



Dairy Industry Farm Performance Data: Australia vs New Zealand vs United States vs Argentina vs Uruguay vs South Africa vs Ireland vs United Kingdom

**Four decades of data for some trends: two
decades of data for other trends**

Background

This report includes some high-level comparative data for the period 1979/80 to 2019/20 and an extensive analysis for the period from 2003 to 2020

Version 1.3

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List of Contents

The table of **Contents** on page 2 outlines the sections related to each ratio and includes a hyperlink to the page related to that ratio.

Data Sources

Primary data sources are listed in the table at right.

Asterisk (*) after region denotes data that is estimated.

Appendix A provides more information on the data sources and describes the methodology for standardising the different data sources so that relevant comparisons could be undertaken.

DATA SOURCES		
COUNTRY	National Statistics	Farm Performance Analysis
Australia	Dairy Australia	Dairy Farm Monitor Project, QDAS, Red Sky
Victoria		Dairy Farm Monitor Project, Red Sky
Tasmania		Dairy Farm Monitor Project, Red Sky
New South Wales		Dairy Farm Monitor Project
Queensland		QDAS
South Australia		Dairy Farm Monitor Project, Red Sky
Western Australia		Dairy Farm Monitor Project, Red Sky
New Zealand	DairyNZ	DairyBase, Red Sky
Argentina	MAGYP	AACREA
Uruguay	INALE	FUCREA
South Africa	MPO	Red Sky
United States	USDA	Genske Mulder
Ireland	CSO	Teagasc
United Kingdom	DEFRA	AHDB

Graph Number Format

Graphs marked 'a' (on left) are actual lines and graphs marked 'b' (on right) are fitted trendlines.

Calculations and Definitions

Appendix B outlines the methodology utilised for calculating or defining each of the ratios referenced in this document.

Energy Corrected Milk (ECM) is utilised extensively in this report, with this corrected to 4.0% fat and 3.3% protein using the formula: $ECM = \text{milk production} \times ((0.383 \times \text{fat}\% + 0.242 \times \text{protein}\% + 0.7832) / 3.1138)$.

International comparisons are in **USD**, with the average foreign exchange rate for each year applied to that year.

References

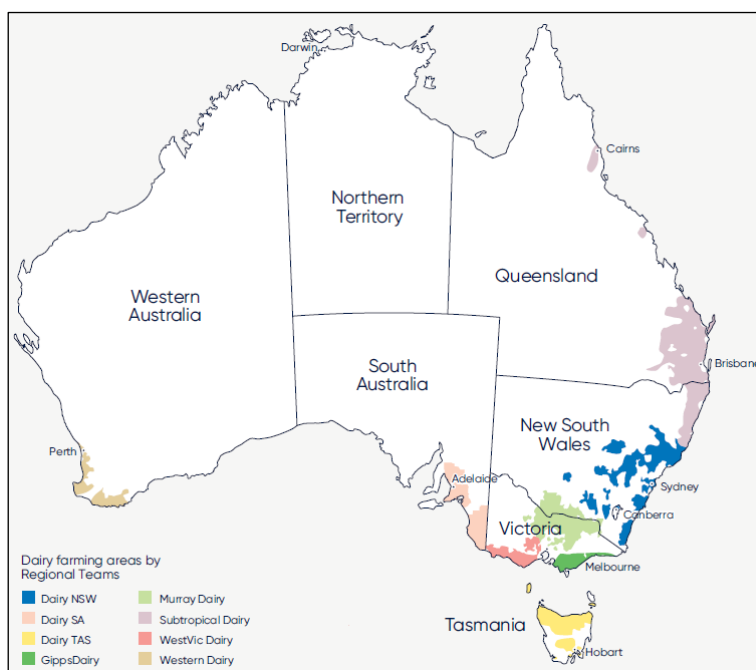
The following two references significantly inform the data in this report:

Beca, D. (2020a), 'Evaluating the Loss of Profitability and Declining Milk Production in the Australian Dairy Industry', *Australasian Agribusiness Perspectives* 23, Paper 9, 136-164.

Beca, D. (2020b), 'Key Determinants of Profit for Pasture-based Dairy Farms', *Australasian Agribusiness Perspectives* 23, Paper 16, 247-274.

Dairy Farming Regions in Australia

Source: Dairy Australia



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1. Introduction

Dairy farming industries in all countries, and farmers within these countries, need to continuously review their business performance and production systems to ensure they retain a sound level of profitability. This is important if these industries, and the farmers within these industries, are to maintain a comparative advantage to other farming enterprises within their region as well as to maintain international competitiveness with dairy industries in other countries.

Comparative dairy industry farm performance data can be an important source of information for identifying trends in countrywide and regional business performance. If the ratios utilised for these comparisons are relevant to changes in profitability (Beca 2020b), then these can be used to identify both positive and negative trends that improve or reduce a country or region's competitiveness (Beca 2020a).

There are eight countries included in the comparisons in this report. There is a full suite of farm performance ratios for six of these countries including Australia, New Zealand, United States, Argentina, Uruguay and South Africa. There is a limited number of farm performance ratios for two of these countries, namely Ireland and United Kingdom, though the intention is that a fuller suite of ratios for these countries will be available in the future. Further countries may also be added to these datasets if robust sets of farm performance data can be accessed.

Where industry performance is assessed on its success in maintaining or increasing farm profitability over time, maintaining or limiting increases in cost of production, and delivering consistent growth in national milk production, then the dairy industry performance trends in this report suggest that New Zealand has the highest level of performance overall, and that Australia has the lowest level of performance. Ireland, United States and South Africa would appear to be the countries that along with New Zealand comprise the top 50 percentile of performance in this sample, with Argentina, Uruguay and United Kingdom along with Australia comprising the bottom 50 percentile. However, all countries except Australia have been growing national milk production in recent years, so it would only be Australia that could be assessed as being relatively unprofitable and likely to be in the bottom 50 percentile of countries if a wider group were to be included in the analysis.

There is a small number of farm performance ratios included for all six States of Australia, including Victoria, Tasmania, New South Wales, Queensland, South Australia and Western Australia. These can potentially provide further insight into the variations in performance between countries. Where Australian state performance is assessed on the same basis as for the countries, then Tasmania has the highest level of performance, and by a wide margin, with New South Wales and Queensland having the lowest level of performance. The three other states of Victoria, South Australia and Western Australia comprise a group somewhere between the highest and lowest performing states. A full suite of farm performance ratios for the Australian states are included in a lengthier report that can be downloaded from: [Red Sky Report webpage](#).

Graphs and tables that outline changes in total milk production, total farm numbers, total cow numbers, and number of cows per farm, highlight where trends over the last two and four decades have been similar and where they have been different. These comparisons can help identify where longer-term trends are consistent across all countries and regions, as opposed to trends that are more specific to a country or region and so potentially worthy of even closer scrutiny.

Graphs that outline changes in milk price highlight how variations between countries, irrespective of their focus on domestic or export markets, has been narrowing over the last two decades. For those countries that have been performing poorly, milk price does not appear to have been a factor in their comparatively poor performance.

Graphs that outline changes in profitability and cost of production confirm how all the countries, and the Australian states, have evolved over recent years. To identify what factors have been creating changes in performance, there is a full suite of ratios that outline how farm performance has changed in all areas of the business. This includes a range of financial ratios, with these split between supplement and feed costs, labour costs, cow costs and hectare costs, as well as a range of physical ratios. These physical ratios include milk production per cow and per hectare, stocking rate (cows per hectare), pasture harvest, pasture as a percent of the cows' diet (production system), and labour efficiency.

There are a number of graphs that help describe farm and business conditions. These graphs include milksolids (fat and protein) percentages, USD exchange rates, inflation rates, minimum hourly salary rates, total value of farm assets per cow, opportunity cost of capital, risk free interest rates and long-term land lease rates.

Most milk related ratios are calculated on Energy Corrected Milk (ECM) with milk corrected to 4.0% fat and 3.3% protein. This has been completed for most litre and milksolids ratios.

This report has been produced so that the data, and its associated trends, might be used by any interested party to inform discussions and create debate on how dairy industries can develop and improve their level of performance and profitability. Please contact the author (details on page 1) if there are queries or requests for further analysis.

This report can also be downloaded from: [Red Sky Report webpage](#).

2. Total Milk Production – International, National, State and Region (industry averages)

Figure 1. International milk production 2003-2020 (b litres ECM)

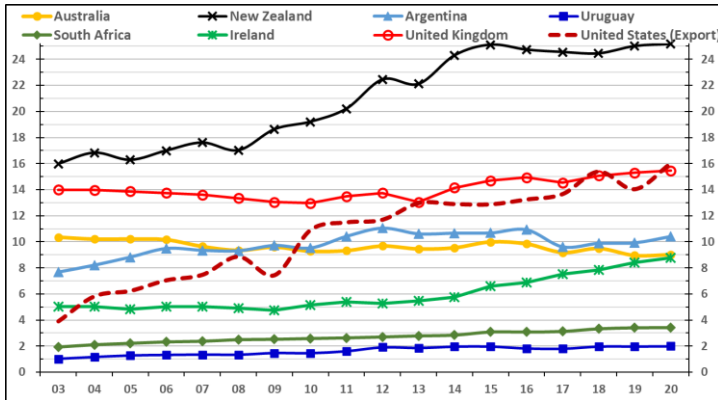


Figure 2: International milk production 1980-2020 (billion litres)

MILK (b litres)	1980	1990	2000	2010	2020
Australia	5.43	6.26	10.85	9.08	8.78
New Zealand	6.00	7.08	11.63	16.48	21.15
United States	55.48	63.85	73.00	83.72	97.07
Argentina	5.15	6.09	9.79	10.31	11.11
Uruguay*	0.63	0.78	1.24	1.50	2.01
South Africa*	0.96	1.23	1.75	2.60	3.32
Ireland	4.42	5.12	5.01	5.17	8.29
United Kingdom*	11.98	13.87	13.77	12.90	14.94

Figure 3. Australian national milk production by State 1980-2020 (million litres)

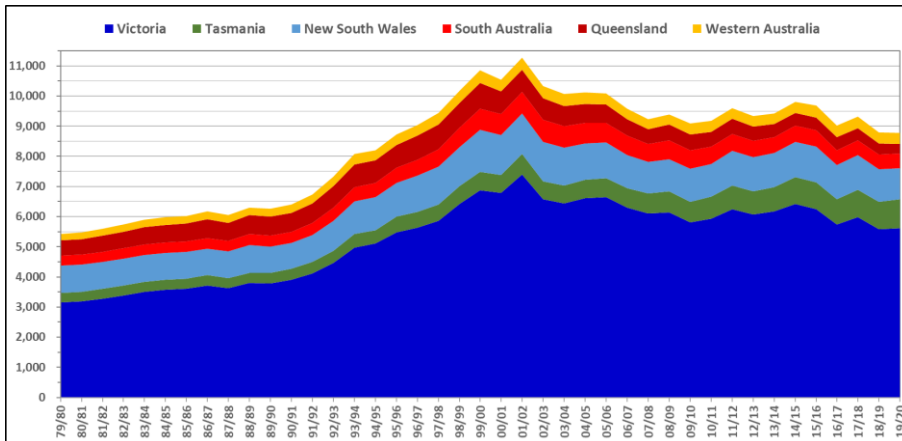
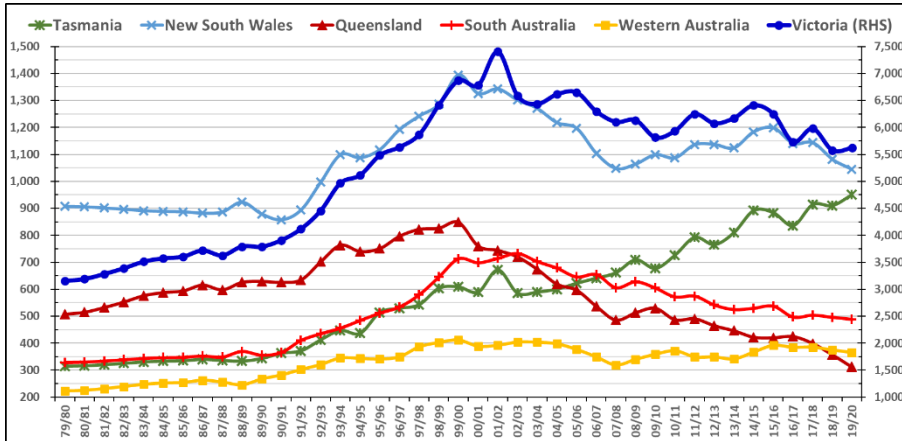


Figure 4. Australian national milk production by State 1980-2020 (million litres)



3. Growth in Milk Production – International, National, State and Region (industry averages)

Figure 5. Change in international milk production 1980-2020 (milksolids)

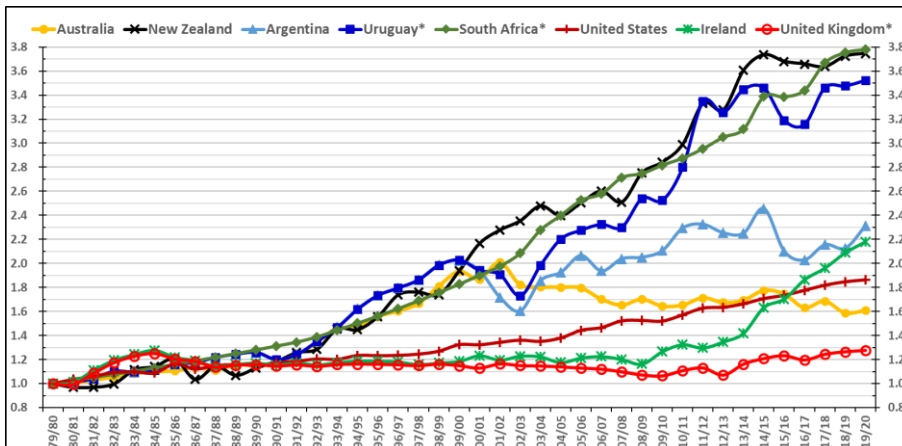
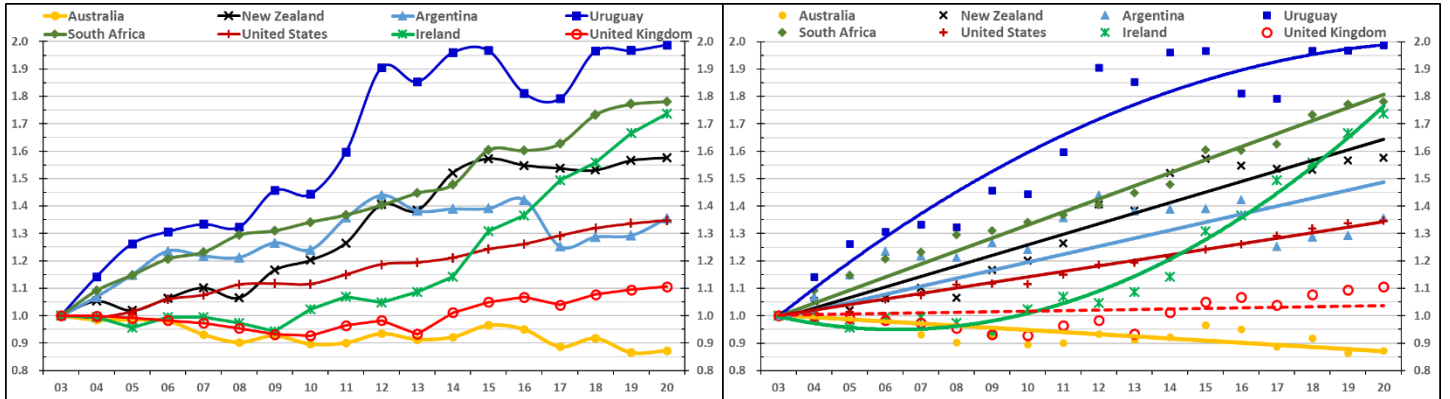


Figure 6. Compound Annual Growth Rate (CAGR) of international milk production 1980-2020 (milksolids)

