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Market Power in the Australian Chicken Meat Industry

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ABSTRACT

The consumption of chicken meat continues to grow in Australia, with a consumption level of almost 50 kg/person in 2022, well above that of other meat species. With this growth in recent decades have emerged concerns about the potential dominance of the major chicken processors. There have been some structural changes in the production and processor segments of the value chain, but also new retail entrants have potentially maintained the competitive environment at the consumer end of the fresh meat market. The Australian Competition and Consumer Commission and other government agencies have conducted multiple investigations and legal proceedings related to competitiveness in Australian food markets, but there has been little published research into market power in the chicken market for more than a decade. In this study the New Empirical Industrial Organisational framework is applied to test for non-competitive behaviour in the chicken meat industry. Primary data from 1970 to 2017 is used. There is found to be consistent evidence of non-competitive behaviour in the purchase of the live chickens in the chicken meat value chain, but not in sales to final consumers. Future study should focus on more in-depth analysis of market power in different sectors of the value chain including the nature and consequences of the vertical integration arrangements in place in this industry.

Keywords: chicken market, market power, NEIO, vertical integration

Introduction

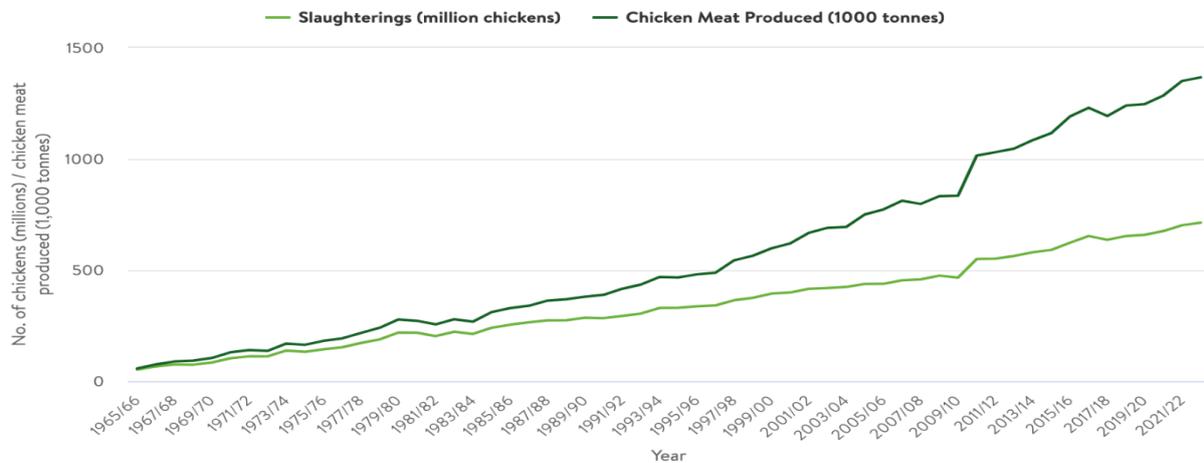
Of the diverse range of animal-based protein sources, the most consumed in Australia is chicken meat. It is purchased as either fresh or already cooked products in many different forms for consumption at home, restaurants, hotels, and other various food service outlets. However, the public's concerns about the degree of competition in the meat marketing chain remain (Chung & Griffith, 2009; Hilli and Griffith, 2022). The recent paper by Hilli and Griffith (2022) examined market power in the beef, sheep meat and pig meat markets; the objective of this current paper is to provide a complementary analysis of the chicken meat market.

Overview of the chicken meat industry in Australia

Compared to Australia's other major livestock industries, the chicken meat industry was a late starter, only reaching commercial quantities during the 1960s. However, its rapid emergence and recent growth have been remarkable. Today, chicken meat consumption is well in excess of the traditional meat products such as beef and lamb. Industry data reveals that Australia produced about three million chickens in 1950-51, while the production level surpassed 700 million in 2021-22 (ACMF,

2022a). With a heavy investment in improving carcase weight and rate of growth, the rate of increase in output has been even higher. Australia produced almost 1.4 million tonnes of chicken meat during 2021-22 (ACMF, 2022a) (Figure 1).

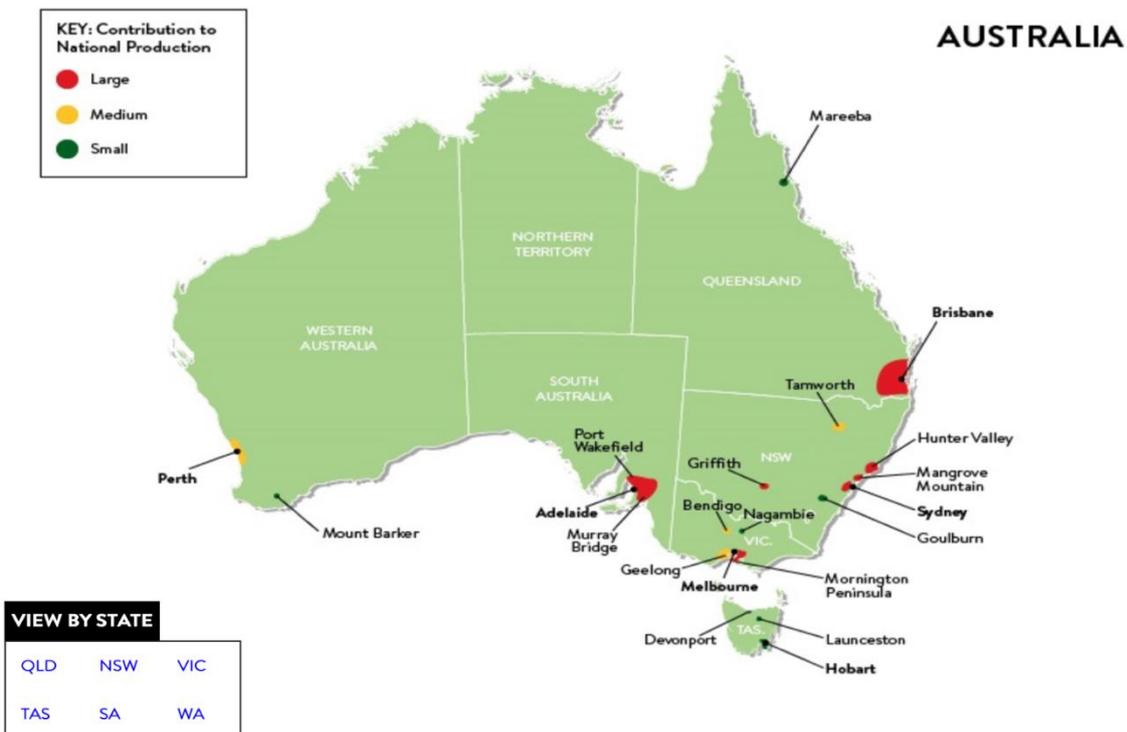
Figure 1. Chicken meat production in Australia, 1966-2022



Source: ABARES (2022)

The industry has dramatically improved production efficiency via declines in the feed conversion ratio (FCR). In the chicken meat industry, FCR has seen a steep downward trend, with the value falling from 2.5 kg feed/kg live weight produced in 1975 to 1.6 kg feed/kg live weight produced in 2020 (ACMF, 2020b). The introduction of improved breeds, better production facilities, access to better quality feed, vaccination, and better industry coordination have boosted the industry's production efficiency. The major production regions are shown in Figure 2.

