Australasian Agribusiness Perspectives
2023, Volume 26, Paper 9
ISSN: 2209-6612

Does the United States Cattle Cycle Still Influence the Australian Beef Market?

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Abstract

The United States cattle cycle has been evident for almost 150 years. Many studies have shown the strong influence this phenomenon has had on the global beef market including on the Australian beef industry. In recent times there have been some indications that the strength of this influence on the Australian beef industry has weakened; that is, activity in the beef industry in Australia is no longer as directly related to activity in the beef industry in the United States as in the past. In this paper the current state of the United States beef industry is examined with a focus on the cattle cycle. The same is done for the Australian beef industry, and then some comparisons are drawn between the two industries. The relationship has weakened in the last 10-15 years. Changes in macroeconomic conditions, climate and market competition, as well as food safety events, have had a role in this weakening relationship between the cattle cycle in the United States and in Australia in recent years.

***Keywords*:** Cattle cycle, value chain drivers, Australian beef industry

Introduction

The United States (US) cattle cycle has been evident for around 150 years. In an often-cited paper, Rosen et al. (1994, p.468) referred to the US cattle cycle as '… among the most periodic time series in economics'. Many influential economists have examined this phenomenon (for example, Breimyer, 1955; Rosen et al., 1994; Mundlak and Huang, 1996). The cattle cycle refers to a regular expansion and contraction process in the size of the national cattle herd, including both grown cattle and calves (USDA, 2022). These regular fluctuations in US beef numbers lead to fluctuations in quantities of beef produced, and consequently of prices, and have spill-over effects world-wide via variations in US traded quantities. Previous research has shown the impact of the US cattle cycle on the beef market globally (Rosen et al., 1994; Mundlak and Huang, 1996; Mathews, et al., 1999; Aadland and Bailey, 2001; Alford and Griffith, 2002).

As indicated by the dates on those papers cited above, most academic interest in the US cattle cycle was around 20-25 years ago. Government and industry market intelligence agencies (such as the US Department of Agriculture (USDA) in the US and the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) and Meat and Livestock Australia (MLA) in Australia) (for example, MLA, 2019; USDA, 2022) have kept track of the cycles, but only recently has academic interest been renewed (Petry, 2015; Fliessbach and Ihle, 2020; dos Santos, et al., 2022a,b). While much recent

[1] The authors thank Bill Malcolm for extensive comments on an earlier draft.

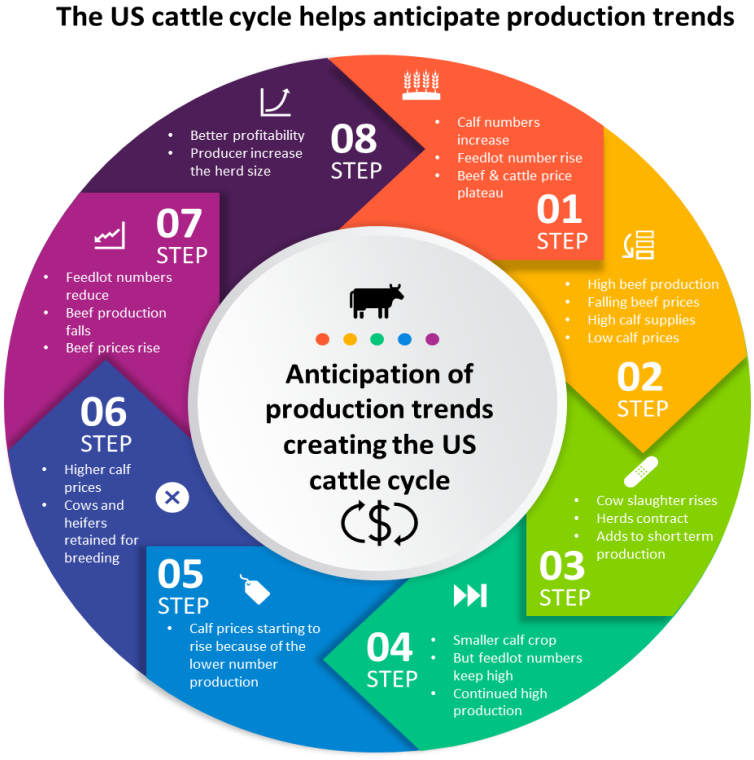
interest has come from the South American beef industries, there has been little formal analysis of these linkages done in Australia for at least 20 years. With major changes evident in the Australian beef industry over this recent period, and major disruptions to global price transmission via the COVID pandemic and trade policy disputes, it is timely that an updated analysis of the US cattle cycle and its impacts on the Australian beef industry is made.

The US Cattle Cycle

The cycles in the US cattle industry have evolved over time as a result of two key factors: the way that producers construct expectations about future prices and profits; and the time necessary for adjustments to occur owing to the biological restrictions of beef production systems (Alford and Griffith, 2002). These two key factors within individual beef production enterprises are tempered by: the changing nature of price relationships between cattle of different ages, weights, genders and location; the complicated linkages between the grainfed and grassfed sectors; the availability and cost of resources required by those sectors, including the effects of natural disasters; and disruptions in global demand influencing the price of beef in world markets.

In is illustrated the stylised decision-making process of US cattle producers, which results in a cyclical pattern of output. The Figure reflects the dynamic anticipation of producers about the future and the decision in the stage of the cycle where an action is profitable and where it is not.

Figure 1. The different stages in beef producer decision-making processes



Source: authors own, based on Alford and Griffith (2002)

First, the level of profit in the current period influences producers' expectations about the future and then affects the decision to increase or decrease cattle numbers. Cyclical patterns emerge due to myopic behaviour in the system. According to Eriksen and Kvaløy (2010), producers who act in accordance only with what they see now (their current view) are said to have myopic behaviour. They are solely concerned with immediate outcomes and give no thought to how a particular course

