RISE AND FALL OF THE DAIRY INDUSTRY IN NEW SOUTH WALES: A SUPPLY-DEMAND RELATIONSHIP ANALYSIS

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ABSTRACT: Dairy has been a major food commodity in Australia since 1788 and a core export commodity since the 1930s, with rapid growth in the 1980s and a rapid decline in 2000 with the introduction of the dairy deregulation policy. The high rate of decline of dairy farms within Australia, particularly in New South Wales (NSW) and Queensland, has left the industry and market unprepared for future development. One reason for this decline would be the domestic supply and demand mismatch. Therefore, this study examines the relationship between supply (i.e., whole milk production), market demand (domestic and international markets) and policy variables. This study collected supply and demand-related data between 1980 and 2021 and then used a multiple regression model to depict the relationship between supply and demand variables. The study found that while there is a significant relationship between total whole milk production and domestic demand, there is relationship between supply, deregulation, and export market has not been identified. Therefore, the Australian dairy industry should look at how do they increase their volume in the export market without reducing the supply to the domestic market.

KEYWORDS: Australia; dairy production; demand; export; NSW; policy.

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1. INTRODUCTION

In the 1980s and 1990s, state governments set market/fresh milk sector policies and regulated food prices and quality. State-based dairy industry peak bodies, such as the Victorian Dairy Industry Authority and the New South Wales (NSW) Dairy Corporation, managed the industry's regulation and exercised control over milk marketing in their respective states. This control included granting dairy farmers licences to manage production and regulate milk quality (Trewin, 2004). By the mid-1990s, the Australian government phased out market support, and by July 1995, export subsidies were terminated. On 1 July 2000, the deregulation of the dairy industry was enforced, impacting farmgate fresh milk pricing (Trewin, 2004).

Australian GDP from the agriculture section in FY2020-2021 was about $71 billion. According to the most recent statistics, Australia has 387 million hectares of agricultural land. Three hundred thirty-two million hectares are grazed, while 32 million are cropped (Australian Bureau of Statistics (ABS), 2022). The number of dairy cattle continues to decrease as producers either reduce their dairy operations, sell their farms, or switch to raising beef cattle. On 30 June 2022, there were 2.1 million head of dairy cattle nationally, a 10% reduction. With a 3% increase to 291,700 head, NSW was the only state to record growth. Victoria, one of the major dairy-producing states, recorded an 11% reduction to 1.3 million head, while Tasmania reported a 3% decrease to 299,300 head (ABS, 2022). Dairy whole milk production in NSW reported the largest decrease of 7.7% between FY20/21 and FY22/23 compared to 5% nationally (Dairy Australia, 2023).

Review of Previous Studies

Understanding the complex dynamics of supply and demand in the dairy industry is crucial for dairy farmers, stakeholders, and policymakers. This section provides the background of the supply and demand relationships, drawing from industry and academic sources.

Several investigations have been conducted to determine the effects of Australian dairy supply and demand variables; however, these studies

focus on economic (Drane and Edwards, 1961), performance (Martin *et al.*, 2000), productivity (Kompas and Che, 2004), milk supply inefficiencies (Huang *et al.*, 2022), climate change (Malik *et al.*, 2022), deregulation reforms (Sheng *et al.*, 2020), domestic sustainability protection (Zeller and Walters, 2022), structural change (Amin and Palash, 2020), exchange rates and export price behaviour (Permani, 2021) and dairy production systems (Clay *et al.*, 2020).

The academic literature has revealed that supply factors incorporate production trends (Dairy Australia, 2020), farm size and structure (Cottle *et al.*, 2017) and technological advancements (Fleming *et al.*, 2021)). In contrast, demand factors encompass changing consumer preferences (Murray *et al.*, 2013), exports (Sheng *et al.*, (2020), and government policy (Dairy Australia, 2020). Several supply and demand interactions have been identified, including price elasticity (Ulubasoglu *et al.*, 2016) and market integration (Fleming *et al.*, 2021).

The complex interplay of regulatory policy frameworks is a critical determinant in transformation and is viewed as a significant driver of productivity and growth Amin and Palash (2020); Sheng *et al.* (2020). Further, Sheng *et al.* (2020) and Kompas and Che (2004) argue that irrigation and technology development are essential productivity drivers; however, Martin *et al.* (2000) looked from a broader perspective, studying the whole farm perspective, discovering that in terms of supply and demand, farm size does not differentiate the return on investment, rather, all farms have the same opportunities in business return generation.

When considering supply and demand variables of the dairy industry, it would be remiss not to include biophysical variables, such as climate change and extreme weather conditions. The Commonwealth Scientific and Industrial Research Organisation (Hennessy *et al.*, 2016) reports, "Australia's changing climate represents a significant challenge to individuals, communities, governments, businesses, industry, and the environment. Australia has already experienced increases in average temperatures over the past 60 years, with more frequent hot weather, fewer cold days, shifting rainfall patterns, and rising sea levels". Additionally, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) (2023) reports that the climate changes seen in recent decades will persist. Further, in a study by Malik *et al.* (2022), a correlation between disasters brought on by extreme weather and climate change was revealed to influence the output of crops and livestock production negatively.

