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Regional feedlot investment study

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Abstract

The feedlot industry is a crucial component of Australia's beef supply chain. This report estimates the industry's existing contribution to the Australian economy, and economic impact of changing the industry. In 2017, the total (direct and indirect) economic contribution of the national feedlot industry to gross domestic product (GDP) was \$4.4 billion and approximately 31,000 full time equivalent (FTE) jobs. The contribution to local, regional, state and the national economy are estimated through case studies of 5,000 and 30,000 SCU feedlots.

The economic impact of changes to the industry is estimated using computable general equilibrium (CGE) modelling. Two scenarios are modelled. In 2029, the economic impact of construction and operation of a new 15,000 SCU feedlot is estimated to increase GDP by \$25m and employment by 100 FTE employees. The economic impact of removing feedlots from beef supply chains is estimated to reduce the size of the national economy by \$10.3 billion and 49,000 FTE employees in 2029. These are large impacts, reflecting how the feedlot industry supports other industries in the beef supply chain, and the wider economy.

These values are greater than the equivalent numbers in the 2012/13 study, reflecting higher beef prices and record beef feedlot turnoff at the time of the current study.

Executive summary

The feedlot industry is a crucial part of Australia's beef supply chain. Commercial feedlots first emerged in Australia in the mid-1960s on the Darling Downs in Queensland (ABS, 2005) addressing variability of beef in the domestic market. Since then, demand for a consistent supply of premium-grade grain-fed beef, both domestically and overseas, has led to a significant expansion in the Australian feedlot sector. In 2017, 2.9 million cattle were turned off from Australian feedlots, 20% above that of a decade ago and almost triple the number in the late 1990s.

Feedlots play an important role in rural and regional economies, as buyer of goods and services and as employers of staff. From a supply perspective, feedlots enable a year-round supply of consistent quality beef that satisfies domestic and international specifications. Through their operations, feedlots also support greater efficiency in the pastoral and processing sectors both up and downstream.

Meat and Livestock Australia (MLA) has commissioned this project to provide up-to-date information on the economic contribution of feedlots in Australia. It is an update of a previous project (B.FLT.0472) and uses similar methodology, including the use of consultation to inform the economic modelling.

The key results from the analysis include:

- Average feedlot utilisation in 2017 was 81%, with a national quarterly average of 1.03 million head of cattle on feed
- The total (direct and indirect) economic contribution of the national feedlot industry to gross domestic product (GDP) in 2017 was $4.4 billion, and approximately 31,000 full time equivalent employees.
- Relative to 2012-13, the feedlot industry had a much higher direct and indirect economic contribution in 2017. This is attributable to improved operating conditions for the feedlot sector, including higher grain-fed cattle prices and lower feed grain prices relative to 2012-13. The higher indirect contribution reflects an increase in feedlot expenditure on intermediate inputs, principally cattle and feed, in 2017, driven by higher industry turnoff, principally via an expansion in capacity and an increase in average turnoff weights.
- Economic contribution alone is not a complete assessment of the value of feedlots to the national economy. Two computable general equilibrium scenarios were modelled in this analysis to highlight the economic impact of the feedlot industry.
- The first scenario considers the regional economic impact of constructing a new 15,000 SCU feedlot in Goondiwindi. The economic impact, including both construction and operational impacts, is estimated to increase in GDP by $25m and employment by approximately 100 FTE employees in 2029.
- The second scenario estimates the national economic impact of removing feedlots and a decline in grazing productivity (upstream), as well as a decline in processed meat manufacturing (downstream). If feedlots shut down in 2018, this is estimated to reduce the size of the economy by $10.3 billion and 49,000 FTE employees in 2029. These values are greater than 2012/13 analysis, reflecting the inclusion of downstream impacts and improved operating conditions and record feedlot turnoff at the time of the current study.

Overall, the economic analysis shows that the value of the feedlot sector goes well beyond the sector itself, increasing productivity in other parts of the beef supply chain and with impacts that flow through the regions in which feedlots operate. When the economy is modelled without feedlots, there is a very large negative impact on GDP reflecting an influence well beyond its direct impacts.

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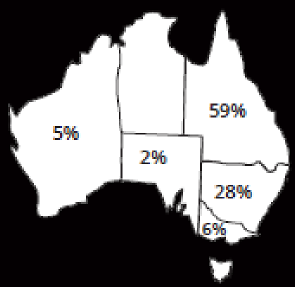
In 2017, the feedlot industry:

- turned off 2.89 million cattle;
- averaged 1.03 million cattle on feed at a time;
- accounted for a record 40% of cattle slaughter; and
- had an average utilization rate of 81%.

State share of output



The national feedlot industry contributes a total **$4.4 billion** to GDP and supports **1,800 direct and 29,200 indirect fulltime employees** across Australia.

This is higher than the industry's 2012-13 contribution of $2.5 billion, reflecting improved operating conditions and record feedlot turnoff in 2017.

Modelling scenario 1

Construction of a new feedlot in Goondiwindi (15,000 SCU)[1]

Greater economic activity from construction and operation of the feedlot (including increased demand for inputs) results in an increase in GDP of $25m and employment by 100 full time employees in 2029.

Modelling scenario 2

An economy without the feedlot industry

Hypothetically, if the feedlot industry did not exist, GDP would be $10.3 billion lower in 2029 and the national economy would lose 49,000 full time employees. This is due to lower productivity in the grazing and processing sectors and reduced demand for inputs.

[1] Standard Cattle Unit is equivalent to an animal with a liveweight of 600kg

1 Introduction

The feedlot industry is a crucial part of Australia's beef supply chain. Commercial feedlots first emerged in Australia in the mid-1960s on the Darling Downs in Queensland (ABS, 2005) addressing variability of beef in the domestic market. Since then, demand for a consistent supply of premium-grade grain-fed beef, both domestically and overseas, has led to a significant expansion in the Australian feedlot sector. In 2017, 2.9 million cattle were turned off from Australian feedlots, 20% above that of a decade ago and almost triple the number in the late 1990s.

In addition to their role as a buyer of goods and services in rural and regional areas, feedlots support greater productivity in the pastoral and processing sectors upstream and downstream. These benefits are quantified in this report.

Meat and Livestock Australia (MLA) has commissioned this project to provide up-to-date information on the economic contribution of feedlots in Australia. It is an update of a previous project (B.FLT.0472) and uses similar methodology, with some updates to the specific scenarios modelled, including the use of data gathering via consultations to inform the economic modelling.

The report is structured as follows:

- chapter 2 provides a profile of the industry and information on recent industry trends;
- chapter 3 presents the methodology and results of the economic contribution modelling;
- chapter 4 presents the methodology and results of the economic impact modelling, which has been used to investigate the impact of constructing a new feedlot and the value that feedlots create in the economy as a whole; and
- chapter 5 concludes the report.

2 Australia's feedlot industry

This chapter provides background information on Australia's feedlot industry, including markets served (section 2.1), a snapshot of 2017 (section 2.2), and historical trends (section 2.3).

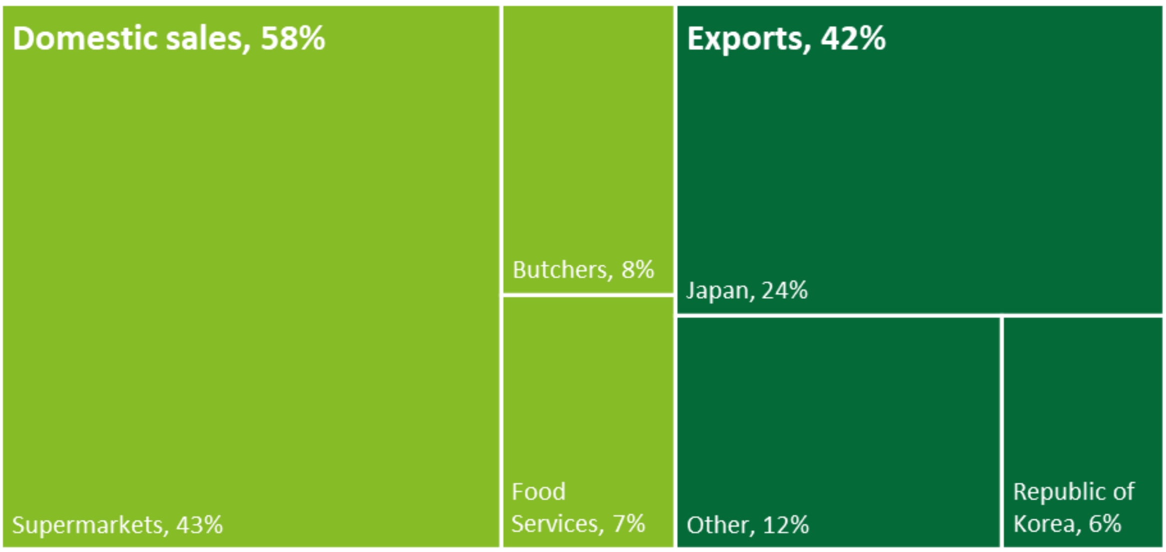
2.1 Markets served

How long cattle spend in feedlots depends on the market for which they are destined. For the domestic market, average time on feed is around 80 days. Cattle processed for exports must spend a minimum of 100 days on feed, with some long fed cattle, such as Wagyu, spending 400-500 days on feed (Condon 2015). On average, cattle that go through feedlots in Australia spend around 95 days on feed. Most cattle turned off from feedlots still spend the majority of their lives (between 85% and 90%) on pasture.

Domestic consumers have grown as a major market for the Australian feedlot industry, accounting for between 50% and 60% of grain fed beef production (Fig. 1). Supermarkets are the main channel for domestic grain fed beef. Feedlots allow supermarkets to provide Australian consumers with consistent beef quality, cut size and supply volumes (IBIS world 2018; ACCC 2016).

Japan is the primary international market for Australian grain fed beef, accounting for more than half of grain-fed beef exports in 2017 (Fig. 1). Demand from Japan largely reflects consumer preferences for the high levels of marbling and fat colour that can be produced through grain finishing. Other export markets include the Republic of Korea, China and United States. Exports to these markets have increased rapidly in recent years but remain considerably smaller than that shipped to Japan.

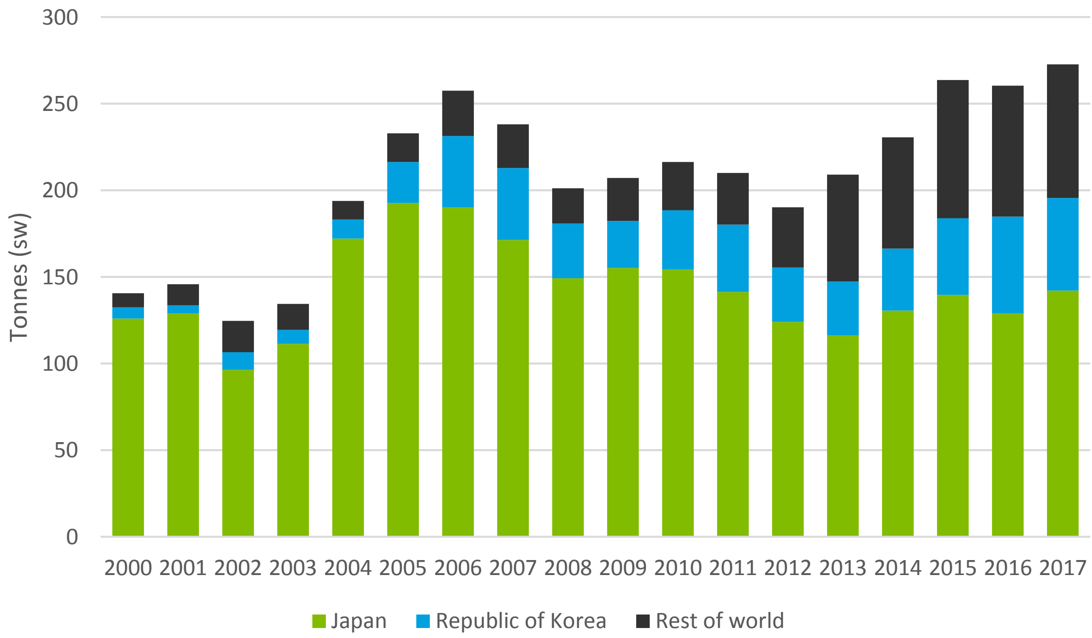
Fig. 1 Grain fed beef market segmentation



Source: IBIS world 2018.

Australian grain fed exports have expanded significantly in recent years, and in 2017 Australia exported around 275,000 tonnes (shipped weight) of grain fed beef (Fig. 2). This increased from an average of around 200,000 tonnes a decade earlier. Increased competition from the United States has resulted in declining exports to Japan. However, this has been offset by increased volumes to other markets, mainly the Republic of Korea, but also the United States and the European Union.