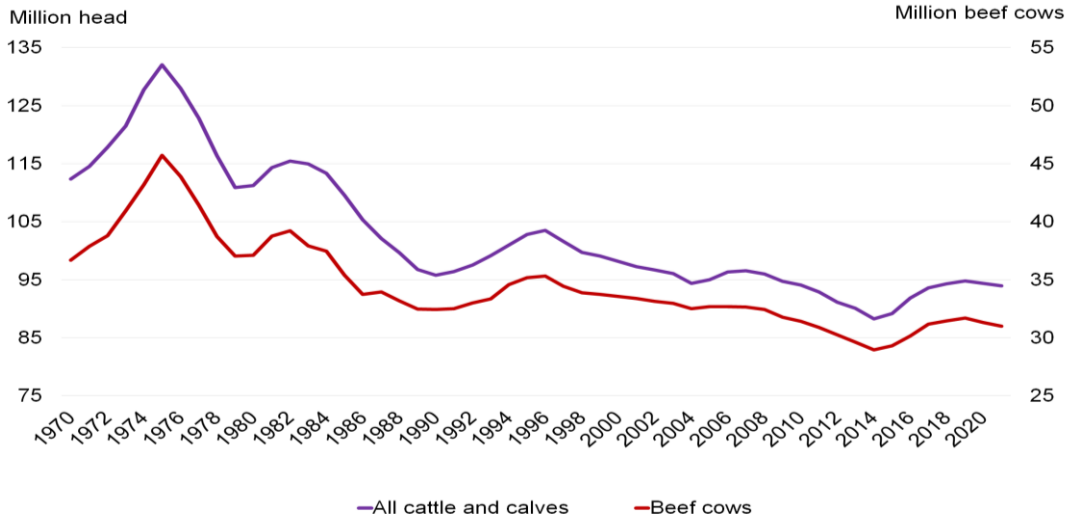
of action can influence them in the future. For example, producers decide whether to increase slaughterings to take advantage of current prices, or to withhold heifers from slaughter to expand their breeding herd capacity when cattle prices change, based on their assessments of current profitability. They disregard actions taken roughly ten years earlier during a comparable stage of the cycle and the consequences when the cycle changed. Cattle farmers could take 'countercyclical' action to stop this cyclical behaviour, if they kept in mind what happened in the past.

The cattle cycle has two major phases. First there is the expansion phase. This phase refers to the growth of herd size, typically associated with higher prices that encourage cattle producers to retain more heifers and limit the culling of mature and reproductively sound cattle (Fliessbach and Ihle, 2020). Second is the liquidation phase, where producers reduce cattle herd size. This contraction phase typically is in response to lower prices, spurring farmers to increase culling of cows and reduce retention of heifers (Prevatt and VanSickle, 2000; Alford and Griffith, 2002). These two phases, repeated over time, create the cyclical pattern of build-up and liquidation evident in data on total herd numbers.

Typically, many factors affect any one cattle cycle. These include cattle prices, the length of a cow's gestation, the amount of time needed to raise a calf to market weight, and climate conditions (Harvey et al., 2021; Troxel and Gadberry, 2013). Cattle cycles typically last 8 to 12 years, but drought and the supply and cost of feed sources influence how long they last (Rosen et al., 1994).

Decisions made about individual beef enterprises are aggregated across the industry and are then measured as a change in the size of the national cattle herd over time. In Figure 2 is illustrated the history of the US cattle cycle in terms of the national cattle herd over the last half-century. First, the pattern of change in cow numbers bears a close relationship to the pattern of change in total beef cattle numbers (r=0.99). Thus, beef producer decisions about the size of the breeding herd translate to the whole beef industry. Second, it is evident that there have been a number of cycles (of approximately 8-12 years as suggested above) in cow numbers and therefore in total beef numbers.

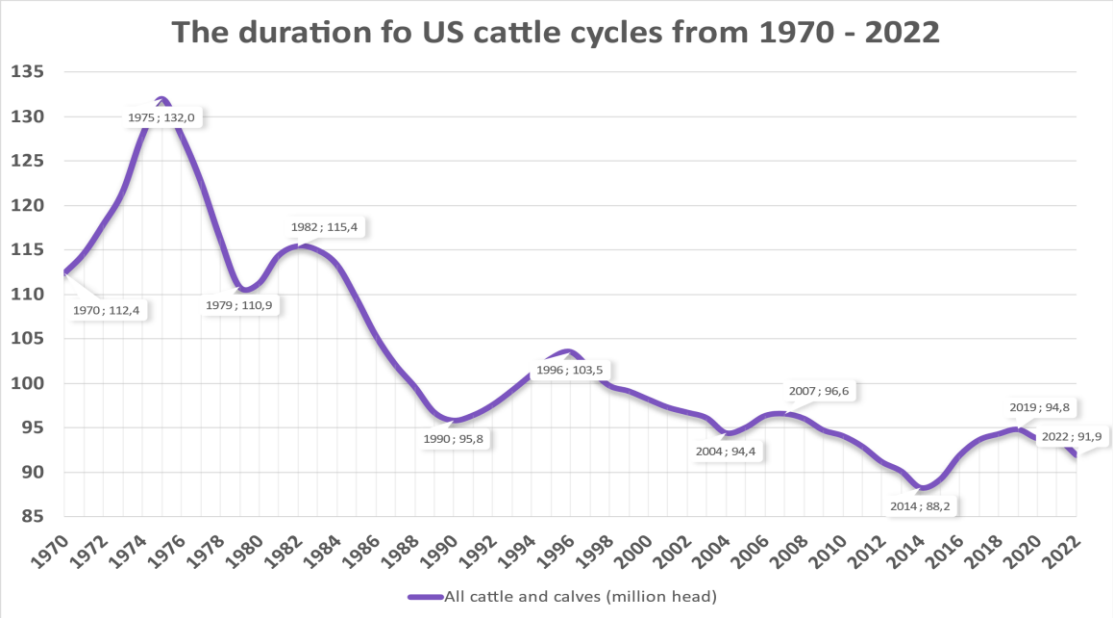
Figure 2. US cattle and cow inventories, 1970 to 2021



Source: Adapted *f*rom USDA (2022)

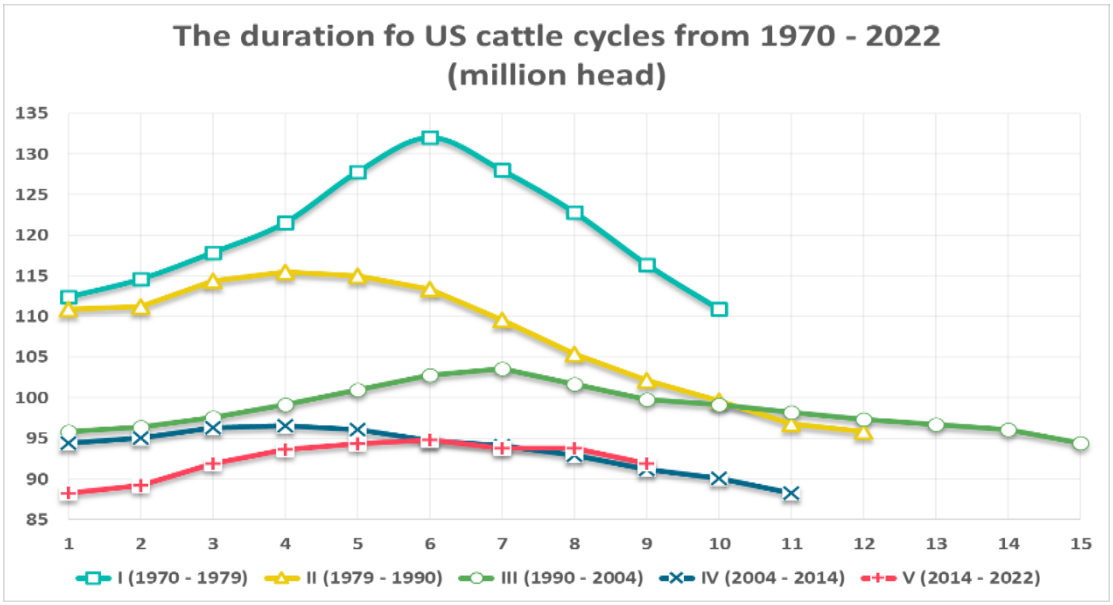
The key points in these cycles are highlighted in Figure 3: the cattle numbers at the turning points. Finally, the same information is presented in Figure 4, but here the individual cycles are separated out.