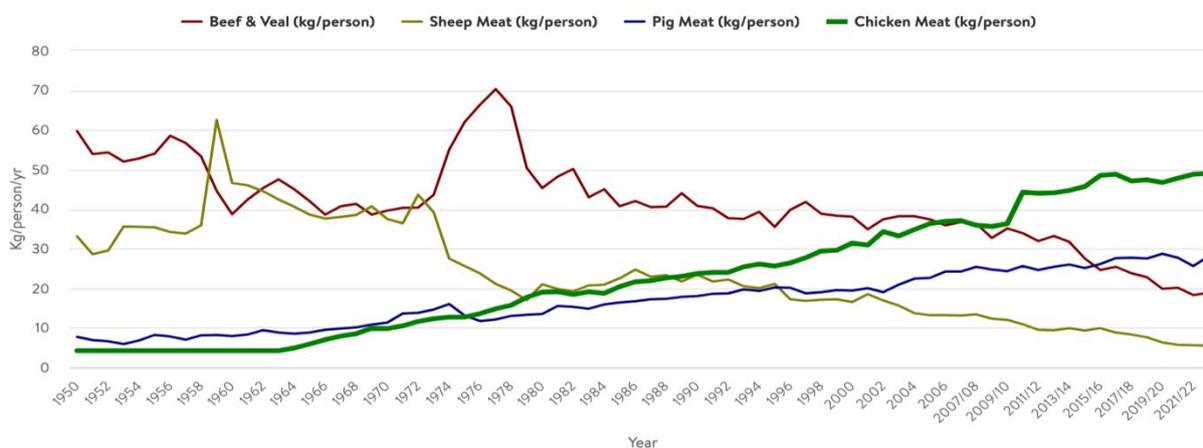
Figure 2. Chicken production regions



Source: ACMF (2020c)

The numerous factors attributed to the rapid emergence and growth of the chicken meat industry in Australia include the high and consistent quality of the product, price competitiveness driven by improvements in the production technology, and the increasing demand for 'fast food' meals through improved marketing structures and strategies (Gatfield, 2006; Nicholls et al., 2008; Mornement and Duver, 2020). In 1950, beef and lamb consumption exceeded chicken consumption by around fifteen times and eight times, respectively. However, after seven decades, in 2021-22, the consumption of chicken was more than double that of beef and around nine times that of lamb (Figure 3). In 1960, the average person in Australia was consuming about 4.44 kg of chicken meat per year (Ranieri, 2019). In 2022, the average person consumed close to 50 kg of chicken meat.

Figure 3. Per capita consumption of meat products in Australia, 1950-2022



Source: ABARES (2022)

The increasing trends in the production and consumption of chicken meat have led to a substantial rise in the gross value of poultry production. Over the past 20 years, the gross value of output from poultry farms has risen from \$1.2 billion in 2001-02 to \$3.1 billion in 2021-22 (ABARES, 2022).

Trade in chicken meat in Australia is small, with almost all domestic production consumed within the domestic market. Currently, Australia only allows the importation of processed chicken meat products, which include products such as canned chicken and pet food. Also, the export market accounted for only 0.48 tonnes of chicken meat in 2021-22 (ACMF, 2022b).

The Value Chain of the Australian Chicken Meat Industry

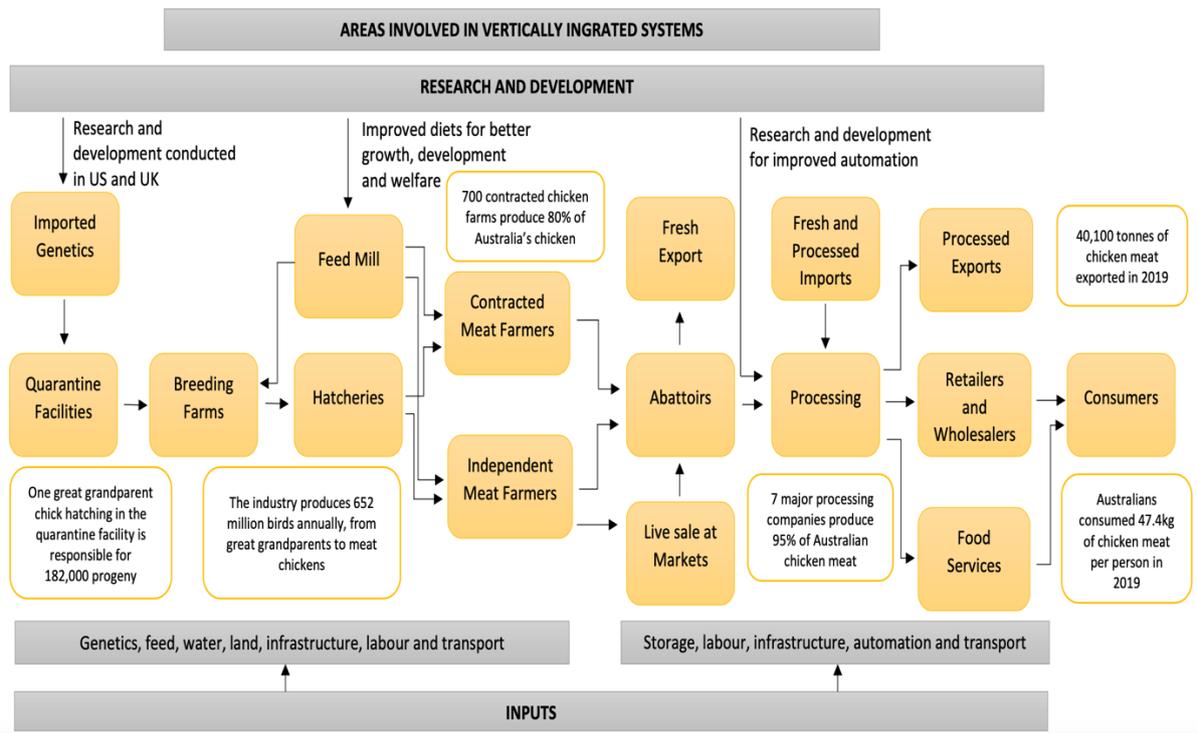
Australia's chicken meat industry is complex: it involves multiple channels linked with multiple value chain actors. Importers, breeders, growers, feed mills, processors, wholesalers, retailers, exporters, and consumers are involved in the value chain. In Figure 4 is shown the chicken meat industry's existing value chain in Australia (taken from McKenzie, 2020).