CAGR-MILK (milksolids)	1980-2020	1980-2000	2000-2020	1980-1990	1990-2000	2000-2010	2010-2020	2015-2020
Australia	1.20%	3.35%	-0.91%	1.43%	5.30%	-1.60%	-0.22%	-1.94%
New Zealand	3.36%	3.37%	3.35%	1.23%	5.54%	3.90%	2.80%	0.06%
United States	1.57%	1.41%	1.72%	1.43%	1.40%	1.39%	2.05%	1.76%
Argentina	2.12%	3.59%	0.67%	2.31%	4.88%	0.40%	0.94%	-1.20%
Uruguay*	3.20%	3.60%	2.80%	2.34%	4.88%	2.21%	3.39%	0.36%
South Africa*	3.38%	3.06%	3.70%	2.50%	3.62%	4.43%	2.98%	2.22%
Ireland	1.97%	0.86%	3.09%	1.60%	0.12%	0.66%	5.58%	5.93%
United Kingdom*	0.61%	0.70%	0.52%	1.48%	-0.08%	-0.76%	1.82%	1.09%

Figure 7a & 7b. Change in international milk production 2003-2020 (milksolids ECM)



4. Number of Farms (industry averages)

Figure 8. Change in international number of farms 1980-2020

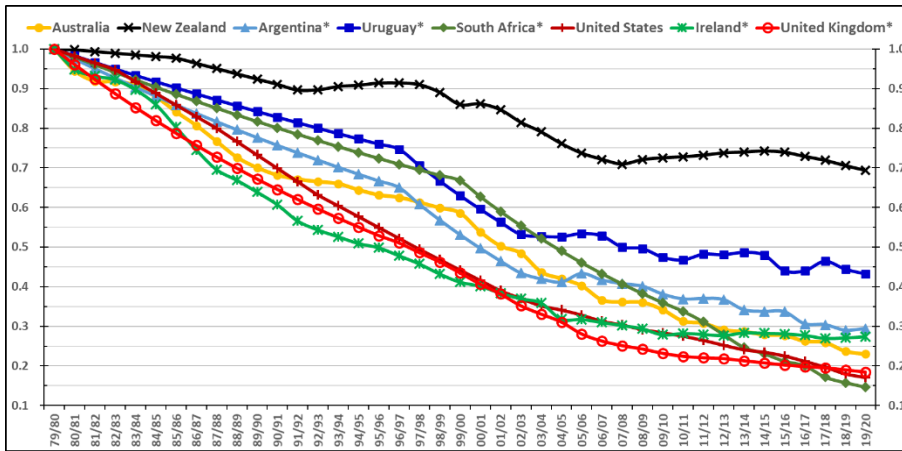


Figure 9. Change in international number of farms 2000-2020

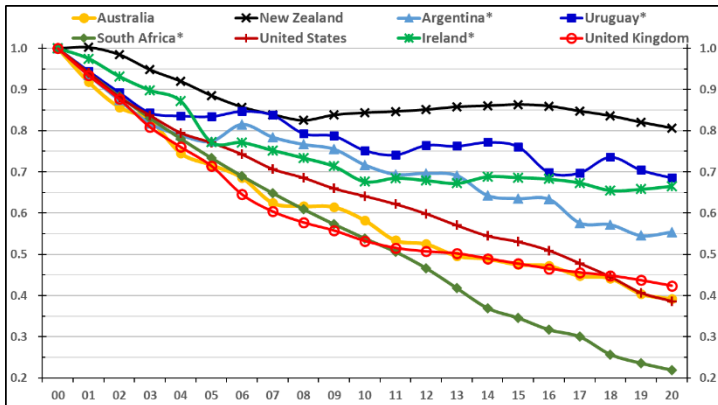


Figure 10: International number of farms 1980-2020

FARM NUMBERS	1980	1990	2000	2010	2020
Australia	21,994	15,396	12,888	7,511	5,055
New Zealand	16,123	14,899	13,861	11,691	11,179
United States	190,000	139,200	84,050	53,900	32,478
Argentina*	36,771	28,547	19,544	14,017	10,832
Uruguay*	5,235	4,410	3,301	2,484	2,264
South Africa*	7,947	6,493	5,305	2,857	1,164
Ireland*	64,559	41,254	26,583	17,988	17,698
United Kingdom*	65,332	43,889	28,422	15,139	12,044

Figure 11. Compound Annual Growth Rate (CAGR) of international number of farms 1980-2020

CAGR-FARM NUMBERS	1980-2020	1980-2000	2000-2020	1980-1990	1990-2000	2000-2010	2010-2020	2015-2020
Australia	-3.61%	-2.64%	-4.57%	-3.50%	-1.76%	-5.26%	-3.88%	-3.78%
New Zealand	-0.91%	-0.75%	-1.07%	-0.79%	-0.72%	-1.69%	-0.45%	-1.36%
United States	-4.32%	-4.00%	-4.64%	-3.06%	-4.92%	-4.35%	-4.94%	-6.14%
Argentina*	-3.01%	-3.11%	-2.91%	-2.50%	-3.72%	-3.27%	-2.54%	-2.70%
Uruguay*	-2.07%	-2.28%	-1.87%	-1.70%	-2.86%	-2.80%	-0.92%	-2.07%
South Africa*	-4.69%	-2.00%	-7.30%	-2.00%	-2.00%	-6.00%	-8.59%	-8.69%
Ireland*	-3.18%	-4.34%	-2.01%	-4.38%	-4.30%	-3.83%	-0.16%	-0.61%
United Kingdom*	-4.14%	-4.08%	-4.20%	-3.90%	-4.25%	-6.10%	-2.26%	-2.36%

5. Number of Cows (industry averages)

Figure 12. Change in international number of cows 1980-2020

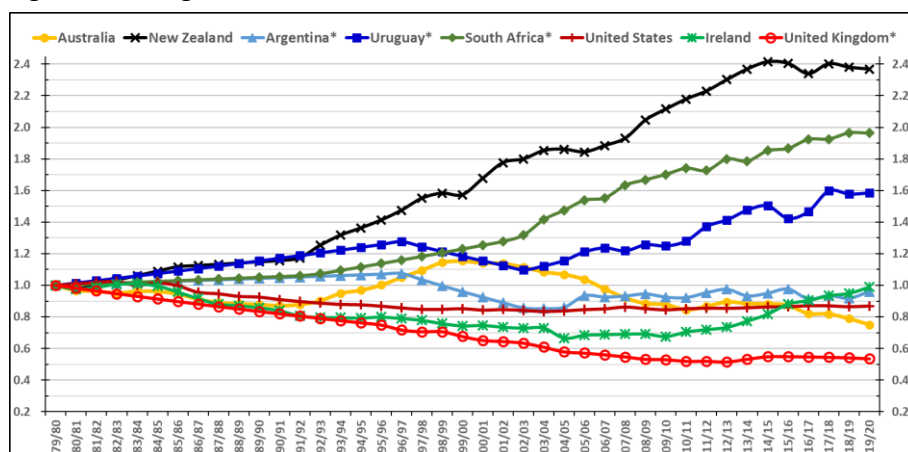


Figure 13. Change in international number of cows 2000-2020

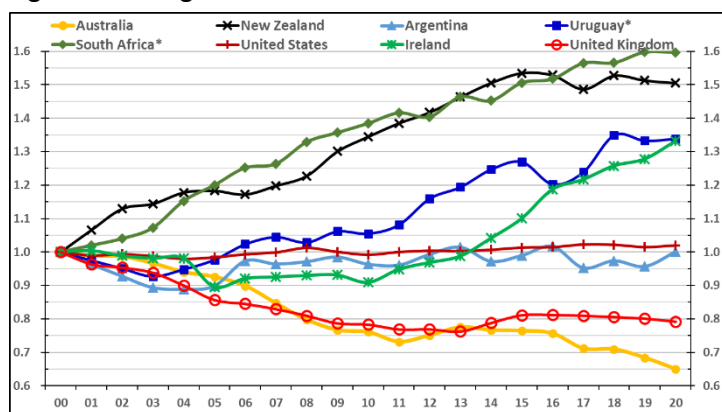


Figure 14: International number of cows 1980-2020 (thousands)

COW NUMBERS ('000)	1980	1990	2000	2010	2020
Australia	1,880	1,652	2,170	1,651	1,411
New Zealand	2,079	2,386	3,269	4,397	4,922
United States	10,799	9,993	9,199	9,123	9,382
Argentina*	1,913	1,996	1,837	1,770	1,839
Uruguay*	237	274	281	297	376
South Africa*	302	318	372	515	594
Ireland	1,583	1,360	1,178	1,071	1,568
United Kingdom*	3,452	2,883	2,336	1,830	1,850

Figure 15. Compound Annual Growth Rate (CAGR) of international number of cows 1980-2020

CAGR-COW NUMBERS	1980-2020	1980-2000	2000-2020	1980-1990	1990-2000	2000-2010	2010-2020	2015-2020
Australia	-0.72%	0.72%	-2.13%	-1.28%	2.76%	-2.70%	-1.56%	-3.20%
New Zealand	2.18%	2.29%	2.07%	1.39%	3.20%	3.01%	1.13%	-0.39%
United States	-0.35%	-0.80%	0.10%	-0.77%	-0.82%	-0.08%	0.28%	0.13%
Argentina*	-0.10%	-0.20%	0.00%	0.43%	-0.83%	-0.37%	0.38%	0.22%
Uruguay*	1.16%	0.85%	1.47%	1.45%	0.25%	0.54%	2.41%	1.06%
South Africa*	1.70%	1.04%	2.37%	0.49%	1.59%	3.31%	1.44%	1.18%
Ireland	-0.02%	-1.47%	1.44%	-1.51%	-1.43%	-0.95%	3.89%	3.88%
United Kingdom*	-1.55%	-1.93%	-1.16%	-1.79%	-2.08%	-2.41%	0.11%	-0.48%

6. Number of Cows per Farm (industry averages)

Figure 16. Change in international number of cows per farm 1980-2020

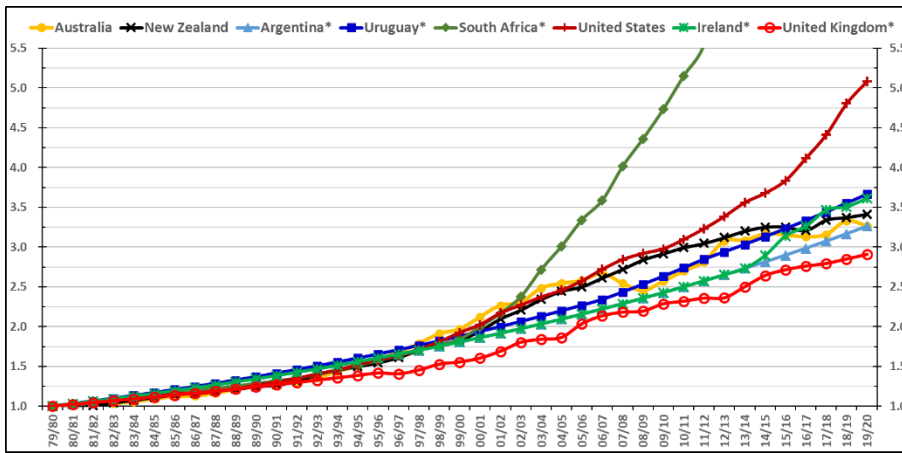


Figure 17. Change in international number of cows per farm 2000-2020

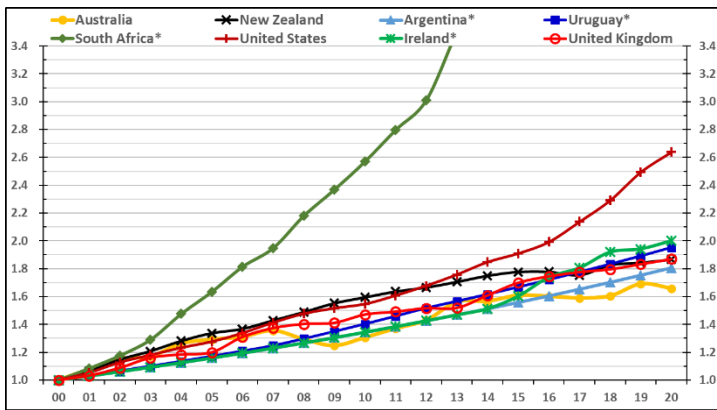


Figure 18: International number of cows per farm 1980-2020

COWS per FARM	1980	1990	2000	2010	2020
Australia	85	107	168	220	279
New Zealand	129	160	236	376	440
United States	57	72	109	169	289
Argentina*	52	70	94	126	170
Uruguay*	45	62	85	119	166
South Africa*	38	49	70	180	510
Ireland*	25	33	44	60	89
United Kingdom*	53	66	82	121	154

Figure 19. Compound Annual Growth Rate (CAGR) of international number of cows per farm 1980-2020

CAGR-COWS per FARM	1980-2020	1980-2000	2000-2020	1980-1990	1990-2000	2000-2010	2010-2020	2015-2020
Australia	3.00%	3.45%	2.56%	2.30%	4.61%	2.70%	2.42%	0.60%
New Zealand	3.12%	3.07%	3.17%	2.19%	3.95%	4.78%	1.59%	0.98%
United States	4.15%	3.33%	4.97%	2.36%	4.31%	4.46%	5.49%	6.68%
Argentina*	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Uruguay*	3.30%	3.20%	3.40%	3.20%	3.20%	3.44%	3.36%	3.20%
South Africa*	6.70%	3.10%	10.43%	2.54%	3.66%	9.90%	10.97%	10.81%
Ireland*	3.26%	3.00%	3.53%	3.00%	3.00%	3.00%	4.05%	4.52%
United Kingdom*	2.70%	2.23%	3.18%	2.20%	2.27%	3.93%	2.43%	1.92%

7. Milk Price per Litre (industry averages)

Figure 20a & 20b. International milk price 2003-2020 (USD c/litre ECM)

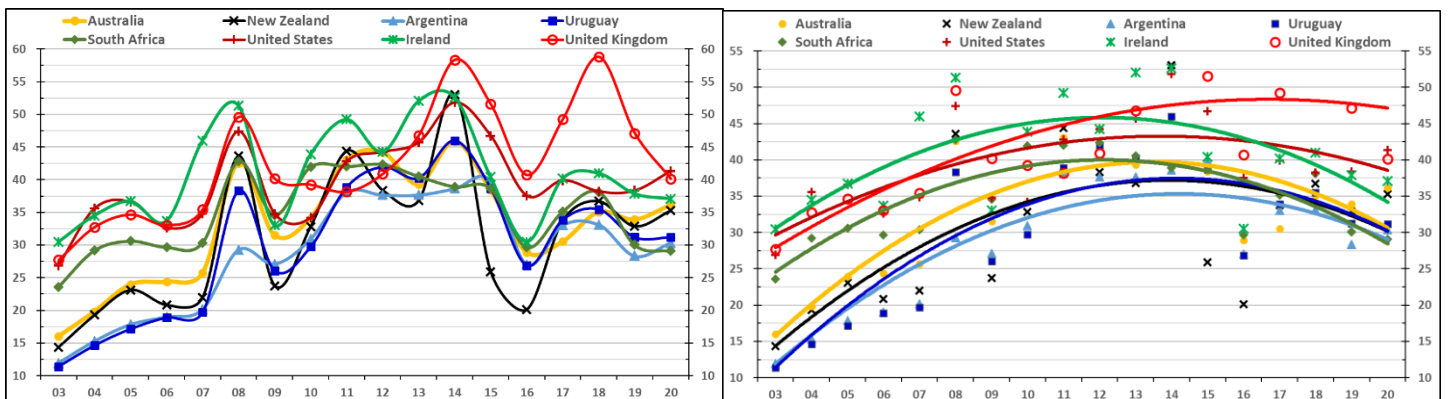
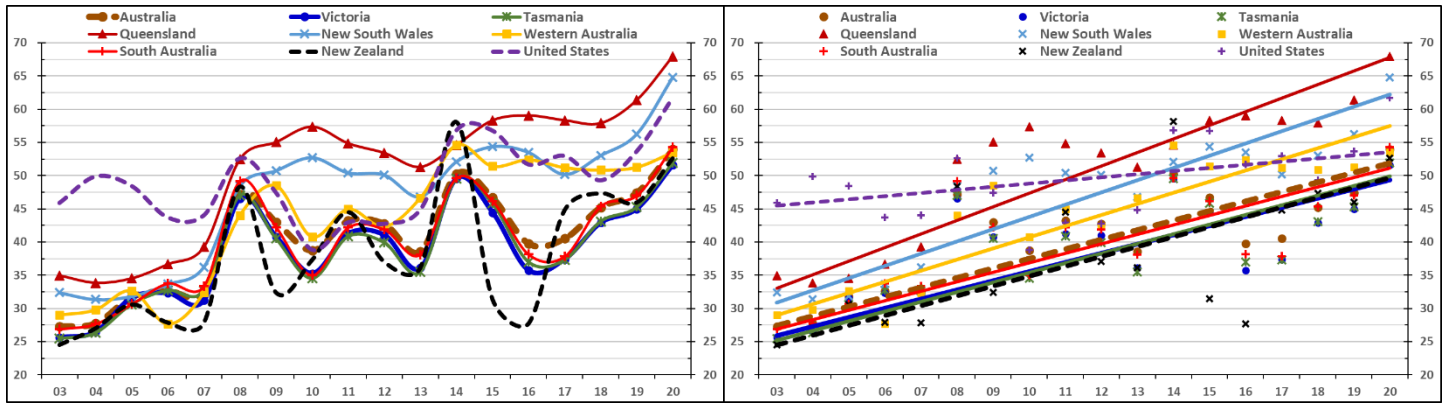