As consumer preferences change and the dairy industry continues to decline, the sustainability and profitability of the industry are critical. Global markets and technology will continue to evolve. Therefore, the

academic literature has raised several contrasting themes to suggest a pertinent role of policy and supply-demand variable relationship to dairy farm survival. However, there remain several aspects whereby very little is known about supply and demand variables and their relationship to the decline of NSW dairy farms.

This study uses a literature review and quantitative research to identify the relationship between dairy farm supply and demand variables. This paper is structured as follows: Section two describes the contextual and analytical aspects of dairy farm decline. Section three provides the conceptual background of the study area, followed by the material and methods for the research project in section four. Section five presents the results and discussions, concluding the study in section six.

Scope and Limitations

This research has considered four supply and demand variables: inflation factors, consumer price index (CPI), farmgate price and policy change, the relationship between total whole milk production and domestic demand, and the relationship with the export market.

This research has several limitations. One key limitation is that not all supply and demand variables were included within the study as the research faced time constraints; therefore, the multiple regression analysis was limited to whole milk production values and excluded several types of dairy products.

2. DAIRY FARM DECLINE: CONTEXTUAL AND ANALYTICAL ASPECTS

Dairy has been a national food commodity since 1788 and a core export commodity since the 1930s, with rapid growth in the 1980s and a rapid decline in 2000 with the introduction of dairy deregulation. In 1932 NSW, there were 858,000 dairy cows (Wilkinson, 1999); in 1979, 320,000 dairy cows; and in NSW 2021, approximately 143,000 dairy cows (Dairy Australia, 2021). The average production of milk per dairy cow in the late 1970s was approximately 2,870 litres (Australian Productivity Commission, 1991). In early 2020, the average was 7,067 litres per cow (Dairy Australia, 2020), indicating a change in either farming or production practices.

Established dairy farms in NSW are currently seeing a critical decline.

In 1933 (15,136), 1960 (13,595), 1971 (7,735), 1980 (3,601), 1980 (2,218) and in 2021 (494), dairy farms (Dairy Australia, 2021). An alarming reduction of 96.74% over eight decades. Australian dairy farms have decreased by 77 per cent between 1979–1980, from 21,994 to 5,055 in 2019–20 (Dairy Australia, 2022), and dairy cows reduced by 28%. In comparison, NSW dairy farms and cows have decreased by 85% and 83%, respectively.

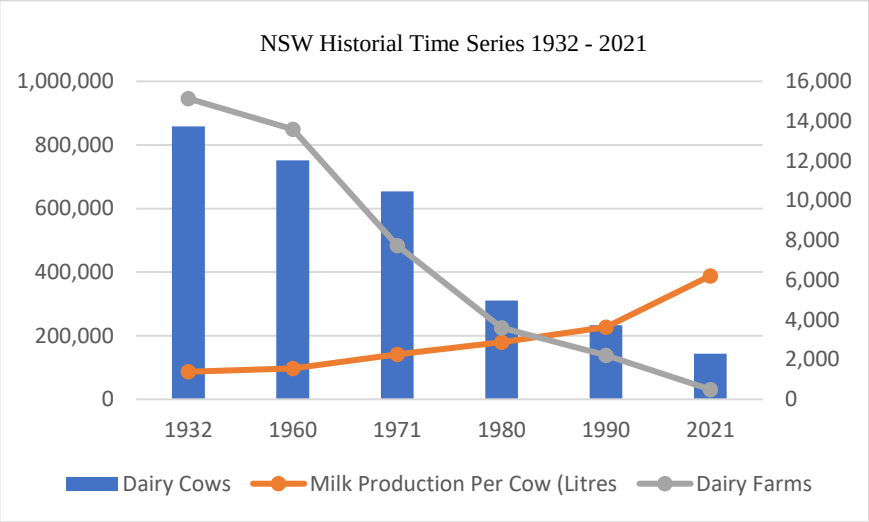

Figure 1. NSW Historical Times Series 1932 to 2021. Source: Australian Productivity Commission (1991); Wilkinson (1999); Dairy Australia (2021) and Dairy Australia (2022).

The high rate of decline of dairy farms within Australia has left the industry and market unprepared and unsustainable over the past two decades. Industry sustainability has many internal and external constraints, such as milk production cost increases, market competition changes, re-building industry confidence, and improved dairy supply chain profitability. All these factors impact internal business management and marketing practices, product diversification and collaboration divergence (Dairy Australia, 2019; Forney and Häberli, 2017; Ivanov *et al.*, 2016; McDonald *et al.*, 2014; Sinclair *et al.*, 2014). The Australian Dairy Industry Council Inc. (2014) and Dairy Australia (2019) argue that the focus of a sustainability framework is enhancing livelihoods, improving well-being, and reducing impact.