Vertical integration

Before the 1960s, chicken farms were mainly owned by backyard producers and family companies (ACMF, 2020b). Meat from these animals was often wasted, and inefficient production resulted in relatively high prices. Due to the lack of consumer access to chicken meat, it was only available from small markets and farms.

Eventually, large-scale farms started to produce chicken meat, which provided a consistent supply of high-quality meat in commercial quantities. During the 1960s, chicken meat companies started adopting a vertically integrated supply chain model from the United States (PoultryHub, 2020). This

Figure 4. Value chain of the Australian chicken meat industry



Source: McKenzie (2020)

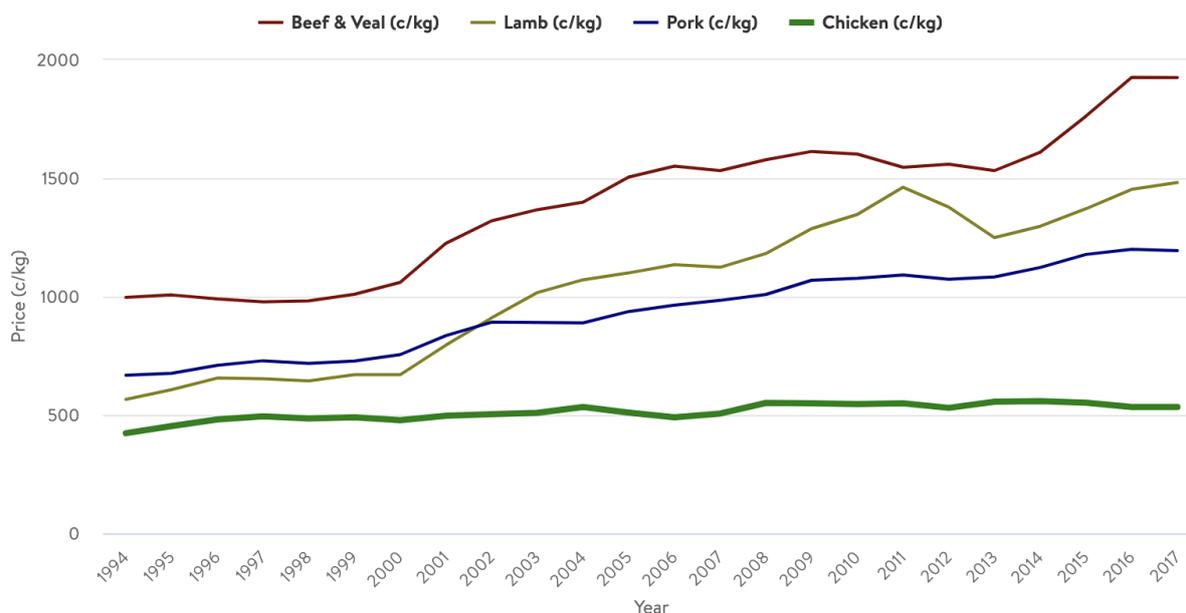
method allows them to control the various elements of the supply chain; it can include various facilities such as breeding farms, feed mills, and growing-out farms. It allowed companies to control the multiple elements of the supply chain and improve their efficiency.

Through vertical integration, companies can improve their efficiency by sharing information and coordinating the various elements of their supply chain. This method also allows them to improve operational efficiency and meet consumers' expectations (Hayenga et al., 2000). This method can also help minimize the risk of disputes between various parties, but if disputes do arise, vertical integration is considered the primary method of resolving minor conflicts (Williamson, 1971). As the industry developed, production contracting became more prevalent. Farmers could secure a steady income and manage their finances more efficiently through this method. Financial institutions were more likely to provide them with loans due to the increased confidence that their repayments would be made.

Now, the chicken meat industry in Australia is highly vertically integrated. Six chicken meat companies represent the Australian chicken meat industry: Baiada, Inghams, Cordina, Turosi, Hazeldenes, and Golden Cockerel. Baiada – privately owned – and Inghams – publicly owned – are the two largest companies and supply around 70 – 75 per cent of Australia's chicken meat. The remaining four companies are medium-sized and privately owned: each individually supply 3 – 9 per cent of Australia's chicken meat (ACMF, 2020c). These integrated companies operate and monitor all aspects of chicken meat production, from the breeding stage to the processing and marketing stage. In terms of live chicken production, some 700 contract chicken growers own and operate their own farms, accounting for 80 per cent of chicken production in Australia (ACMF, 2020c). The remaining 20 per cent of Australia's chicken output is produced on the farms owned by the integrated companies or by smaller independent growers (ACMF, 2020c).

Batch production is mainly used in chicken production facilities, which allows them to deliver consistent lines of birds and improve the quality of their meat. This process also helps reduce the time it takes to deliver meat to the consumers. Integration of the feed supply chain and automation of the processing plants has also helped in improving the efficiency of the chicken production process. It has allowed the companies to maintain low prices and compete with other meat products, as illustrated in Figure 5 and Table 1.

Figure 5. Retail prices of different meat industries in Australia from 1994-2017



Source: ACMF (2022b)

Table 1. The retail price ratio of chicken with respect to beef and lamb, c/kg, 1965-2020

Year	Price of chicken/Price of beef	Price of chicken/Price of lamb
1965	1.24	1.70
1975	1.06	1.39
1985	0.61	1.14
1995	0.45	0.75
2005	0.34	0.46
2015	0.31	0.40
2020	0.26	0.31

Source: MLA (2020)

Advances in retailing and food services

The rapid emergence and evolution of supermarkets in Australia during the 1960s provided the necessary vehicle to service the increasing demand for chicken meat (Insch, 2008). Major processors then formed supply arrangements with retailers to maintain their growth. In addition, the improved coordination and information sharing between the various agencies contributed to the industry's steady growth.