Fig. 2 Grain-fed beef exports, 2000 to 2017

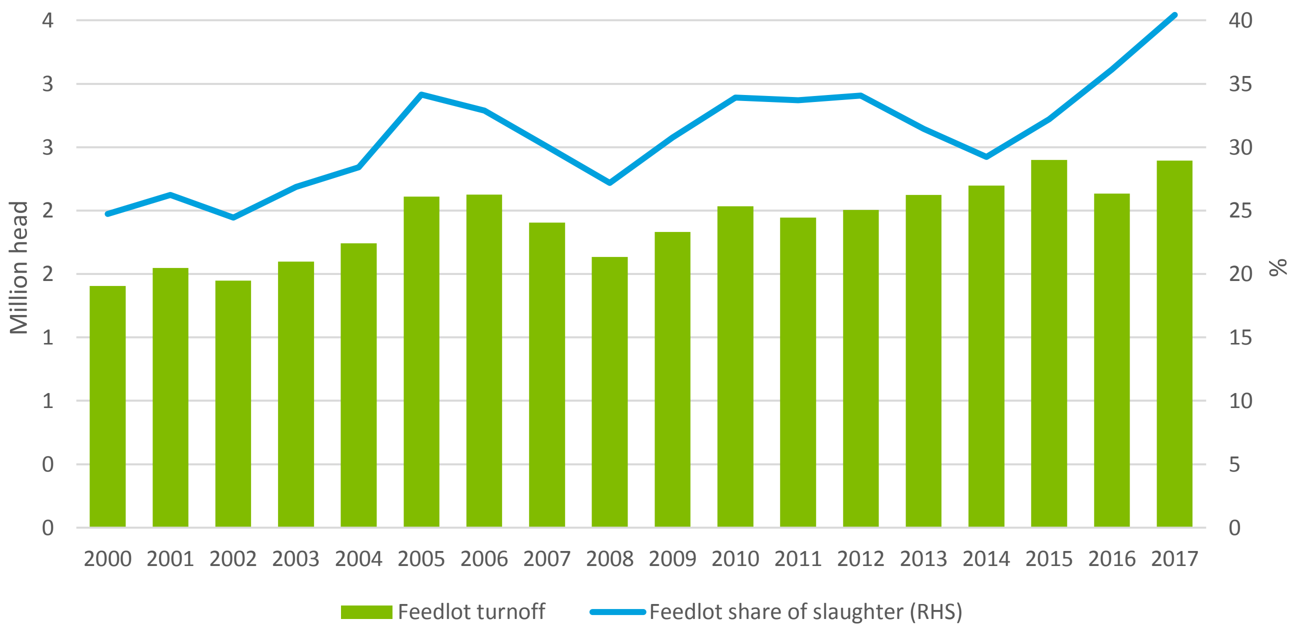


Source: MLA 2018.

2.2 A snapshot of 2017

In 2017, the Australian feedlot industry turned off 2.89 million cattle, with an average of 1.03 million cattle on feed at any one time and an average utilization rate of 81%. While turnoff was marginally below the 2015 record of 2.90 million head, it equated to a record 40% of cattle slaughter in 2017 well above the 30% averaged since 2000 (Fig. 3). This large volume of throughput mainly reflects a sharp increase in average utilisation rates (with higher numbers on feed due to drought) and feedlots capitalising on an improved operating environment. The increase also reflects a steady expansion in industry capacity, discussed in more detail in Section 2.3 below.

Fig. 3 Feedlot turn off and share of cattle slaughter



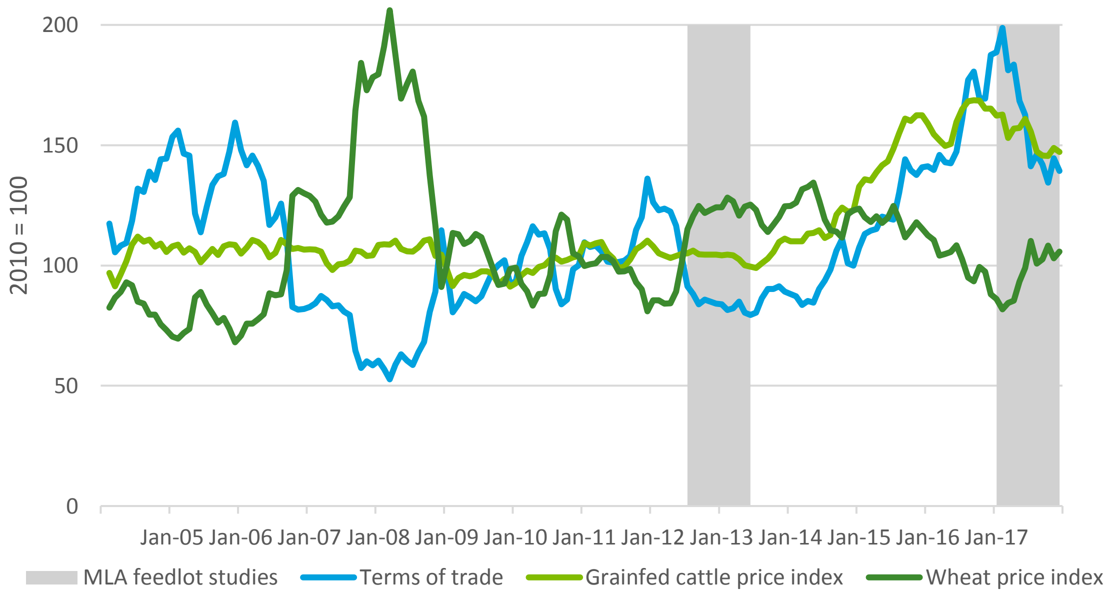
Sources: MLA 2018; ABS 2018.

The operating environment for Australia's feedlot industry has been very favourable in recent years both in a historical context and compared to 2012–13 when the value of Australia's feedlot industry was last assessed (Deloitte, 2015). The Feedlot Terms of Trade Index (FTTI) (depicted in Fig. 4) provides an indicator of the general operating conditions for the sector. It is as a ratio of output (Queensland 100 day grain-fed OTH cattle) prices and input (feed wheat, delivered Sydney) prices.

The improved operational environment for Australian feedlots in recent years was the result of a sharp increase in global beef prices between 2014 and 2016, while feed prices steadily declined over the same period. Between January 2014 and December 2016, Australian prices for grain-fed cattle increased by 50%, while prices for feed fell 38%. This caused the FTTI to increase from 94 in 2014 to 159 in 2016.

The FTTI fell throughout 2017 as a result of steadily deteriorating global cattle prices, combined with a recovery in wheat prices. Despite this, the average FTTI rose marginally to average 161 in 2017. This compares with an average of 101 recorded between 2004 and 2014 and an average of 84 during 2012–13 when the contribution of the Australian feedlot industry was last estimated (Deloitte 2015).

Fig. 4 Grain-fed cattle and wheat price indices and feedlot terms of trade– January 2004 to December 2017



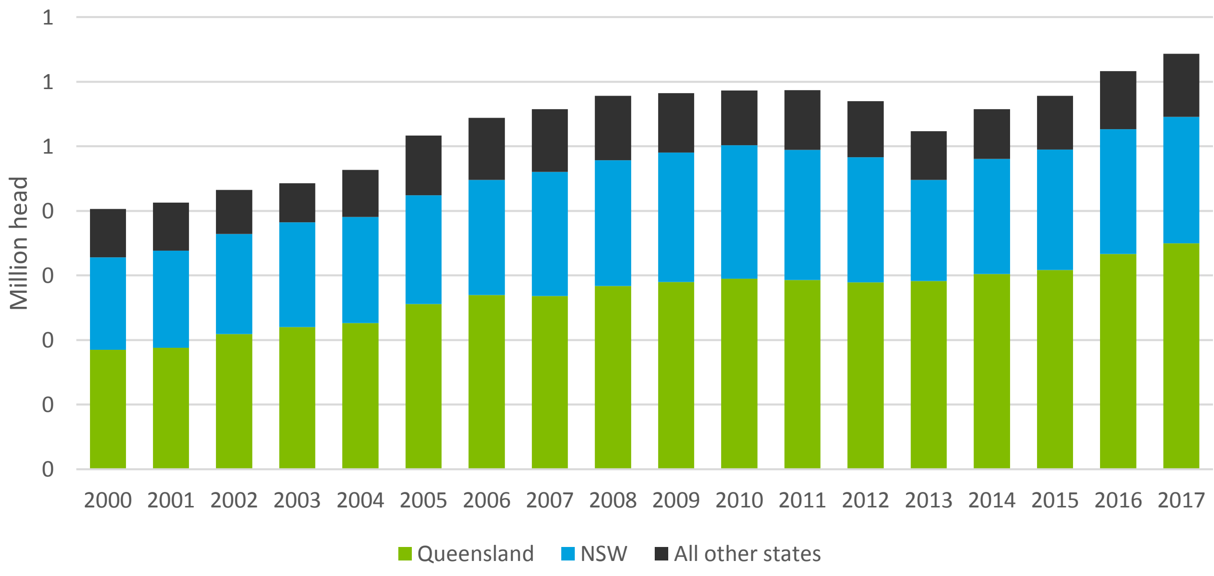
Sources: ABARES 2018, MLA 2018

2.3 Historical trends

Most feedlot activity occurs in Queensland and New South Wales (NSW), which respectively account for 59% and 28% of Australian grain fed cattle slaughter. These states are relatively large producers of grain and cattle, the two primary inputs for the feedlot sector. Access to feed is a key determinant of feedlot location.

Australia's feedlot industry continues to evolve. Between 2000 and 2017 licenced capacity in the sector increased by 60% (Fig. 5). Most of this growth occurred in Queensland, where capacity expanded by 89%. This increased Queensland's share of national capacity to around 55%, up from 46% in 2000. Growth in capacity was comparatively smaller, but relatively large for NSW (up 37%), Victoria (up 39%) and Western Australia (up 57%). South Australia was the only region where feedlot capacity did not increase during this period, falling by 8%.

Fig. 5 Feedlot capacity by state, 2000 to 2017

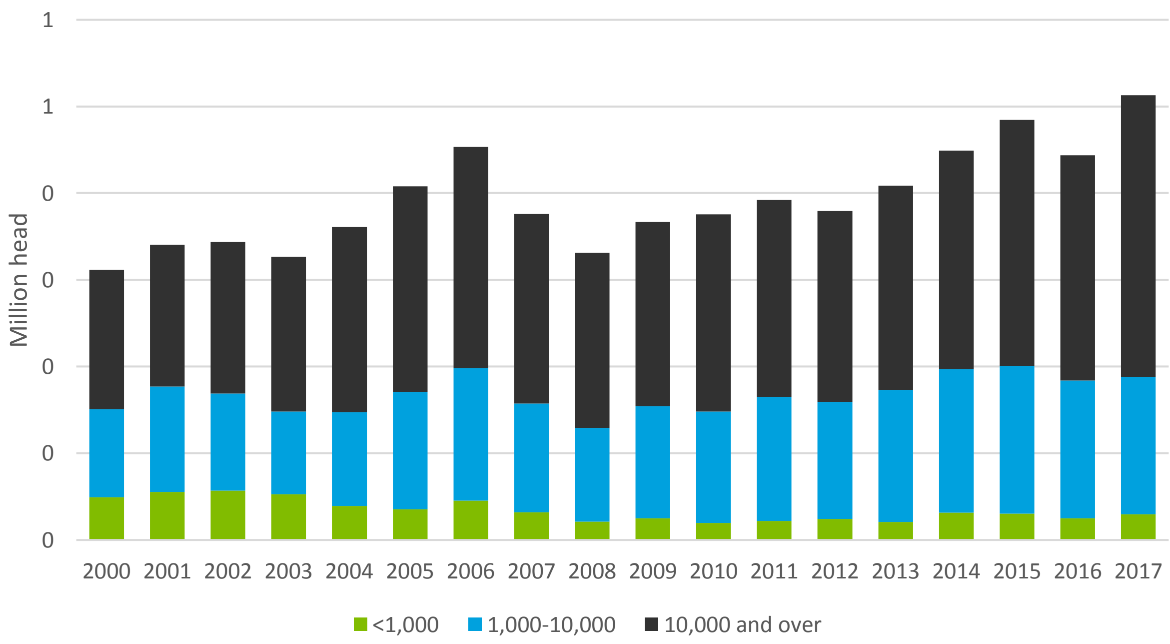


Source: MLA 2018.

Note: Capacity data collected by ALFA prior to and including June 2016, after June 2016 feedlot capacity collected by AUS-Meat.

There has also been variation in which parts of the industry have expanded – net investment continues to focus on larger feedlots, as clearly demonstrated in Fig. 6. Between 2000 and 2017 numbers on feed increased by 56% and 102% respectively for medium (capacity of between 1,000 and 10,000) and larger feedlots (10,000 head or greater), while numbers on feed contracted by 40% for small feedlots (less than 1,000 head capacity).

