below.

Figure 11 Processed sheep meat imports by major live sheep import countries, Western Australian and Australian exports of processed sheep meat products to major live sheep import countries (tonnes)

Source: Department of Agriculture, Fisheries and Forestry red meat export statistics from 1997 to 2012 and the Food and Agricultural Organization of the United Nations FAOSTAT database.

Note: Includes lamb and mutton. Major live sheep import countries is composed of Bahrain, Israel, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, Turkey and the United Arab Emirates.

The trend increase in consumption of processed sheep meat products in the Middle East coupled with a trend decline in processed sheep meat exports from Western Australia to the Middle East suggests there are export opportunities available for mutton redirected away from the live sheep export trade. The increase in consumption of processed sheep meat products is likely to continue given strong population growth across the Middle East. As
previously discussed in section 4, there is more than enough physical processing capacity in Western Australia to absorb the entire Australian live sheep export trade.

The replacement of live sheep exports with processed meat exports to the Middle East is consistent with the views of Roger Fletcher:

> Why do you think the two big exporters (Wellard and Jordan’s Livestock Shipping Services) have bought abattoirs in Western Australia?

According to DAFWA (Kingwell, et al., 2011, p. 43), the sheep meat processing sector would be a principal beneficiary of any cessation in live sheep exports which would expand its activity. The WA meat processing sector would also probably need to expand the size of its labour force.

On the other hand, sheep farmers selling heavy wethers would lose the premium they currently receive at sale yard auctions when they sell to live sheep exporters. On this basis, these sheep farmers would be materially worse-off. However, WA sheep farmers on average earn the bulk of their income from cropping.

Those participating in the live sheep export logistic chain would also be adversely affected, most notably shippers of live of sheep. However, in the case of shippers, they are not locked into plying their trade in Australia and can easily sail elsewhere. On the other hand, there would be adjustment costs incurred elsewhere in the live sheep export logistic chain.

Finally, recipient countries of live sheep exports may have to look elsewhere to satisfy continuing demand for live sheep in the event of the cessation of Australian live sheep exports. However, according to the Chief Executive Officer of the Sheep Meat Council of Australia, Mr Ron Cullen (2012):

> There are quite a few other suppliers in the market place that are ready to compete with us.

> Sudan, Romania, Syria, China, even France and Hungary export live animals. So there’s quite a number; Somalia, Mauritania. They’re all in there all the time looking for sales of live animals.

Saudi Arabia is the largest importer of live sheep in the world (Babiker, Abdullah, & Al-Feel, 2011, p. 28). However, Australia has lost market share in Saudi Arabia to Sudan, Syria and Somalia (Deards & Thompson, 2012, p. 88). Bulgaria has emerged as Australia’s main competitor in supplying live sheep to Turkey while Jordan is also a major exporter of live sheep in the Middle East (Deards & Thompson, 2012, p. 90). There would appear to be no shortage of alternative suppliers of live sheep in the event of the cessation of the live sheep export trade from Australia.
7. References


Curtis, K. (2009). *Recent Changes in the Australian Sheep Flock (The Disappearing Flock).* Perth: Department of Agriculture and Food Western Australia.


Department of Agriculture and Food Western Australia. (2012f, March 8). *If we produce more sheep will the price of sheep meat drop?* Retrieved January 23, 2013, from Department of Agriculture and Food Western Australia: http://moresheep.agric.wa.gov.au/if-we-produce-more-sheep-will-price-sheep-meat-drop


Department of Agriculture and Food Western Australia. (2012b). *Steady Climb for WA sheep flock, markets sound but unity needed, forum told. Media Release*, 13 November.

Department of Agriculture and Food Western Australia. (2012c, March 8). *What are the benefits (of more sheep) to the sheep industry?* Retrieved December 5, 2012, from Department of Agriculture and Food Western Australia: http://moresheep.agric.wa.gov.au/what-are-the-benefits-more-sheep-sheep-industry


Department of Agriculture, Fisheries and Forestry. (2012). *Western Australia and South Australia exporters granted approval to export sheep and cattle to Middle East. Media Release*, 24 September.


Hall, B., Ferguson, M., Curnow, M., & Thompson, A. (2011). *Sheep — the simple guide to making more money with less work*. Perth: Cooperative Research Centre for Sheep Industry Innovation & Department of Agriculture and Food Western Australia.