At the same time, the emergence of the food service sector during the 1960s allowed consumers to purchase pre-cooked chicken. It increased their consumption, primarily due to the rise of fast food.

Kentucky Fried Chicken, the first major chicken-based restaurant chain to establish a presence in Australia, had 75 stores within a decade (PoultryHub, 2020). Its popularity led to the establishment of other similar establishments.

Retail challenges and associated stakeholder concerns

The fresh meat industry is a significant contributor to the revenue of Australian supermarkets. According to Youl (2018), it accounts for around 13.8 per cent of its total revenue and is the primary channel for domestic sales.

The two major supermarket chains, Woolworths and Coles, control about 60-70 per cent of the broad grocery market (Delforce et al., 2005; ACCC, 2017). Grimmer (2018) notes that the conduct of the two major supermarkets has placed their suppliers in a disadvantageous position, according to the findings of ACCC's investigations (ACCC, 2007, 2017). In addition, Sutton-Brady et al. (2015) noted a significant power imbalance in the grocery industry. This imbalance can be beneficial for consumers as it allows them to lower their prices. However, it can also threaten the long-term sustainability of Australia's grocery industry. They have been accused of acting as a duopoly.

In addition to the structural changes in the retail environment, the product mix of the major supermarkets has also changed. As a result, they have increased their dependence on the development and production of their house brands. Woolworths and Coles have gradually increased their own-brand portfolio. In 2018, they had a total of 20 per cent of the market. They are expected to reach a target of 40 per cent by 2023 (Youl, 2018). Hattersley et al. (2013) noted that the rise of supermarkets in Australia had increased the demand for own-brand products. They also stated that these products are a crucial component of their strategy to compete with the traditional food suppliers.

However, since 2007, the dominance of the traditional supermarkets has been challenged by new entrants such as Aldi. From 2007 to 2017, the number of supermarkets owned by Aldi grew and their market share expanded from 9.9 per cent to 14.9 per cent (Youl, 2018). Some market analysts believe intense competition has led to lower retail prices (Thomson, 2019), which is beneficial for the consumer, but its effects on the broader value chain must be further analyzed (Sutton-Brady et al., 2015). ACCC (2007) highlighted the importance of conducting an in-depth analysis of the sector. It also noted that the country's retail climate could be conducive to the entry of another retail chain (see also Round, 2006).

However, despite the positive effects of this expansion on consumers, concerns remain about the dominance of the major supermarkets and their ability to influence their suppliers. It could result in them abusing their power and forcing suppliers to accept their terms (Richards et al., 2013; Freebairn 2018). Although it is acknowledged that the producers could negotiate, the environment in Australia, which has just a few large retailers, can make them feel that they have limited options. Davey and Richards (2013) noted that the power imbalance in the grocery industry had been highlighted by the role that supermarkets play in enforcing standards.

The rapid advancements in the chicken meat industry over the last five decades, in conjunction with the changes in retailing noted above, have led to concerns expressed about market competition in the value chain. Small operators are merging, large operators are scaling up their production level, and some are exiting. Chicken growers, in particular, are possibly facing lower bargaining power for their outputs where some processors may benefit from their monopsony position in the market. The Australian food industry has evolved from being driven by agricultural producers to retailers who pull their products from the suppliers to meet the needs of their customers (Griffith, 2004). All these

changes have been in the context of the almost total deregulation of agricultural product marketing caused by the implementation of National Competition Policy. Some argue that these changes have forced individual producers to make more marketing decisions against a small number of large buyers.

Previous Research

There have been few previous studies looking at competition in the chicken meat market. Hyde and Perloff (1998) analysed the competitive structure of the Australian meat market. They used a structural method to analyze the market's demand system, marginal cost function, and market power parameter. They found that the market power of the various meat products had not increased over time.

The Australian Parliament (1999) found that the country's major supermarkets have a competitive advantage over their rivals in the food retail industry.

Using a simple empirical model and a highly aggregated data set, Griffith (2000) estimated the market power of different food chains. He found that the null hypothesis about the competitive behaviour of the various food products could not be rejected for the meat product groups. Chung and Griffith (2009) explored market power in meat markets in Australia in particular, and again did not reveal any evidence of market power. However, more recently, Hilli and Griffith (2022) revealed that the fresh pork input market exhibited significant market power.

Insch (2008) discussed the various triggers and patterns that affect value creation in Australia's poultry meat supply chain, but there was no clear understanding of how these patterns and triggers can be transformed into a better performing supply chain.

The conventional methods for assessing market power have been based on the Structure-Conduct-Performance and New Empirical Industrial Organisation (NEIO) Frameworks (see also Digal and Ahmadi-Esfahani, 2002). Despite the merit in the various arguments presented in support of market power assessments, the complexity of modern food markets (for example, multiple products, multiple channels and the use of different selling systems such as contracts) makes it difficult to determine the true extent of market power.

According to McCorrison (2014), the NEIO framework cannot capture the multiproduct buyer power generated through retail relationships. It is identical to the limitations identified in industry texts (Perloff et al., 2007; Kaiser and Suzuki, 2017). Bonanno et al. (2018) reviewed the modern approaches to assessing market power. They noted that the changes in agricultural relationships, such as the establishment of non-traditional procurement schemes and vertical relationships, will require new market power assessments. Bonanno et al. (2018) replaced these with the research of Meral and Sexton (2017), which focused on the effects of monopsony on the overall market surplus and access.

However, despite these criticisms, the NEIO framework remains one of the most common and successful types of market power assessments, as supported by Ahn and Nagya (2016) and Umar Muzau et al. (2016). In this framework, market competition can be assessed by examining the patterns in the real marketing margin over time (Chung and Griffith, 2000).

In this paper the aim is to explore the competitive structure of the chicken meat industry in the Australian market. As mentioned above, it is a follow-up study to Griffith (2000) and Chung & Griffith (2009) and complements the recent update of the competitive structure of the beef, lamb and pork markets by Hilli and Griffith (2022). The data period covered is kept the same as the Hilli and Griffith (2022) study to enable direct comparison of the results.