Fig. 6 Numbers on feed by feedlot size, 2000 to 2017

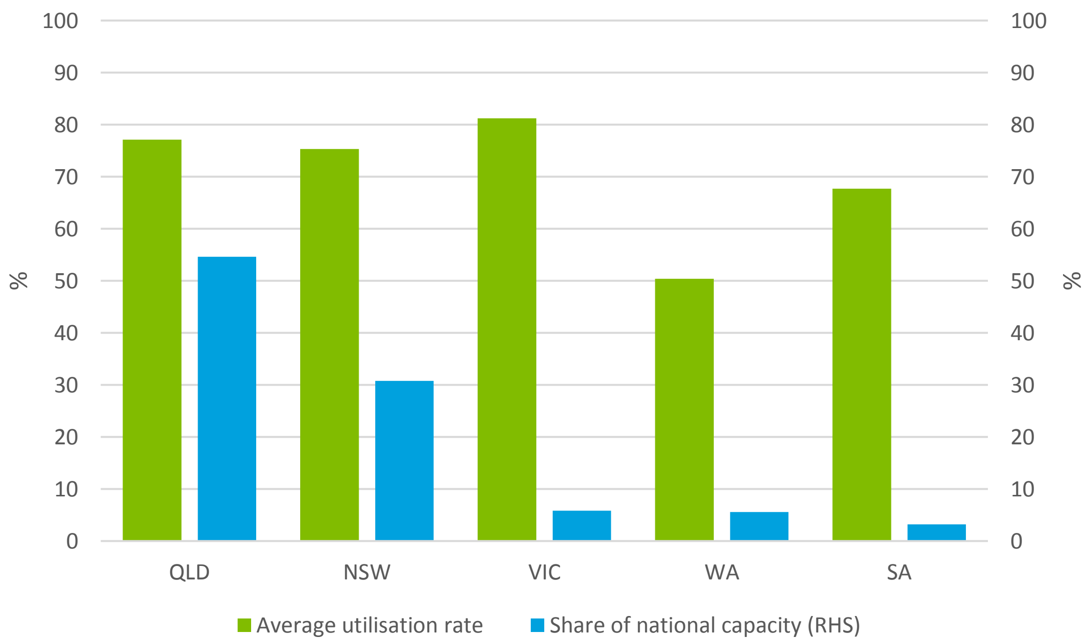


Source: MLA 2018.

Utilisation rates also vary markedly between states, with feedlots on the east coast of Australia operating relatively closer to capacity than those in South or Western Australia. In 2017, Victorian feedlots operated closest to capacity on average, while Western Australian feedlots had a utilization rate of around 50% (Fig. 7). This reflects structural differences between the states, with larger feedlots typically located on the east coast and serving domestic and export markets. On the other hand, feedlots in Western Australia primarily serve the domestic market and face greater variability in demand.

Consultation undertaken for this project has highlighted the shift in the focus of the industry that has occurred over the last 20 to 30 years. Initially the Australian feedlot sector was characterised by 'opportunistic' operations, where utilisation and grain-fed turnoff rose in response to the lack of quality cattle in times of poor seasonal conditions. Today the Australian feedlot industry is focused on satisfying consumer demand for beef of high and consistent quality all-year round. Because of this, grain-fed cattle turnoff is less likely to fluctuate in response to seasonal conditions, with decisions on utilisation driven by factors such as demand growth and feed costs.

Fig. 7 State share of national capacity and average utilisation rate, 2017



Source: MLA 2018.

3 Economic contribution

This chapter provides the methodology and estimates of the existing economic contribution of the feedlot industry in Australia in 2017. The chapter is structured as follows:

- an overview of the economic contribution methodology is presented in section 3.1;
- national and state methodology and results are presented in section 3.2;
- methodology and results relating to 5,000 and 30,000 standard cattle unit (SCU) feedlots are presented in section 3.3; and
- the results of this study are compared and contrasted with the results of the 2012/13 study in section 3.4.

3.1 Methodology overview

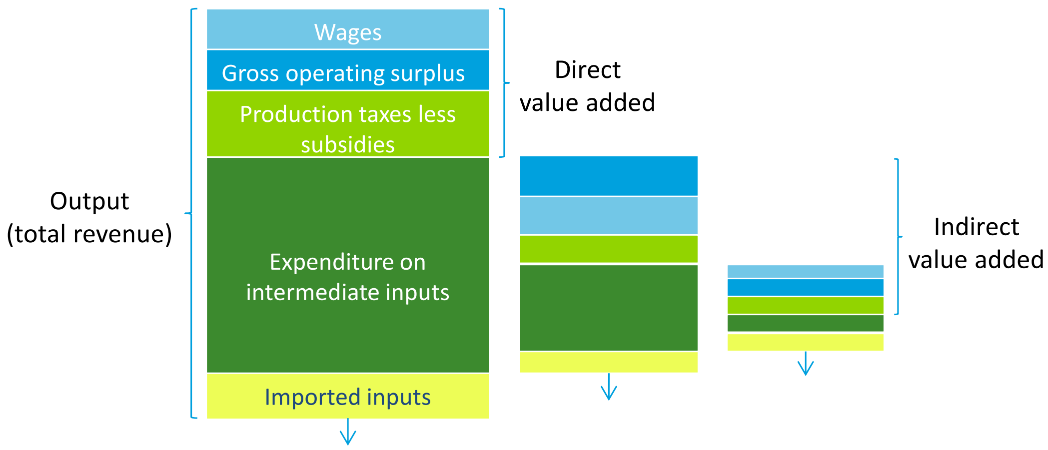
The economic contribution of an industry is the value of compensation of employees and gross operating surplus (jointly referred to as value added) in the industry as well as in the businesses supplying the industry of interest with goods and services. This concept aligns with the measurement of gross value added in the Australian Bureau of Statistics (ABS) System of National Accounts and the income approach to measuring Gross Domestic Product (GDP). The economic contribution of an industry includes direct and indirect contributions.

The direct economic contribution of the feedlot industry is the value added generated within the industry itself. The ABS provides estimates of direct contribution, or value added, of 114 industries including the 'sheep, grains, beef and dairy cattle industry'. Feedlots are not separately represented.

An industry's indirect contribution reflects its expenditure on goods and services from other industries, which also generate value added. In the context of the feedlot industry, this is predominantly expenditure on feeder cattle and feed. There are returns to labour and capital in the businesses supplying cattle and feed to the feedlot industry, and this is measured in the indirect economic contribution of the industry.

Suppliers of intermediate inputs to the industry of interest also utilise intermediate inputs from industries that generate value added, and so on. This is depicted in Fig. 8 below. It should be noted that expenditure on imported intermediate inputs does not contribute to value added in Australia. For this economic contribution analysis, only upstream effects are considered.

Fig. 8 Economic contribution framework



3.2 National and state estimates

3.2.1 National level

Estimating the economic contribution of the feedlot sector at the national level has five main steps:

1. **Calculate total feedlot industry revenue**
   This is calculated by multiplying total turnoff in 2017 ($2.89 billion) by an estimated revenue per head turned off ($1713). This estimate is based on consultation and analysis of indicator prices.
2. **Calculate total feedlot industry gross operating surplus**
   This is calculated as a percentage of total feedlot industry revenue using data on industry revenue, profit and costs drawn from consultation and other sources. These sources produce an estimate of profits being 6.1% of revenue in 2017.
3. **Calculate total feedlot industry employment and wages paid**
   This is calculated in two parts. First, total industry employment is calculated using consultation and other data on the number of full time equivalent (FTE) employees typically used to manage a given feedlot capacity and National Feedlot Accreditation Scheme (NFAS) data on average capacity throughout 2017. Average capacity in 2017 is divided by capacity managed per FTE (715)[1]. This gives the number of FTEs employed in the feedlot industry in 2017. Total wages paid is based on the estimated number of FTEs employed and the estimated average wage of feedlot workers calculated using the 2016 Census of Population and Housing ($57,177).
4. **Calculate industry spending on intermediate inputs**
   This is calculated using cost data provided through consultations and available online resources. It is estimated that 91.92% of a typical feedlot costs go towards cattle and feed purchases (the two primary inputs for feedlot operations). This proportion is multiplied with the estimated costs of the industry (calculated by subtracting profit from total revenue).
5. **Calculate indirect economic contribution using national IO tables**
   This is undertaken in two parts. First, total spending on intermediate inputs is broken down into spending into the different industries represented in the IO tables (for example, cattle and feed purchases are attributed to the Sheep, Grains, Beef and Dairy Cattle industry[2]) based on consultation and other data sources. This information is used as input to the Deloitte Access Economics Input-Output model, which then produces estimates of gross operating surplus and compensation of employees (and employment) associated with the feedlot industry's spending on intermediate inputs. A detailed description of this processes is outlined in Appendix A.7.

[1] There can be significant differences in feedlot capacities and employment levels, with larger feedlots tending to require less staff per unit of capacity, reflecting economies of scale. In the absence of industry employment data, the average employment to capacity ratio used in the modelling was informed through the consultation process and takes into account the variation that can occur by feedlot size. Any differences in the overall results are expected to be minor. While out of scope, a more extensive consultation process with feedlots of different sizes would facilitate a more detailed estimate of total employment using the capacity split by feedlot size provided by NFAS.
[2] For a complete list see http://www.abs.gov.au/ausstats/abs@.nsf/mf/1292.0.

Steps 1-3 provide estimates of the industry direct economic contribution – gross operating surplus accruing to owners of feedlots and compensation of employees working on feedlots.

Taking as input the estimate of total industry revenue calculated at step 1, steps 4 and 5 involve the calculations used to estimate the feedlot industry's indirect economic contribution – the gross operating surplus and compensation of employees (and employment) in industries supplying feedlots with cattle, feed and other intermediate inputs.

These calculations are based on estimates of industry averages. In reality, there is of course significant variation in profitability, employment, revenue and costs across the feedlot industry. For this project, the sources consulted only represent a small proportion of the industry. Sections 3.2.2 and 3.3.1 go into further detail on how the state, 5,000 SCU and 30,000 SCU contribution figures are estimated.

3.2.2 State level

Estimates of the economic contribution of the feedlot industry in each state are based on the estimate of the industry's contribution at the national level. The direct and indirect contribution of the industry in each jurisdiction is calculated by multiplying the industry's national economic contribution by that state's turnoff in 2017.

The limitations of this approach are that it does not factor in the purchase of intermediate inputs (including cattle and feed) across state borders, or implicitly assumes that such trades offset each other. It also entails an assumption that the industry has the same characteristics across jurisdictions, though it is noted that each state has a different profile in terms of the feedlot sizes.

In the absence of data on all interstate trade and employment by state, these estimates present a useful indicative split of the national economic contribution by state, and are presented for consistency with the 2012/13 analysis. These assumptions do not affect the validity of the national estimates.

3.2.3 Results

The economic contribution of the feedlot industry is estimated at $4.4 billion in 2017. Queensland leads the states with the largest economic contribution, at $2.6 billion, which is a reflection of the number of feedlots and level of turn-off in the state.

The total economic contribution of the industry is composed of:

- direct value added - the value added generated in the industry itself (the payments to labour and capital employed in the industry), and;
- indirect value added - the value added in industries supplying inputs to the industry.

As the results in Fig. 9 indicate, the feedlot industry had a large indirect contribution relative to its direct contribution ($3,881 million compared with $500 million). This is large compared to other industries, and reflects the fact that feedlotting is a low margin activity having relatively high operating costs – mostly cattle and feed – relative to total revenue.

Fig. 9 Economic contribution of the feedlot industry, 2017 ($m)

	Direct	Indirect	Total
New South Wales	140	1,085	1,225
Queensland	294	2,281	2,575
South Australia	11	87	98
Victoria	31	241	272
Western Australia	24	187	211
Australia	**500**	**3,881**	**4,380**

Source: Deloitte Access Economics, MLA data, industry consultation data. Note: The distribution across states is based on the state distribution of feedlot turn-off in the 2017 calendar year. This approach requires the assumption that all inputs are purchased in the state of turn-off (or that trade between states perfectly offsets). The state figures should be interpreted with a degree of caution, noting that they are provided for the purpose of demonstrating a rough breakdown of the economic contribution across states.

For the 2017 calendar year, payments to capital and labour are estimated at $398 million and $102 million, respectively. This compares to a combined spend of approximately $4.28 billion on cattle and feed. The large difference between these figures is the primary driver of the difference in the industry direct and indirect contribution figures.

The feedlot industry contributed an estimated 31,100 full-time equivalent (FTE) jobs to Australia in 2017. Of these, 1,800 are employed at feedlots (including owner-operators), with a further 29,300 jobs contributed indirectly through employment in those industries supplying inputs to feedlots (see Fig. 10).

As with the value added industry measures, the contribution to employment is also realised predominantly through indirect employment to feedlots. A major driver of this relationship is the low employment of feedlots per unit of output, paired with the high employment per unit of output in the farming sector (the main supplier of inputs to feedlots).

Fig. 10 Economic contribution of the feedlot industry, 2017 (FTE)

	Direct	Indirect	Total
New South Wales	497	8,187	8,683
Queensland	1,044	17,211	18,255
South Australia	40	654	694
Victoria	110	1,817	1,927
Western Australia	86	1,410	1,495
Australia	**1,776**	**29,279**	**31,055**

Source: Deloitte Access Economics, MLA data, industry consultation data, ABS. Note: The distribution across states is based on the state distribution of feedlot turn-off in the 2017 calendar year. The average wage used to calculate the direct employment from the wage data provided is $80,100, which is an adjusted figure from consultations and the ABS.

3.3 Economic contribution of 5,000 and 30,000 SCU feedlots

This section provides estimates of the economic contribution of example feedlots with capacities of 5,000 and 30,000 SCU. The economic contribution of feedlots of each size has been estimated, based on its share of industry capacity. In 2017, a 5,000 SCU feedlot represented 0.39% of the industry capacity and a 30,000 SCU feedlot represented 2.23% of the industry's capacity. Under the methodology used, this means that the economic contribution of feedlots of each size will be 0.39% and 2.23% of the national estimates provided in the previous section.