International Monetary Fund. (2012). *Regional Economic Outlook: Middle East and Central Asia*. Washington DC.


Appendix 1: Incidents in Australia’s live sheep export trade

1989
In late July 1989 two vessels carrying around 192,000 Australian sheep were rejected in Saudi Arabia due to veterinary health concerns (de Silva, 1989). Apparently a Saudi veterinary doctor that the sheep had the clinical symptoms of bluetongue. However, an Australian veterinarian based in Saudi Arabia examined sheep from one of the ships and found there was no evidence of bluetongue or any other major infectious disease in the sheep and that they were, in fact, healthy. There were suggestions that political groups representing the interests of Saudi Arabia’s domestic sheep producers may have been behind the disruption.

On 10 August 1989 a vessel carrying around 34,000 Australian sheep was rejected in Saudi Arabia due to what Saudi officials said was discovery of sheep pox (Reuters News, 1989). Following this, the then Primary Industry and Energy Minister John Kerin commented in response to claims by Saudi Arabian officials regarding bluetongue and sheep pox infections that “none of these claims have been supported by clinical evidence” and that “neither of these diseases have ever been found in commercial sheep flocks in Australia.”

On 18 August 1989 a further vessel carrying around 66,000 sheep was rejected in Saudi Arabia on the grounds that it was infected with sheep pox (Young, 1989). This shipment was rejected as an Australian delegation, led by one of the Australian Government’s most senior veterinary officers, arrived in Saudi Arabia to try to sort out the situation. On 21 August 1989 yet another vessel carrying 17,000 sheep was rejected in Saudi Arabia with Saudi officials claiming that sheep had sheep pox (Seccombe, 1989). On 22 August 1989 the Australian Meat and Livestock Corporation formally suspended all live sheep exports to Saudi Arabia (Reuters News, 1989a). Then in early September another vessel carrying around 100,000 sheep, that left the day before the export ban was imposed, was rejected in Saudi Arabia with no reason was given for its rejection (Seccombe, 1989a).

The ban on Australian live sheep exports to Saudi Arabia was lifted just before Christmas 1989 by the Australian Meat and Livestock Corporation (Bolt, 1989).

1990
The live sheep trade between Australia and Saudi Arabia commenced again at the beginning of 1990. However, on 11 April 1990 two Australian shipments of around 48,000 sheep were rejected on the grounds of scabby mouth (Reuters News, 1990). In early May a shipment of around 68,000 sheep was also rejected by Saudi Arabia on grounds of scabby mouth. Then

---

8 Bluetongue is an insect borne, viral disease that can affect sheep and is potential fatal.
9 Sheep pox is a contagious viral disease and can cause heavy production losses and mortalities.
10 Sheep suffering from scabby mouth form wart-like, dark-greyish scabs around the lips, mouth, nose, teats and feet. While it is a highly contagious, it is a minor ailment, and once isolated, sheep can be clear of symptoms in two to three weeks.
on the weekend of 5 and 6 May 1990 a further shipment of around 55,000 sheep was rejected by Saudi Arabia on the grounds that the sheep were too old (Wire Services, 1990).

In July 1990 the ALMC issued new revised controls to ensure that export sheep were free from disease, reduced animal numbers per ship to minimise disease potential, and an age limit of three years on sheep (Allison, 1990).

Also in July, a shipment of around 20,000 sheep to Bahrain was rejected on grounds some were old and others infected with scabby mouth (Reuters News, 1990a).

The live sheep trade from Australia to Kuwait was suspended in August 1990 following the Iraqi invasion of Kuwait (Reuters News, 1990b). This was as part of an international trade embargo under United Nations imposed sanctions.

In late November 1990 another shipment of around 85,000 sheep was rejected by Saudi Arabia on the grounds of scabby mouth (Reuters News, 1990c). This shipment was later also rejected by the United Arab Emirates.

1991

In January 1991 the Australian Government imposed an export ban on live sheep exports to Saudi Arabia until a health and quarantine protocol could be negotiated between the two countries (Bolt, 1991).

In June 1991, a shipment of around 71,000 sheep was rejected by Egypt because about 2 per cent of the sheep were suffering from scabby mouth (Wahlquist, 1991).