The NSW Department of Primary Industries (2014) acknowledges that "…as milk markets become increasingly volatile, NSW dairy businesses will need to continue to evolve and develop production and management systems and appropriate business models to adjust to these markets and maintain competitiveness" (p. 14). The study presented in this paper employed a multiple linear regression model to identify the relationship between supply and demand factors, using a case study comparison of NSW and Australia.

Figure 1 shows the trend of declining dairy farms in both NSW and Australia, which has sharply declined over the last 20 years. Several reasons affecting this decline include not having a resilient supply chain and government policy change.

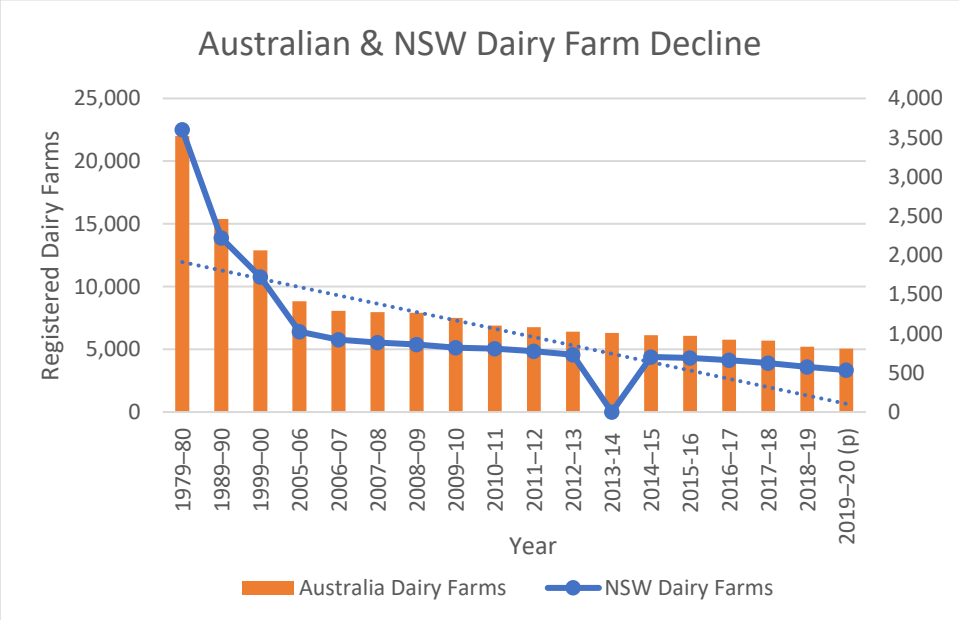

Figure 2. Australian and NSW Dairy Farm Decline. Source: Dairy Australia (2022).

Several studies have found there is a significant association between an Australian dairy supply chain and the demise of dairy farms (Forney and Häberli, 2017; Ivanov *et al.*, 2016; McDonald *et al.*, 2014; Sinclair *et al.*, 2014). The dairy supply chain system is rated as "time-critical" (Ivanov *et al.*, 2016, p. 3) as there are high incidences of environmental instability. These high incidences cause breaks in the supply chain's economic

performance, and the need for reactive recovery methods is critical (Ivanov *et al.*, 2016). Essential supply chain components are the critical need for transportation to access roads so that dairy products can be moved from the dairy farm to the consumer table, as shown in Figure 2 (Ivanov *et al.*, 2016).

Figure 3. The Structure of the Dairy Farm Supply Chain. Source: Adopted from Ivanov *et al.* (2016).

Inventory planning, deviation strategies, and recovery measures in a dairy farm recovery plan can ease economic loss in the supply chain (Ivanov *et al.*, 2016). Deregulation affected the supply chains in New Zealand, Eastern Australia, Switzerland, and Ireland when quotas and subsidies were abandoned (Forney and Häberli, 2017; McDonald *et al.*, 2014; Sinclair *et al.*, 2014). However, an alternative argument is that government policy changes bring freedom of action for dairy farmers to adapt supply chains (Forney and Häberli, 2017; Sinclair *et al.*, 2014). Adapting supply chain opportunities allows for creativity, individual competition, new roles and responsibilities, and the development of new business structures (Forney and Häberli, 2017; Sinclair *et al.*, 2014).

The next section explores the case study and the supply and demand relationship of NSW Dairy.

3. STUDY AREA: NEW SOUTH WALES

The Population as an Industry Influence

The study area was the state of NSW. As of March 2022, NSW has 8,130,100 residents (NSW Government, 2023), the most of any state in Australia. Sydney is the NSW capital located on the eastern coast (NSW Government, 2022). Greater Sydney is home to approximately 64.5% of the state's residents. NSW population has the fastest growth rate in Australia, with an increase of 44,400 people from 2021 to 2022, approximately 0.5% (ABS, 2022). Greater Sydney and Newcastle have the

highest population densities in the state, with 391 and 423 inhabitants per square kilometre (NSW Government, 2022).