Figure 3. US cattle inventories, 1970 to 2022



Source: Adapted *f*rom USDA (2022)

Figure 4. The most recent durations of the US cattle cycle, 1970 to 2022



Source: Adapted *f*rom USDA (2022)

Several features are evident. First, the consistent decline in the size of the US beef industry is clear. Each identified peak and each identified trough is sequentially lower than the preceding peaks and troughs, respectively. The US beef cattle industry reached a maximum of 132 million head in 1975, and this declined to some 88 million head in 2014, with current numbers not that much above that figure.

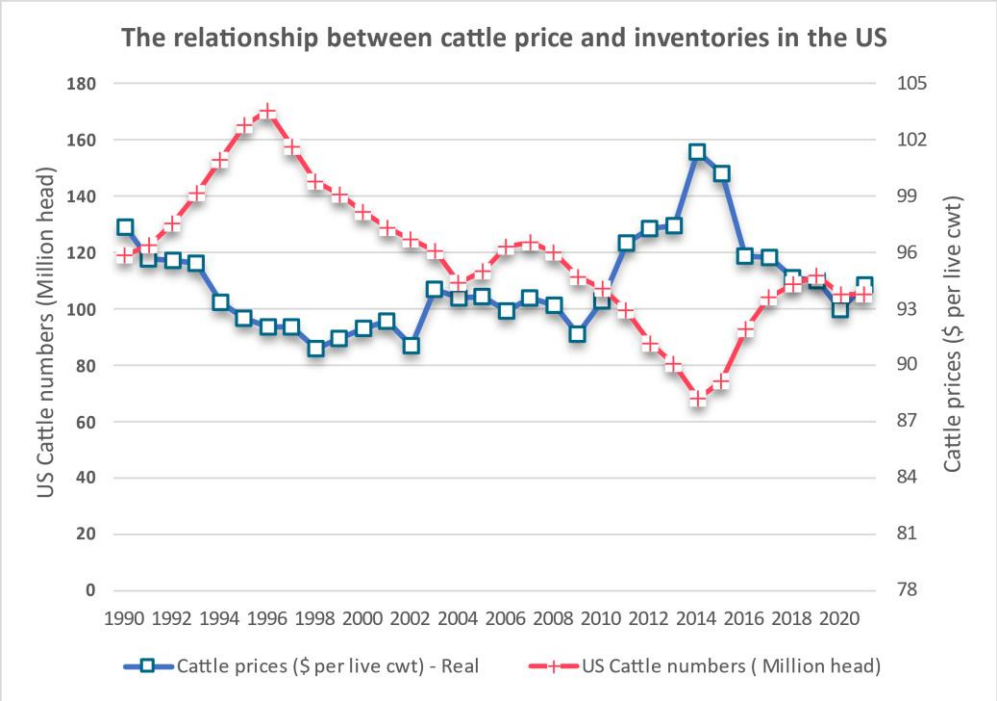
Second, the cycles have become of progressively lower amplitude. The peaks and troughs are not as far apart in terms of total numbers. One point made earlier was that farmers may be switching away from the myopic behaviour of the past. This means not expanding and contracting their cow herds in

the herd expansion and liquidation phases to the same extent as they traditionally had. This seems to have occurred in the most recent cycles, as seen in Figure 4.

Third, the cycles seem to be generally longer. Again, this may be a result of changes in behaviour around expectations; but it might also be an outcome of the generally more complex production and market environment, with a wider range of issues to consider when making decisions about expanding and contracting the herd.

As indicated in Figure 1, changes in prices and in inventory levels are the key motivators of the cattle cycle. In Figure 5 is depicted the strong inverse correlation between the US cattle inventory and US beef prices in the last three cycles (r=-0.72). Producers have the propensity to sell more stock when beef prices are high, but they hold onto stock when the prices are low (Gillespie et al., 2004). Alford and Griffith (2002) suggested that there is a lag in cattle slaughterings of up to two years after a turning point in prices. Biological factors constrain quick responses to price signals by the industry. These are primarily the cattle gestation period and the time required for rearing calves to market weight (USDA, 2022).

Figure 5. The relationship between the US cattle price and cattle inventories, 1990 to 2021



Source: USDA (2020a), updated. *Note*: The US prices are deflated using 2015/16 =100. Cattle prices, monthly average. Iowa/Minnesota choice steers, total all grades ($ per live cwt).

The changes in the size and duration of the US cattle cycle in recent decades lead to questions about why this has happened and whether there are consequences for global cattle and beef markets, particularly in Australia.

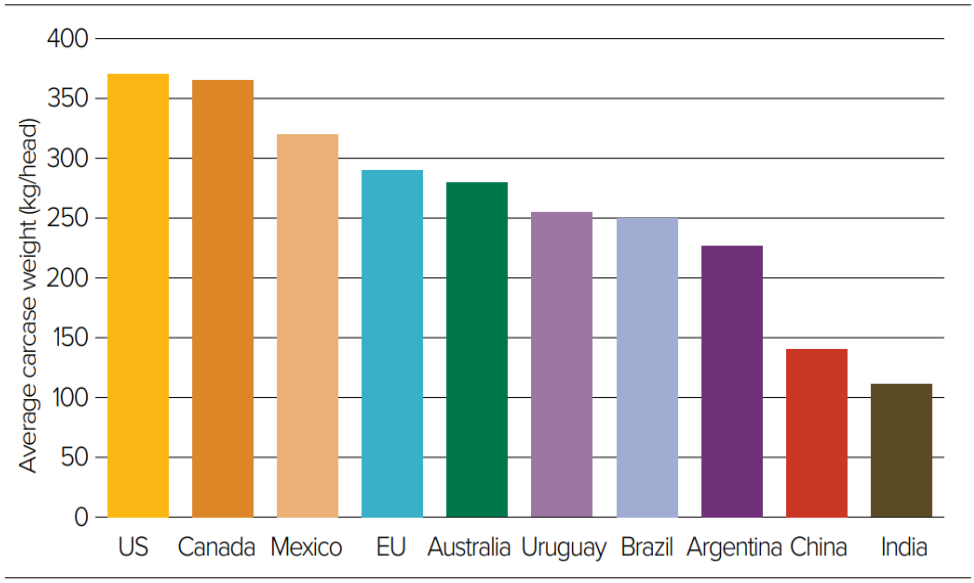
The US Beef Industry

The US is a major producer and exporter of beef. The US is the third largest agriculture producer in the world, with the gross value of agricultural production averaging A$458 billion over the five years through 2016 (CRS, 2018). Beef production contributed 15 per cent of this total number as the largest component (37 per cent) of the meat and animal products sector (CRS, 2018; USDA, 2021).