Later in June 1991, Algeria’s religious authorities ruled Australian sheep ineligible for ritual slaughter because their tails have been docked (Walker, 1991). Algerian religious authorities issued a fatwa or religious ruling that banned the sacrifice of Australian sheep for the feast of Eid-al-Adha, the Muslim festival celebrating the Haj or pilgrimage to Mecca.

1995

In March 1995 the Australian Government announced that it would resume the live sheep export trade to Saudi Arabia after sheep exporters had agreed to a set of strict conditions set by Saudi authorities (Reuters News, 1995). Under the new conditions, each shipment had to be accompanied by a veterinarian, go directly to Saudi Arabia and the sheep must conform with strict age requirements. However, the first shipment of around 75,000 sheep that set sail was diverted by Saudi authorities to Jordan in early May based on fears the sheep would fail inspection based on concerns around scabby mouth (Georgy, 1995a). Later in May, the Australian Government reimposed a suspension on live sheep exports to Saudi Arabia (Reuters News, 1995a).

1996

In March 1996 the AMLC said no permits would be issued to export live sheep or cattle to Saudi Arabia until agreement on health standards was reached with Saudi authorities (BBC Monitoring Service: Middle East, 1996).

In October 1996 an agreement was established between the governments of Australia and Arabia to establish a new export protocol (McKenzie, 1996).
1997
In March 1997 the Australian Government announced a planned trial shipment of live sheep from Australia to Saudi Arabia that would seek to establish a protocol to re-open exports (Reuters News, 1997).

1999
In October 1999 it was announced that Australia would send a trial shipment of live sheep to Saudi Arabia (Reuters News, 1999).

2000
In January 2000 it was announced by the Australian Government that a trial shipment of live sheep would be sent to Saudi Arabia (Reuters News, 2000). Under the trial Australia would send a total of six trial shipments and would closely monitor them to determine whether live shipment to Saudi Arabia could be resumed. Following the successful completion of the trial shipments, the live export trade with Saudi Arabia was formally resumed in August 2000 (Reuters News, 2000).

2003
In August 2003 Saudi Arabia rejected a shipment of 57,000 live sheep as its officials said about six percent of the animals were affected by scabby mouth disease (Reuters News, 2003). An Australian veterinarian who travelling with the ship disputed the finding, contending that the rate of scabby mouth was 0.35% (Paddock, 2003). Subsequently, Dr. Ghazi Yehia, an independent veterinarian from the World Animal Health Organization, examined the sheep and declared them healthy. There was no evidence, he said, that there had ever been a significant outbreak of scabby mouth during the voyage.

Several reasons have been advanced as to why Saudi Arabia rejected the shipment. One theory suggests that Saudi Arabia was expressing its disdain for Australia joining with US and UK forces in the invasion of Iraq (Paddock, 2003). Another theory suggested that Saudi Arabia wanted to scuttle the deal because they could obtain cheaper sheep from Somalia and Ethiopia.

Following this incident, the Australian Government announced once again it was suspending the live sheep trade to Saudi Arabia.

The shipment, that was labelled as the ship of death following the death of more than 4,000 sheep, was eventually redirected to Kuwait in October 2003 (Agence France Presse, 2003). While the sheep were found them disease-free, Kuwait was obliged to reject the shipment under the rules of the Gulf Cooperation Council (GCC) (Agence France Presse, 2003a). Under the GCC rules, which includes the countries of Bahrain, Oman, Qatar, Saudi Arabia and the United Arab Emirates, no member state can accept a shipment rejected by another on health grounds. The shipment was eventually donated and offloaded to Eritrea.

2004
In January 2004 the Australian Government said Australia would not resume livestock exports to Saudi Arabia until the two countries could agree on health standards for the animals to avoid any repeat of the kingdom’s rejection of a major shipment of sheep in 2003 (O’Connor, 2004). According to the then Agriculture Minister Warren Truss:

It is going to require a great deal of negotiation to achieve a resumption of that trade and I don’t think we are close to a resolution.
2005
In March 2005 Australia and Kuwait signed a memorandum of understanding which included arrangements to unload sheep into a quarantine facility if a problem arises when they arrive in the Middle East (Australian Broadcasting Corporation (ABC) News, 2005).

On 4 May 2005 Australia and Saudi Arabia signed a memorandum of understanding on protecting the welfare of the animals (Australian Broadcasting Corporation (ABC) News, 2005). The agreement required all live sheep to be immunised and for animals to be held in a quarantine facility if a dispute developed or a problem was suspected with the animals.