An important consideration in choosing where to locate a feedlot is proximity to feed and (to a lesser extent) cattle. Even a feedlot of only 5,000 SCU capacity will spend millions of dollars every year on these inputs.

Because of this importance, estimates are provided on the economic contribution of feedlots at the local and regional level. 'Local' can broadly be understood as within 75 kilometres, and 'regional' as within 150 kilometres. The modelling results are based on these definitions, but in reality every feedlot varies in their sourcing decisions (which will impact the relative size of the local, regional, state and total economic contribution).

The local and regional economic contributions are estimated, based on information provided in consultations on the distances from which feedlots tend to source their cattle and feed. State-level estimates of economic contribution are based on the use of the Goondiwindi LGA (in Queensland) as the location of the hypothetical 5,000 and 30,000 feedlots. The results for each successively larger spatial unit include the results for the smaller spatial unit (i.e. the regional economic contribution includes the local economic contribution).

It is assumed that direct economic contribution is always contained within the local economy.

3.3.1 Methodology

The economic contribution of example 5,000 and 30,000 SCU feedlots have been calculated, based on their share of the national industry. It is assumed that the direct economic contribution of 5,000 and 30,000 SCU feedlots (payments to capital and labour used in the business) is retained within the local government area (LGA) where the facility is located.

To capture the regional economic flows from goods and services from businesses located elsewhere, a specific location must be used to estimate the feedlots' indirect economic contribution. As in the 2012/13 report, the LGA of Goondiwindi has been used for this purpose.

The total, state, regional and local indirect economic contribution of 5,000 and 30,000 SCU feedlots has been estimated using information on spending on intermediate inputs across each geography and IO tables that represent each geography:

- total indirect economic contribution is calculated using the national IO table for 2015-16 (the last available year) and total estimated spending on intermediate inputs within Australia (that is, how much a feedlot of a given size would spend on cattle, feed, etc.);
- state indirect economic contribution is calculated using a Queensland IO table for 2015-16 and an estimate of spending within the state;
- regional indirect economic contribution is calculated using an IO table based on the Goondiwindi LGA and all LGAs that share a boundary with the Goondiwindi LGA[3] and estimated spending within this geography; and
- local indirect economic contribution is calculated using an IO table representing the Goondiwindi LGA and estimated spending within this area.

The indirect economic contribution of any given actual feedlot will depend on where it purchases inputs from, and this can vary significantly from feedlot to feedlot. One general feature of feedlots' purchasing decisions is that cattle may be bought from further afield than feed. Whereas cattle may be trucked to feedlots from locations up to and even over 1,000 kilometres, feedlots would generally find it difficult to pay more than $15-$20/tonne for transport of feed, hence feed tends to have a maximum drawing range of around 500 kilometres.

[3] This includes the Queensland regions of Goondiwindi, Western Downs, Toowoomba, and Southern Downs, as well as the Shire of Balonne. This region covers around 77,400km^2, reaching 550 kilometres north to south and 650 kilometres east to west.

3.3.2 5,000 SCU feedlot – results

The total economic contribution of a 5,000 SCU feedlot is estimated to be just under $17 million per year. The relationship between the direct and indirect contribution mirrors that of the wider industry due to high costs compared to revenues and low GOS/labour costs (see Fig. 11). All direct contribution comes from the feedlot itself, meaning it is all within the region. It is only the indirect contribution that spills out to the State and the rest of Australia.

Fig. 11 Economic contribution of a 5,000 SCU feedlot, 2017 ($m)

	Direct	Indirect	Total
Local	1.9	2.3	4.3
Regional	1.9	5.3	7.3
State	1.9	8.5	10.4
Australia	**1.9**	**14.9**	**16.9**

Source: Deloitte Access Economics, MLA data, industry consultation data.

The direct FTE employment figure of seven is comparable to the estimated amount of eight FTE employment in the 2012/13 study. A typical 5,000 SCU feedlot has an indirect FTE employment of 113, stemming from the feedlot industry's strong reliance on cattle and feed inputs.

Fig. 12 Economic contribution of a 5,000 SCU feedlot, 2017 (FTE)

	Direct	Indirect	Total
Local	7	20	27
Regional	7	43	50
State	7	68	75
Australia	**7**	**113**	**120**

Source: Deloitte Access Economics, MLA data, industry consultation data.

3.3.3 30,000 SCU feedlot – results

The total economic contribution of a typical 30,000 SCU feedlot is estimated to be $101 million. The majority of this is due to the high indirect contribution of $90 million, compared to an estimated $12 direct economic contribution.

Fig. 13 Economic contribution of a 30,000 SCU feedlot, 2017 ($m)

	Direct	Indirect	Total
Local	11.6	14.0	25.6
Regional	11.6	32.1	43.7
State	11.6	51.0	62.6
Australia	**11.6**	**89.6**	**101.2**

Source: Deloitte Access Economics, MLA data, industry consultation data.

As with a 5,000 SCU feedlot, the majority of the employment associated with a 30,000 SCU feedlot is in the industries supplying feedlots with inputs (the indirect employment contribution). The estimated direct contribution of 41 FTE employees is less than the estimate of 47 FTE jobs in the 2012/13 study. This is likely due to an improvement in feedlot procedures and utilisation, making it possible to operate a typical 30,000 SCU feedlot with a lower number of employees.

Fig. 14 Economic contribution of a 30,000 SCU feedlot, 2017 (FTE)

	Direct	Indirect	Total
Local	41	122	163
Regional	41	259	300
State	41	411	452
Australia	**41**	**677**	**718**

Source: Deloitte Access Economics, MLA data, industry consultation data.

3.4 Comparison with 2012/13 study

Despite following similar methodologies, there are a number of minor differences between the contribution figures in this report and those presented in B.FLT.0472. Differences will generally be the norm rather than the exception when comparing economic contribution results across years because business conditions, prices and industry structure change over time. Changes can be especially pronounced in agriculture and related industries because of the effects of weather and commodity prices.

The feedlot industry had a much higher direct economic contribution in 2017 compared with 2012-13 ($500 million versus $147 million). This difference is mostly due to an increase in gross operating surplus in the industry, which was estimated to be $68 million in 2012-13, but is estimated to have been $398 million in 2017.[4] This increase can largely be attributed to improved operating conditions for the feedlot sector, as outlined in Section 2.2. In 2017 grain-fed cattle prices (the primary output for the feedlot sector), were around 50% above the 2012–13 average, while feed grain prices (the primary input for the sector) were 22% below the 2012–13 average. This, combined with record feedlot turnoff, is estimated to have driven a sharp increase in industry profits in 2017, particularly when compared to 2012–13.

Fig. 15 Comparison of results, raw estimates

Year of source data (for analysis)	2012-13	2017
Direct contribution ($m)	147	500
Indirect contribution ($m)	2,361	3,881
Total contribution ($m)	2,509	4,380
Direct employment (FTE)	1,761	1,776
Indirect employment (FTE)	26,831	29,279
Total employment (FTE)	28,593	31,055

Source: Deloitte Access Economics (2015/2018).

The indirect contribution figure is also significantly larger than the previous study. This result is due to an increase in feedlot expenditure on intermediate inputs, principally cattle and feed, in 2017 compared with 2012–13. The increase in cattle and feed purchases has likely been driven by both higher industry throughput and an increase in average turnoff weights. In 2017, lot-fed cattle throughput was approximately 15% higher than in 2012-13, while average Australian slaughter weight also increased by 5% or 15 kilograms.

The two studies are largely consistent in their estimates of direct FTE employment, though as noted in the previous section, there has been a slight increase in direct employment. While the industry has grown in terms of revenue and turnoff, the direct employment estimate suggests that the industry continues to be efficient in its utilisation of employment. An increase in indirect FTE

[4] https://www.mla.com.perau/download/finalreports?itemId=2986

employment is consistent with an increase in demand for intermediate goods used in feedlots, such as cattle and feed.

The 2016 Census by the Australian Bureau of Statistics (ABS) indicates that Australian beef cattle feedlots employed 922 people (785 full-time, 137 part-time) in that year.[5] This estimate appears much lower than one would expect based of national turnoff data and industry consultations. To demonstrate this case, multiple sources put the number of accredited feedlots in Australia in the range of 400 to 451, which with the ABS estimate, would suggest an average of only 2 to 2.3 employees working at each feedlot.[6] To address this issue, the direct FTE employment estimate of 1,776 presented in this report uses the feedlot employee wage as an input, but also draws on industry analysis and relevant consultations with feedlots.

[5] Census of Population and Housing, 2016, TableBuilder.

[6] Australian Lot Feeders' Association 2015 factsheet indicate there were 400 accredited feedlots in that year (accessed via http://www.feedlots.com.au/factsheets/Feedlot-industry-statistics-OCT15.pdf). An alternate source, the National Feedlot Accreditation Scheme Annual Report (2015) indicated that as of December 2015, there were 451 feedlots accredited (accessed via https://www.ausmeat.com.au/media/1353/nfas-annual-report_2015.pdf).

4 Economic impact

4.1 Methodology overview

Unlike the economic contribution study that was the focus of the last chapter – which looks at the existing contribution an industry makes through the economy based on what the industry spends – an 'economic impact' study looks at what happens in the economy as a result of some economic change. This type of analysis is conducted using a computable general equilibrium (CGE) model of the economy. This modelling approach reflects how changes in one part of the economy impact other parts of the economy over time.

Deloitte Access Economics has used its in-house regional general equilibrium model (DAE-RGEM) in this project, to explore the economic impacts of changes in the feedlot industry. DAE-RGEM is a large-scale, dynamic, multi-region, multi-commodity model of the world economy. The model is comprised of a set of relationships between representative agents of the economy, including households, producers, investors and an international component. Further detail on DAE-RGEM can be found in Appendix B.

For this project, the database underlying DAE-RGEM has been customised to represent the feedlot industry. This has involved building a profile of the feedlot industry, including from which industries it buys inputs (and in what proportions) and to which industries it sells its products.

The rest of chapter describes the approach and results of the modelling:

- the economic impact of constructing and operating a new feedlot (section 4.2); and
- the value that the feedlot sector creates as a buyer of inputs and as an enabler of higher productivity up and down the supply chain (section 4.3)

4.2 Scenario 1 – construction and operation of a new feedlot

4.2.1 Scenario methodology

This scenario models the economic impact of the construction of a new 15,000 SCU feedlot in 2018 and its continued operation, with the modelling period extending to 2029[7]. For the purposes of this analysis, it has been assumed this feedlot has been constructed in the LGA of Goondiwindi, within the broader Darling Downs region. The model input has been incorporated as construction expenditure of $17 million dollars, followed by operational expenditure of $466 million (in net present value (NPV) terms using a 7% discount rate over the period from 2019 to 2029, which represents an annual 5% increase in annual regional feedlot turnoff (not cumulative)), as detailed in Fig. 16 and discussed below.

[7] Construction occurs in 2018 and the impacts are presented in the subsequent years from 2019 to 2029.

Fig. 16 Scenario 1 DAE-RGEM model inputs

	Description	2018	2019 to 2029
Feedlot construction phase	The feedlot is constructed and industry output increases	$17 million construction expenditure	
Feedlot operations phase	The feedlot operations begin from 2019 and industry output increases		5% annual increase, equivalent to $466 million* operating expenditure

Note: *This figure is in NPV terms using a 7% discount rate over the period from 2019 to 2029, which is representative of an annual 5% increase in turnoff, as detailed below.

From 2019, the constructed feedlot is also assumed to operate on average at 85% of capacity and, in line with our consultations, it is assumed that cattle spend 100 days on feed. This suggests annual turnoff for the feedlot is approximately 46,500 head.

According to QDAF (2017), there are around 300 feedlots in Queensland, with more than half of these located in the Darling Downs region. Assuming Queensland feedlot turnoff is spread proportionately throughout the state, the Darling Downs region is assumed to account for 54% of feedlot turnoff in Queensland. This equates to around 920,000 head in 2017. The construction of the 15,000 head feedlot in Goondiwindi would therefore be estimated to increase turnoff in the Darling downs region by 5% to 967,000 head.

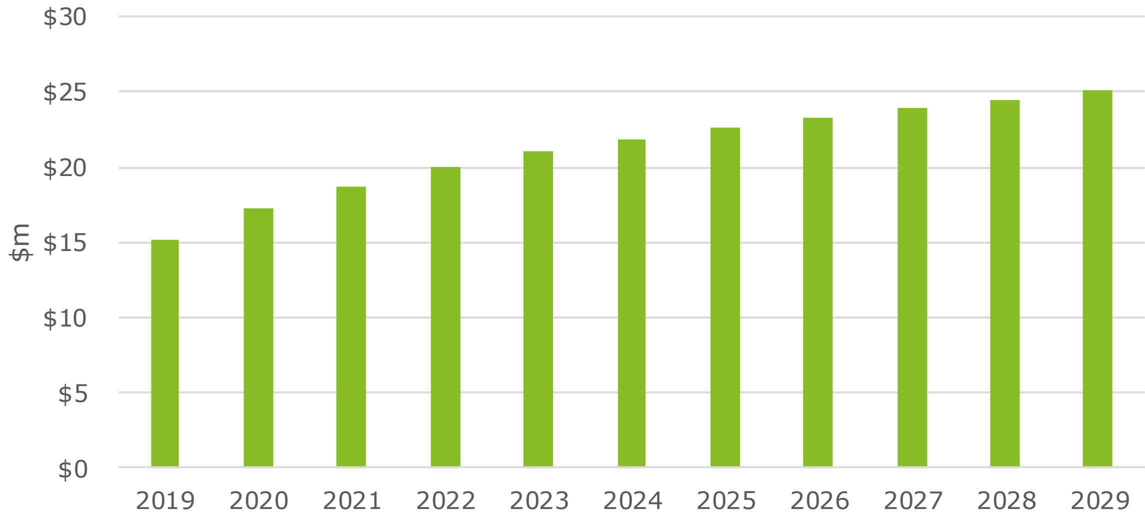
4.2.2 Gross regional product

The modelling indicates that the construction and operation of the 15,000 SCU feedlot would increase the wider Darling Downs region’s gross regional product (GRP) by $165 million in net present value (NPV) terms over the period 2019 to 2029[8]. Adjusting for inflation, the average annual increase in GRP over the entire construction and operational period is about $15 million per year.