Method

Application of the New Empirical Industrial Organization (NEIO) framework

The NEIO framework is a method of separating a marketing margin into the costs of inputs of various marketing services and any potential economic rent that comes from non-competitive behaviour in the markets (Chung & Griffith, 2009). Following O'Donnell (1999), in equation 1, the contributors to the marketing margin can be broken down into the following vital components (Chung and Griffith, 2009, p.222): "the marketing services cost, referring to the cost of transitioning the product from a raw commodity into a saleable retail product; any financial benefits from non-competitive behavior in the output market; and any financial benefits from non-competitive behavior in the input market." It is the same method as used in Griffith (2000), Chung and Griffith (2009) and Hilli and Griffith (2022).

The model is expressed as follows (from O'Donnell, 1999):

$$m_j = a_j + \sum_{k=1}^K c_{jk} Z_k + \beta_j q_j + \sum_{m=1}^M \gamma_{jm} X_m / W_m, \quad \dots \dots \dots (1)$$

Where for any product j;

m_j = industry marketing margin, $p_j - w_j$;

p_j = price of the food output j;

w_j = price of the agricultural input j;

a_j = constant term;

c_{jk} = coefficient of the price of non-agricultural inputs (marketing services) k, that contributes to food output j;

z_k = price of non-agricultural inputs k (and trend, seasonal and dummy variables where required);

q_j = quantity of the food output j;

β_j = output conjectural coefficient;

γ_{jm} = input conjectural coefficient;

x_m = quantity of agricultural input m.

All value variables are expressed in real terms. The real marketing margin measures the variations in the industry's profitability. The output (β_j) and input (γ_{jm}) conjectural coefficients describe a dominant firm's (or in this case the industry's) potential market power in output and input markets respectively. These two coefficients estimate the extent to which firms change their sales decisions about outputs and their purchase decisions about inputs and as their competitors' demand and supply change.

If market power is present, these output and input coefficients must be statistically significant and non-negative. Estimation restrictions may be necessary to prevent these two coefficients from being negative. If there is no market power, the industry marketing margin simply reflects the costs of providing the necessary market services, and any trend, seasonal and dummy variables if required.

Data requirements

For a meat product sold in the domestic market, as chicken is, the industry specific data required are its farm-level and retail prices, and the quantity demanded. The consumer price index for food is also an appropriate measure of the changing value of various goods and services over time.

Next are measures of the value chain's costs of providing the necessary market services. Labour, energy and capital are the three most important inputs, so wages, electricity charges, and interest rates incurred are the relevant measures. One approach is to treat these costs as different variables,

but this leads to multicollinearity. In Table 2 is shown the high correlations between these three cost variables. Hence, an aggregate cost index is developed to replace those individual cost variables. Zhao, Griffith, and Mullen (1998) suggested the ratios of the aggregate cost index where, for example, the labour cost accounts for 75 per cent of the cost incurred in the Australian food retailing and processing sector. This approach was followed by Griffith (2000), Chung and Griffith (2009) and Hilli and Griffith (2022). All subsequent estimations resulted in more significant t-statistics for the aggregate cost index, which led to the higher overall levels of explanation.

Table 2. Correlation matrix of the cost indices for marketing service of Australian chicken meat

	Wage Rate	Electricity	Interest Rate	Cost Index	Time
Wage Rate	1.00				
Electricity	0.935	1.00			
Interest Rate	-0.749	-0.646	1.00		
Cost Index	0.964	0.948	-0.563	1.00	
Time	0.988	0.932	-0.714	0.964	1.00

Following the recent study by Hilli and Griffith (2022), a number of dummy variables are added to reflect changes in the industry structure and policy environment that may have influenced behaviour. These variables take the value of zero starting from 1970 until the designated year, and then they take the value of one. Five potential dummy variables are proposed: DUM75, DUM90, DUM95, DUM07, and DUM11. For instance, DUM95 indicates the time after 1995 when the Commonwealth government introduced a new deregulation policy. For DUM95, its value is zero from 1970 to 1994 and then one from 1995 to 2017. Similarly, DUM75 reflects a policy intervention by Japan in the world beef market during 1974 and 1975; DUM90 reflects the opening up of the Australian pigmeat market to imports; DUM07 depicts the entrance of Aldi into the national supermarket sector; and DUM11 reflects changes in ownership in red meat processing firms.

As an alternative, a trend variable (TIME) is also tested, which aims to capture the various structural changes that have occurred in the retail and agricultural environments over the past few years that are not captured in the individual dummy variables. One of these is the gradual evolution of the multiple quality standards for meat products.

Results

Real marketing margin of Australian chicken meat

The real (MMCKR) and nominal (MMCK) margins over the study period from 1974 to 2017 for chicken meat in Australia are plotted in Figure 6. The nominal margins, which do not account for inflation, have a slight increasing trend over the whole data period, suggesting a rise in the price of chicken meat relative to the price of chickens. However, there is considerable variability, with two periods of consistent upward trend, and a period of significant decline in the early 1990s. In contrast, the real margins have an overall downward trend, especially between 1974 and 1994, with a very slight downward trend in the second half of the data series. With the base of the CPI used being 1990, the real margin before 1990 is higher than the nominal margin, and the reverse is the case after 1990.

The summary statistics for the real and nominal marketing margin of the Australian chicken meat industry from 1974 to 2017 are shown in Table 3. The average real market margin for Australian chicken meat is 109.49c/kg, with the values ranging from 44.60c/kg to 232.06c/kg, while the average nominal market margin is 97.63c/kg, with the values ranging from 57.55c/kg to 147.08c/kg. Given