2009
In July 2009 it was reported the Islamic Development Bank, a Saudi Arabian government organisation that funds the purchase of sheep for the Hajj religious festival, had decided to abandon Australian sheep in favour of African sheep (Kelly & Myers, 2009).

2012
In late August 2012 Bahrain refused a shipment of around 22,000 live sheep over concerns some of the sheep had scabby mouth (Valdini, 2012). The Bahrain Government later confirmed that the consignment was rejected as the sheep were infected with Orf disease (Staff Reporter, 2012).

In September 2012 the Australian Livestock Exporters Council imposed a voluntary ban on live sheep exports to Bahrain (Varischetti, 2012). ALEC chief executive Alison Penfold commented that it would simply be too big a risk to send more animals without any assurances in place.

This shipment of live sheep was eventually redirected to Pakistan where it was eventually culled (Martin L., 2012). Despite the sheep being culled, test results from an independent international laboratory confirmed the sheep were free from the tested diseases and fit for human consumption. Graphic footage of sheep cull was aired by ABC’s Four Corners in early November 2012.

In late August 2012 Kuwait initially rejected a shipment of around 50,000 live sheep (Alberici, 2012). While the sheep were initially rejected due to an outbreak of scabby mouth, they were eventually accepted and unloaded (Australian Broadcasting Corporation (ABC) News, 2012).

In late September the Department of Agriculture, Fisheries and Forestry (2012) announced that livestock exporters must now:

• provide more detail about what they would do if a shipment is delayed or refused unloading;
• carry additional feed, water and veterinary supplies to cover the possibility of diversions and delay; and
• engage additional stock handlers.
Appendix 2 : Modelling sheep meat prices

Error correction models are based on the assumption that two or more time series exhibit an equilibrium relationship that determines both short- and long-run behaviour (De Boef, 2000, p. 83).

First, a long run equation has been estimated for the indicator price of WA mutton ($WAM$) as a function of a constant term ($\beta_0$), the indicator price of NSW mutton ($NSWM$) and an error term ($\varepsilon_t$).

$$WAM_t = \beta_0 + \beta_1 NSWM_t + \varepsilon_t$$ (1)

Second, a long run equation has been estimated for the indicator price of WA heavy wethers ($WAHW$) as a function of a constant term ($\beta_0$), the indicator price of NSW heavy wethers ($NSWHW$) and an error term ($\delta_t$).

$$WAHW_t = \beta_0 + \beta_1 NSWHW_t + \delta_t$$ (2)

A series is stationary if its mean and variance is time invariant. Any series that is not stationary is said to be nonstationary. The stationarity properties of the four variables under consideration were tested using the Augmented Dickey-Fuller (ADF) test.

Table 2 Augmented Dickey-Fuller (ADF) test with three specifications

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF</th>
<th>ADF test with a constant</th>
<th>ADF test with a constant and linear trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>$WAM$</td>
<td>-0.798*</td>
<td>-1.959*</td>
<td>-2.193*</td>
</tr>
<tr>
<td></td>
<td>(0.369)</td>
<td>(0.305)</td>
<td>(0.489)</td>
</tr>
<tr>
<td>$NSWM$</td>
<td>-0.504*</td>
<td>-1.739*</td>
<td>-1.579*</td>
</tr>
<tr>
<td></td>
<td>(0.496)</td>
<td>(0.409)</td>
<td>(0.796)</td>
</tr>
<tr>
<td>$WAHW$</td>
<td>-0.594*</td>
<td>-2.117*</td>
<td>-2.428*</td>
</tr>
<tr>
<td></td>
<td>(0.458)</td>
<td>(0.239)</td>
<td>(0.363)</td>
</tr>
<tr>
<td>$NSWHW$</td>
<td>-0.5789*</td>
<td>-1.832*</td>
<td>-1.719*</td>
</tr>
<tr>
<td></td>
<td>(0.465)</td>
<td>(0.364)</td>
<td>(0.738)</td>
</tr>
</tbody>
</table>

**Source:** Data supplied by Meat and Livestock Australia

**Note:** Figures in brackets are the corresponding probabilities. * indicates that the null hypothesis of a unit root has been accepted at the 5 per cent level.