Figure 21a & 21b. Australian national and state milk price (plus NZ, US) 2003-2020 (AUD c/litre ECM)



8. Milk Production per Cow per Year (industry averages and benchmark averages)

Figure 22a & 22b. International milk production per cow 2003-2020 (litres ECM)

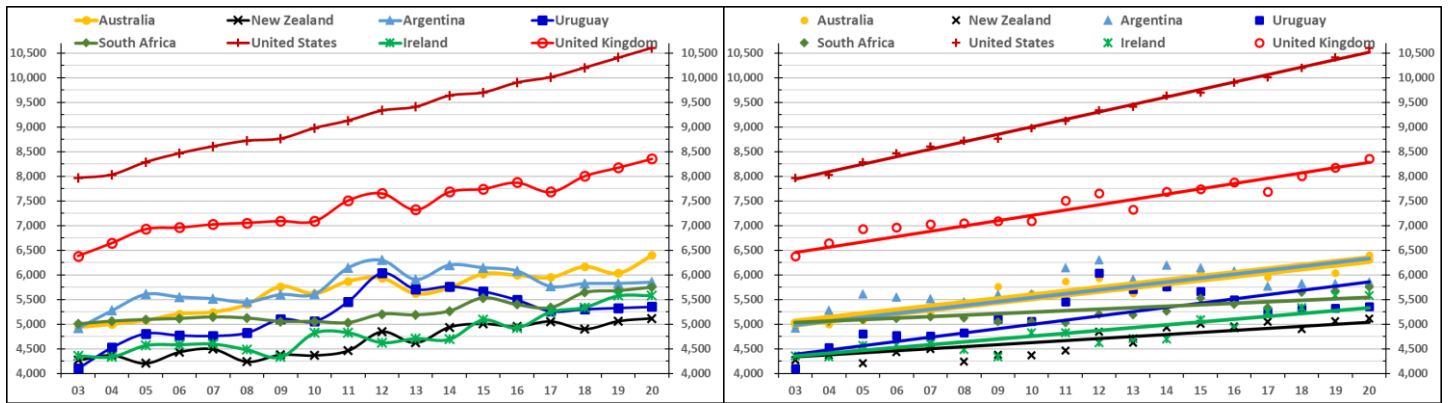


Figure 23a & 23b. Australian INDUSTRY national and state milk production per cow (plus NZ) 2003-2020 (litres ECM)

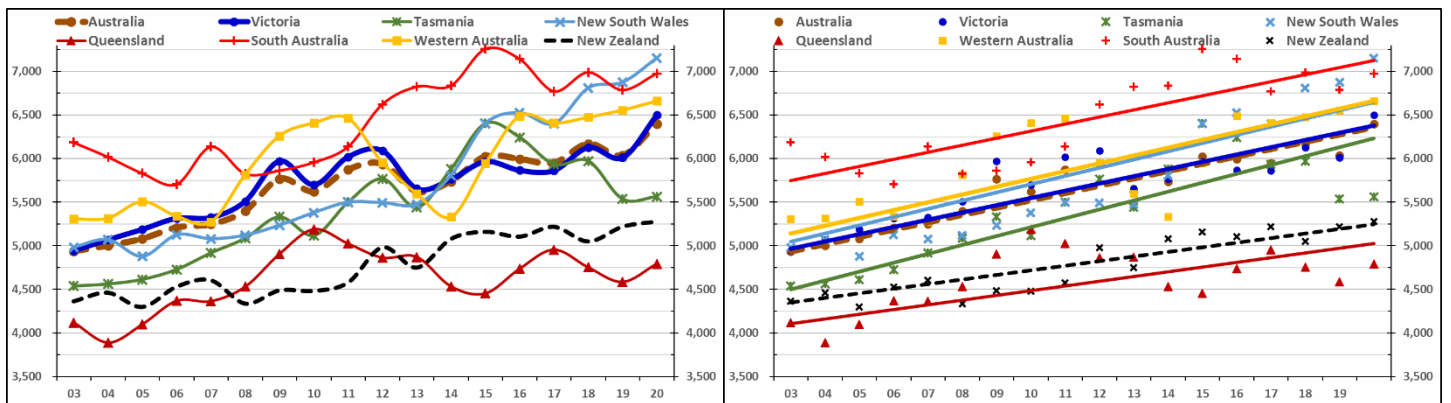


Figure 24. Change in international milk production per cow 1980-2020 (milksolids)

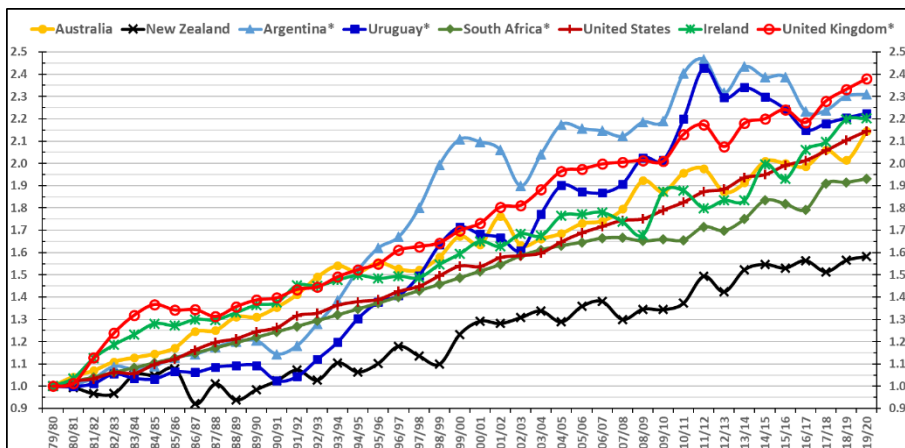


Figure 25. Change in international milk production per cow 2000-2020 (milk solids)

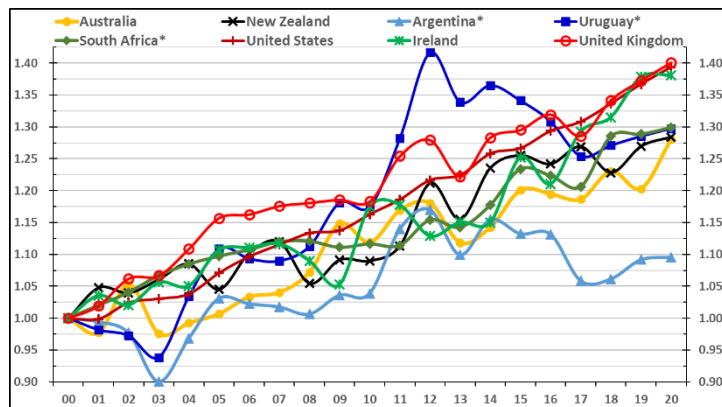


Figure 26: International milk production per cow 1980-2020 (milk solids)

MILK per COW (kgMS)	1980	1990	2000	2010	2020
Australia	220	289	368	412	472
New Zealand	243	240	300	327	385
United States	363	452	559	650	779
Argentina*	176	213	372	387	408
Uruguay*	175	191	299	352	388
South Africa*	219	267	325	363	422
Ireland	186	254	297	349	410
United Kingdom*	254	353	432	511	605

Figure 27. Compound Annual Growth Rate (CAGR) of international milk production per cow 1980-2020 (milk solids)

CAGR - MILK per COW	1980-2020	1980-2000	2000-2020	1980-1990	1990-2000	2000-2010	2010-2020	2015-2020
Australia	1.92%	2.61%	1.24%	2.75%	2.47%	1.13%	1.36%	1.30%
New Zealand	1.15%	1.05%	1.26%	-0.15%	2.27%	0.87%	1.65%	0.45%
United States	1.93%	2.18%	1.67%	2.21%	2.15%	1.52%	1.83%	1.93%
Argentina*	2.12%	3.80%	0.46%	1.88%	5.76%	0.38%	0.53%	-0.66%
Uruguay*	2.02%	2.73%	1.31%	0.89%	4.61%	1.62%	1.00%	-0.66%
South Africa*	1.66%	2.00%	1.32%	2.00%	2.00%	1.11%	1.53%	1.03%
Ireland	1.99%	2.36%	1.63%	3.15%	1.57%	1.62%	1.63%	1.97%
United Kingdom*	2.19%	2.68%	1.70%	3.32%	2.05%	1.70%	1.70%	1.58%

Figure 28. Impact of increasing milk production per cow on profit for pasture-based farms (Beca 2020b)

As milk production per cow INCREASES	Change	R ²	P
Return on Capital (PROFIT)	No change	0.05	0.0049
Cost of production per litre	No change	0.02	0.213
Core per cow cost	Increases	0.28	<= 0.001
Supplement cost per litre	Increases	0.26	<= 0.001
Total feed cost per litre	Increases	0.22	<= 0.001
Labour cost per cow	Increases	0.19	<= 0.001
Pasture cost per tonne dry matter	Increases	0.12	<= 0.001
Core per hectare cost per tDM of pasture harvest	Increases	0.09	<= 0.001

9. Milk Production per Effective Milking Hectare (benchmark averages)

Figure 29a & 29b. International milk production per hectare 2003-2020 (litres ECM)

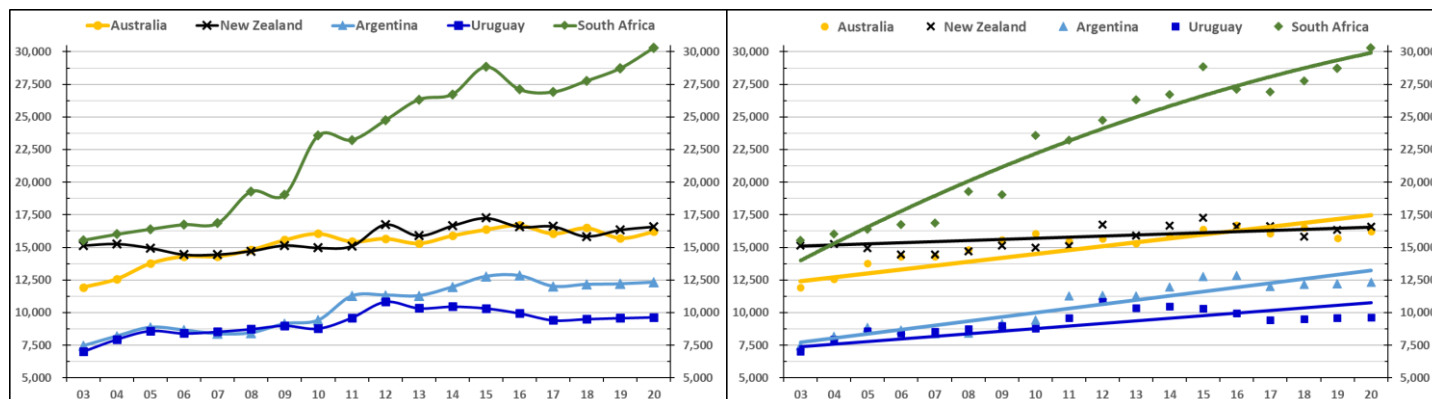
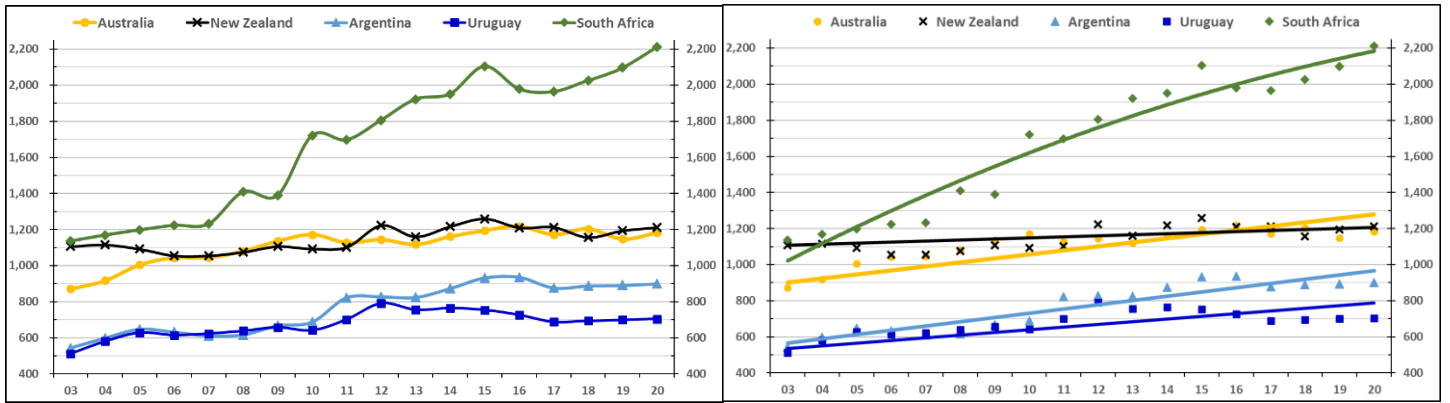
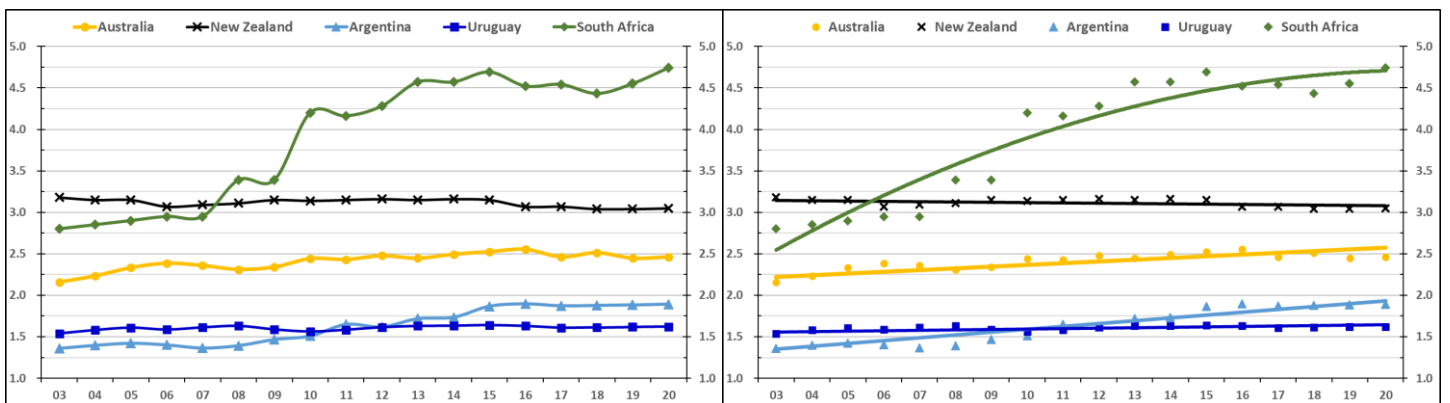