According to ABARES (2019a), the US is a price setter in some export products, including beef, because of its share in the world market and having a product which is sufficiently differentiated from those of competitors (Bratsiotis, 2008).

In 2019, the US slaughtered 34.3 million head of its 94.8 million head of cattle (USDA, 2020a). The US was the world's largest beef producer, with 12.3 million tonnes produced in 2019 (Greenwood, 2021). The US is also a major exporter and importer of beef, exporting some 1.36 million tonnes in 2019. The top destinations for American beef exports in 2019 were Japan, South Korea, Mexico, and Canada (USDA, 2020a). Further, the average carcass weight of US slaughter cattle is higher than in competing countries, such as Canada, Australia, and Brazil (MLA, 2020c) (Figure 6.). This magnifies the changes in output resulting from changes in numbers, in terms of tonnes of product.

Figure 6. Comparison of slaughter cattle carcase weights by nations



Source: USDA

Note. From MLA (2020c)

The US beef industry has many comparative advantages, including geographic diversity, economic scale, technology, human skills, and resource endowments (Dev Gupta, 2014). The natural endowments include a vast area of pasture, favourable climate patterns, and access to low-cost inputs such as corn, soybean, and fertiliser (Drouillard, 2018). Moreover, the US is the largest beef consuming country in the world, accounting for roughly 21 per cent of beef consumption worldwide in 2020 (USDA, 2020b). This indicates that the US beef industry operates at large scale, contributing to the nation's comparative advantage.

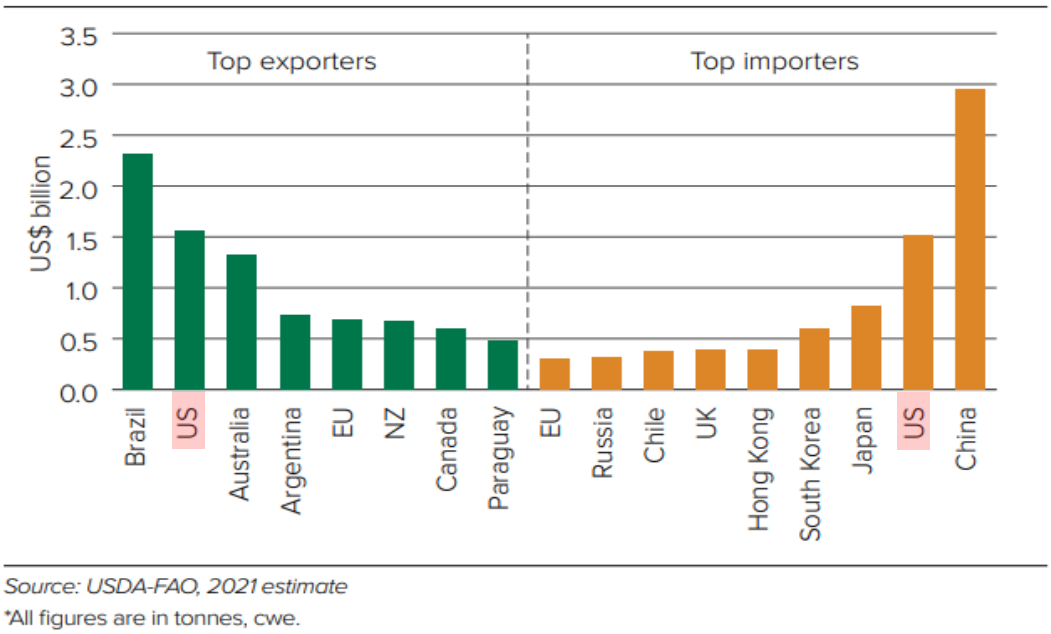
As mentioned, the US is also one of the largest exporters and one of the largest importers of beef in the world, with around US$1.5 billion in both export and import value in 2021 (MLA, 2021) (Figure). But imports are primarily low cost lean beef for blending with trim from domestic slaughter cattle to supply the hamburger market, while exports are primarily higher quality cuts for high value markets such as Japan, Korea, Canada and now China.

In *Source:* MLA (2021)

Figure Figure 8 is illustrated the size of the US beef industry compared to other countries. In this picture, the US has the largest beef production with a low export share. This illustration also shows

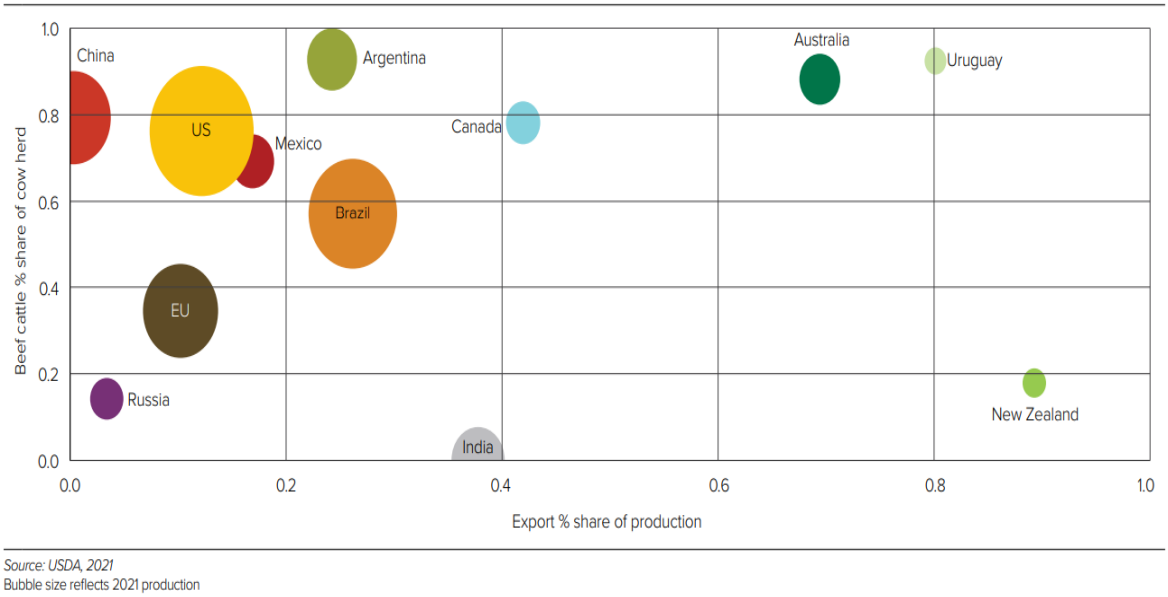
other countries, such as Australia, are relatively small producers but have high export shares. Since the US beef industry has such a significant role in the world beef market, cyclical changes in the US herd size will likely influence the beef market internationally.