The null hypothesis for the presence of a unit root has been accepted for each variable at the 5 per cent level.
Estimates of relationships between nonstationary variables could lead to spurious regression by suggesting significant relationships between wholly unrelated variables (Granger & Newbold, 1974). Given that all variables are integrated of the same order, it is possible the linear combination of these variables could in fact be stationary. Granger coined the term cointegration to describe a stationary combination of nonstationary variables (Granger, 1981). Where a linear combination of nonstationary variables are cointegrated then ordinary least squares analysis can still provide a satisfactory framework for evaluating econometric evidence (Stock & Watson, 1988, pp. 164-165).

Equations (1) and (2) have been estimated using ordinary least squares (OLS) with 131 monthly observations from January 2002 until November 2012. As the equations exhibited signs of first order serial correlation (according to Durbin’s m test), they were re-estimated using the heteroskedasticity and autocorrelation-consistent (HAC) standard errors as developed by Newey and West (1987). This will ensure that the standard errors are robust in the event of both heteroskedasticity and autocorrelation of an unknown form. The results are reported below in Table 3 and Table 4.\textsuperscript{11}

\textbf{Table 3 OLS regression for equation (1) (HAC t-statistic probabilities in brackets)}

<table>
<thead>
<tr>
<th>Variable</th>
<th>Equation 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant ($\beta_0$)</td>
<td>49.702 (0.001)</td>
</tr>
<tr>
<td>NSWm</td>
<td>0.829 (0.000)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.811</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.810</td>
</tr>
<tr>
<td>AIC</td>
<td>10.193</td>
</tr>
<tr>
<td>SC</td>
<td>10.237</td>
</tr>
<tr>
<td>F-statistic</td>
<td>553.928</td>
</tr>
<tr>
<td>Durbin-Watson Statistic</td>
<td>0.716</td>
</tr>
</tbody>
</table>

\textsuperscript{11} Eviews 6.0 was used for estimation.
Table 4 OLS regression for equation (2) (HAC t-statistic probabilities in brackets)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Equation 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>73.537 (0.000)</td>
</tr>
<tr>
<td>NSW_HW</td>
<td>0.746 (0.000)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.774</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.772</td>
</tr>
<tr>
<td>AIC</td>
<td>9.895</td>
</tr>
<tr>
<td>SC</td>
<td>9.939</td>
</tr>
<tr>
<td>F-statistic</td>
<td>441.952</td>
</tr>
<tr>
<td>Durbin-Watson Statistic</td>
<td>0.635</td>
</tr>
</tbody>
</table>

The R-squared and adjusted R-squared for equations (1) and (2) indicates the model fits the data reasonably well. The estimated t-statistics on the independent variables indicate that these coefficients are statistically significant at less than the 1 per cent level.

Granger (1986) has suggested two methods for testing whether a cointegrating relationship exists within an equation: the first is through testing whether the residuals from the equation are stationary; and the second is through testing whether the Durbin-Watson statistic is significantly greater than zero. In the first instance, a unit root test using the Dickey-Fuller test, which in this instance is known as the Engle-Granger (EG) test, was performed on the residuals from equation 4 to determine whether they are stationary.12 The results for equations 1 and 2 are reported below in Table 5.

---

12 The lag length for the Augmented Dickey-Fuller test conducted was undertaken using the Schwarz Information Criteria in Eviews 6.0 which was zero, resulting in the Augmented Dickey-Fuller test becoming a Dickey-Fuller test.
Table 5 Engle-Granger test of the residuals for equations (1) and (2)

<table>
<thead>
<tr>
<th>Equation</th>
<th>ADF</th>
<th>ADF test with a constant</th>
<th>ADF test with a constant and linear time trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equation (1) residuals ($\varepsilon_t$)</td>
<td>-5.495</td>
<td>-5.474</td>
<td>-5.458</td>
</tr>
<tr>
<td>Equation (2) residuals ($\delta_t$)</td>
<td>-4.952</td>
<td>-4.933</td>
<td>-5.066</td>
</tr>
</tbody>
</table>

The critical values for the EG test at the 1 per cent level with 100 observations is -4.07. On the basis of the EG test results, the alternative hypothesis that the residuals from equations (1) and (2) do not contain a unit root and are stationary is accepted at less than the 1 per cent level.