Figure 30a & 30b. International milk production per hectare 2003-2020 (kg milksolids ECM)



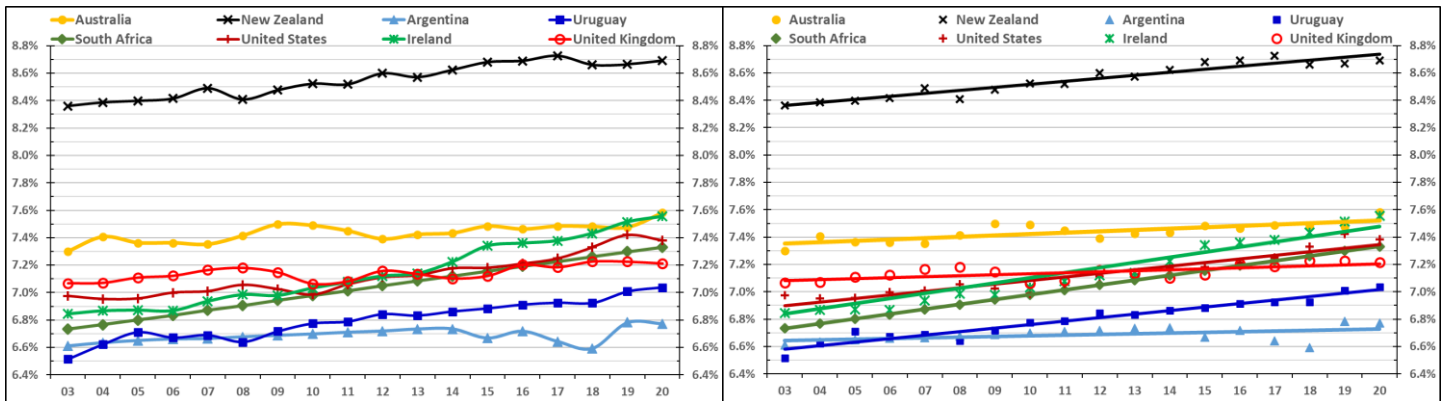
10. Stocking Rate (benchmark averages)

Figure 31a & 31b. International stocking rate 2003-2020 (cows per effective milking hectare)



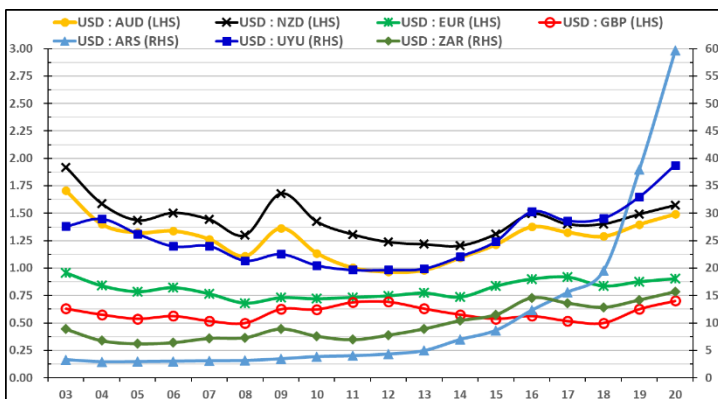
11. Milksolids (fat and protein) Percentage (industry averages)

Figure 32a & 32b. International milksolids (fat + protein) percentage 2003-2020



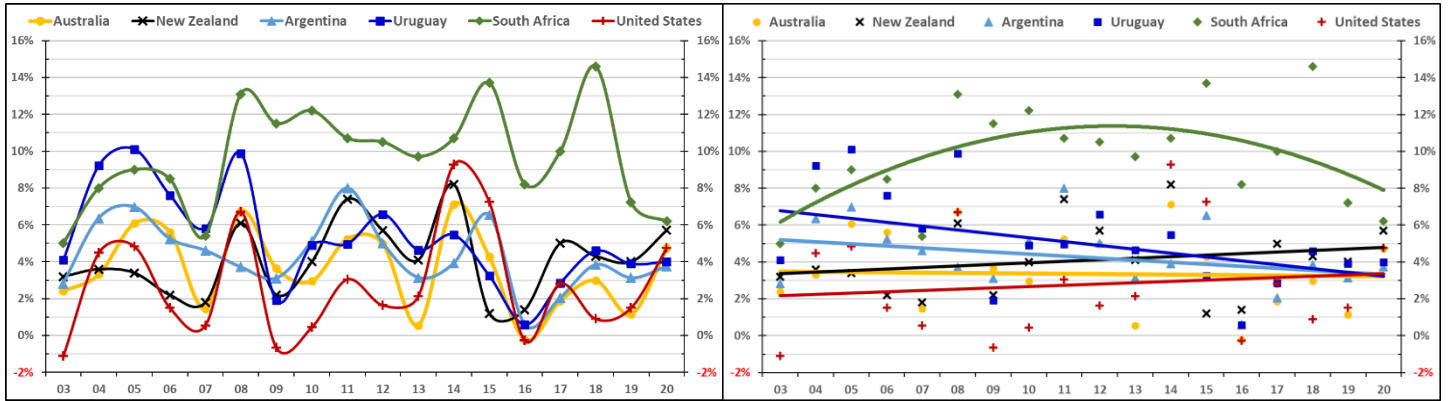
12. USD Exchange Rates (international)

Figure 33. USD exchange rates 2003-2020



13. Return on Capital (benchmark averages)

Figure 34a & 34b. International return on capital 2003-2020



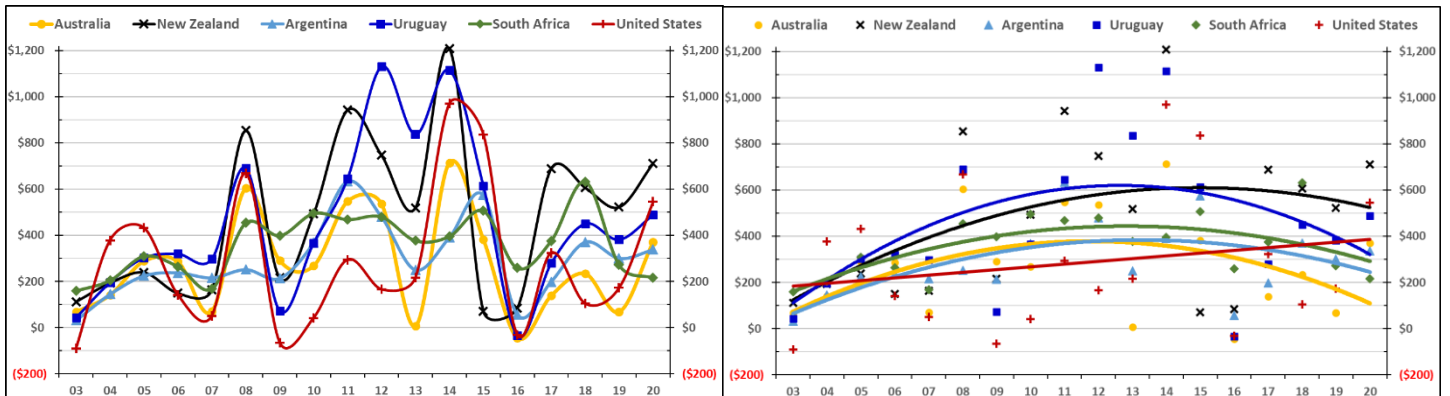
14. Ratios that Correlate with Return on Capital (Beca 2020b)

Figure 35. Ratios that Correlate with Return on Capital (Beca 2020b)

Primary ratio	R ²	P	Secondary ratio or proxy	R ²	P
Return on total capital (ROC) [defines profit]	Comparator for other ratios		Profit per hectare	0.79	<= 0.001
			Profit per cow	0.73	<= 0.001
Operating profit margin	0.75	<= 0.001	Profit per litre	0.76	<= 0.001
Cost of production per litre	0.44	<= 0.001	Total expenses per litre	0.51	<= 0.001
Pasture harvest	0.41	<= 0.001			
Pasture cost per tonne dry matter	0.23	<= 0.001			
Milk price	0.20	<= 0.001			
Milk production per hectare	0.20	<= 0.001	Stocking rate	0.25	<= 0.001
Supplement cost per litre	0.20	<= 0.001	Total feed cost per litre	0.21	<= 0.001
Core per cow cost	0.20	<= 0.001			
Labour cost per cow	0.18	<= 0.001	Cows per full-time staff equivalent	0.13	<= 0.001
			Labour cost per litre	0.17	<= 0.001
			Litres per full-time staff equivalent	0.11	<= 0.001
Core per hectare cost per tonne dry matter of pasture harvest	0.17	<= 0.001			
Pasture as per cent of diet	0.08	<= 0.001	Pasture consumed per cow	0.07	0.001
Ratios of low utility		R²	P	(some impractical to apply)	
Milk production per cow	0.05	0.0049	Little to no positive or negative correlation with ROC		
Income over feed costs per litre	0.28	<= 0.001	Correlation calculated on annual basis (for practical use, would need to be calculated on monthly or weekly basis)		
Income over feed costs per cow	0.25	<= 0.001	Correlation calculated on annual basis (for practical use, would need to be calculated on monthly or weekly basis)		
Grams concentrate per litre	0.10	<= 0.001	Correlation calculated on annual basis (for practical use, would need to be calculated on monthly or weekly basis)		
Grams supplement per litre	0.08	<= 0.001	Correlation calculated on annual basis (for practical use, would need to be calculated on monthly or weekly basis)		

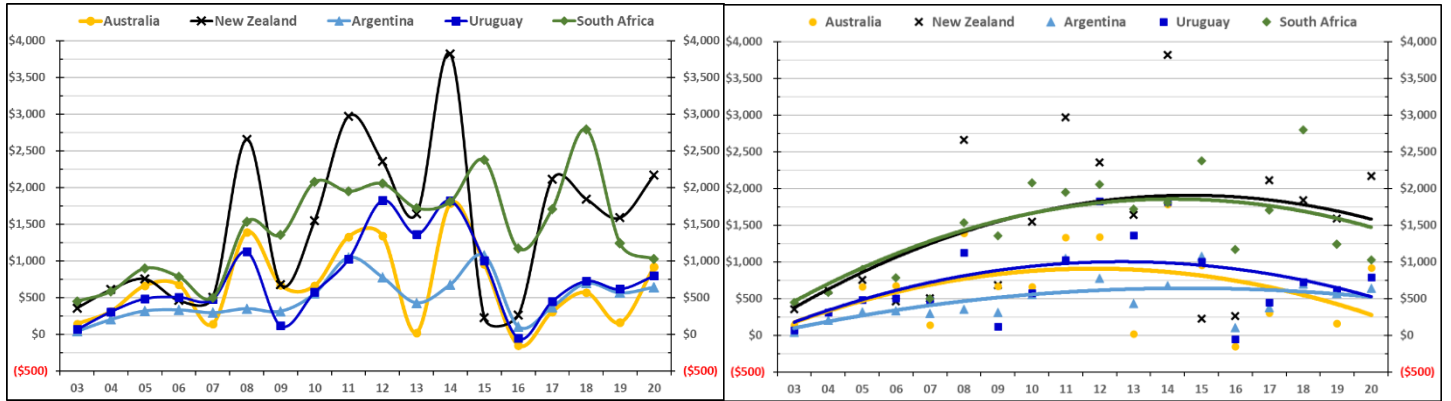
15. Profit per Cow (benchmark averages)

Figure 36a & 36b. International profit per cow 2003-2020 (USD)



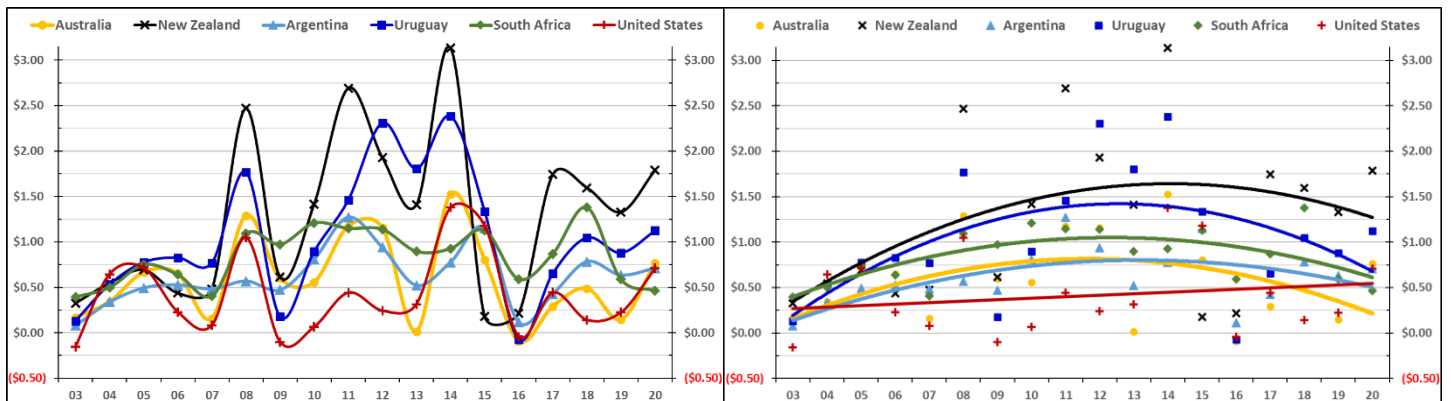
16. Profit per Effective Milking Hectare (benchmark averages)

Figure 37a & 37b. International profit per effective milking hectare 2003-2020 (USD)



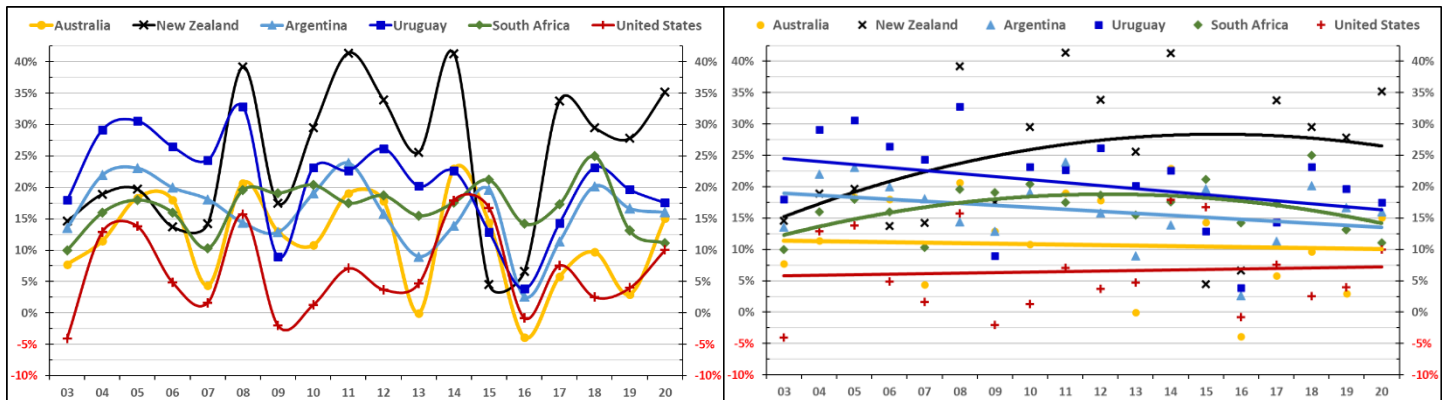
17. Profit per kg Milk solids (benchmark averages)

Figure 38a & 38b. International profit per kg milk solids 2003-2020 (USD/kgMS ECM)



18. Operating Profit Margin (benchmark averages)

Figure 39a & 39b. International operating profit margin 2003-2020



19. 'Operating' Cost of Production per Litre (benchmark averages)

Operating (accounting) cost of production = Operating expenses minus livestock revenue minus other non-milk revenue

Figure 40a & 40b. International operating cost of production 2003-2020 (USD c/litre ECM)