Figure 7. Top beef exporter and importer countries worldwide, 2021



Source: MLA (2021)

Figure 8. The size of the beef industry in several nations around the world, 2021



Source: USDA (2021) and MLA (2021)

Several factors have been identified as influencing the US cattle cycle. One major influence is climate variability. The US beef industry is vulnerable to extreme weather changes, with the weather having a major effect on pasture, forage, and crop production (Cordeiro et al., 2022). Lack of feed is the main problem, the result of extreme weather conditions like drought and flooding (Fróna et al., 2019). For instance, droughts frequently prolong liquidation phases by limiting the amount of animal

feed (Mata-Padrino et al., 2017). During droughts, producers can either sell cattle to reduce the number of animals grazing or feed animals supplemental harvested forages, increasing operating costs (Mata-Padrino et al., 2017). Producers selling cattle often do so by selling younger cattle at lighter weights, thus lowering the prices they receive. Extreme weather may result in a reduced national herd and change the trajectory of the US cattle cycle.

Aside from the weather, other factors frequently impact the cattle cycle. Recent cycles have been altered by changes in industry structure and technological advancements. For instance, modern slaughterhouses support processing of larger, heavier animals, which extend time on feed. Further, cropping policy and other government programs affect the sector by offering incentives to use farmland for improved pasture or crops. According to Norton (2005), variations in the amount of harvested crop acres are negatively correlated to changes in cattle numbers. Additionally, inflation and changes in beef demand can boost incentives to move from expansion to liquidation or vice versa, while grain prices influence cattle production costs and feeding decisions (Mathews, 1999). Lastly, changes in import and export demand for beef and grain can substantially effect the cattle cycle by encouraging herd expansion or herd liquidation (Norton, 2005).

The Australian Beef Industry

The Australian beef industry's main single market is the domestic market, taking around 30-35 per cent of production in any year. The Australian beef industry has also diversified into a wide range of export markets, such as supplying premium meat to the Japanese market (Oro and Pritchard, 2011). Other major markets are South Korea and China (MLA, 2022), while Australia also competes with the US in many other third-country markets including Indonesia, Hong Kong, and Vietnam.

In 2019, Australia produced only 4 per cent of the world's beef but contributed 16 per cent of global trade. In that year, Australia exported 70 per cent of total national beef production (MLA, 2019a). Over seven decades, Australia has consistently ranked among the top three beef-exporting countries (MLA, 2019a) (Figure 7). This situation results in a reliance of the Australian beef industry on international market conditions, and previous research has shown a strong link between cattle prices in the US and in Australia. In particular, given the relative sizes of the two industries and their relative export shares, changes in the US beef industry have been recognised as critical factors influencing the Australian beef industry (Howden and Zammit, 2016).

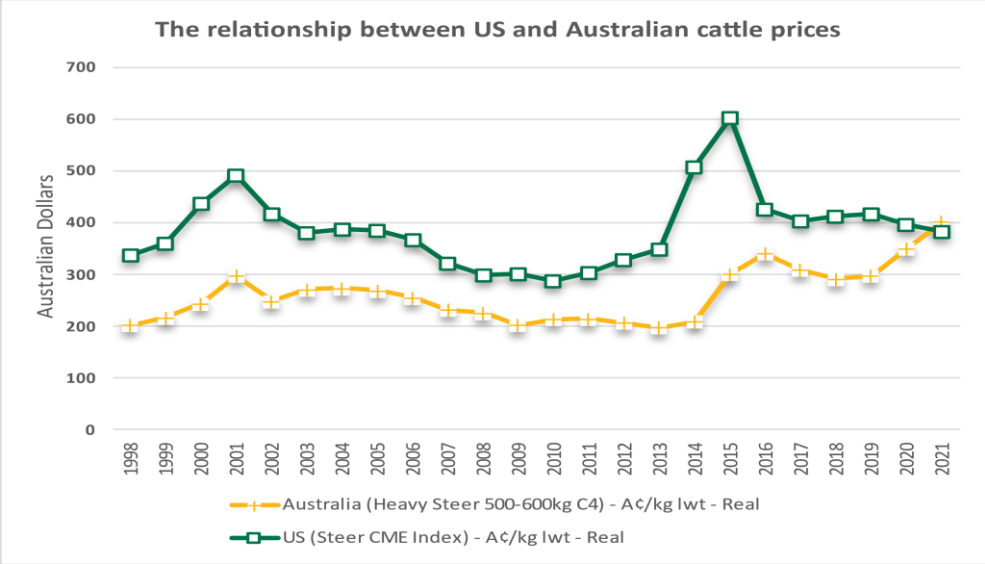
Alford and Griffith (2002) found that the cattle inventory in the US had an inverted relationship with the Australian beef prices. A higher number of slaughtered cattle in the US resulted in a lower beef price in Australia, and *vice versa*. Similarly, Bindon and Jones (2001) argued that the crash in international and Australian beef prices between 1995 and 1998 was caused by increased cow slaughter, reduced calf prices, and unprofitable feed lotting activities in the US.

Recently, the Australian beef industry has undergone major changes. Australian beef suppliers to export markets are no longer just price takers, supplying low-quality beef into commodity markets. Australia has gained ground in high-marbled products and high-value markets such as Japan and South Korea, which has caused an increase in the Australian average herd size over the last decades (Siriwardana, 2015). The value added to Australia's red meat and livestock sectors has climbed 89 per cent over the last decades, mostly as a result of increasing demand for high-quality protein in international markets (MLA, 2020c). Australia has expanded its market reach by also supplying high-quality meat products to the US, in addition to the traditional lean beef trade. This has involved greater reliance on feedlots to meet the higher quality specifications demanded, causing the production system to change.

Comparing US and Australian Beef Data

The relationship between US and Australian beef prices in the respective domestic markets is shown in Figure 9, with the US price converted to $AU.