Fig. 17 shows the annual economic impact of constructing a new feedlot. By 2029, GRP would be about $25 million higher, representing an increase of about 0.1% (compared to the baseline scenario in which no feedlot is constructed). This impact ramps up over the construction phase and is subsequently supported by ongoing operations and exports associated with the feedlot sector directly, as well as indirect impacts up and down the supply chain. The impact attributable to the increased operations over time outweigh the original construction benefits.

[8] All NPV figures in this chapter are calculated using a 7% real discount rate.

Fig. 17 Impact on economic output



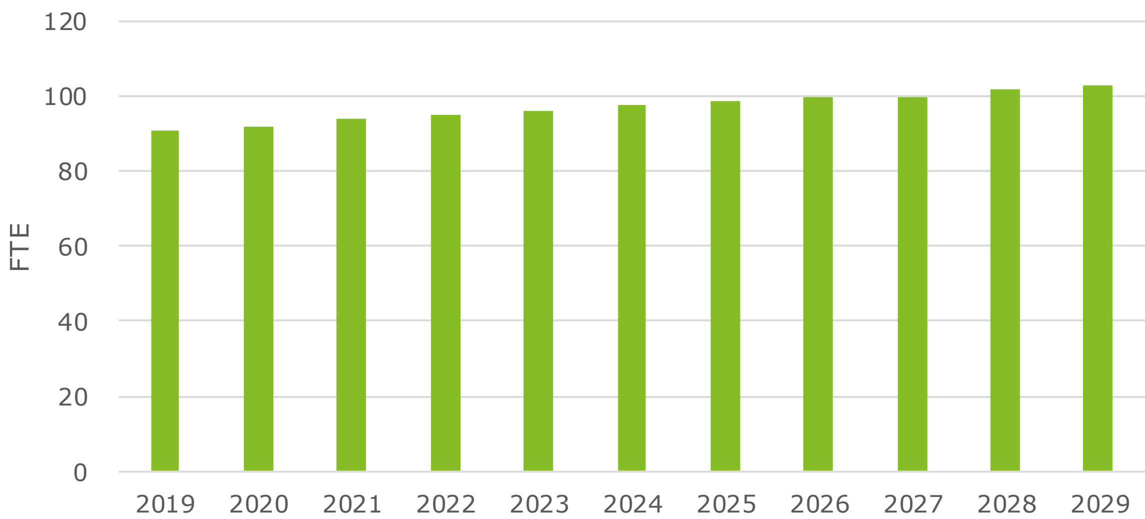
Source: Deloitte Access Economics.

4.2.3 Employment

The modelling shows that the construction and operation of the feedlot would result in an additional 97 full-time equivalent jobs (FTEs) annually on average over the period 2019 to 2029 in the regional economy. By 2029, there would be an additional 103 FTE jobs, representing an increase of about 0.1% (compared to the baseline scenario).

Fig. 18 highlights that the employment impacts increase in line with the capital expenditure, as additional labour (either directly, or through increased demand for inputs from other industries) is demanded. Employment is also supported over the longer run through ongoing operations of the feedlot sector, along with other sectors stimulated across the broader supply chain.

Fig. 18 Impact on employment



Source: Deloitte Access Economics.

4.2.4 Sectoral results

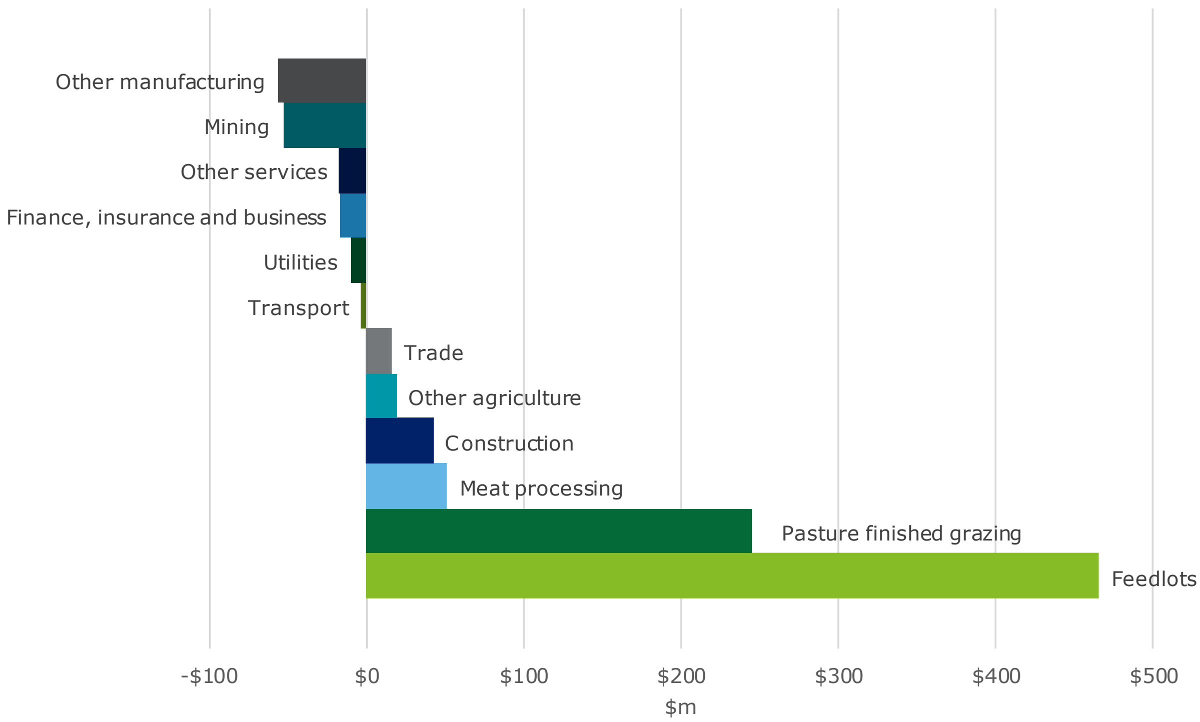
Fig. 19 below shows the deviation in output across sectors in the regional economy. Relative to a baseline scenario with no new feedlot, the new feedlot, as expected, directly stimulates increased output in the feedlot and construction industries, by $466 million and $42 million respectively[9]. In turn, this creates additional demand in industries which supply the feedlot and construction industries with intermediate inputs, such as pasture finished grazing (which includes grazing cattle) and to a lesser extent, other agriculture (which includes feed).

On the other hand, the expenditure leads to reduced activity in other parts of the economy as it draws productive resources away from them and reallocates these to the expanding industries. This is known as 'crowding out' and the effect can be seen, for example, in mining as well as some manufacturing and services sectors.

The negative deviation shown for some industries in Fig. 19 does not necessarily imply that those industries are projected to contract. Rather, it indicates that they are not growing as fast, relative to the base case.

Though there are decreases across some industries, the additional activity due to the increased domestic expenditure has an overall positive impact on the regional economy in terms of GRP and aggregate employment.

Fig. 19 NPV of deviation in industry output, 2019 to 2029



Source: Deloitte Access Economics

[9] in NPV terms over the period 2019-2029

4.3 Scenario 2 results – no feedlots and decline in upstream and downstream productivity

4.3.1 Scenario methodology

This scenario considers the economic impact of (hypothetically) removing the feedlot sector from the Australian economy. To capture this impact, four model inputs were implemented:

- **Model input 1:** removal of the feedlot sector is estimated to reduce demand for feeder cattle, feed and other goods and services used by feedlots[10]. However, simply removing feedlots from the model does not capture the full extent of upstream and downstream impacts, which are modelled through additional inputs, as detailed below.
- **Model input 2:** lower grazing sector productivity as the national herd and supply chain would need to be restructured, with some breeding enterprises for example required to finish cattle; and
- restrict processors to sourcing cattle only from the grazing sector. This is assumed to reduce processing sector productivity by:
  - **Model input 3a:** lowering average capital utilisation because of an increase in seasonal variation of pasture finished cattle, and
  - **Model input 3b:** reducing the amount of meat produced per animal processed, with pasture finished cattle estimated to have lower average slaughter weights than cattle in feedlots.

These model inputs are summarised in Fig. 20 and explained in more detail throughout this chapter. Due to the industrial structure of the model, it was necessary to scale both the beef cattle grazing and processed beef manufacturing productivity model inputs:

- **Beef cattle grazing:** this industry sits within a broader 'pasture-finished grazing' industry in the model, which includes cattle, sheep, goats, horses, asses and other meat. The model input relating to the cattle grazing is scaled by 60% to reflect the share of beef cattle grazing within this sector; and
- **Red meat processing:** this industry similarly sits within a broader 'meat processing' industry in the model, which includes fresh or chilled meat and edible offal of cattle, sheep, goats, horses, asses, mules, and other meat processing. Therefore, this model input is scaled by 75% to reflect the share of processed beef manufacturing.

Fig. 20 Scenario 2 DAE-RGEM model inputs

	Description	Model inputs included in the model (from 2018 onwards)
Removal of feedlot sector	1. The feedlot sector ceases to exist	Removal of industry in the model
Lower cattle grazing productivity	2. Total factor productivity in the cattle grazing sector declines	-4.1% (scaled by 60% to -2.5%)
Lower red meat processing productivity	3a. Capital productivity in the red meat processing sector declines	-2.4% (scaled by 75% to -1.8%)

[10] though these resources then become available for other businesses in the economy

	3b. Total factor productivity in the red meat processing sector declines	-4.5% (scaled by 75% to -3.4%)

The model inputs (described above) are implemented in 2018 and the impacts of removing the feedlot sector and broader supply chain productivity effects on the Australian economy have been presented from 2019 to 2029.

It is acknowledged that there are also likely to be other impacts that are challenging to quantify and are not captured in this economic impact analysis. For example, it is unlikely that Australia's major supermarkets could secure sufficient year-round supplies of MSA-graded beef in the absence of the feedlot sector. The analysis also does not consider the impact on specific brands unable to deliver products to certain specifications.

Model input 1: Removal of the feedlot sector

The feedlot industry is a major buyer of feeder cattle and feed, including grains, roughage, protein and other supplements. Import restrictions mean these inputs are sourced solely from within Australia. Recent evidence indicates that the feedlot industry accounts for more than a third of the total supply of cattle for slaughter in Australia and around a quarter of feed consumed by livestock (MLA, 2018; JCS solutions, 2016). The first model input is the removal of the feedlot sector from 2018 onwards, affecting the Australian beef supply chain in the model. This has a significant impact on upstream suppliers, namely those producing feeder cattle and feed.

Of course, if the feedlot industry did not exist, demand from other buyers of cattle and feed would (to an extent), fill the gap created, and possibly benefit from lower prices for these goods and services (because aggregate demand for them has declined).

Model input 2: Reduced productivity in the grazing sector

Should there no longer be a feedlot industry, the grazing industry would also suffer productivity losses in being required to finish cattle. As in the economic impact modelling undertaken for the previous version of this study (Deloitte Access Economics, 2015), a negative model input is applied to the grazing sector's productivity in the scenario in which the feedlot industry does not exist.

Conceptually, this negative productivity model input relates to the fact that Australia's beef cattle industry is structured in part to utilize land to produce cattle that can be finished on feedlots, rather than that land needing to also be used to prepare cattle for slaughter. This flexibility means that, with feedlots, more grazing land can be used to breed and background cattle, rather than fatten them. Without feedlots, less cattle can be turned off grazing land. Furthermore, some marginal grazing land may no longer be viable for grazing at all, with reduced opportunities to fatten cattle elsewhere. Consistent with the previous study (Deloitte Access Economics, 2015), this model input has been implemented as a 4.1% reduction in the productivity of the cattle grazing sector.[11]

[11] The 4.1% model input is calculated based on value of output divided by DSE equivalent, showing that grazing production is 87% as efficient as feedlot production. Based on the lot fed share of total slaughter, the

As discussed earlier, since the beef cattle grazing sector lies within a broader pasture-finished grazing sector, the model input has been adjusted to reflect the share of beef cattle in the sector (60%). This results in a 2.5% model input. This is applied in 2018 and is sustained throughout modelling period to 2029.