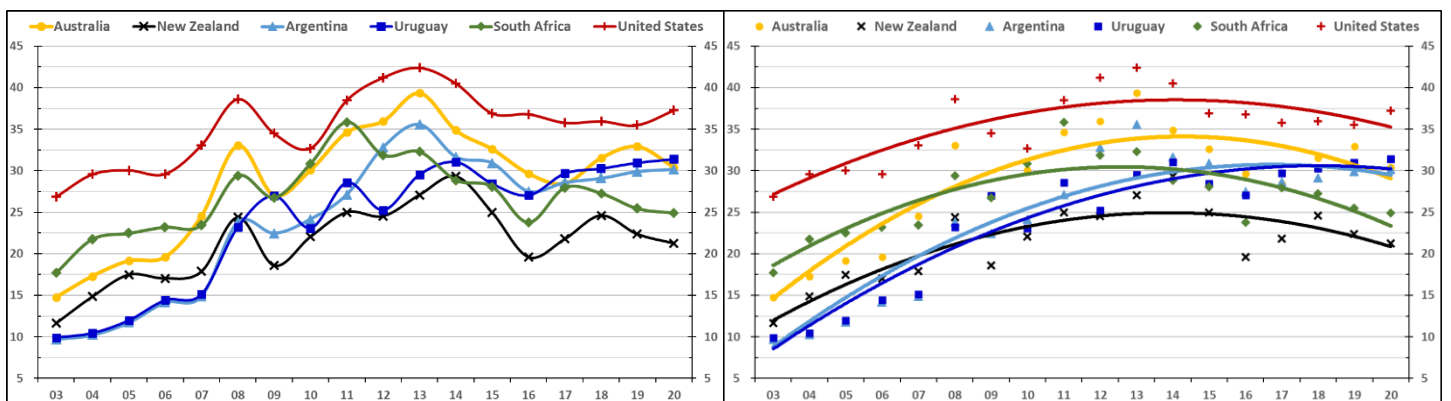
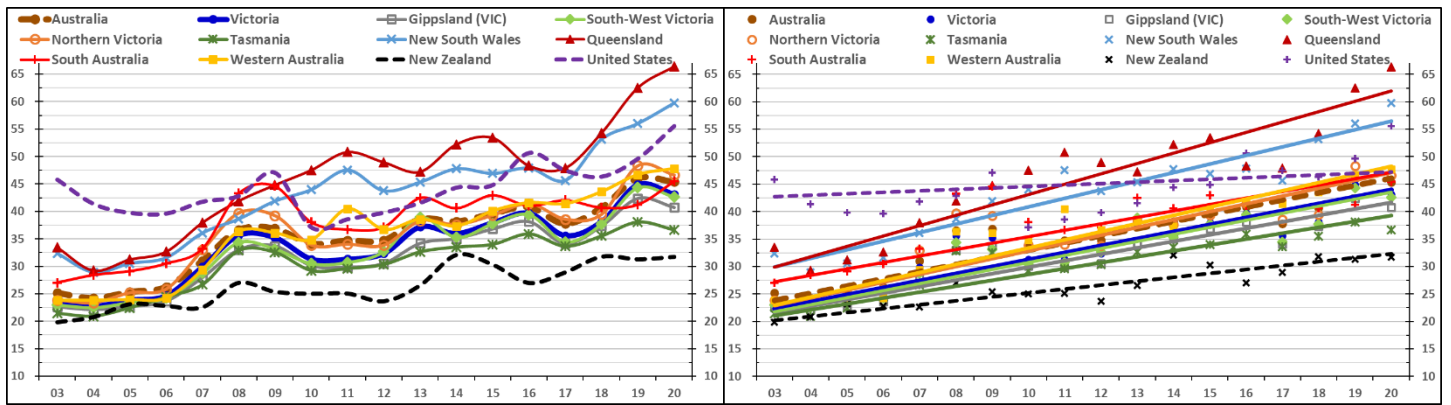
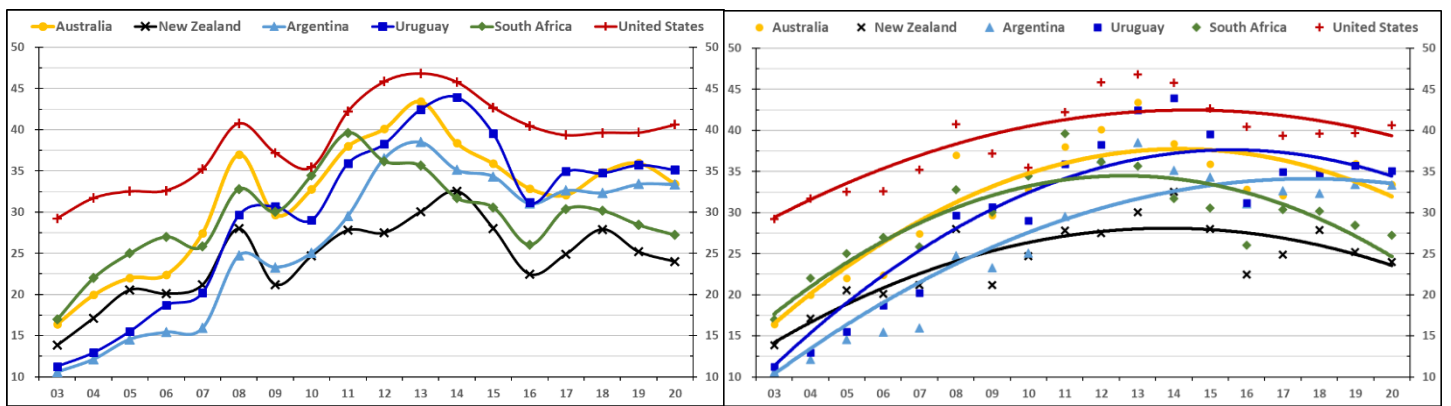


Figure 41a & 41b. Australian national, state and Vic regions cost of production (plus NZ, US) 2003-2020 (AUD c/litre ECM)



20. Total Operating Expenses per Litre (benchmark averages)

Figure 42a & 42b. International total operating expenses 2003-2020 (USD c/litre ECM)



21. Pasture Harvest (benchmark averages)

Figure 43a & 43b. International pasture harvest 2003-2020 (tonne DM/ha)

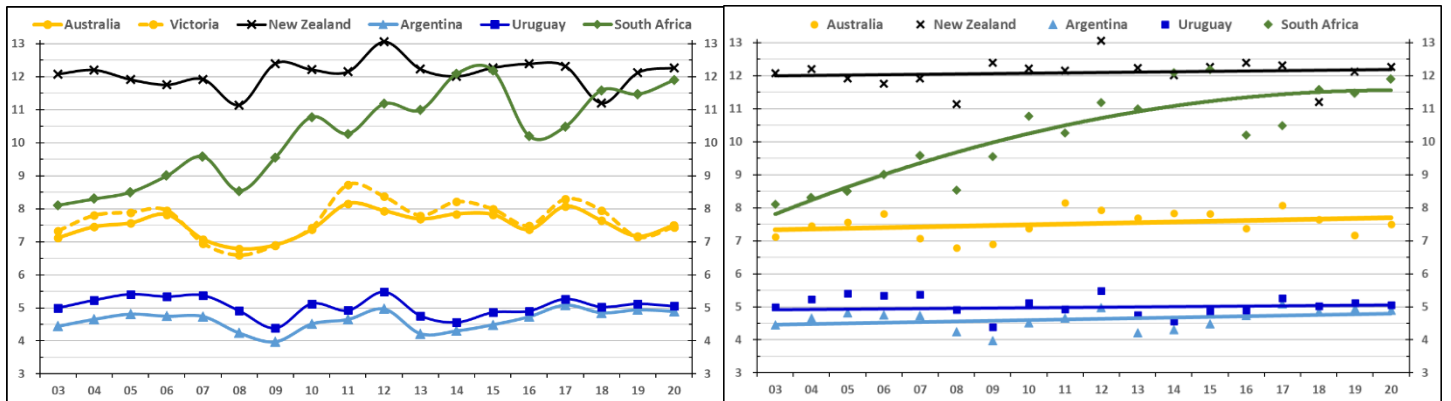


Figure 44a & 44b. Australian national, state and Vic regions pasture harvest (plus NZ, ARG) 2003-2020 (tonne DM/ha)

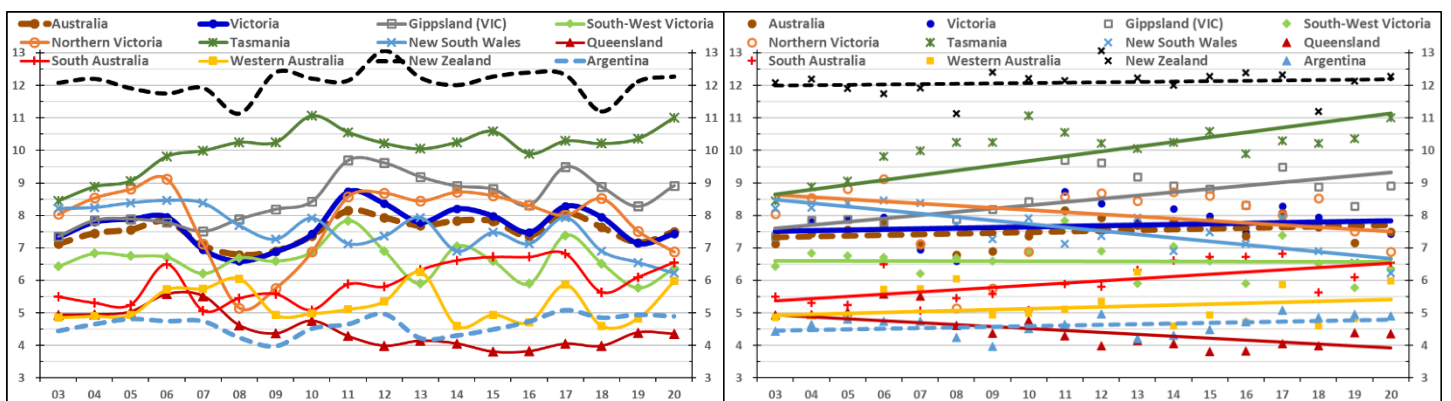


Figure 45. Impact of increasing pasture harvest on profit for pasture-based farms (Beca 2020b)

As pasture harvest INCREASES	Change	R ²	P
Return on Capital (PROFIT)	Increases	0.41	<= 0.001
Cost of production per litre	Decreases	0.14	<= 0.001
Core per hectare cost per tDM of pasture harvest	Decreases	0.31	<= 0.001
Pasture cost per tonne dry matter	Decreases	0.23	<= 0.001
Supplement cost per litre	Decreases	0.12	<= 0.001
Labour cost per cow	Decreases	0.09	<= 0.001
Core per cow cost	Decreases	0.08	<= 0.001
Other factors			
Stocking rate impact on pasture harvest	Increases	0.63	<= 0.001
Pasture consumed/cow impact on pasture harvest	Increases	0.07	<= 0.001

22. Pasture as Percent of Cows' Diet (benchmark averages)

Figure 46a & 46b. International pasture as percent of cows' diet 2003-2020

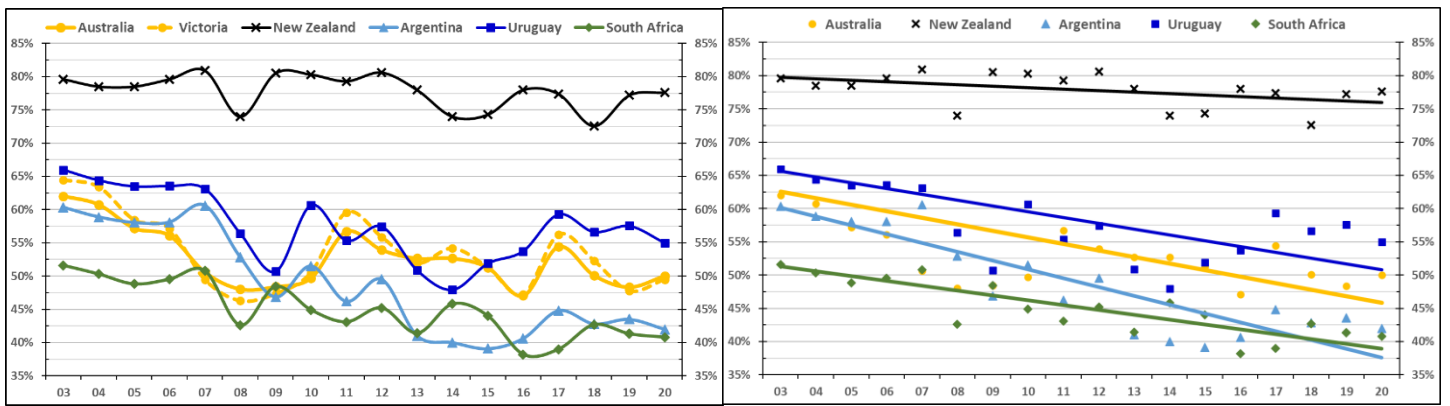


Figure 47a & 47b. Australian national, state and Vic regions pasture as percent of cows' diet (plus NZ) 2003-2020

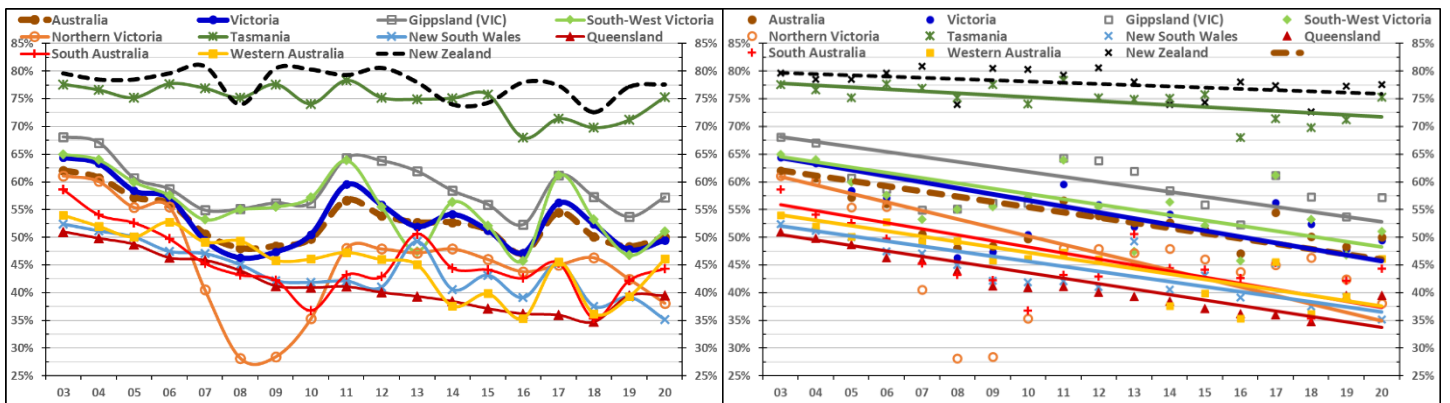
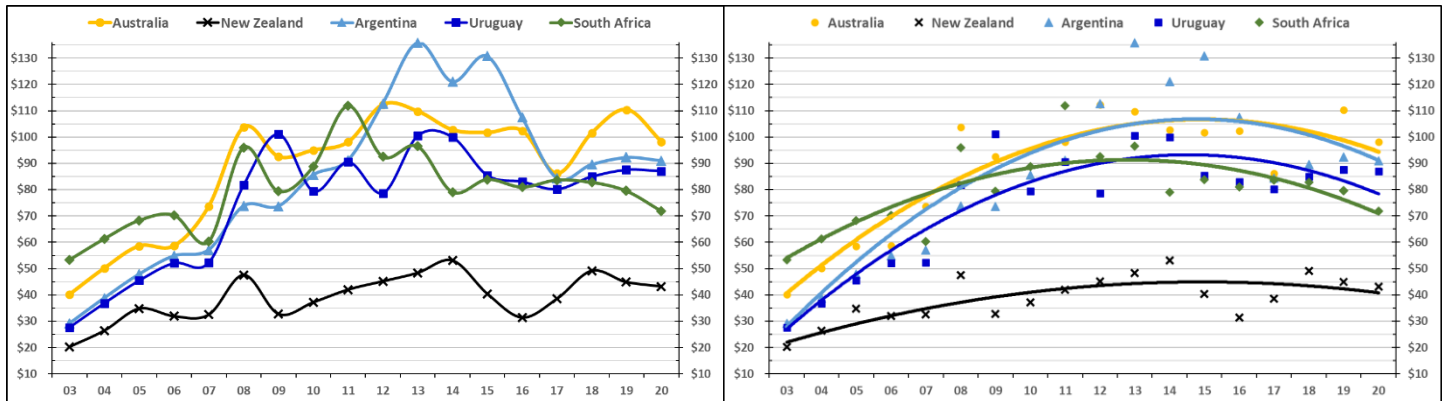