Figure 9. The relationship between US and Australian cattle prices, 1998 to 2021



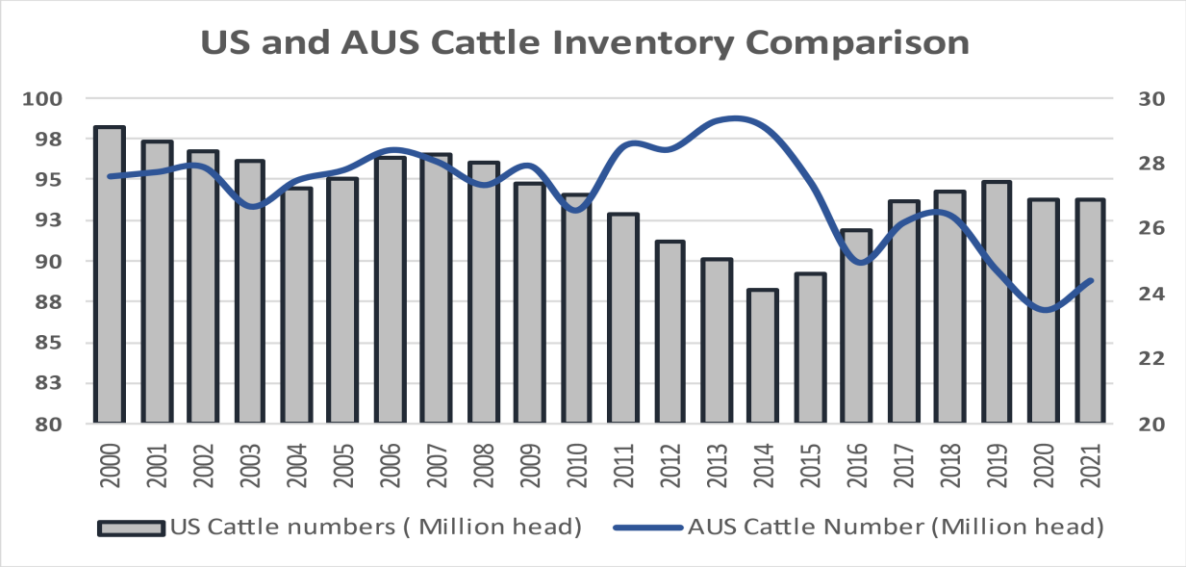
Source: MLA (2022). *Note*: Both series are real values.

Over the period from 1998 to 2021, Australian and US beef prices are moderately positively correlated (r=0.43). The two prices were very closely aligned up until the mid-2000s (r=0.71), but the relationship has changed since 2008 with prices moving in opposite directions more than half the time since 2008. The correlation between the prices is much lower in the second half of the data (r=0.37). If prices are not well aligned, it is unlikely that the cattle cycles will be aligned. This is shown in Figure 10, where the US and Australian cattle inventories are compared over the period 2000 to 2021. As the axes indicate, the US herd size is much larger than the Australian herd.

As with prices, the size of the cattle herds in the two countries has moved in opposite directions much of the time since the mid-2000s. In particular, 2014 was a trough in the US cattle cycle, the lowest numbers over the whole 21 years, whereas 2014 in Australia was a peak in the cycle. Australian cattle numbers have trended down since 2014, whereas US numbers have risen to close to the average levels of the early 2000s. The correlation coefficient for the period 2000 to 2010 is r=0.32, and for the period since 2010 it is r=-0.72. For the whole series it is r=-0.12.

A strong indicator of producer intentions is the ratio of slaughterings to total inventory. This ratio indicates whether producers are liquidating their herds (a ratio higher than the long-term annual average) or rebuilding their herds (a ratio lower than the long-term annual average). The long-term annual average ratio depends on the type of production system – in Australia it is around 33-34 per cent, while in the US it is higher at 35-36 per cent (Figure 11). In the US, breeding cows are typically replaced at a faster rate than in Australia.

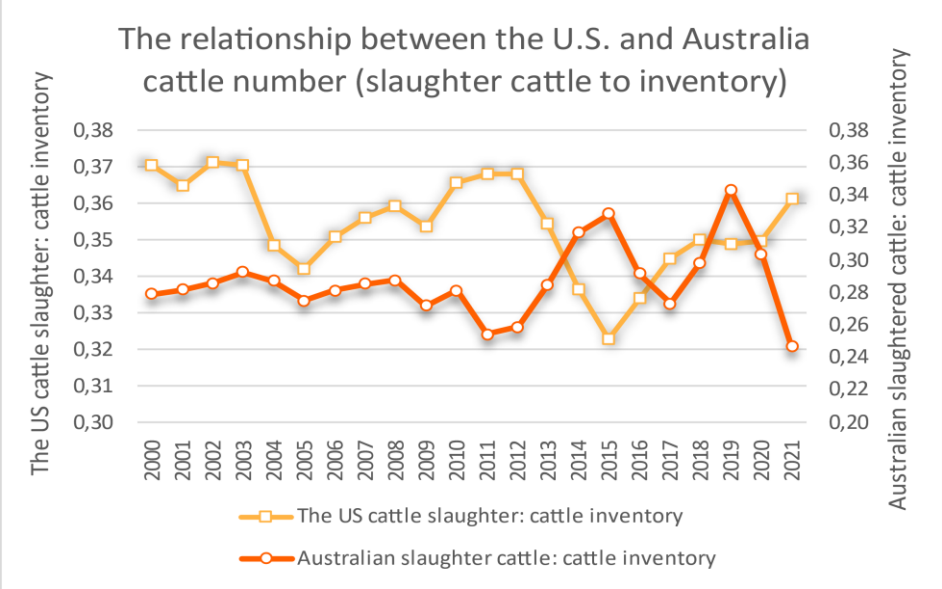
Figure 10. The relationship between US and Australian cattle inventories, 2000 to 20021



Source: From ERS USDA (2022) and MLA (2022)

In Figure 11 is shown a comparison between the slaughter rates of cattle in the US and Australia. The same pattern occurs as in prices and inventory levels: the series are more or less well-aligned up until around 2010 (r=0.43) and then they move in opposite directions (r=-0.63). The correlation value for the whole time period is -0.49. This means there is a relatively strong inverse relationship between both variables, and that the periods of opposite movement outweighs the periods of synchronous movement. If the slaughter-to-inventory ratios are not aligned then the cattle cycles in the two countries are not aligned.

Figure 11. The relationship between the US and Australian slaughter to inventory ratio, 2000 to 2021