Agricultural production advice, biosecurity, natural resources, and emergency management have a dedicated Local Land Services (LLS) agency established by the NSW Government in eleven regional boundaries: Central Tablelands; Central West; Great Sydney; Hunter; Murray; North Coast; Northwest; Northern Tablelands; Riverina; Southeast and Western (NSW Government, 2022). The following section examines comparative statistics between NSW dairy farms and population growth.

The Rationale for Choosing the Selected Dairy Supply and Demand Factors

When comparing the statistical differences between NSW dairy farm growth and NSW population growth, Dairy Australia (2022) shows that dairy farms in NSW are falling at an average of 4% per year from 2017 to 2020 (12.4%), adding several arguments to this study. If NSW has the highest annual population growth of 0.5% and dairy farms are declining at a higher annual rate of 4%, we need to question what consumers use for dairy products. Secondly, a critical question directly related to this study is: Why is the Australian population at a steady annual increase rate and dairy farms steadily declining annually?

This data suggests a direct link between consumer consumption and two areas of business: (i) desirability and (ii) viability (Osterwalder, 2017). Desirability focuses on the business, customer segments, customer communication, customer touchpoints, customer relationships and the products that create specific value for the customer (Osterwalder and Pigneur, 2013). Viability focuses on the value a customer is willing to pay, the business costs, and the cash flow generated from doing business with different customer segments (Osterwalder and Pigneur, 2013). Therefore, this paper examines the population over the last 30 years as a proxy of demand and export value.

Australia is a net export of dairy products in volume and value terms. However, the proportion of dairy products designated for export has decreased with a growing population and a fall in total raw milk supply. In 2018-19, the NSW Department of Primary Industries (NSW DPI) (2020) reported that 35% of total milk production was exported (down from 56% in 2001-02). Australian dairy exports in 2018-19 were valued at $2,441 million (NSW DPI, 2020). Raw milk production in NSW peaked in 2015-16. Since then, state output has constantly been declining, falling 10% in

the three years to June 2019. The total amount produced in 2018-19 was 1,082 million litres, the lowest volume since 2010-1,117 million. NSW production is down 5% as of March 2020 (NSW DPI, 2020). It has become clear that raw milk production is affected by population growth and export $ values.

The following section will examine in depth a variety of dairy sector commodity metrics and trends, covering a variety of critical supply and demand elements such as production, price, export of NSW and Australian population, and the number of dairy cows in NSW and Australia.

4. MATERIALS AND METHODS

The study used quantitative methodology, a literature review, secondary data collecting, and analysis to support its case study approach. Data were collected between 1980 to 2021 for NSW and Australia to identify the supply and demand variables. A literature review has obtained a set of dependent and independent variables. However, the data have been primarily sourced from ABS, Australian Bureau of Agriculture and Science (ABARES), and Dairy Australia (Table 1).

The study examined a range of crucial dairy industry commodity parameters and trends – including essential supply and demand factors: production, price, export of NSW and Australian population and the number of dairy cows in NSW and Australia. Theoretical production levels are evaluated in the supply chain system. The dairy deregulation in 2000 was also considered in the model as a dummy variable to illustrate its effect on the dairy industry. For analysis purposes, we code the deregulation status as 1 and prior to deregulation as 0.

Some missing data in the data set was recovered using multiple imputation and trend analysis methods. The consumer price index data for milk was also considered to adjust the price and export value figures. The adjustment was done considering 1980 data as the base year data.

The multiple regression model is the basis for simulating supply and demand factor values. A multiple regression model using SPSS evaluated the impacts of dairy supply on dairy demand factors. Regression modelling investigates the strength of the relationship between the dependent variable and several predictor variables. These relationships may explain the supply variation in the performance of the supply commodities (whole milk production and the number of dairy cows with the independent (demand) variables relating to population, consumer consumption, export values and farmgate price over two decades, 1990 to 2021.

Table 1. The Dependent Variable and Independent Variables. Source: the Authors.

Dependant Variable	**Data Source**
Whole milk production volume (M litres)	NSW Department Primary Industries (DPI)
Explanatory/independent variables	
Population	Australian Bureau of Statistics (ABS)
Number of cows	Dairy Australia (DA)
Dairy Export (M $)	NSW Department Primary Industries (DPI) Australian Bureau of Agriculture and Science (ABARES)
Drinking Milk Sales (M litres)	NSW Department Primary Industries (DPI)
Milk Pricing (farmgate price)	Australian Bureau of Statistics (ABS)
Policy implication	Deregulation from the year 2000 onwards

The score of either an NSW or Australian dependent factor may be positive or negative. A positive score indicates that factors within a NSW or Australia-wide demand commodity benefit enhancing dairy production supply, which may point to industry and individual farm impacts. A negative score indicates unfavourable factors contributing to dairy farm commodity negative supply growth.

A literature review has obtained a set of independent variables for NSW and Australian dairy demand factors. However, the data has been primarily sourced from the ABS, ABARES, and Dairy Australia. The location variables relate to NSW and Australia.

Multiple Regression Models

Two models were selected that were essential to identify factors that affect the supply and demand relationship. An ordinary least square (OLS) regression model was implemented using SPSS version 29 to evaluate the impact of the selected independent variables on milk production.