Reduced productivity in the processing sector

The feedlot sector principally supplies goods (finished cattle) to the processing sector. Consultation has highlighted two benefits in particular that the feedlot sector creates for the processing sector:

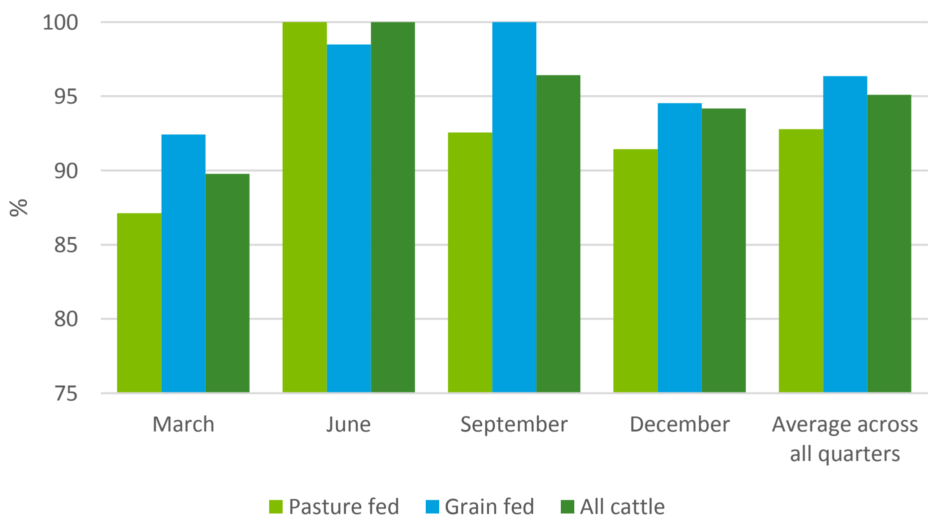
- greater utilisation due to the ability of the feedlot sector to finish cattle to market specification more consistently throughout the year, than what is possible from pasture reared grazing cattle; and
- processing the higher weight cattle that the feedlot sector can reliably provide, compared to pastured cattle from grazing land.

These benefits to the processing sector have been quantified and included as a negative model input to reflect the effect of removing feedlots from the Australian beef supply chain.

Model input 3a: Utilisation of processing sector capital

There is seasonality in cattle turnoff in Australia, and grass finished cattle exhibit comparatively greater variability in weight than grain finished cattle (see Fig. 21 below). Between 2010 and 2017, slaughter of pasture finished cattle was highest in the June quarter, with an average of 1.35 million head (Row A of Fig. 22 below). This compares with an average of 1.22 million head across the rest of the year head (Row B of Fig. 22 below). In comparison, lot-finished cattle are mostly turned off in the September quarter (689,000 head), with an average of 655,600 across all other quarters.

Fig. 21 Quarterly turnoff relative to peak quarter, average 2010 to 2017



reduction in efficiency is estimated at 4.1% and further adjusted to reflect the beef cattle share of the broader grazing sector.

Source: ABS (2018); MLA (2018). Note: Peak turnoff is September for grain fed cattle, and June for Pasture finished cattle and the average across all cattle.

This means that capital resources used to process lot fed cattle can be utilised relatively closer to capacity than that used to process grass fed cattle.[12] Assuming that the number of cattle processed in the peak quarter represents maximum capital utilisation, then capital used to process pasture finished cattle operate on average at 92.8% of capacity across the whole year (Row C of Fig. 12). This represents the policy case scenario modelled in DAE-RGEM, and compares with 95.1% in the base case, which is an average for the beef sector as a whole and includes grass and pasture finished cattle.[13]

Fig. 22 Seasonality in quarterly turnoff

	Quarterly cattle turnoff	Policy case		Base case
		Pasture fed	Grain fed	All cattle
	March	1,178,756	636,816	1,785,022
	June	1,352,811	678,633	1,988,478
	September	1,252,333	688,968	1,917,589
	December	1,237,061	651,359	1,872,749
	Peak quarter			
		June	September	June
A	Throughput in quarter	1,352,811	688,968	1,988,478
B	average of all other quarters	1,222,717	655,602	1,858,453
	% difference	10.6%	5.1%	8.0%
	Throughput relative to peak quarter			
		Pasture fed	Grain fed	All cattle
	March	87.1%	92.4%	89.8%
	June	100.0%	98.5%	100.0%
	September	92.6%	100.0%	96.4%
	December	91.4%	94.5%	94.2%
C	**Average across all quarters**	**92.8%**	**96.4%**	**95.1%**

Source: ABS (2018); MLA (2018).

The difference between the base and policy cases equates to a 2.4%[14] reduction in the capital productivity of the processing sector. This 2.4% reduction has been scaled by 75% to reflect the share of beef in the red meat processing sector (as discussed at the start of section 4.3.1), and hence implemented in DAE-RGEM as a 1.8% model input to the productivity of capital in the red meat processing sector.

Model input 3b: Reduction in average slaughter weights

Multiple industry stakeholders consulted as part of this project have attested to the benefit created by being able to process cattle of greater turnoff weights. These sources have suggested that cattle finished in feedlots typically have carcass weights around 40 kilograms higher than grass finished cattle. This difference aligns with information presented in Andrews and Littler (2015). Adult cattle slaughter weights averaged 298 kilograms in 2017 and pasture finished cattle accounted for around

[12] Of course, most processors handle both types of cattle. This is a feature of the model that is not represented in the modelling.

[13] For grain finished cattle, capital was estimated to be utilised on average at 96.4% across the year.

[14] 100*(92.8%-95.1%)/95.1% = 2.4%

two-thirds of turnoff in that year. From this, it can be estimated that pasture finished cattle weighed on average 284 kilograms at slaughter.[15]

Fig. 23 Calculation of model inputs to processing sector productivity

		Calculation	2017 average
A	Pasture finished slaughter weight		284.2 kg
B	Grain finished slaughter weight		324.2 kg
C	Average slaughter weight (all cattle)		297.6 kg
D	Difference in pasture finished cattle and all cattle (kg)	C-A	13.5 kg
E	Difference in pasture finished cattle and all cattle (%)	(C-A)/C	4.5%

Source: ABS (2018); MLA (2018).

The difference in slaughter weights between the pasture finished cattle only and an average of grain and pasture finished cattle equates to 13.5 kilograms or 4.5%. This difference represents a 4.5% reduction in processing productivity in the base case (both grass and grain finished cattle) and policy case (pasture-finished cattle only) scenarios.

The 4.5% reduction in processing sector productivity scaled by 75% to reflect the share of beef in the red meat processing sector, and hence was implemented in the model as a 3.4% model input.

4.3.2 Gross domestic product

The modelling indicates that, in the absence of the feedlot sector, the national economy would be about $10.3 billion lower, as measured by the change in gross domestic product (GDP) by 2029[16] (see Fig. 24).

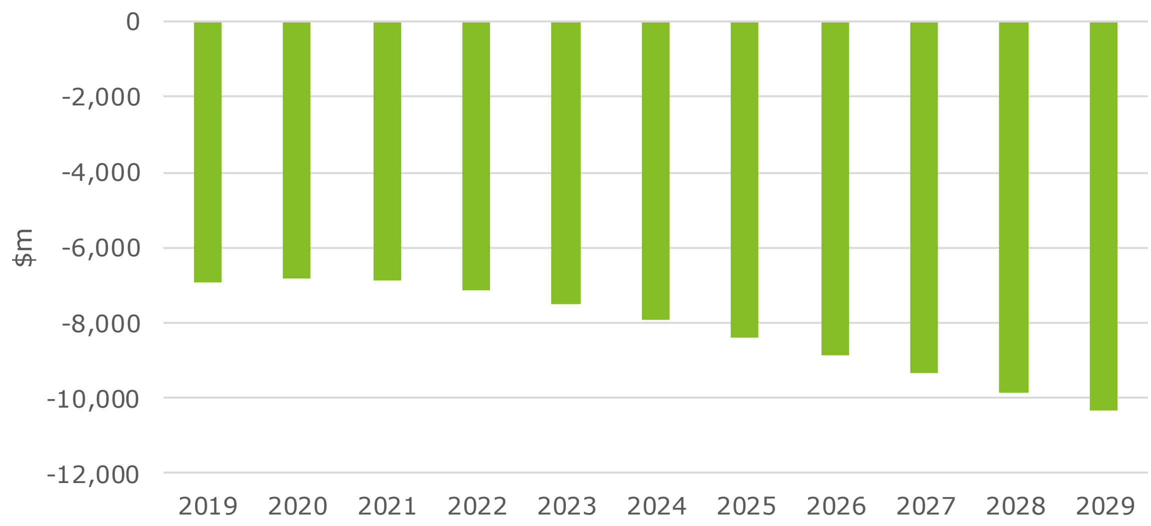
Feedlots contribute directly to the economy through their use of primary factors, but also more broadly through their upstream and downstream activities. In the absence of the feedlot sector, there would be less demand for primary inputs, such as capital, labour and land. There would also be less demand for upstream and downstream goods and services. For example, in upstream goods and services, there would be less demand for cattle and feed, and as a result, these industries would lose a large source of sales. While these resources could be used (to an extent) by other sectors, feedlots support a large amount of activity in other industries. Downstream, meat processing will also be less efficient in the absence of feedlots, with reduced cattle weights, quality and consistency of supply.

The deviation in GDP in 2019 of around $6.9 billion is higher than the results of the economic contribution results (approximately $4.4 billion in 2017). This means that, should the feedlot cease to exist, what is lost to the economy is different to the economic contribution. Whereas the economic contribution of feedlots is a function of what feedlots buy, the economic impact of losing the industry includes wider productivity and efficiency losses in the grazing and meat processing industries as well.

[15] For grain finished cattle, slaughter weights were estimated to average around 324 kilograms (carcase weight).

[16] The impact on economic output and employment (Fig. 24 and Fig. 25 respectively) worsen over time. This is due to the fact that the deviations (in level terms) in economic output and employment are expressed relative their respective growing base case values, which are themselves growing over time. Therefore, a constant or slightly decrease percentage deviation increases over time in level terms.

Fig. 24 Impact on economic output

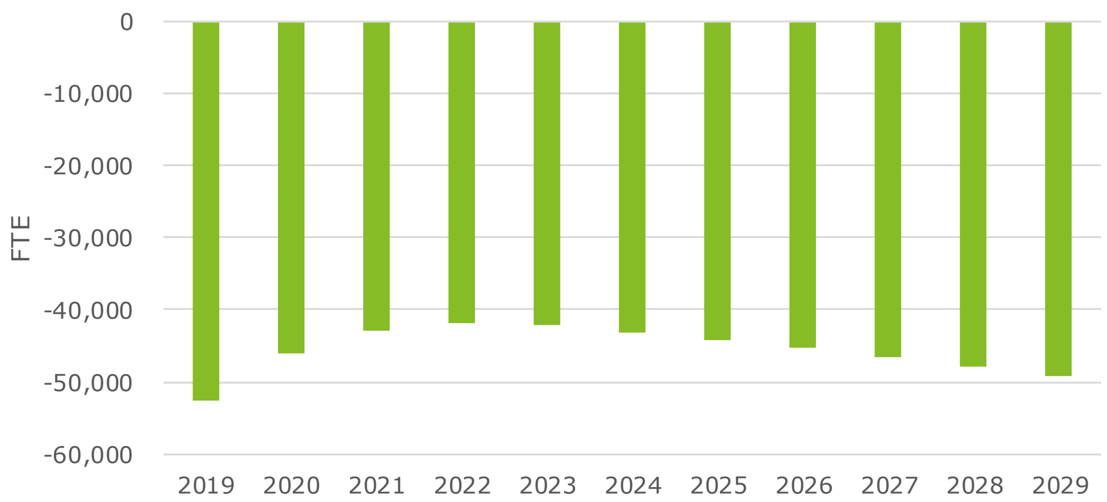


Source: Deloitte Access Economics.

4.3.3 Employment

The modelling indicates that the national economy would lose around 49,000 FTEs by 2029 if the feedlot sector shut down in 2018 (see Fig. 25). It should be noted that this employment figure includes the change in both direct employment in the feedlot sector, as well as flow on impacts to other industries (such as rest of cattle and processed meat manufacturing). The decline in aggregate employment is driven to a large extent by the indirect employment that the feedlot sector supports upstream and downstream, rather than the direct employment of the sector itself.

Fig. 25 Impact on employment



Source: Deloitte Access Economics.