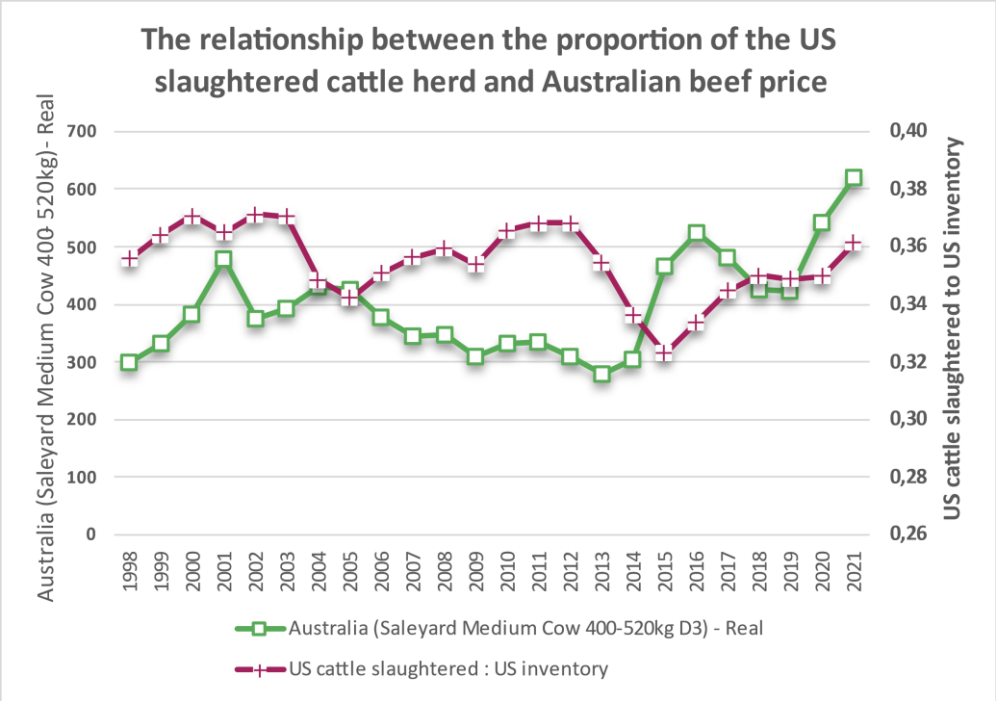
Source: USDA (2022) and MLA (2022)

Finally, the prices paid to Australian producers can be compared with the ratio of US slaughtered cattle to its cattle inventory (Figure 12). There is a weak inverse correlation over the whole period between high cattle slaughter rates in the US with lower beef prices received by Australian

producers (r=-0.35). An increasing percentage of slaughtered cattle indicates a decline in the breeding herd and a subsequent decrease in beef supply.

When Alford and Griffith (2002) wrote, a high proportion of cattle slaughtering occurred close to the time of price troughs, a period of industry pessimism. Since 2010, in three separate periods, prices and the slaughter rate moved in the same direction. The correlation coefficient is a little weaker in the second half of the data set (-0.27). This is further evidence that the US and Australian cattle cycles are no longer closely aligned.

Figure 12. The relationship between the proportion of the US slaughtered cattle and Australian beef price, 1998 to 2021



Source: USDA (2022), MLA (2022). *Note*: Australia prices are deflated using 2020/21 =100 Cattle prices, Saleyard Medium Cow 400 - 520kg.

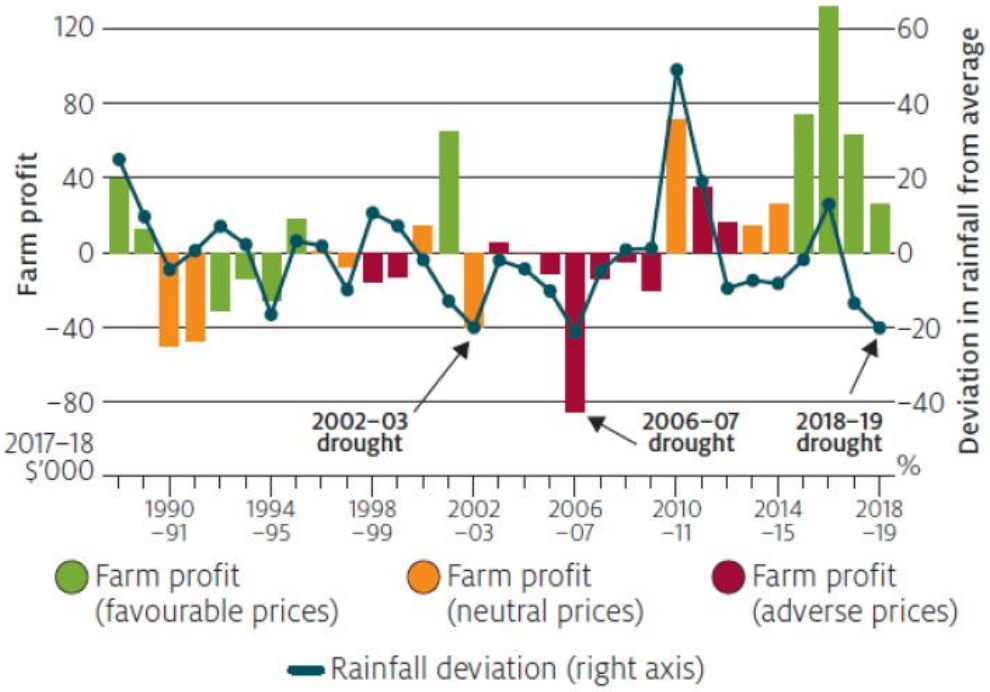
Reasons for this recent lack of alignment are to do with the external factors noted earlier. There are three key factors. Periods of adverse climate are a major cause, where slaughterings often have to be accelerated because of shortages of feed resources. Food safety scares have influenced policy settings and export demand. The third reason is the way the two countries interact in world markets. According to MLA (2017), there is a tendency for Australian beef to fill gaps in supply left by the US.

Information regarding climate change

Changing weather patterns and extreme weather events have significantly affected profits from producing beef in both Australia and the US (Moore and Ghahramani, 2013). In Australia, ABARES (2019b) research has shown the link between weather changes and commodity prices. In Figure 13 is illustrated this influence by showing the annual average agricultural revenue together with variations in rainfall and commodity prices from 1998 to 2019. The graph shows that farmers are most profitable in years of high rain, with favourable pricing in 2016, and least profitable in years of drought, with unfavourable pricing in 2006 and 2007, respectively.

The US has experienced similar issues with extreme weather in recent years, causing livestock production losses due to animal mortality and feeding reduction (Belasco et al., 2015). For instance, extreme heat waves resulted in roughly 5,000 animal deaths yearly in Midwestern states from 1995 to 1999 (Hahn et al., 2001). In 2010, a severe drought resulted in large economic losses for beef producers in the Southern High Plains (Zaied et al., 2021). In this case, calves were compelled to be placed earlier into feedlots, there was a considerable increase in culled animals, and many stock had to be relocated to areas where grass and hay were more easily available (Strom, 2013).