Figure 6. Nominal and real chicken meat marketing margins, 1974 to 2017

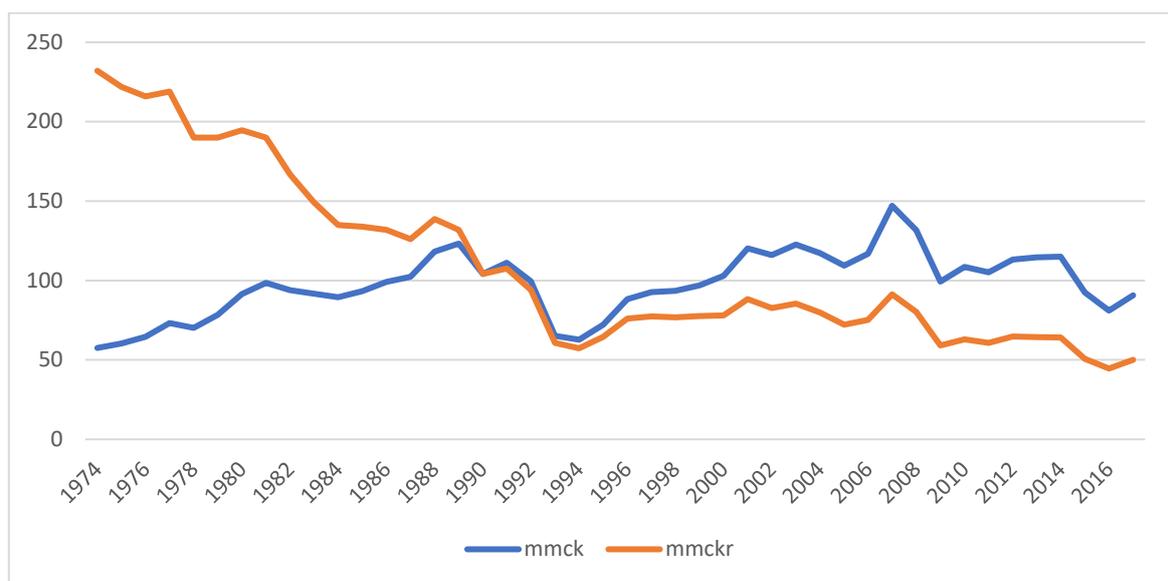


Table 3. Summary of nominal and real marketing margins for Australian chicken meat, 1974 to 2017

Chicken market margin	Mean (c/kg)	SD (c/kg)	Minimum (c/kg)	Maximum (c/kg)	Coefficient of variation (CV)
Nominal margin	97.63	20.28	57.55	147.08	0.21
Real margin	109.49	54.82	44.60	232.06	0.50

that deflating tends to exacerbate variability in economic time series, the coefficient of variation, a measure of relative variability, is twice as large for the real series compared to the nominal series.

Examining the plots of data series like these also suggests some points for analysis. Although not done here, for consistency with the comparable previous studies, 1994 seems like a likely turning point in industry behaviour and may warrant a segmentation of the data set at this point.

Unit root tests

Even though real prices and costs are used, and the graphs do not suggest strong trends, it is necessary to test for stationarity before proceeding further. Most econometric estimation techniques assume that the time series being examined are stationary, that is “the mean and variance are constant over time and the covariance between two values from the series depends only on the length of time separating the two values and not on the actual time at which the variables are observed” (Hill et al., 2001, p.335). If the series are non-stationary, spurious regressions may result, where significant relationships are found when there are none. High R² values together with low Durbin-Watson statistics are common indicators of non-stationarity.

The stationarity of a time series can be tested by using a unit root test. Here we use the augmented Dickey-Fuller test which allows the addition of constant and trend variables, and where appropriate, other exogenous variables such as dummy variables (Hall and Cummins, 2003, pp.42-48). For the various series to be considered as stationary, the Dickey-Fuller tau statistic should be significantly different from zero. The results of applying these tests are shown in Table 4.

Table 4. Unit root tests, 1974-2017

Variable	Tau statistic	P value	Optimal lag length
MMCKR	-4.739	0.0006	3
DMCK	-4.969	0.0002	3
DMCKI	-4.833	0.0004	3
COSTIND	-5.565	0.0000	3

Given these unit root test results, the null hypothesis of non-stationarity is rejected, and the analysis can proceed with the variables as defined without the need for further transformation, such as first differencing.

NEIO model output

The model was estimated using a number of different techniques: simple linear equations (OLSQ), nonlinear equations (NL LSQ), with and without autocorrelation correction (AUTO), with and without constraints on the signs of the market power variables, and with and without the addition of one or more of the dummy or trend variables described above. The key results from estimating the model are reported in Table 5. The value of R-squared (R^2) and Durbin Watson (DW) statistics are reported for each equation, and the estimated t-statistic for each variable is given. At the 5 per cent significance level, the variable will be significant if its t-statistic is greater than 2.03 (applying a two-tailed test; for $n=44$).

Table 5. Regression estimates of real chicken marketing margin equations, 1974-2017

CONSTANT	COSTIND	DMCK	DMCKI	TIME	RHO	R^2	DW	Method
133.85 (5.20)	0.740 (4.70)	-0.094 (-2.27)	19.39 (5.46)	-5.089 (-4.15)		0.97	0.95	OLSQ
128.26 (5.19)	0.736 (4.75)	-0.126 (-2.16)	16.69 (4.40)	-3.630 (-2.70)	0.632 (3.87)	0.98	1.66	OLSQ/AUTO
109.91 (3.98)	0.923 (4.85)	-0.128 (-2.39)	17.80 (4.59)	-3.753 (-3.01)	0.508 (3.74)	0.97	1.55	NL LSQ/AUTO
126.51 (4.35)	0.734 (3.80)	0.0 (0.0)	12.31 (3.53)	-5.627 (-5.53)	0.554 (4.08)	0.97	1.68	NL LSQ/AUTO
107.17 (3.13)	0.669 (2.48)	-0.005 (-0.07)	0.0 (0.0)	-2.433 (-1.43)	0.785 (7.06)	0.96	1.73	NL LSQ/AUTO

Note: All t-statistics are tested at the 5% level of significance. Values in brackets are t-statistics.

In all cases, the dummy variables were not significant, individually, as a group, or together with the TIME variable. The dummy variables were excluded from all reported equations.

The first two models report OLS results, without and then with an autocorrelation correction respectively. The size and significance of the estimated autocorrelation RHO coefficient and the change in the DW value from a number less than 1 to a number closer to 2 indicates that the autocorrelation correction was necessary. This was the case for all estimated models, so only the autocorrelation-corrected versions are reported in the remainder of Table 5. The third model is the same as the second except it is estimated using a more general nonlinear least squares approach, while the remaining models contain different combinations of constraints on the market power coefficients, recalling from equation 1 that if market power is present, the coefficients on the DMCK and/or DMCKI variables must be statistically significant and non-negative.

In the non-constrained second and third models, the cost variable is positive and significant and the time trend is negative and significant. The DMDK variable is significant but negative; however, the DMCKI variable is highly significant and positive. This may indicate some degree of market power in input markets, but this cannot be confirmed until the constrained models are estimated.

The fourth and fifth models are constrained so that the coefficients on the two market power variables individually must be non-negative for the presence of market power. In the fourth model, a corner solution is found for the sign on the coefficient of the DMCK variable - a coefficient value of zero. Previous estimates had been negative, and when the constraint was imposed, the coefficient found the smallest possible non-negative value, zero. Further, when the DMCKI variable alone is constrained in the fifth model, the coefficient on the DMCK variable remains negative. This is strong evidence that there is no market power in the output market of the Australian chicken meat industry. The result from this model is identical to the previous findings by Griffith (2000) in the food marketing chain and Chung and Griffith (2009) in the Australian fresh meat industries using a similar type of model.