(1) The relationship of NSW whole milk production, with the number of cows, export value, policy implication, price, domestic consumer dairy consumption and population.

(2) The relationship of Australian whole milk production with the number of cows, export value, policy implication, price, domestic consumer dairy consumption and population.

Multiple Linear Regression Analysis

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + e$$

Where Y refers to the dependent variable, the milk production, and the independent variables such as the number of cows, export value, price, policy implication, domestic consumer dairy consumption and population are denoted by X_1 to X_6, respectively. β_0 is the intercept and, β_1 through β_6 are the corresponding regression coefficients, and e is the error term. This model was run in the cases of NSW and Australia. A multicollinearity test was also carried out to investigate the dependency among the independent variables and their effect on the model.

5. ANALYSIS AND FINDINGS

The supply and demand factors: milk production, number of cows, population, drinking milk consumption, farmgate price and value of exports $ of NSW and Australia were evaluated using Multiple Linear Regression Analysis.

The R^2 squared value represents the proportion of the variance in the dependent variable explained by the independent variables combined. The scale, 0 - 100%, R-squared measures the strength of the association between the independent and dependent relationships.

Dairy Cows and Milk Production

Figure 4 compares data from 2000 to 2021 (Dairy Australia, 2022). It reveals that in 2021, the number of dairy cows decreased from 2,171,000 to 1,384,000 in Australia and from 289,000 to 143,000 in NSW. The reduction of dairy cows across Australia and NSW is also supported by the decrease in whole milk production, as shown in Figure 5, spanning from 2000 to 2021 (ABARES, 2022). The Australian milk production decreased from 10,178,000 litres to 8,803,000 litres and NSW's whole milk production from 1,285,300 litres to 1,075,400 litres. The results indicate a high level of correlation between the dairy cow decline in Australia and NSW, which is mirrored by the decline in whole milk production over time.

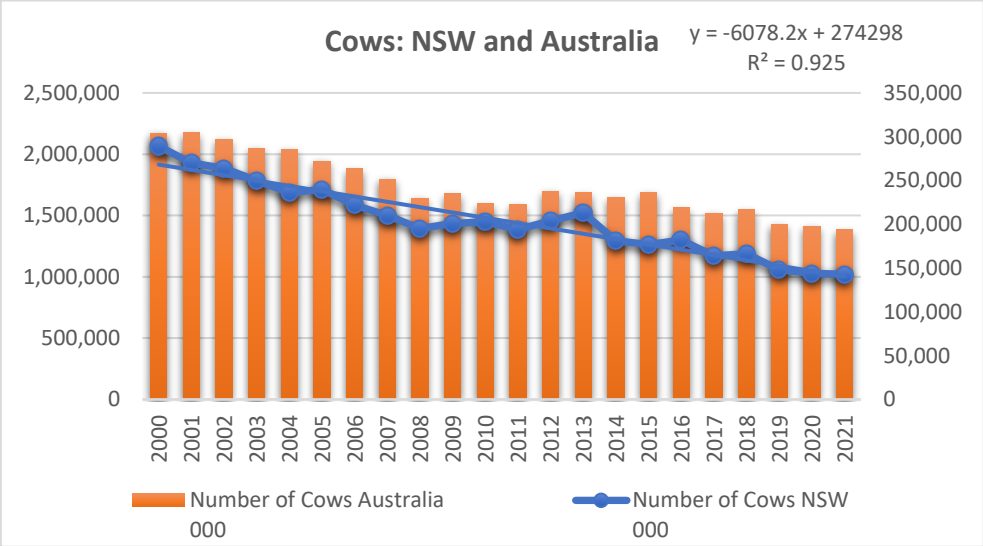

Figure 4. Longitudinal Trend of the Number of Cows in NSW and Australia. Source: Dairy Australia (2022).