Figure 48. Impact of decreasing pasture as percent of cows' diet on profit for pasture-based farms (Beca 2020b)

As pasture as per cent of cows' diet DECREASES	Change	R ²	P
Return on Capital (PROFIT)	Decreases	0.08	<= 0.001
Cost of production per litre	Increases	0.16	<= 0.001
Pasture consumed per cow	Decreases	0.68	<= 0.001
Supplement cost per litre	Increases	0.58	<= 0.001
Total feed cost per litre	Increases	0.50	<= 0.001
Core per hectare cost per tDM of pasture harvest	Increases	0.49	<= 0.001
Pasture cost per tonne dry matter	Increases	0.26	<= 0.001
Core per cow cost	Increases	0.09	<= 0.001
Labour cost per cow	Increases	0.08	<= 0.001
Pasture harvest	Decreases	0.10	<= 0.001
Total consumed per cow	Increases	0.31	<= 0.001
Milk production per cow	Increases	0.32	<= 0.001

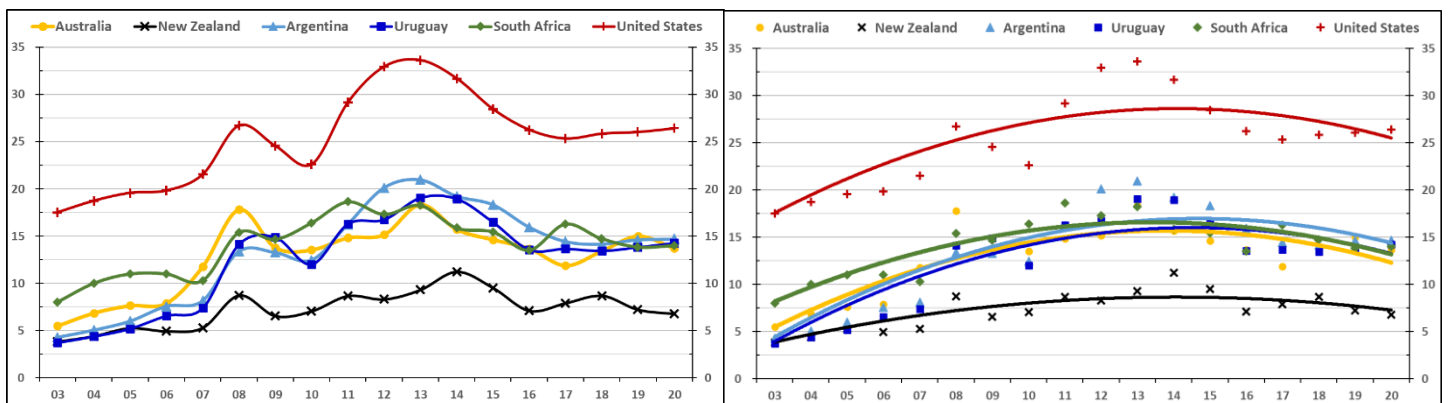
23. Pasture Cost per Tonne Dry Matter (benchmark averages)

Figure 49a & 49b. International pasture cost per tonne dry matter 2003-2020 (USD/tDM)



24. Supplement Cost per Litre (benchmark averages)

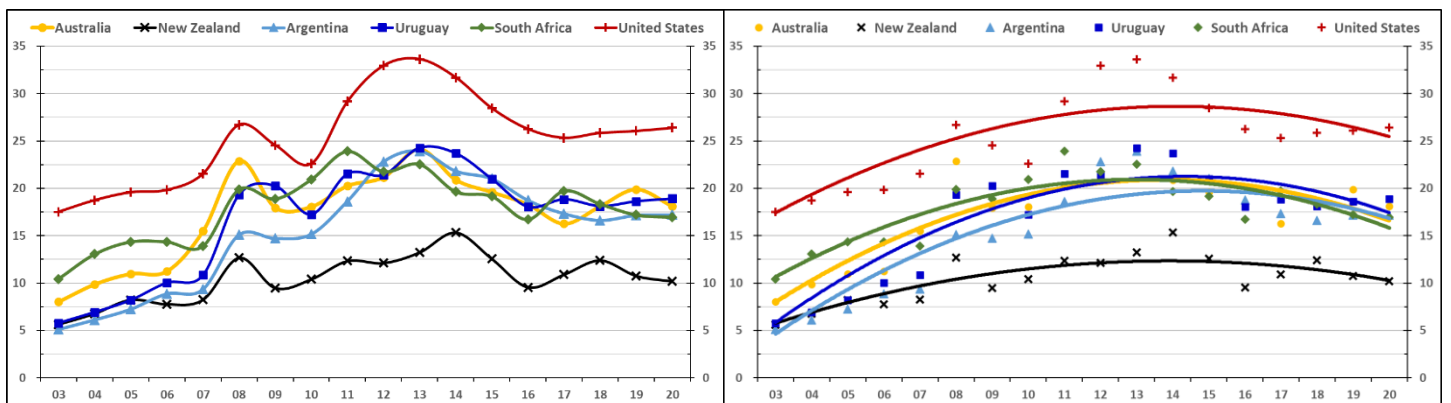
Figure 50a & 50b. International supplement cost 2003-2020 (USD c/litre ECM)



25. Total Feed Cost per Litre (benchmark averages)

Total feed cost = Supplement cost plus Pasture cost

Figure 51a & 51b. International total feed cost 2003-2020 (USD c/litre ECM)



26. Labour Cost per Cow (benchmark averages)

Labour cost includes full cost of management (including imputed owner salary)

Figure 52a & 52b. International labour cost 2003-2020 (USD/cow)

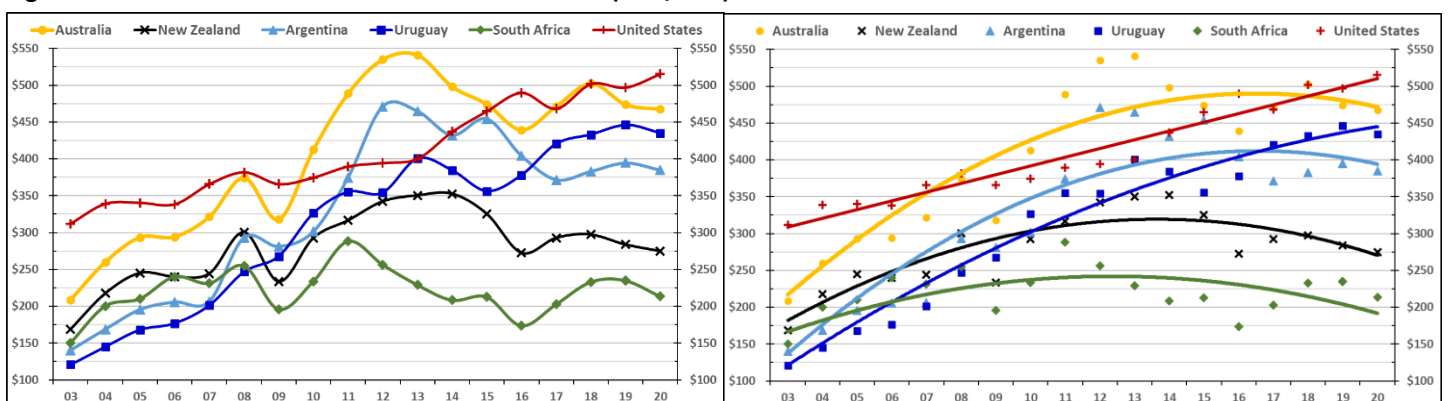
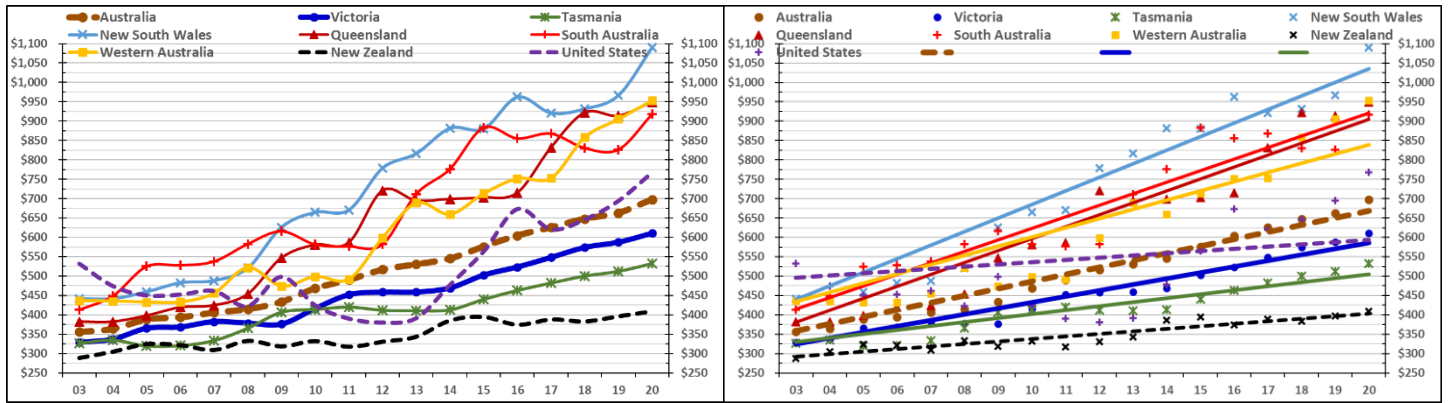


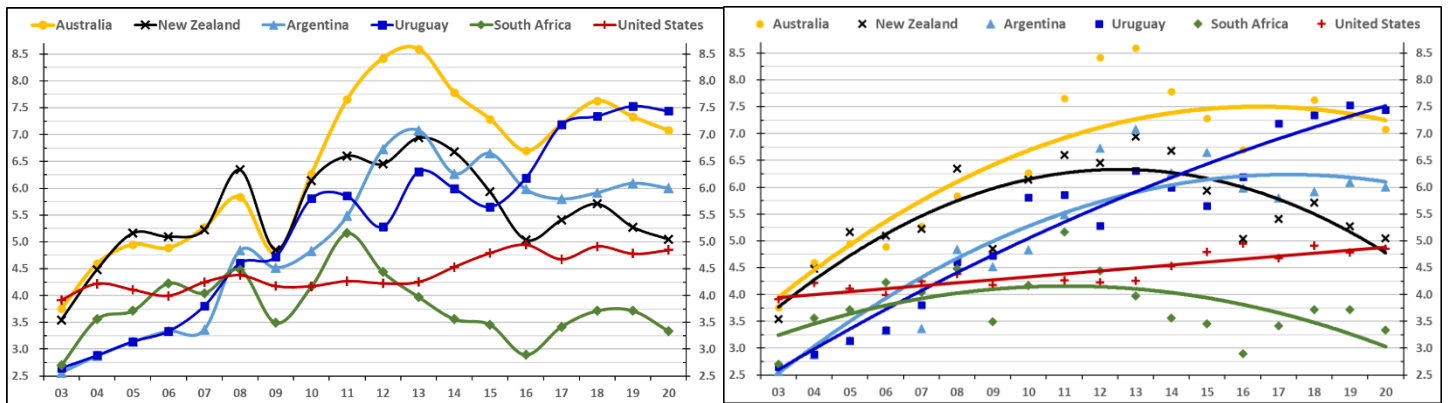
Figure 53a & 53b. Australian national and state labour cost (plus NZ, US) 2003-2020 (AUD/cow)



27. Labour Cost per Litre (benchmark averages)

Labour cost includes full cost of management (including imputed owner salary)

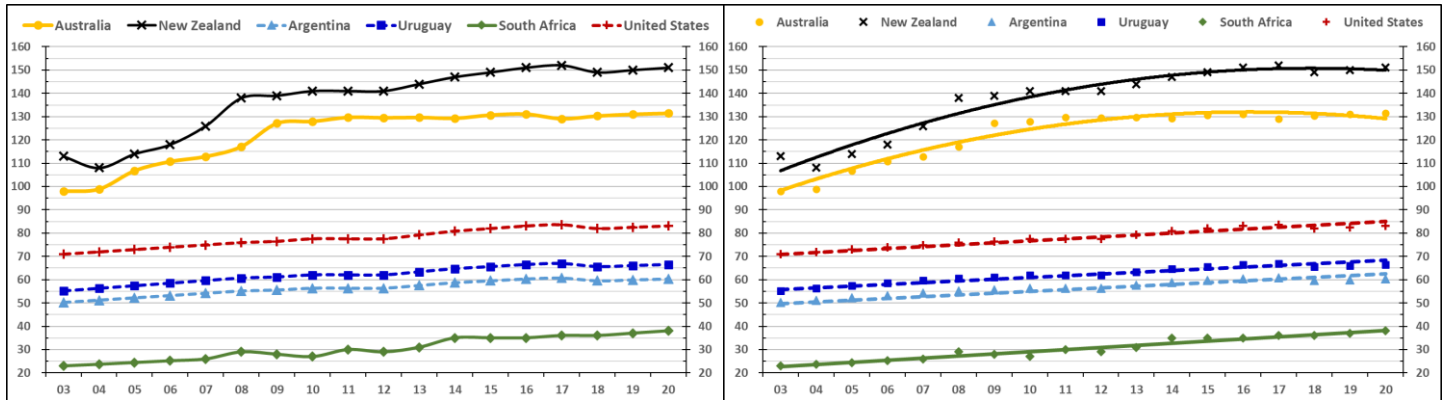
Figure 54a & 54b. International labour cost 2003-2020 (USD c/litre ECM)



28. Labour Efficiency = Cows per 50-hour Full-Time Equivalent (benchmark averages)

Cows = Cows in Herd. Full management time included. 50-hour Full-Time Equivalent = 'FTE'.