Cointegration can also be tested for through the Cointegrating Regression Durbin Watson (CRDW) test which involves examining the Durbin-Watson statistic of the cointegrating regression. The CRDW test rejects non-cointegration if the Durbin-Watson statistic is too big. According to Engle and Granger, the critical value of the Durbin-Watson statistic at the 1 per cent level of significance for 100 observations is 0.511 (Engle & Granger, 1987). The Durbin-Watson statistic for equations (1) and (2) is significantly above the critical value at the 1 per cent level of significance.

A further test of a cointegrating relationship is provided through construction of an error-correction model (ECM) where the residuals from the long-run equilibrium regression are entered into the ECM in the place of the levels terms (Engle & Granger, 1987). Whenever cointegrating variables drift away from their long-run equilibrium, they are expected to restore themselves and the ECM is constructed to estimate this short-run behaviour (Ramanathan, 1999, p. 324). The ECM that will be estimated for equation (1) is outlined below:

$$\Delta WAM_t = \beta_0 + \beta_1 \Delta NSWM_t + \beta_2 \varepsilon_{t-1} + \eta_t$$

where $\Delta WAM$ is the first difference of $WAM$, $\beta_0$ is a constant, $\Delta NSWM$ is the first difference of $NSWM$, $\varepsilon_{t-1}$ is the residual from equation 1 lagged one period and $\eta_t$ is the residual for equation (3).

The ECM that will be estimated for equation (2) is outlined below:

$$\Delta WAWH_t = \beta_0 + \beta_1 \Delta NSWHW_t + \beta_2 \delta_{t-1} + \ell_t$$

where $\Delta WAWH$ is the first difference of $WAW$, $\beta_0$ is a constant, $\Delta NSWHW$ is the first difference of $NSWHW$, $\delta_{t-1}$ is the residual from equation 2 lagged one period and $\ell_t$ is the residual for equation (4).

Equations (3) and (4) have been estimated using ordinary least squares (OLS) with 131 monthly observations from January 2002 until November 2012. As both equations exhibited signs of heteroskedasticity according to the White Heteroskedasticity test, they were re-estimated using the heteroskedasticity and autocorrelation-consistent (HAC) standard errors.

The results for equations (3) and (4) are presented below in Table 6 and Table 7.
Table 6 OLS regression for equation (3) (HAC t-statistic probabilities in brackets)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Equation 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant ($\beta_0$)</td>
<td>-0.4131 (0.872)</td>
</tr>
<tr>
<td>$\Delta$NSWM</td>
<td>0.356 (0.000)</td>
</tr>
<tr>
<td>$\varepsilon_{t-1}$</td>
<td>-0.350 (0.002)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.266</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.255</td>
</tr>
<tr>
<td>AIC</td>
<td>9.472</td>
</tr>
<tr>
<td>SC</td>
<td>9.538</td>
</tr>
<tr>
<td>F-statistic</td>
<td>23.063</td>
</tr>
<tr>
<td>Durbin-Watson</td>
<td>1.902</td>
</tr>
</tbody>
</table>
Table 7 OLS regression for equation (4) (HAC t-statistic probabilities in brackets)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Equation 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant ($\beta_0$)</td>
<td>-0.064</td>
</tr>
<tr>
<td></td>
<td>(0.975)</td>
</tr>
<tr>
<td>$\Delta N3/THP'$</td>
<td>0.349</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
</tr>
<tr>
<td>$\delta_{t-1}$</td>
<td>-0.305</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.264</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.253</td>
</tr>
<tr>
<td>AIC</td>
<td>9.099</td>
</tr>
<tr>
<td>SC</td>
<td>9.165</td>
</tr>
<tr>
<td>F-statistic</td>
<td>22.820</td>
</tr>
<tr>
<td>Durbin-Watson Statistic</td>
<td>1.963</td>
</tr>
</tbody>
</table>

To confirm the cointegrating relationship identified in equations (1) and (2), it is necessary for the coefficient on $\varepsilon_{t-1}$ in equation (3) and on $\delta_{t-1}$ in equation (4) to be negative and statistically significant. The coefficient on both $\varepsilon_{t-1}$ and $\delta_{t-1}$ are negative and statistically significant at less than the 1 per cent level.

For equation (3) the value of the coefficient on the $\varepsilon_{t-1}$ term signifies that adjustment towards its long-run equilibrium level occurs at around 35 per cent within the first month. For equation (4) the value of the coefficient on the $\delta_{t-1}$ term signifies that adjustment towards its long-run equilibrium level occurs at around 30 per cent within the first month.