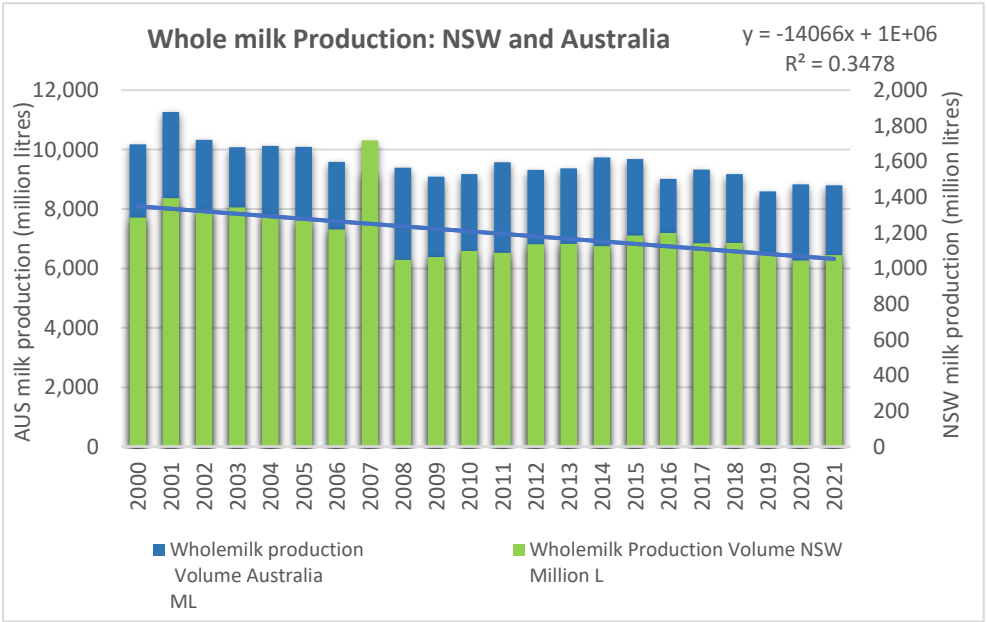

Figure 5. Relationship Between Whole Milk Production in NSW and Australia. Source: ABARES (2022).

Consumer Consumption and Desirability

Dairy consumption in NSW (2000) totalled 633,000,000 litres in 2000, compared to 663,300,000 litres in 2022. NSW drinking milk sales peaked in 2015 at 732,000,000 litres and steadily declined yearly as the NSW population grew. Figure 6 indicates a moderate relationship between NSW drinking milk consumption decline and whole milk production population growth. Several variables may be significant in impacting consumer dairy consumption. According to NSW Farmers (2019), alternative milk products such as rice, soy, oats, and yoghurt are becoming a popular trend that may detract from consumer consumption of whole milk products. Additionally, multiculturalism in Australia is growing and, therefore, the population; this change in consumer dietary needs may have a causal impact on consumer consumption.

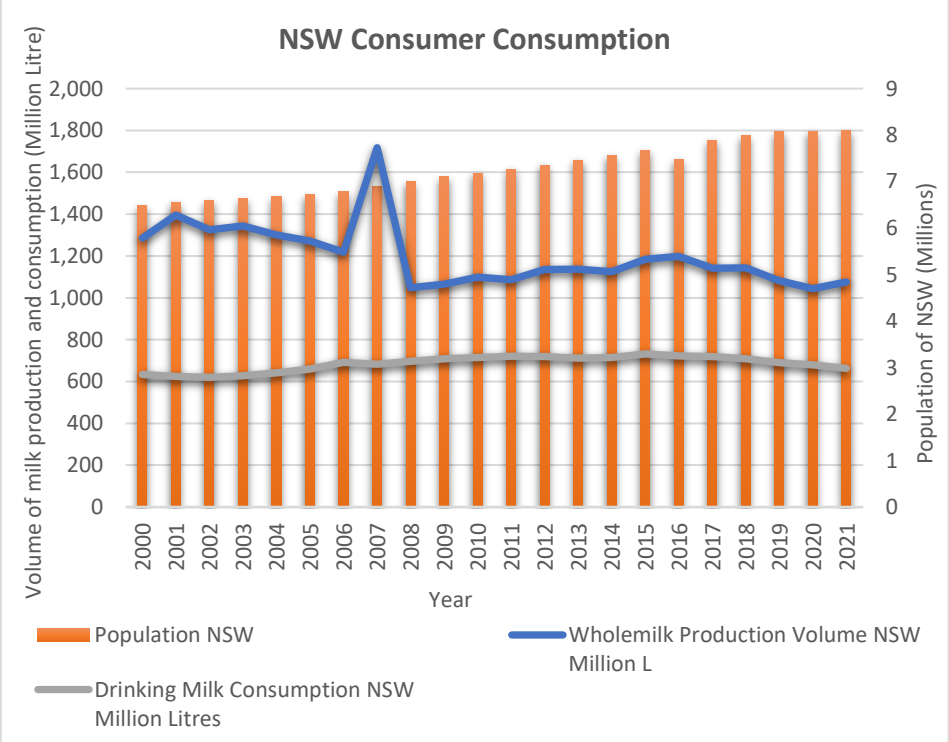

Figure 6. Relationship Between Whole Milk Production, NSW Population and NSW Consumer Consumption. Source: ABARES (2020); ABS (2022) and Dairy Australia (2022).

Dairy Production and Purchase Viability

In the year 2000, deregulation changed the industry's landscape for the future. The control and domination of a staple family food commodity began, and many, including supermarkets, seized the opportunity to increase consumer sales by implementing devastating contracts within the supply chain and driving down farmgate prices, thus crushing the dairy farmer (producer). From 2012 to 2018, the supermarket war and the start of $1.00 milk entered the market. Figure 7 shows that milk production is moderately affected by the consumption of drinking milk and pricing. Drinking milk consumption peaked between 2006, 2011 and 2015 (732,000,000) litres. As the population continued to grow, supermarket generic 1-liter milk pricing increased to $1.60 in 2021. This change in pricing dynamics has had a noticeable effect on both milk production and consumer purchasing, leading to a decrease in both.