Figure 55a & 55b. International labour efficiency 2003-2020 (cows/FTE)



29. Minimum hourly salary including taxes/superannuation/levies (international)

Figure 56a & 56b. International minimum hourly salary 2003-2020 (USD/hour)

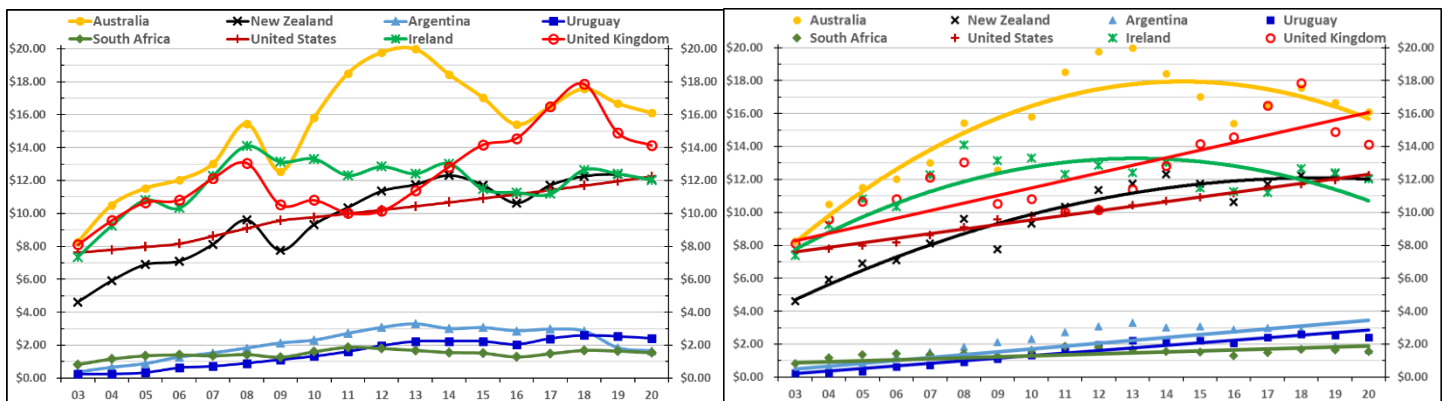
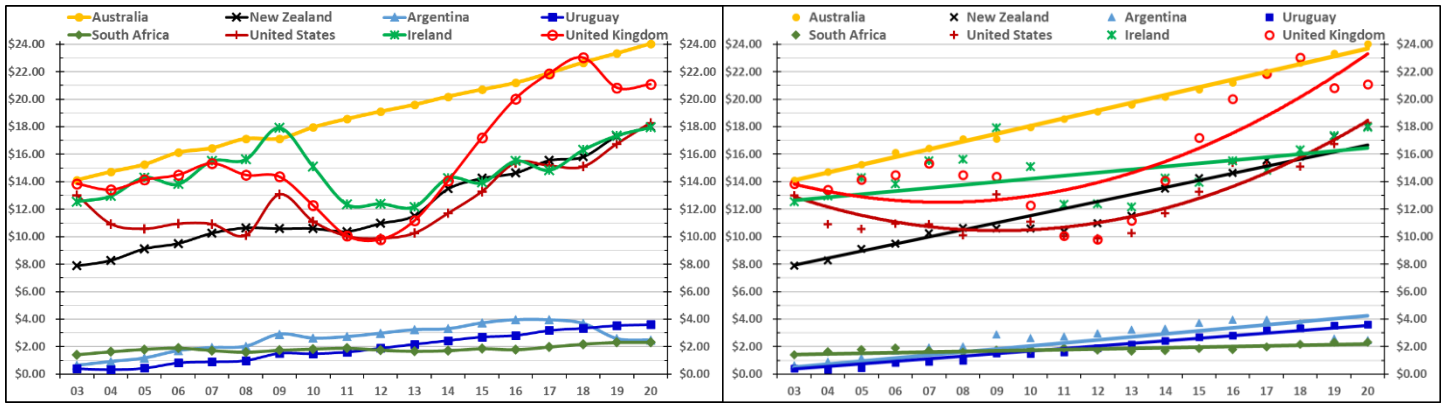


Figure 57a & 57b. International minimum hourly salary 2003-2020 (AUD/hour)

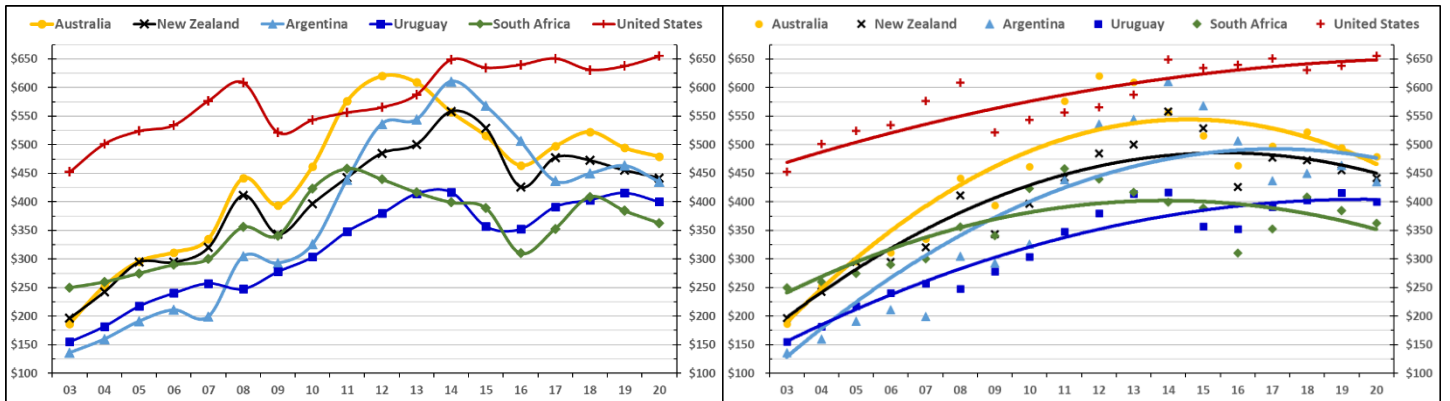


30. Core per Cow Cost (benchmark averages)

Figure 58. Costs included in 'Core per Cow Cost' calculation (Beca 2020b)

Costs included in Core per Cow Costs	Percent
Animal Health	100%
Breeding	100%
Dairy Shed Expenses	100%
Electricity / Energy	100%
Freight on Livestock	100%
Support / Youngstock	100%
Repairs & Maintenance	50%
Vehicle Expenses incl. fuel & oil	70%
Industry Levies	100%
Depreciation	50%

Figure 59a & 59b. International core per cow cost 2003-2020 (USD/cow)

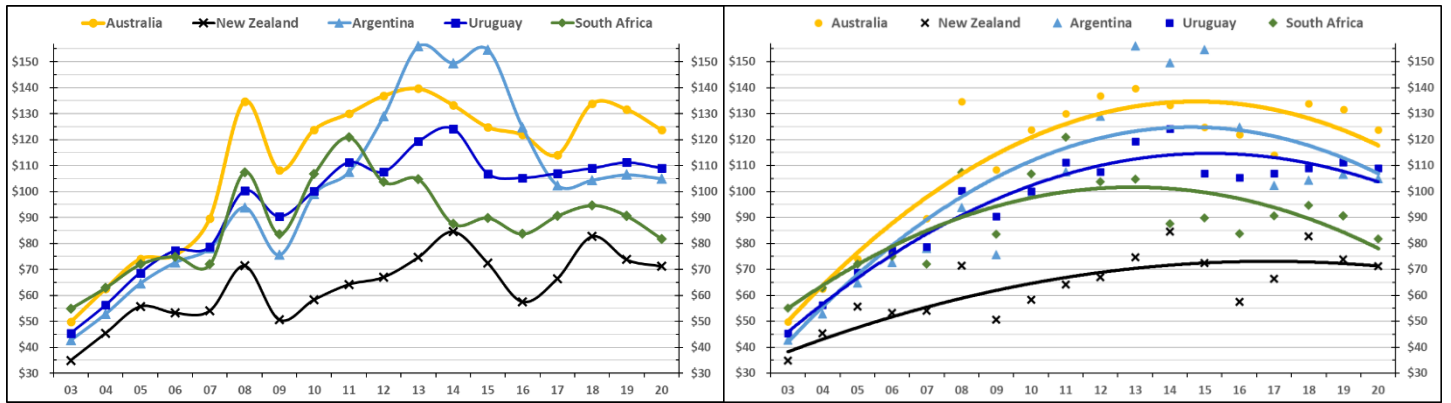


31. Core per Hectare Cost per tonne Dry Matter of Pasture (benchmark averages)

Figure 60. Costs included in 'Core per Hectare Cost per tonne Dry Matter of Pasture' calculation (Beca 2020b)

Costs included in Core per Hectare Costs	Percent
Cropping (greenfeed)	100%
Fertiliser excl. Nitrogen	100%
Pasture Maintenance & Renewal	100%
Repairs & Maintenance	50%
Vehicle Expenses incl. fuel & oil	30%
Administration	100%
Insurance, Land Taxes, Licenses	100%
Professional fees	100%
Depreciation	50%

Figure 61a & 61b. International core per hectare cost 2003-2020 (USD/ha/tDM)



32. 'Economic' Cost of Production per Litre (benchmark averages)

Economic cost of production = Operating cost of production plus Opportunity cost of capital

Figure 62a & 62b. International economic cost of production 2003-2020 (USD c/litre ECM)

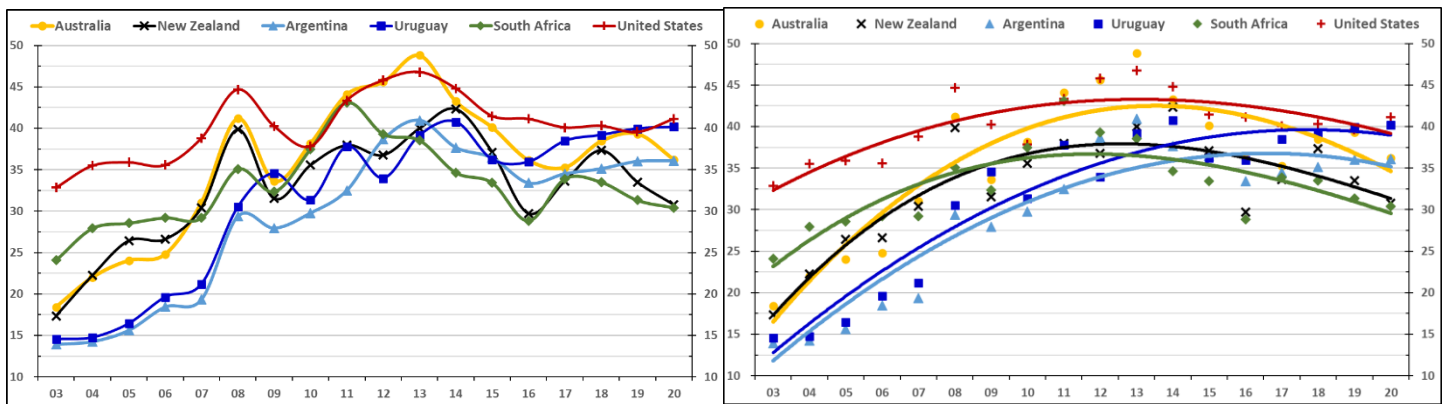
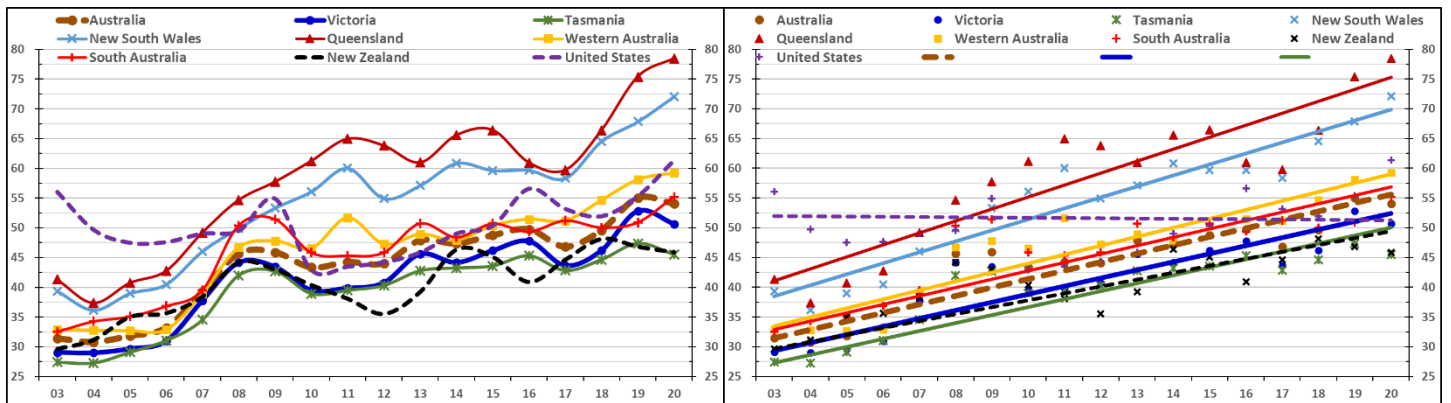
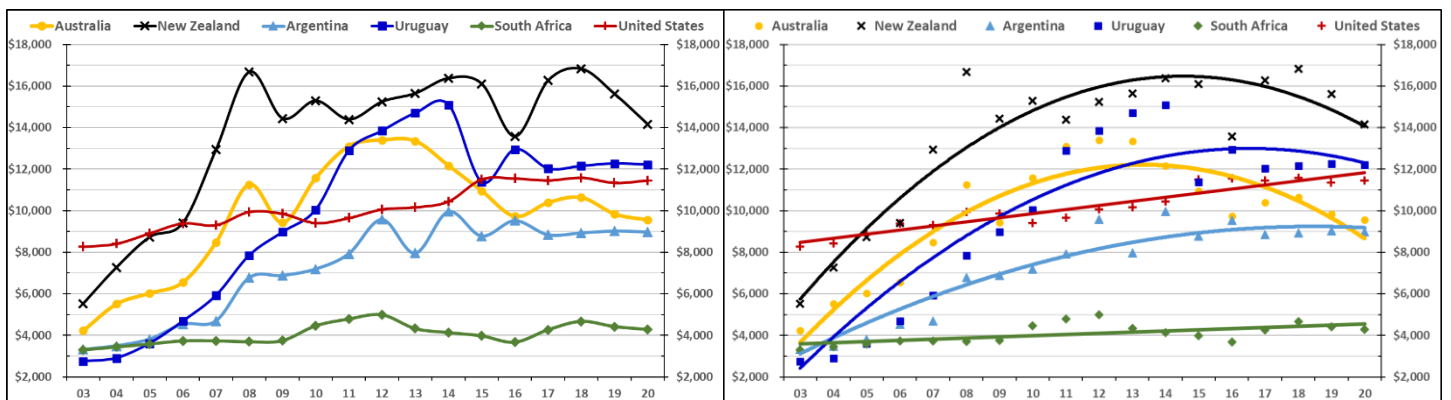


Figure 63a & 63b. Australian national and state economic cost of production (plus NZ, US) 2003-2020 (AUD c/litre ECM)



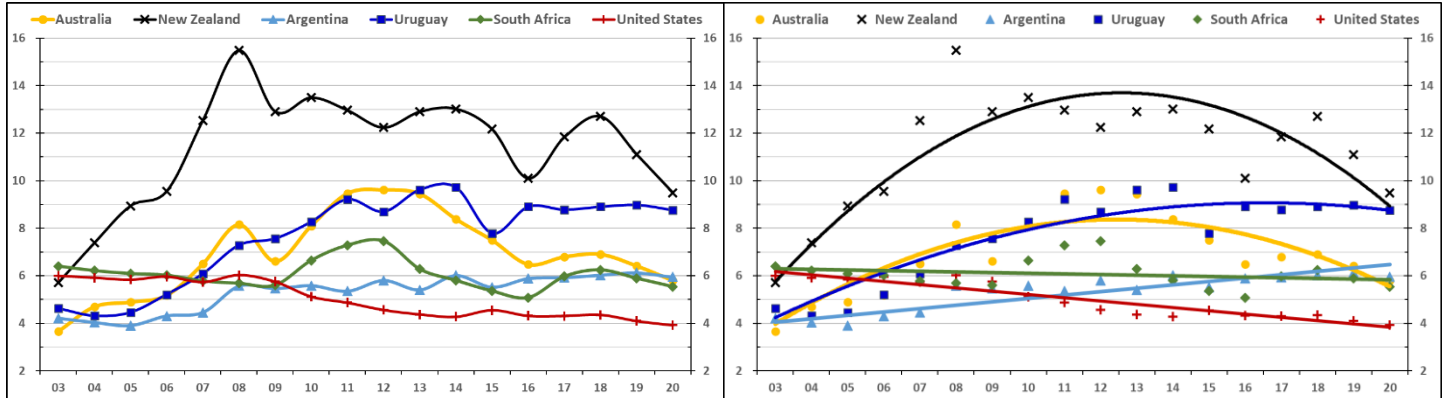
33. Value of Total Dairy Farm Assets per Cow (benchmark averages)

Figure 64a & 64b. International value of dairy farm assets 2003-2020 (USD/cow)



34. Opportunity Cost of Capital per Litre (benchmark averages)

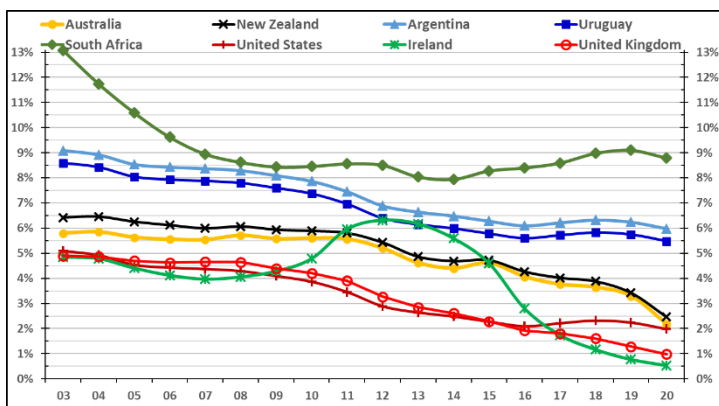
Figure 65a & 65b. International opportunity cost of capital 2003-2020 (USD c/litre ECM)