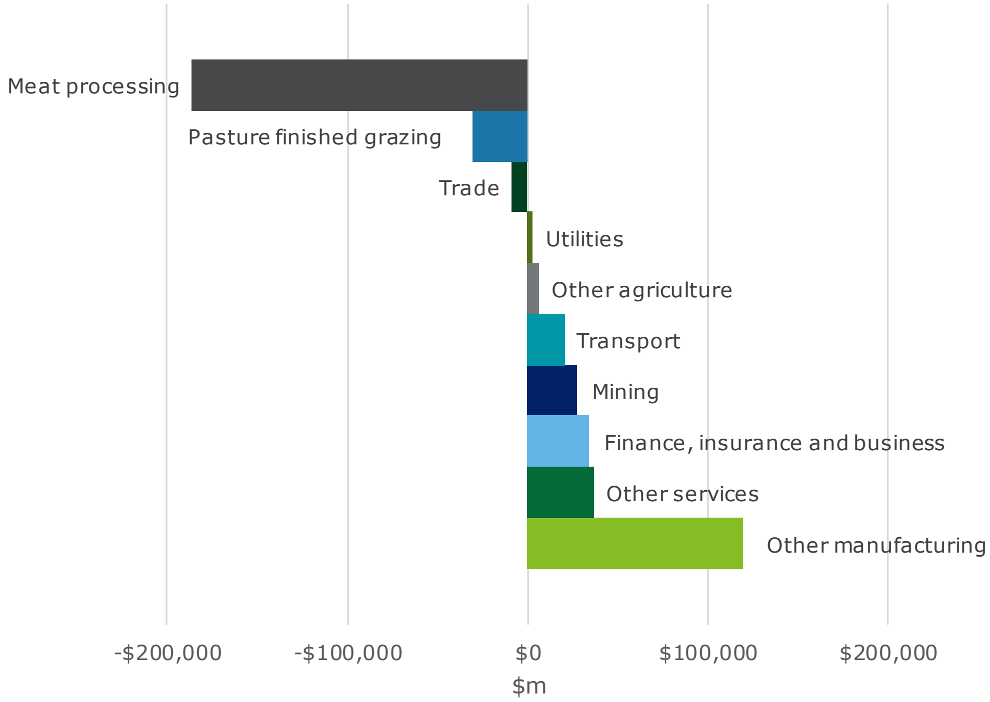
4.3.4 Sectoral results

Fig. 26 below shows the deviation in industry output. As noted above, feedlots contribute directly to the economy, but also more broadly through their upstream and downstream activities. As a result, the modelling shows that the removal of the feedlot sector has impacts throughout the economy. The largest negative impacts are within the downstream and upstream supply chain industries, including meat processing and pasture finished grazing, respectively.

Some industries, however, are able to expand from the shutdown of the feedlot sector. This 'crowding in' effect is best explained as the inverse of the 'crowding out' effect in scenario 1. As resources (for example, labour) are released from certain industries, these can be captured to some degree by other industries. As an example, while feedlots, processed meat manufacturing and rest of cattle contract and subsequently demand less labour, other manufacturing and services can reemploy this labour and use it to expand. In addition, the removal of beef exports would act to weaken the Australian dollar (relative to base), and would therefore benefit the trade exposed industries (for example, mining). In the absence of feedlots, the reallocation of resources tends to benefit more transport-intensive industries. Further, in a grazing sector without feedlots, production would be more geographically dispersed, and also require more transport. Some other industries also benefit from reduced competition and lower prices for inputs. An example here would be the intensive poultry and pork industries, who would benefit from lower grain prices.

However, although there are benefits in some industries, in aggregate, the removal of the feedlot sector results in a large negative impact on the national economy.

Fig. 26 NPV of deviation in industry output, 2019 to 2029



Source: Deloitte Access Economics

4.4 Comparison with 2012/13 study

As with the economic contribution, the results of the economic impact analysis differ somewhat from the 2012/13 study. As explained earlier, differences will generally be the norm rather than the exception when comparing results across years because business conditions, prices and industry structure change over time. For example, better operating conditions for the feedlot sector have increased the industry's value added since the last study (from $147 million in 2012-13 to $500 million in 2017) and, as a result, removing a larger sector from the economy would naturally have more profound impacts.

However, in addition to these external changes that will invariably occur over time, the scenarios modelled differ from the 2012/13 study. Specifically, that study considered:

1. the national economic impact of removing feedlots; and
2. the national economic impact of removing feedlots and a decline in grazing productivity (upstream).

In contrast, this study considers:

1. the regional economic impact of constructing a feedlot; and
2. the national economic impact of removing feedlots and a decline in grazing productivity (upstream), *as well as a decline in processed meat manufacturing (downstream).*

As a result, in comparing scenario 2 across the studies, the economic impacts would be expected to be greater in magnitude. Indeed, this is what we find when we compare the results across the two studies.

Further, the differences reflect the different operating conditions in the years of analysis. The improved operating conditions, higher expenditure on intermediate inputs and record feedlot turnoff at the time of the current study, relative to the 2012/13 analysis, result in a greater negative impact when feedlots are removed. This demonstrates the growing importance of the feedlot industry directly and indirectly to the broader beef supply chain.

5 Discussion

The feedlot industry is a key part of Australia's beef supply chain. In 2017, there was a record number of cattle on feed, with dry conditions, low grain prices at the start of the year and robust demand from key export markets.

This report presents an update and extension of the analysis conducted on the economic value of the feedlot industry 2012-13. It highlights the economic value proposition of the feedlot industry as part of the beef supply chain and notes its influence goes far beyond its direct economic contribution.

Relative to 2012-13, the feedlot industry had a much higher direct and indirect economic contribution in 2017. The higher direct contribution is attributable to improved operating conditions for the feedlot sector, including higher grain-fed cattle prices and lower feed grain prices relative to 2012-13. The significantly higher indirect contribution reflects an increase in feedlot expenditure on intermediate inputs, principally cattle and feed, in 2017, driven by higher industry throughput and an increase in average turnoff weights.

The two studies are also largely consistent in their estimates of direct FTE employment. While the industry has grown in terms of revenue and turnoff, the direct employment estimate suggests that the industry continues to be efficient in its utilisation of employment. An increase in indirect FTE employment is consistent with an increase in demand for intermediate goods used in feedlots, such as cattle and feed.

As with the economic contribution, the results of the economic impact analysis differ somewhat from the 2012/13 study. This also reflects changes in business conditions, prices and industry structure over time. However, in addition to these external changes, the scenarios modelled differ from the 2012/13 study. Results from this analysis suggest a greater economic impact of removing feedlots, given the broader scope of the modelling to not only include the upstream impacts of a decline in grazing productivity, but to also include downstream economic impacts in the processed meat manufacturing market.

Overall, the economic analysis shows that the value of the feedlot sector goes well beyond the sector itself, increasing productivity in other parts of the beef supply chain and with impacts that flow through the regions in which feedlots operate. When the economy is modelled without feedlots, there is a very large negative impact on GDP (down by $10.3 billion relative to baseline in 2029), reflecting an influence well beyond the feedlot industry itself.

6 References

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Appendix A: Economic contribution analysis

A.1. Analysis introduction

Economic contribution studies are intended to quantify measures such as value added, exports, imports and employment associated with a given industry or firm, in a historical reference year. The economic contribution is a measure of the value of production by a firm or industry.

All direct, indirect and total contributions are reported as gross operating surplus (GOS), labour income, value added and employment (with these terms defined in Table A.1).

Table A.1 Definitions of economic contribution estimates

Estimate	Definition
Direct economic contribution	The direct economic contribution is a representation of the flow from labour and capital committed in the economic activity.
Employment (FTE)	Employment is a fundamentally different measure of activity to those above. It measures the number of workers (measured in full-time equivalent terms) that are employed by the entity, rather than the value of the workers' output.
Gross operating surplus (GOS)	GOS represents the value of income generated by the entity's direct capital inputs, generally measured as the earnings before interest, tax, depreciation, and amortisation (EBITDA).
Indirect economic contribution	The indirect contribution is a measure of the demand for goods and services produced in other sectors as a result of demand generated by economic activity.
Input Output (IO) Tables	IO tables describe the sale and purchase relationships between producers and consumers within an economy. They can either show flows of final and intermediate goods and services defined according to industry outputs
Labour income	Labour income is a subcomponent of value add. It represents the value of output generated by the entity's direct labour inputs, as measured by the income to labour.
Total economic contribution	The total economic contribution to the economy is the sum of the direct and indirect economic contributions.
Value added	Value added measures the value of output (i.e. goods and services) generated by the entity's factors of production (i.e. labour and capital) as measured in the income to those factors of production. The sum of value added across all entities in the economy equals GDP. Given the relationship to GDP, the value added measure can be thought of as the increased contribution to welfare.

Source: Deloitte Access Economics

A.2. Definitional notes

When calculating the GOS for a typical for-profit firm or industry, income streams from government (such as transfers or production subsidies) are excluded as they are a transfer of public funds, not reflective of income generated by the activities of the firm or industry.

Similarly, value added is typically calculated as GOS plus labour income net of subsidies; under the ABS Australian System of National Accounts (ASNA) (ABS 2013):

> *A subsidy on a product is a subsidy payable per unit of a good or service. An enterprise may regard a subsidy as little different from sales proceeds. However, in the national accounts, subsidies are regarded as transfer payments from general government, enabling enterprises to sell their output for less than would otherwise be the case.*

A.3. Value added

The measures of economic activity provided by this contribution study are consistent with those provided by the Australian Bureau of Statistics. For example, value added is the contribution the sector makes to total factor income and gross domestic product (GDP).

There are a number of ways to measure GDP, including:

- **expenditure approach** – measures expenditure: of households, on investment, government and net exports; and
- **income approach** – measures the income in an economy by measuring the payments of wages and profits to workers and owners.

Below is a discussion measuring the value added by an industry using the income approach.

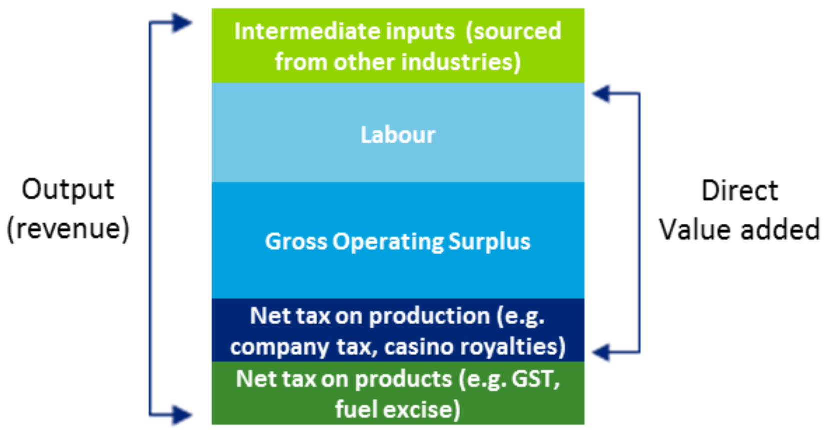
A.4. Measuring the economic contribution – income approach

There are several commonly used measures of economic activity, each of which describes a different aspect of an industry's economic contribution:

- **Value added** measures the value of output (i.e. goods and services) generated by the entity's factors of production (i.e. labour and capital) as measured in the income to those factors of production. The sum of value added across all entities in the economy equals gross domestic product. Given the relationship to GDP, the value added measure can be thought of as the increased contribution to welfare.
  Value added is the sum of:
  - Gross operating surplus (GOS) represents the value of income generated by the entity's capital inputs, generally measured as the earnings before interest, tax, depreciation and amortisation (EBITDA).
  - Tax on production less subsidy provided for production.
  - Labour income, which represents the value of output generated by the entity's direct labour inputs.

Figure A.1 shows the accounting framework used to evaluate economic activity, along with the components that make up output. Output is the sum of value added and the value of intermediate inputs used by the firm or industry. The value of intermediate inputs can also be calculated directly by summing up expenses related to non-primary factor inputs.

Figure A.1 Economic activity accounting framework



Source: Deloitte Access Economics.

Contribution studies generally outline employment generated by a sector. Employment is a fundamentally different measure of activity to those above. It measures the number of workers that are employed by the entity, rather than the value of the workers' output.

A.5. Direct and indirect contributions

The **direct** economic contribution is a representation of the flow of labour and capital to businesses in the CPP industry.

The **indirect** contribution is a measure of the demand for goods and services produced in other sectors as a result of demand generated by the direct economic activity of the CPP industry. Estimation of the indirect economic contribution is undertaken in an input-output (IO) framework using Australian Bureau of Statistics IO tables which report the inputs and outputs of specific sectors of the economy (ABS 2018).

The total economic contribution to the economy is the sum of the direct and indirect economic contributions.

Other measures, such as total revenue or total exports are useful measures of economic activity, but these measures alone cannot account for the contribution made to GDP. Such measures overstate the contribution to value added because they include activity by external firms supplying inputs. In addition, they do not discount the inputs supplied from outside Australia.

A.6. Limitations of economic contribution studies

While describing the geographic origin of production inputs may be a guide to a firm or industry's linkages with the local economy, it should be recognised that these are the type of normal industry linkages that characterise all economic activities.

Unless there is unused capacity in the economy (such as unemployed labour) there may not be a strong relationship between a firm's economic contribution as measured by value added (or other static aggregates) and the welfare or living standard of the community. The use of labour and capital by demand created from the industry comes at an opportunity cost as it may reduce the amount of resources available to spend on other economic activities. This is not to say that the economic contribution, including employment, is not important. As stated by the Productivity Commission in the context of Australia's gambling industries: (Productivity Commission 1999):

> *Value added trade and job creation arguments need to be considered in the context of the economy as a whole … income from trade uses real resources, which could have been employed to generate benefits elsewhere. These arguments do not mean that jobs, trade and activity are unimportant in an economy. To the contrary they are critical to people's well-being. However, any particular industry's contribution to these benefits is much smaller than might at first be thought, because substitute industries could produce similar, though not equal gains.*

In a fundamental sense, economic contribution studies are simply historical accounting exercises. No 'what-if', or counterfactual inferences – such as 'what would happen to living standards if the firm or industry disappeared?' – should be drawn from them.