Figure 13. How the average annual broadacre agricultural profit was influenced by rainfall and commodity prices, 1998 to 2019

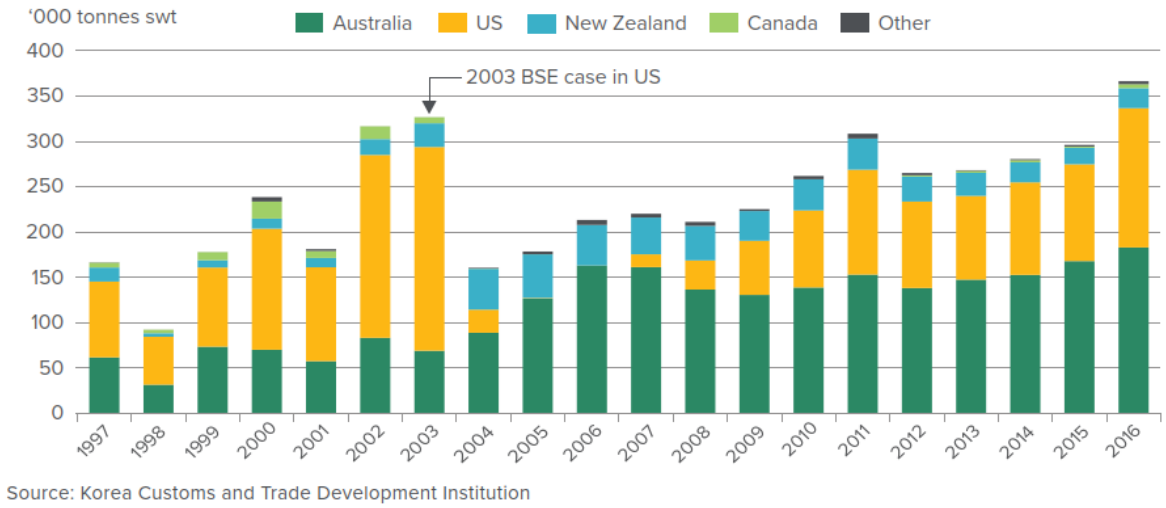


Source: From ABARES (2019b).

Information regarding food safety

Food safety affects consumer confidence and trade opportunities (MLA, 2017). Recent food safety issues in the beef industry include Bovine Spongiform Encephalopathy (BSE) in 2003. Issues around BSE in Europe and in North America directly aroused Korean beef consumer concerns (MLA, 2017). Korean beef consumption declined by around 9 per cent due to the BSE incident in North America. In addition, the outbreak of BSE caused a ban on US products in the South Korean market. The US was the largest beef supplier to Korea (market share of 69 per cent in early 2003), and the outbreak of BSE reduced the US market share significantly (Marsh et al., 2008). By late 2003, Australia had increased its market share in Korea from 29 to 77 per cent, and exports to Korea have stayed at around 150,000 tonnes per annum ever since, including when the US was allowed to re-enter the market (Figure 14) (MLA, 2017). The BSE outbreak in North America influenced both the US and Australian cattle inventories, but in opposite ways and over an extended time period (Marsh et al., 2008).

Figure 14. The Korean beef imports, 1997 to 2016

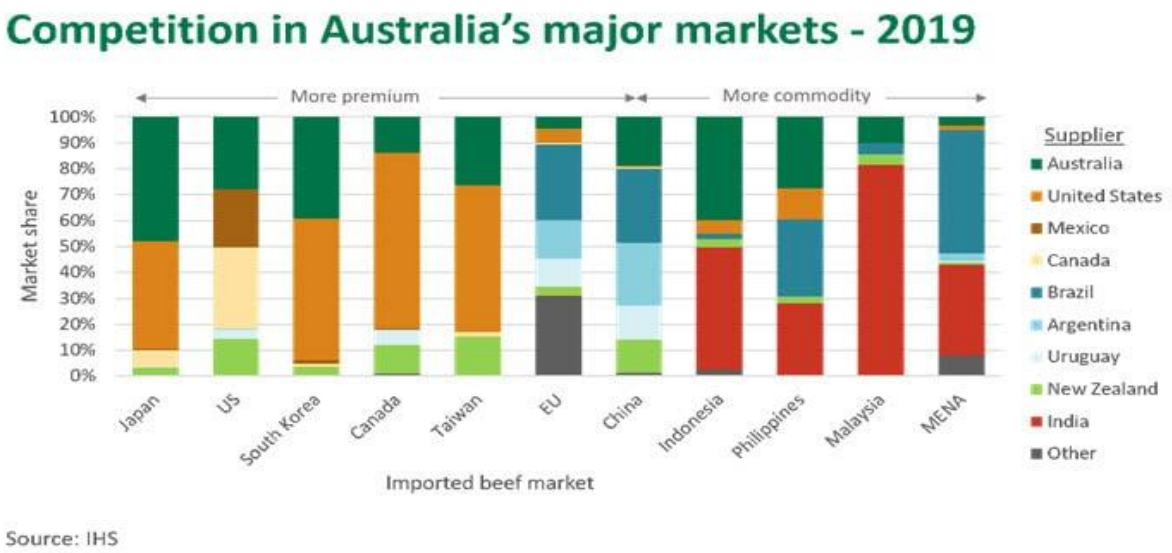


Source: MLA (2017)

Information regarding market competition

The third major factor which significantly influences the Australian beef industry is global market competition. Market competition relates to market access and price rivalry. Australia competes with other major cattle producers, such as Brazil, India and Argentina, as well as the US (Kidane, 2003). In Figure 15 is depicted the competition in the different major markets globally in 2019. Australia and the US compete mostly in more premium meat markets, such as Japan, Korea, Canada, and Taiwan. On the other hand, India and Brazil were the major Australian competitors in the commodity categories for the Asian market. As mentioned above, Australia also exports significant quantities of lean beef to the US.

Figure 15. Australia's global beef market competitors, 2019



Source: From MLA (2020c)

China has become a major market for Australian beef, contributing $1.85 billion ($883 million more than the previous year) to the Australian beef market in 2019, but Australia faces heavy competition

from many other suppliers. The influence of trade policy decisions has become evident in this market in recent years.

The dynamics of supply and demand in the global beef market and the intersection of exchange rates, domestic and trade policies in each country have a large influence on access and trade revenues and, therefore, ultimately the incentives or disincentives cattle farmers have to change the size of their herds.

Conclusion

Over the two decades to 2021, there is evidence over a number of indicators of a weakening in the economic relationships between the US and Australian beef industries. The strong positive linkages in cattle prices and cattle numbers evident in the past have softened and sometimes changed direction entirely. In some recent years, cattle numbers, cattle prices and slaughter ratios in the US and Australia have all moved in opposite directions.

Since around 2010, there is a relatively strong inverse relationship between cattle numbers in both countries (r=-0.72) and between the slaughter-to-inventory ratios in both countries (r=-0.63). The link between the US slaughter ratio and Australian beef prices has weakened (r=-0.27), and the relationship between beef prices in the two countries has similarly weakened (r=0.37). The two beef industries are not as closely aligned in recent years as they were in the past. Other than the traditional disruptions due to drought and other adverse weather events, food safety scares and changes in market competition are some of the influences that have disrupted the previously strong link between the cattle cycles of Australia and the US.

Opportunity exists for further research on this topic. Alternate analytical methods could be applied, and the coverage could be broadened, such as a comparative study of cattle cycles in other top five cattle producer countries, to review the nature of the price relationships and the implications for the global beef value chain.

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