35. Risk Free Interest Rates (international)

Risk free interest rate (for opportunity cost of capital excluding land) = Rolling 5-year average of 10-year bond rate

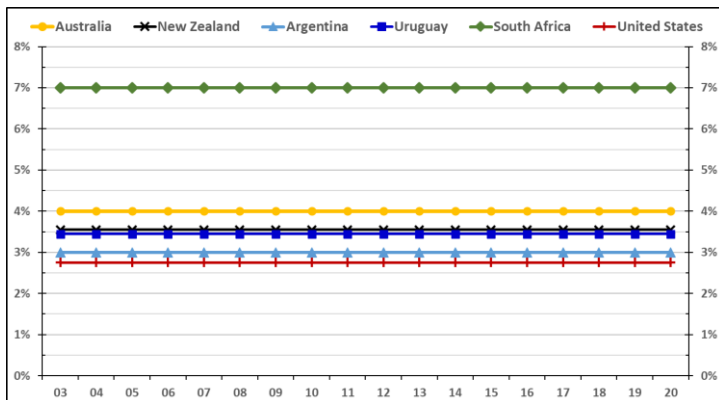
Figure 66. International risk free interest rates 2003-2020



36. Land Lease Rates (international)

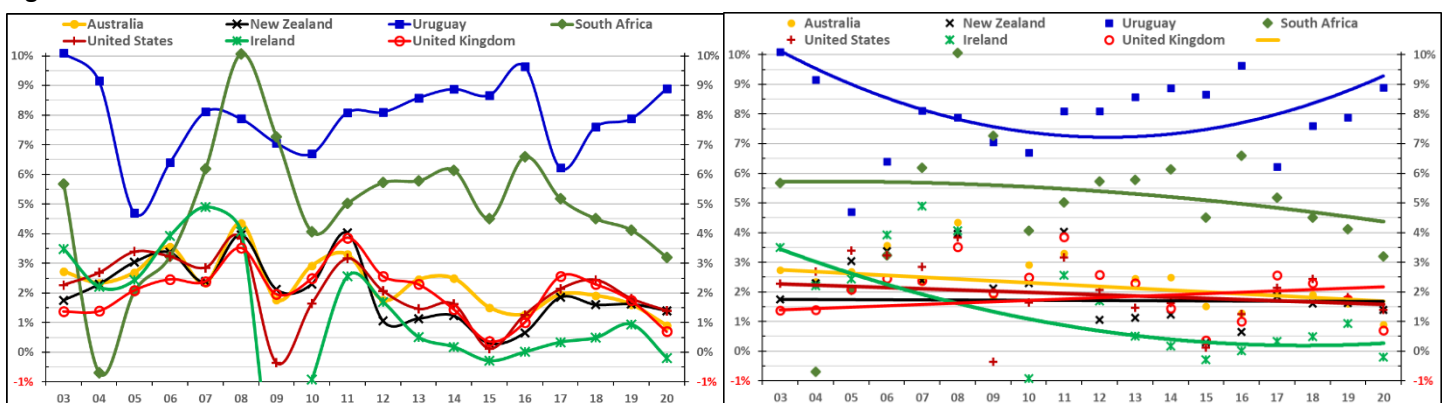
Land lease rate (for opportunity cost of capital) = Average long-term lease rates for agricultural (dairy) land

Figure 67. International land lease rates 2003-2020



37. Inflation Rates (international)

Figure 68a & 68b. International inflation rates 2003-2020



APPENDIX A – Data Sources and Methodology for Standardising Data

Sources of data

AACREA (Asociación Argentina de Consorcios Regionales de Experimentación Agrícola) www.crea.org.ar; producer-owned organisation in Argentina that has as its main purpose to help producers improve the economic and financial results of their farm business. AACREA has the largest dataset of dairy farm performance in Argentina.

AHDB (Agriculture and Horticulture Development Board, United Kingdom) www.ahdb.org.uk.

CSO (Ireland’s Central Statistics Office) www.cso.ie/en.

Dairy Australia www.dairyaustralia.com.au.

Dairy Farm Monitor Project (‘DFMP’, Australia) www.dairyaustralia.com.au/farm/farm-business-management/dairy-farm-monitor-project.

DairyBase (New Zealand) www.dairynz.co.nz/business/dairybase.

DairyNZ www.dairynz.co.nz.

DEFRA (United Kingdom’s Department for Environment Food & Rural Affairs) www.gov.uk/government/organisations/department-for-environment-food-rural-affairs.

FUCREA (Federación Uruguaya de Grupos CREA) www.fucrea.org; producer-owned organisation in Uruguay that has as its main purpose to help producers improve the economic and financial results of their farm business. FUCREA has the largest dataset of dairy farm performance in Uruguay.

Genske Mulder (United States) www.genskemulder.com; the largest dairy farm accountancy practice in United States. Genske Mulder produce benchmark data for dairies in Arizona, California, Colorado, Idaho, New Mexico, Texas and Washington and in the regions of the Upper Midwest and Lower Midwest.

INALE (Instituto Nacional de la Leche) www.inale.org; the Uruguayan National Milk Institute is a non-state public entity with its main task being to advise the government on dairy policy. The aim is to contribute to a joint public-private partnership aimed at the development of the Uruguayan dairy industry.

MAGYP (Ministerio de Agricultura, Ganadería y Pesca) www.argentina.gob.ar/agricultura-ganaderia-y-pesca; the Argentinian government’s Ministry of Agriculture, Livestock and Fishing.

MPO (South Africa’s Milk Producers Organisation) www.mpo.co.za.

Red Sky Agricultural (‘Red Sky’) www.redskyagri.com; commercial provider of farm business analysis and benchmarking software that is primarily operating in Australia, New Zealand and South Africa. Red Sky’s major shareholder is the author of this paper.

Teagasc (Ireland’s Agriculture and Food Development Authority) www.teagasc.ie.

USDA (United States Department of Agriculture) www.usda.gov.

Developing consistent calculations for dairy farm performance comparisons

DairyBase (New Zealand) and Red Sky have near identical methodologies for calculating dairy farm business performance and would generally be considered to be utilising best practice.

All New Zealand and South African data, as well as Tasmanian, Victorian and its three regions’ data, were processed via Red Sky even when informed partially or significantly from DairyBase (New Zealand) or Dairy Farm Monitor Project (Australia).

South Australian data for the years 2004/05 to 2011/12, and Western Australian data for the years 2005/06 to 2012/13, were processed entirely by Red Sky.

South Australian data for the years 2013/14 to 2019/20, Western Australian data for the years 2015/16 to 2019/20, and New South Wales data for the years 2011/12 to 2019/20, were entirely based on Dairy Farm Monitor Project reports and then converted into a similar format to Red Sky/DairyBase (NZ).

Queensland data for all years was entirely based on QDAS reports and then converted into a similar format to Red Sky/DairyBase (NZ).

All years for which data were not available were developed from other Australian states that as closely as possible resembled the missing data, with the data scaled on a similar basis to how the states compared in years when data was available. The years for

COUNTRY	DATA SOURCES	
	National Statistics	Farm Performance Analysis
Australia	Dairy Australia	Dairy Farm Monitor Project, QDAS, Red Sky
Victoria		Dairy Farm Monitor Project, Red Sky
Tasmania		Dairy Farm Monitor Project, Red Sky
New South Wales		Dairy Farm Monitor Project
Queensland		QDAS
South Australia		Dairy Farm Monitor Project, Red Sky
Western Australia		Dairy Farm Monitor Project, Red Sky
New Zealand	DairyNZ	DairyBase, Red Sky
Argentina	MAGYP	AACREA
Uruguay	INALE	FUCREA
South Africa	MPO	Red Sky
United States	USDA	Genske Mulder
Ireland	CSO	Teagasc
United Kingdom	DEFRA	AHDB

which data were not available included 2002/03 and 2003/04 for South Australia (2 years), 2003/04, 2004/05, 2013/14 and 2014/15 for Western Australia (4 years), and 2002/03 to 2010/11 for New South Wales (9 years).

The Australian national data were based on the individual state and Victoria regions with each state and region's contribution being weighted on the basis of the percent of milksolids contributing to the national total for that year.

The balance of the international data, from Argentina, Uruguay and United States, were entirely based on AACREA, FUCREA and Genske Mulder data respectively, and then converted into a similar format to Red Sky/DairyBase (NZ).

Categorisation of countries (Beca 2020a)

The following table broadly categorises the countries for milk market focus, climate and the level of government support or subsidies.

MILK MARKET		
Primary export focus	Combined export and domestic focus	Primary domestic focus
New Zealand, Uruguay	Australia, Argentina, United States, Ireland	South Africa, United Kingdom
CLIMATE		
"Cool" temperate	"Moderate-Hot" temperate (some areas subtropical)	
New Zealand, Ireland, United Kingdom	Australia, Argentina, Uruguay, South Africa, United States	
GOVERNMENT SUPPORT / SUBSIDIES		
Some / Significant	Very little to none	
Argentina, United States, Ireland, United Kingdom	Australia, New Zealand, Uruguay, South Africa	

APPENDIX B – Definitions and Calculations for Ratios (Beca 2020b)

Ratios	Calculation / Definition
Core per cow cost	[100% x (Animal health + Breeding & herd testing + Dairy shed expenses + Electricity + Freight + Grazing/Support area expenses + Industry levies) + 70% x Vehicle expenses + 50% x (Depreciation + Repairs & maintenance)] divided by total cows in herd.
Core per hectare cost per tonne dry matter of pasture harvest	[100% x (Administration fees & overheads excl. industry levies + Fertiliser excl. nitrogen + Green feed crops grazed in-situ + Pasture maintenance & renovation) + 30% x Vehicle expenses + 50% x (Depreciation + Repairs & maintenance)] divided by effective dairy hectares divided by tonne of dry matter harvested per hectare.
Economic cost of production per litre or per kg milksolids	(Operating cost of production plus Opportunity cost of capital) divided by total litres or total milksolids (ECM) produced.
Farm size (cow numbers)	Total number of cows in herd (milking plus dry cows).
Farm size (hectares)	Effective dairy farm area that is grazed by the cows.
Grams concentrate per litre	Grams of concentrate consumed per annum divided by total litres (ECM) produced.
Grams supplement per litre	Grams of supplement consumed per annum divided by total litres (ECM) produced, where supplement includes concentrates and forages but excludes pasture.
Income over feed costs per cow	(Milk revenue - concentrate costs - forage costs) divided by total cows in herd. This is an annual calculation and not a daily calculation.
Income over feed costs per litre	(Milk revenue - concentrate costs - forage costs) divided by total litres (ECM) produced. This is an annual calculation and not a daily calculation.
Labour cost per cow	Management & staff costs incl. imputed labour costs divided by total cows in herd.
Labour cost per litre or per kg milksolids	Management & staff costs incl. imputed labour costs divided by total litres or total milksolids (ECM) produced.
Labour efficiency - cows per full-time staff equivalent	Total cows in herd divided by number of 50-hour full-time staff equivalents.
Labour efficiency - litres per full-time staff equivalent	Total litres (ECM) produced divided by number of 50-hour full-time staff equivalents.
Milk price	Milk price per litre or per kg milksolids (ECM).
Milk production per cow	Total litres (ECM) produced divided by total cows in herd.
Milk production per hectare	Total litres (ECM) produced divided by effective dairy hectares.
Operating cost of production per litre or per kg milksolids	(Operating expenses minus livestock revenue minus other non-milk revenue) divided by total litres or total milksolids (ECM) produced.
Operating profit margin	Operating profit divided by operating revenue.
Opportunity cost of capital	Opportunity cost of capital for land based on the long-term lease or rental cost for land. Opportunity cost of capital for all non-land assets based on rolling 5-year average of 10-year bond rate plus 2%.
Pasture as per cent of diet	Percent of energy provided from pasture harvested on the effective dairy area as a percentage of total annual energy requirements of the cows.
Pasture cost per tonne dry matter ('Consumed')	Direct pasture cost divided by tonne of dry matter harvested. Direct pasture cost includes pasture maintenance and renovation (including green feed crops grazed in situ), fertiliser (including nitrogen), all pasture irrigation costs, and the direct silage and hay costs for pasture conserved on the dairy farm.
Pasture harvest	This is the equivalent tonnage of standardised (11.0 MJ ME/kgDM) energy density pasture consumed per hectare. Any hay and silage conserved on the dairy farm is included in the total pasture yield. This is a back-calculation based on inputs and outputs.
Profit per cow	Operating profit divided by total cows in herd (milking plus dry cows).
Profit per hectare	Operating profit divided by effective dairy hectares (grazed by the cows).
Profit per litre or per kg milksolids	Operating profit divided by total litres or total milksolids (ECM) produced.
Return on (total) capital	Operating profit divided by the total value of all assets employed in the business (regardless of ownership/financing structure). Changes in asset values, including appreciation of land values, are not included in this calculation.
Risk free interest rate	Rolling 5-year average of 10-year bond rate or equivalent plus 2% premium.
Stocking rate	Total cows in herd divided by effective dairy hectares.
Supplement cost per litre or per kg milksolids	(Concentrates + Forages + Grazing/Support area expenses) divided by total litres or total milksolids (ECM) produced.
Total consumed per cow (tDM/cow/year)	Total tonnes of dry matter consumed per cow in herd per year, where the energy supplied from pasture is standardised at 11.0 MJ ME/kg DM, the energy supplied from forages is standardised at 9.5 MJ ME/kg DM, and the energy supplied from concentrates is standardised at 12.5 MJ ME/kg DM.
Total expenses per litre or per kg milksolids	Operating expenses divided by total litres or total milksolids (ECM) produced.
Total feed cost per litre or per kg milksolids	(Concentrates + Forages + Grazing/Support area expenses + Green feed crops grazed in-situ + Fertiliser incl. nitrogen + Irrigation + Pasture maintenance & renovation) divided by total litres or total milksolids (ECM) produced.

Definitions of operating revenue and expenses utilised in calculation of operating profit (Beca 2020a and 2020b)

Operating profit calculation	Definitions
Operating revenue	Milk sales + Livestock revenue ¹ + Other non-milk revenue
¹ Livestock revenue	Livestock sales - livestock purchases + (closing numbers - opening numbers) x closing value per head
Operating expenses	Administration fees & overheads ² + Animal health + Breeding & herd testing + Dairy shed expenses + Depreciation ³ + Electricity + Fertiliser + Freight + Irrigation + Pasture maintenance & renovation + Repairs & maintenance + Total supplement expenses ⁴ + Vehicle expenses + Management & labour expenses ⁵
² Administration fees & overheads	Includes all office expenses plus professional fees plus rates, licences, levies and insurance
³ Depreciation	Based on straight line depreciation over economic life of asset
⁴ Total supplement expenses	Includes all concentrate and forage expenses (excluding pasture grown on dairy farm) fed to cows and growing heifers plus green feed crops grazed in-situ plus all expenses for grazing/support area utilised for cows and growing heifers as well as supplement production
⁵ Management & labour expenses	Includes all direct labour expenses plus market salary value of any management provided by owner/family plus market hourly rate value of any labour provided by owner/family
Operating profit	Operating revenue - Operating expenses

Energy Corrected Milk (ECM)

ECM determines the amount of energy in the milk based upon milk, fat and protein and adjusted to 4.0 per cent fat and 3.3 per cent protein. ECM formula = milk production x ((0.383 x fat% + 0.242 x protein% + 0.7832) / 3.1138). Converting all milk ratios to energy corrected milk is required due to the otherwise confounding impact of the wide range in fat and protein per cent as a result of differing cow types, diets and production systems. This formula is used by the Dairy International Farm Comparison Network, as outlined in the following: <https://dairymarkets.org/PubPod/Reference/Library/Energy%20Corrected%20Milk>.