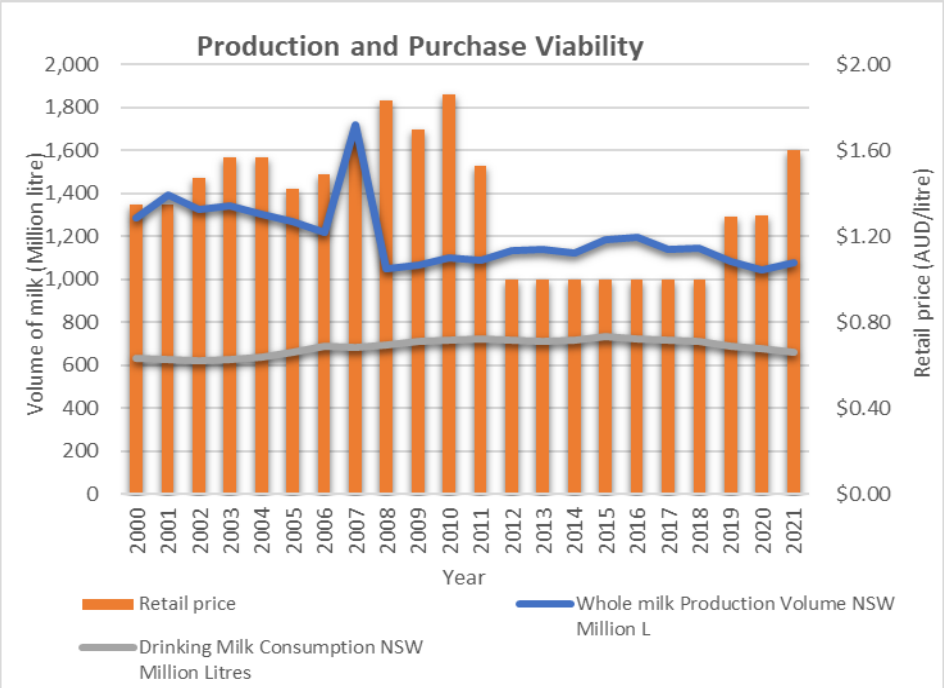

Figure 7. Relationship Between NSW Milk Production, Consumption and Supermarket Price. Source: ABARES (2020); ABS (2011, 2022) and Dairy Australia (2022).

Export Markets

The relationship between whole milk production and NSW Dairy Export Values is shown in Figure 8. The (R^2 = 61.41 %) indicates a high-level relationship between the value of NSW dairy products exports and NSW whole-milk production. In the year 2,000, dairy exports were valued at $84,453,000 and by 2021, the value of dairy exports had risen to $257,687,000.

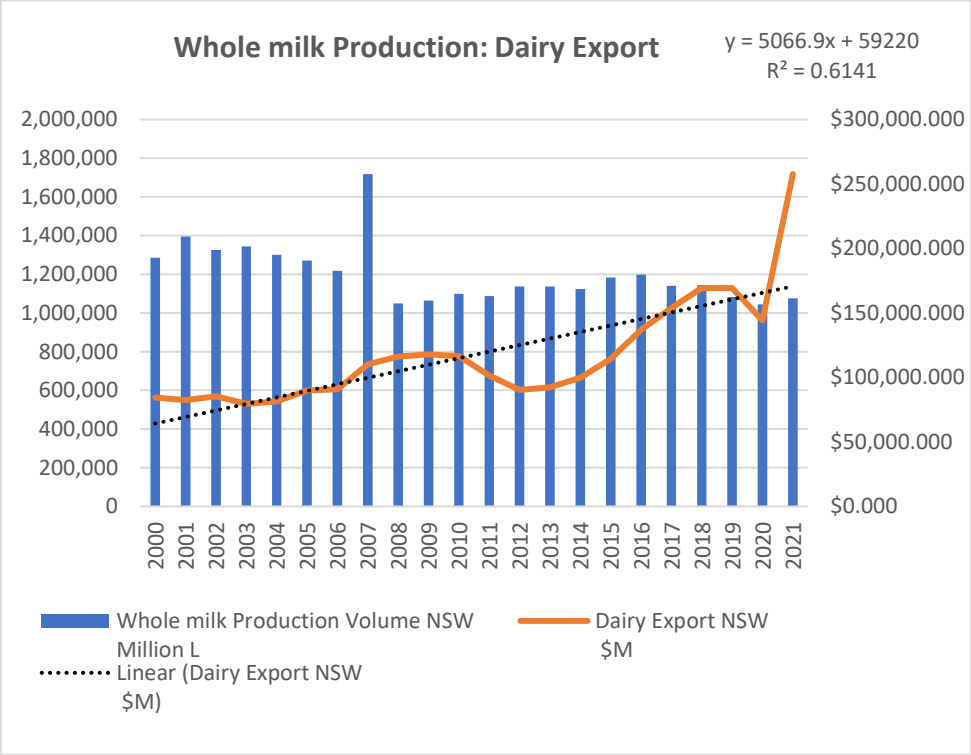

Figure 8. Relationship Between NSW Whole Milk Production and NSW Dairy Export $ Value. Source: ABARES (2020) and DFAT (2022).