However, the coefficient on DMCKI variable remains highly significant and positive, except for the case where the coefficient on that variable is constrained. This does indicate some degree of market power in input markets, and in the present situation that means in the 'purchase' of live broilers from growers.

Discussion

This study shows that there is market power on the input side of Australian chicken meat industry but not on the output side. The concern of chicken growers about lower bargaining power for their products appears justified. As there is a minimum amount of chicken export, they rely heavily on the economies of scale within the domestic market. With the transition in the industry and some processors exiting the market, the existing processors have strengthened their monopsony position. This has impacted the farm gate price of growers and the sustainability of their business.

One of the main factors that constrains output non-competitive behaviour in the chicken meat industry is the presence of independent butcher shops. In Australia, independent shops account for over one-third of the total meat sales (ACCC, 2007), which means that they still have a considerable influence over the market. Despite the high concentration of supermarkets and butcher shops, the competition in the retail meat market is still intense.

Further, within the major supermarket chains – Coles, Woolworths, Aldi and the IGA group – there is intense competition between them for market share and they all have adopted strategic marketing decisions to keep the prices of their products attractive to customers. If one of these chains raises the retail prices of their meat products above their rivals, then the market share of that chain will immediately decrease. The oligopolistic structure of the major supermarkets has led to the lower prices that consumers can expect from the retail meat market. This is also evidenced by the increasing number of one-stop shopping locations and deregulated trading hours (Griffith, 2000).

The NEIO model used here has some major drawbacks, such as being unable to point out the origin of market power and being unable to identify market power in different sectors of the value chain. Russo and Goodhue (2018) proposed a solution to the inadequacies in the market power models of the NEIO framework. Their objective was to analyse the effects of the volatility in farm-gate prices and the supermarket pricing campaigns on the development of market power. In Australia, farm-gate prices have experienced significant volatility over the past few years. It has affected the domestic market and supermarkets, some of the most vulnerable groups to market volatility. Future research could

also consider the effects of both the pricing campaigns and market volatility on the suppliers of the relevant industries.

Conclusion

The objective of this study was to analyse the competitive behaviour in Australia's chicken meat industry. The null hypothesis of the absence of imperfect competition in output markets for chicken meat were not rejected. Despite the several factors that have been identified as contributing to non-competitive behaviour in the food marketing chain, the empirical results were still consistent with the previous studies by Chung and Griffith (2009) and Griffith (2000). However, the study also showed that there is market power on the input side of Australian chicken meat industry. The concern of chicken growers about lower bargaining power for their products appears justified.

The model used aggregate data from ABARES and ABS at the national level over the period 1970 to 2017; so the data reflect the average market behaviour. The lack of reliable and timely data on the product-level performance of the chicken meat industry is a significant limitation of the study. This issue is also caused by the lack of data on farm-gate prices. Other factors such as the assumptions underlying the specific model used in the study also affected the results.

So, for finer analysis it is necessary to be able to access primary data from the various value chain actors. Furthermore, future researchers might also consider the effects of the pricing campaigns and market volatility on the supply chain of supermarkets for evidence of market power in the chicken meat industry.

References

Ahn, B.II, and Nayga, R.M. (2016), 'Market power of domestic marketers and its influence on the consequences of the Korea–US and Korea–Australia FTAs on the beef market', *Global Economic Review*, 45(2), 170–188. <https://doi.org/10.1080/1226508X.2016.1152561>

Australian Bureau of Agricultural and Resource Economics (2022), *Agricultural Commodity Statistics*. Retrieved from <http://www.agriculture.gov.au/abares/research-topics/agricultural-commodities/agricultural-commodities-trade-data#2018>

Australian Chicken Meat Federation (2020a), Chicken meat production. Retrieved from <https://www.chicken.org.au/chicken-meat-production/>.

Australian Chicken Meat Federation (2020b), Facts and figures. Retrieved from <https://www.chicken.org.au/facts-and-figures/>.

Australian Chicken Meat Federation (2020c), Structure of the Industry. Retrieved from <https://www.chicken.org.au/structure-of-the-industry/>.

Australian Competition and Consumer Commission (2007), *Examination of the Prices Paid to Farmers for Livestock and the Prices Paid by Australian Consumers for Red Meat*. ACCC, Canberra.

Australian Competition and Consumer Commission (2017), *Cattle and Beef Market Study – Final Report*. Retrieved from <https://www.accc.gov.au/focus-areas/market-studies/cattle-and-beef-market-study>

- Australian Parliament (1999), *Report of the Joint Select Committee on the Retailing Sector*. Senate, Canberra.
- Bonanno, A., Russo, C. and Menapace, L. (2018), 'Market power and bargaining in agrifood markets: A review of emerging topics and tools', *Agribusiness*, 34(1), 6-23. doi:10.1002/agr.21542
- Chung, K. and Griffith, G. (2009), 'Another look at market power in the Australian fresh meat industries', *Australian Agribusiness Review*, 17(18). Retrieved from <https://econpapers.repec.org/article/agsauagre/125718.htm>
- Davey, S.S. and Richards, C. (2013), 'Supermarkets and private standards: unintended consequences of the audit ritual', *Agriculture and Human Values*, 30(2), 271-281. doi:10.1007/s10460-012-9414-6
- Delforce, R., Dickson, A. and Hogan, J. (2005), 'Australia's food industry – recent changes and challenges', *Australian Commodities*, 12 (2), 379-390.
- Digal, L.N. and Ahmadi-Esfahani, F.Z. (2002), 'Market power analysis in the retail food industry: a survey of methods', *Australian Journal of Agricultural and Resource Economics*, 46(4), 559-584. doi:10.1111/1467-8489.00193
- Freebairn, J. (2018), 'Effects of supermarket monopsony pricing on agriculture', *Australian Journal of Agricultural and Resource Economics*, 62(4), 548-562. doi:10.1111/1467-8489.12251
- Gatfield, T. (2006), 'Australia's gone chicken! An examination of consumer behaviour and trends related to chicken and beef meats in Australia', *Journal of Food Products Marketing*, 12(3), 29-43.
- Griffith, G. (2000), 'Competition in the food marketing chain', *Australian Journal of Agricultural and Resource Economics*, 44(3), 333–367. <https://doi.org/10.1111/1467-8489.00115>
- Griffith, G.R. (2004), 'The impact of supermarkets on farm suppliers', *Australian Economic Review*, 37(3), 329-336. doi:10.1111/j.1467-8462.2004.00334.x
- Grimmer, L. (2018), 'The diminished stakeholder: Examining the relationship between suppliers and supermarkets in the Australian grocery industry', *Journal of Consumer Behaviour*, 17(1), 13-20.
- Hall, Bronwyn H. and Cummins, Clint (2003), *Time Series Processor Version 4.5 Reference Manual*, TSP International, Palo Alto, United States.
- Hattersley, L., Isaacs, B. and Burch, D. (2013), 'Supermarket power, own-labels, and manufacturer counterstrategies: international relations of cooperation and competition in the fruit canning industry', *Agriculture and Human Values*, 30(2), 225-233. doi:<http://dx.doi.org/10.1007/s10460-012-9407-5>
- Hayenga, M., Schroeder, T., Lawrence, J., Hayes, D., Vukina, T., Ward, C. and Purcell, W. (2000), *Meat packer vertical integration and contract linkages in the beef and pork industries: An economic perspective*. Report prepared for the American Meat Institute, Washington, DC.
- Hill, R.C., Griffiths, W.E. and G.G. Judge (2001), *Undergraduate Econometrics*, 2nd Edition, John Wiley & sons, Inc., New York and Brisbane.