The analysis – as discussed in the report – relies on a national IO table modelling framework and there are some limitations to this modelling framework. The analysis assumes that goods and services provided to the sector are produced by factors of production that are located completely within the state or region defined and that income flows do not leak to other states.

The IO framework and the derivation of the multipliers also assume that the relevant economic activity takes place within an unconstrained environment. That is, an increase in economic activity in one area of the economy does not increase prices and subsequently crowd out economic activity in another area of the economy. As a result, the modelled total and indirect contribution can be regarded as an upper-bound estimate of the contribution made by the supply of intermediate inputs.

Similarly the IO framework does not account for further flow-on benefits as captured in a more dynamic modelling environment like a Computerised General Equilibrium (CGE) model.

A.7. Input-output analysis

Input-output tables are required to account for the intermediate flows between sectors. These tables measure the direct economic activity of every sector in the economy at the national level. Importantly, these tables allow intermediate inputs to be further broken down by source. These detailed intermediate flows can be used to derive the total change in economic activity associated with a given direct change in activity for a given sector.

A widely used measure of the spill-over of activity from one sector to another is captured by the ratio of the total to direct change in economic activity. The resulting estimate is typically referred to as 'the multiplier'. A multiplier greater than one implies some indirect activity, with higher multipliers indicating relatively larger indirect and total activity flowing from a given level of direct activity.

The IO matrix used for Australia is derived from the ABS 2015-16 IO tables, the latest available IO data at the time of the analysis. The industry classification used for IO tables is based on the Australian and New Zealand Standard Industrial Classification (ANZSIC), with 114 sectors in the modelling framework.

Appendix B: CGE modelling

The Deloitte Access Economics regional general equilibrium model (DAE-RGEM) is a large scale, dynamic, multi-region, multi-commodity computable general equilibrium model of the world economy with bottom-up modelling of Australian regions. The model allows policy analysis in a single, robust, integrated economic framework. This model projects changes in macroeconomic aggregates such as GDP, employment, export volumes, investment and private consumption. At the sectoral level, detailed results such as output, exports, imports and employment are also produced.

The model is based upon a set of key underlying relationships between the various components of the model, each which represent a different group of agents in the economy. These relationships are solved simultaneously, and so there is no logical start or end point for describing how the model actually works. However, they can be viewed as a system of interconnected markets with appropriate specifications of demand, supply and the market clearing conditions that determine the equilibrium prices and quantity produced, consumed and traded.

DAE-RGEM is based on a substantial body of accepted microeconomic theory. Key assumptions underpinning the model are:

- The model contains a 'regional consumer' that receives all income from factor payments (labour, capital, land and natural resources), taxes and net foreign income from borrowing (lending).
- Income is allocated across household consumption, government consumption and savings so as to maximise a Cobb-Douglas (C-D) utility function.
- Household consumption for composite goods is determined by minimising expenditure via a CDE (Constant Differences of Elasticities) expenditure function. For most regions, households can source consumption goods only from domestic and imported sources. In the Australian regions, households can also source goods from interstate. In all cases, the choice of commodities by source is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption for composite goods, and goods from different sources (domestic, imported and interstate), is determined by maximising utility via a C-D utility function.
- All savings generated in each region are used to purchase bonds whose price movements reflect movements in the price of creating capital.
- Producers supply goods by combining aggregate intermediate inputs and primary factors in fixed proportions (the Leontief assumption). Composite intermediate inputs are also combined in fixed proportions, whereas individual primary factors are combined using a CES production function.
- Producers are cost minimisers, and in doing so, choose between domestic, imported and interstate intermediate inputs via a CRESH production function.
- The supply of labour is positively influenced by movements in the real wage rate governed by an elasticity of supply.
- Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. A global investor ranks countries as investment destinations based on two factors: global investment and rates of return in a given region compared with global rates of return. Once the aggregate investment has been determined for Australia, aggregate investment in each Australian sub-region is determined by an Australian investor based on: Australian investment and rates of return in a given sub-region compared with the national rate of return.

- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.
- Prices are determined via market-clearing conditions that require sectoral output (supply) to equal the amount sold (demand) to final users (households and government), intermediate users (firms and investors), foreigners (international exports), and other Australian regions (interstate exports).
- For internationally-traded goods (imports and exports), the Armington assumption is applied whereby the same goods produced in different countries are treated as imperfect substitutes. But, in relative terms, imported goods from different regions are treated as closer substitutes than domestically-produced goods and imported composites. Goods traded interstate within the Australian regions are assumed to be closer substitutes again.
- The model accounts for greenhouse gas emissions from fossil fuel combustion. Taxes can be applied to emissions, which are converted to good-specific sales taxes that impact on demand. Emission quotas can be set by region and these can be traded, at a value equal to the carbon tax avoided, where a region's emissions fall below or exceed their quota.

Below is a description of each component of the model and key linkages between components.

B.1. Households

Each region in the model has a so-called representative household that receives and spends all income. The representative household allocates income across three different expenditure areas: private household consumption; government consumption; and savings.

The representative household interacts with producers in two ways. First, in allocating expenditure across household and government consumption, this sustains demand for production. Second, the representative household owns and receives all income from factor payments (labour, capital, land and natural resources) as well as net taxes. Factors of production are used by producers as inputs into production along with intermediate inputs. The level of production, as well as supply of factors, determines the amount of income generated in each region.

The representative household's relationship with investors is through the supply of investable funds – savings. The relationship between the representative household and the international sector is twofold. First, importers compete with domestic producers in consumption markets. Second, other regions in the model can lend (borrow) money from each other.

- The representative household allocates income across three different expenditure areas – private household consumption; government consumption; and savings – to maximise a Cobb-Douglas utility function.
- Private household consumption on composite goods is determined by minimising a CDE (Constant Differences of Elasticities) expenditure function. Private household consumption on composite goods from different sources is determined is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption on composite goods, and composite goods from different sources, is determined by maximising a Cobb-Douglas utility function.
- All savings generated in each region is used to purchase bonds whose price movements reflect movements in the price of generating capital.

B.2. Producers

Apart from selling goods and services to households and government, producers sell products to each other (intermediate usage) and to investors. Intermediate usage is where one producer supplies inputs to another's production. For example, coal producers supply inputs to the electricity sector.

Capital is an input into production. Investors react to the conditions facing producers in a region to determine the amount of investment. Generally, increases in production are accompanied by increased investment. In addition, the production of machinery, construction of buildings and the like that forms the basis of a region's capital stock, is undertaken by producers. In other words, investment demand adds to household and government expenditure from the representative household, to determine the demand for goods and services in a region.

Producers interact with international markets in two main ways. First, they compete with producers in overseas regions for export markets, as well as in their own region. Second, they use inputs from overseas in their production.

- Sectoral output equals the amount demanded by consumers (households and government) and intermediate users (firms and investors) as well as exports.
- Intermediate inputs are assumed to be combined in fixed proportions at the composite level. As mentioned above, the exception to this is the electricity sector that is able to substitute different technologies (brown coal, black coal, oil, gas, hydropower and other renewables) using the 'technology bundle' approach developed by ABARE (1996).
- To minimise costs, producers substitute between domestic and imported intermediate inputs is governed by the Armington assumption as well as between primary factors of production (through a CES aggregator). Substitution between skilled and unskilled labour is also allowed (again via a CES function).
- The supply of labour is positively influenced by movements in the wage rate governed by an elasticity of supply is (assumed to be 0.2). This implies that changes influencing the demand for labour, positively or negatively, will impact both the level of employment and the wage rate. This is a typical labour market specification for a dynamic model such as DAE-RGEM. There are other labour market 'settings' that can be used. First, the labour market could take on long-run characteristics with aggregate employment being fixed and any changes to labour demand changes being absorbed through movements in the wage rate. Second, the labour market could take on short-run characteristics with fixed wages and flexible employment levels.

B.3. Investors

Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. The global investor ranks countries as investment destination based on two factors: current economic growth and rates of return in a given region compared with global rates of return.

Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.

B.4. International

Each of the components outlined above operate, simultaneously, in each region of the model. That is, for any input the model forecasts changes to trade and investment flows within, and between, regions subject to optimising behaviour by producers, consumers and investors. Of course, this implies some global conditions that must be met, such as global exports and global imports, are the same and that global debt repayment equals global debt receipts each year.

Appendix C: Economic contribution vs economic impact, benefits and limitations

There are a number of significant shortcomings associated with using an economic contribution analysis in the context of the feedlot industry as the sole way to develop an overall value proposition. These shortcomings can be addressed through CGE modelling.

Most important of these shortcomings is that economic contribution analysis considers the impact of feedlots narrowly, only capturing the economic contribution of the feedlot production in an accounting sense, rather than the contribution that feedlotting makes to the beef cattle industry more broadly.

Capturing the value of Australian feedlots though its purchases would be satisfactory where feedlotting is the dominant means of cattle production for the animal's life, as it tends to be in other areas like the United States. However in Australia this approach does not fully capture all of the value the industry generates.. Most importantly, it doesn't reflect a reality that pasture grazing of animals across some marginal and seasonally unreliable areas of Australia is only economically viable because there is the prospect of feedlotting to finish animals that otherwise may not meet market specifications.

This, along with the role of feedlots in ensuring overall beef industry productive stability and maintaining herd sizes even in bad times – needs to be an important part of a study such as this. These types of value – which are effectively raising productivity and acting as insurance for another industry – cannot be captured by IO modelling, but can be by economic impact (CGE) modelling.

That said, an economic contribution analysis is an important step in developing a sound understanding of the industry in its current form, as IO tables are a building block of the CGE modelling. Economic contribution studies of this nature outline the value-add generated through the normal operations of an entity such as a feedlot, or the entire feedlotting industry. Value-add is the measure of the contribution the entity makes to the local/regional, state and national economies because of what the entity directly buys and sells. In addition to value add, economic contribution studies also report the contribution to (regional) employment.

Economic impact analysis has a number of benefits:

- The CGE model allows for consideration the economic impact of the feedlot industry in a broader sense (i.e. including its impact on the non-feedlot (grazing) cattle industry).
- The CGE model considers global impacts and thus better captures the reality of the feedlot industry operating in a global market.
- Where the economic contribution model is static (and linear) and does not project the supply-side impact or any crowding out, the CGE model is a dynamic (and non-linear) economic model that incorporates these effects. The overall impact on the labour force is an important consideration for government, as increased employment in one sector may draw resources away from other parts of the economy.

Assumptions and limitations of the approach

Deloitte Access Economics' approach in estimating the economic contribution of feedlots is based on consultations with 'representative' case study feedlots. The process of case study selection and its limitations are discussed in Appendix D.

For the economic impact modelling, the definition of the feedlot sector in the CGE model was important in determining its impact. Public and consultation data sources enabled customisation of the model to support modelling of industry-specific model inputs and their broader economic impacts. In the database used in the modelling (GTAP 8), the beef industry was separated from all other 4-legged livestock production. Further, the industry was then split into grazing beef and feedlot beef production based on the value of production of these sectors.

Finally, consideration of the 2017 production season in this analysis has implications for the overall estimates (see section 2.2). Conditions for lot feeders can be generally described as very favourable in a historical context and when compared to 2012–13, the last period in which the economic contribution of the Australian feedlot sector was estimated. The improved operating environment in 2017 is a result of strong grain-fed cattle prices and low feed prices. This resulted in a significant increase in industry turnover and contributed to comparatively higher estimates of the industry's economic contribution and impact.

Appendix D: Industry consultations

Data used in the estimation of the economic contribution of the feedlot sector was collected through case study consultations between Deloitte Access Economics and Australian feedlots. The survey of feedlots was conducted informally, with discussions wide ranging but covering key issues including:

- Operations — target markets, utilisation
- Turnoff — capacity, finished weights, weight gains, prices received, throughput
- Inputs — feed mix, cattle, sources, distances travelled, prices, share of costs
- Industry — seasonal conditions impacts, interconnectedness with grazing and processing industries

Surveyed feedlots were selected based on capacity and location. Not all feedlots approached were available for input into the study. Family and privately owned feedlots were both surveyed, as well as medium and large feedlots spread across Western Australia, the Darling Downs and Riverina.

It is acknowledged that such an approach is an approximation only and does not fully capture the differences across the industry. While a sample across geographies intends to capture differences in climate and access to inputs, and a sample across different sized feedlots reflects the differences in economies of scale in production, the sample size was limited.

Indeed, individual operations may be affected by a number of specific factors, such as the operator's relationship with suppliers and markets, contract discounts or varying animal husbandry techniques. Such anomalies are difficult to isolate and therefore are likely to affect the overall contribution when extrapolated to an industry-wide estimate.

It is acknowledged that a more detailed survey or consultation process involving a greater proportion of feedlots would improve the robustness of the analysis and its results, but was not feasible as part of this study.

Limitation of our work

General use restriction

This report is prepared solely for the internal use of Meat & Livestock Australia. This report is not intended to and should not be used or relied upon by anyone else and we accept no duty of care to any other person or entity. The report has been prepared for the purpose of estimating the economic contribution and value of the feedlot industry in Australia. You should not refer to or use our name or the advice for any other purpose.