Results of the Regression Modelling

This section presents the empirical findings of the OLS models to portray the statistical relationships between milk production and the selected independent variables. The results from the first run of the model for NSW are presented in the following Table 2.

Table 2. NSW Statistical Relationships Between Milk Production and the Selected Independent Variables. Source: the Authors.

	Unstandardised Coefficients	**Standardised Coefficients (Beta)**	**Collinearity Statistics**	
			Tolerance	**VIF**
(Constant)	-1323.411			
NSW Cows	3.521	1.062	.126	7.944
Pop NSW	.000	2.047	.032	31.333
Milk Consumption NSW	-.344	-.173	.099	10.081
CPI Exp NSW	-1.363	-.139	.207	4.838
CPI Price	-26.367	-.386	.635	1.575
Policy	-125.711	-.433	.232	4.318

The results indicated that severe multicollinearity exists in the model, and variance inflation factors (VIF) are very high for the two independent variables, population and milk consumption. Similar results occur for the model run for Australia. Based on the outcomes, these variables are redundant compared to the other independent variables in the model, and hence, we strip them off from the model and run the regression. We set the VIF tolerance level at 5, which is a moderate threshold. The regression results for NSW are presented in Table 3.

Table 3. NSW Regression Results. Source: the Authors.

	Unstandardised Coefficients	**Standardised Coefficients (Beta)**	**Level of significance**	**VIF**
(Constant)	1293.536		<.001	
NSW Cows	.437	.132	.526	3.122
CPI Exp NSW	5.115	.522	.008	2.541
CPI Price	-32.963	-.482	.002	1.474
Policy	2.666	.009	.964	3.060

The results indicate that the CPI-adjusted export value and farmgate average price have some effect on the production of milk in NSW, which are statistically significant. The results indicate that the higher export from the state triggers higher milk production. However, the higher farmgate price reduces milk production, as the model results suggest. This could be because of the uncertainty associated with supplying milk at a higher price

to the market. Policy change (deregulation in 2000) has some positive impact on production; however, this result is not statistically significant.

The model was also run for the Australian context, and we had to exclude the population and consumption variables for a similar reason. The results are summarised in the following table 4.

Table 4. Australia CPI-Adjusted Export Value, Farmgate Price, and Policy Change. Source: the Authors.

	Unstandardised Coefficients	**Standardised Coefficients (Beta)**	**Level of significance**	**VIF**
(Constant)	7330.230		<.001	
AUS Cows	-.725	-.085	.292	3.053
CPI Exp AUS	6.608	.804	<.001	2.305
CPI Price	-143.377	-.179	.012	2.244
Policy	484.335	.143	.063	2.699

The results presented in Table 4 are more significant overall than the model run results for NSW. Results indicate that CPI-adjusted export value, farmgate price, and policy change affect milk production, and the effects are statistically significant. Similar to the NSW model run results, the export value has a strong positive impact on milk production. Farmgate price has a mildly negative effect on milk production, while deregulation positively impacts milk production. The results presented in this section only considered the selected variables, and the model did not capture the effect of all possible variables. The findings explain the variation in milk production to some extent; however, further analysis of the other variable may explain the milk production variability both in NSW and Australia.

6. CONCLUSION

This study aimed to assess the dependent and independent variables in the supply and demand relationship of dairy production and to evaluate the impact of the selected independent variables on milk production in the cases of NSW and Australia. Applying an ordinary least square (OLS) regression model, theoretical production levels were evaluated within the supply chain system. The study's findings highlight four key issues affecting dairy production supply, demand and export approach for NSW and Australia: inflation factors, CPI, farmgate price, and policy change. The study also identified that the higher the export price for NSW and Australia, the stronger the relationship formed with a positive impact on

milk production. However, the data revealed that the Australian farmgate price negatively affects milk production, while deregulation positively impacts milk production.

Additionally, the results revealed a significant relationship between total whole milk production and domestic demand. The results revealed that the milk yield had a moderate increase, while dairy cow numbers decreased, thus revealing a causal relationship with unknown factors. Additionally, several factors affecting consumer consumption patterns and dairy viability may be due to the impacts of alternative dairy products. Further, it was identified that the NSW population, drinking milk consumption, and supermarket pricing had a significant impact on whole milk production volumes. Finally, the value of dairy exports impacted whole milk production volumes substantially.

Future studies should investigate the unidentified variables that continue to impact the rapid decline in dairy farm numbers and the fluctuations in production over the past two decades. Additionally, identifying strategies whereby dairy production volumes, export volumes and retail markets can collaborate to form opportunities for economies of scale growth without lowering the per-unit fixed costs would significantly maximise value creation. At the same time, this study has identified the factors important to dairy industry supply and demand, identifying the extent of all variables as a topic for future work.

Industry bodies, governments and processors could likely open opportunities for collaboration with export markets in order to reduce the decline of the dairy industry.

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