Hilli, Alastair and Griffith, Garry (2022), 'Re-examining market power in the domestic fresh meat market', *Australasian Agribusiness Review* Volume 30, Paper 8, 190-217.

Hyde, C.E. and Perloff, J.M. (1998), 'Multimarket market power estimation: the Australian retail meat sector', *Applied Economics*, 30(9), 1169–1176. <https://doi-org.ezp.lib.unimelb.edu.au/10.1080/000368498325066>

Insch, A. (2008), 'Triggers and processes of value production in Australia's chicken meat industry', *British Food Journal*, 110(1), 26–41. <https://doi.org/10.1108/00070700810844777>

Kaiser, H.M. and Suzuki, N. (2017), *New Empirical Industrial Organization and the Food System*. [electronic resource] (1st ed.): Peter Lang Inc., International Academic Publishers.

McCorrison, S. (2014), *Background Note: Competition Issues in the Food Chain Industry*. Organisation for Economic Co-Operation and Development. Retrieved from <https://www.oecd.org/daf/competition/competition-issues-in-food-chain.htm>

McKenzie, B. (2020), 'How has the increase in chicken meat consumption since 1960 changed the chicken meat value chain?', *Australasian Agribusiness Perspectives* 23, 239–246.

Mérel, P. and Sexton, R.J. (2017), 'Buyer power with atomistic upstream entry: Can downstream consolidation increase production and welfare?', *International Journal of Industrial Organization*, 50, 259-293. doi:<https://doi.org/10.1016/j.ijindorg.2016.11.002>

MLA (2020), Statistics Database. Retrieved from: <http://statistics.mla.com.au/Report/RunReport/bb5a6146-6d3f-4d5c-a090-cef7a8095669>

Mornement, C. and Duver, A. (2020), Pigs and chickens: March quarter 2020. Retrieved from <https://www.agriculture.gov.au/abares/research-topics/agricultural-outlook/pigs-chickens>.

Nicholls, C., Paterson, J. and Waller, R. (2008), *Chicken : the story of chicken in Australia*. Cloverdale, W.A: Kondinin Group.

O'Donnell, C.J. (1999), *Marketing Margins and Market Power in the Australian Dairy Processing and Retailing Sectors*. 43rd Conference of the Australian Agricultural and Resource Economics Society, Christchurch, New Zealand, February.

Perloff, J.M., Karp, L. and Golan, A. (2007), *Estimating Market Power and Strategies*. Cambridge University Press. Retrieved from <https://search-ebSCOhost-com.ezp.lib.unimelb.edu.au/login.aspx?direct=true&db=cat00006a&AN=melb.b3131529>

PoultryHub (2020), Meat chicken (broiler) industry. Retrieved from <http://www.poultryhub.org/production/industry-structure-and-organisations/chicken-meat/>.

Ranieri, G. (2019), Australia's changing taste for meat. Retrieved from <http://thecityjournal.net/data-journalism-2019/australias-changing-taste-for-meat/>.

Richards, C., Bjørkhaug, H., Lawrence, G. and Hickman, E. (2013), 'Retailer-driven agricultural restructuring--Australia, the UK and Norway in comparison', *Agriculture and Human Values*, 30(2), 235-245. doi:<http://dx.doi.org/10.1007/s10460-012-9408-4>

Round, D.K. (2006), 'The power of two: squaring off with Australia's large supermarket chains', *Australian Journal of Agricultural and Resource Economics*, 50(1), 51–64. <https://doi-org.ezp.lib.unimelb.edu.au/10.1111/j.1467-8489.2006.00319.x>

Russo, C. and Goodhue, R. (2018), 'Farmgate prices, retail prices, and supermarkets' pricing decisions: An integrated approach', *Agribusiness*, 34(1), 24-43. doi:10.1002/agr.21530

Sutton-Brady, C., Kamvounias, P. and Taylor, T. (2015), 'A model of supplier–retailer power asymmetry in the Australian retail industry', *Industrial Marketing Management*, 51, 122- 130. doi:10.1016/j.indmarman.2015.05.008

Thomson, J. (2019), *IBISWorld Industry Report C1111 Meat Processing in Australia*. IBISWorld, Sydney.

Umar Muazu, A., Abidin Mohamed, Z., Shamsuddin, M.N., & Abdulatif, I. (2016), 'Measuring market power in the integrated Malaysian poultry industry: New Empirical Industrial Organization approach', *Journal of Food Products Marketing*, 22(4), 455–470. <https://doi.org/10.1080/10454446.2014.885860>

Williamson, O. (1971), 'The vertical integration of production: market failure considerations', *The American Economic Review*, 61(2), 112-123.

Youl, T. (2018), *IBISWorld Industry Report G4111 Supermarkets and Grocery Stores in Australia*, IBISWorld, Sydney.

Zhao, X., Griffith, G.R. and Mullen, J.D. (1998), *The Competitive Structure of the Australian Beef Industry: Accounting for Trade*. Working Papers in Econometrics and Applied Statistics. No. 101, Department of Econometrics, University of New England, Armidale.