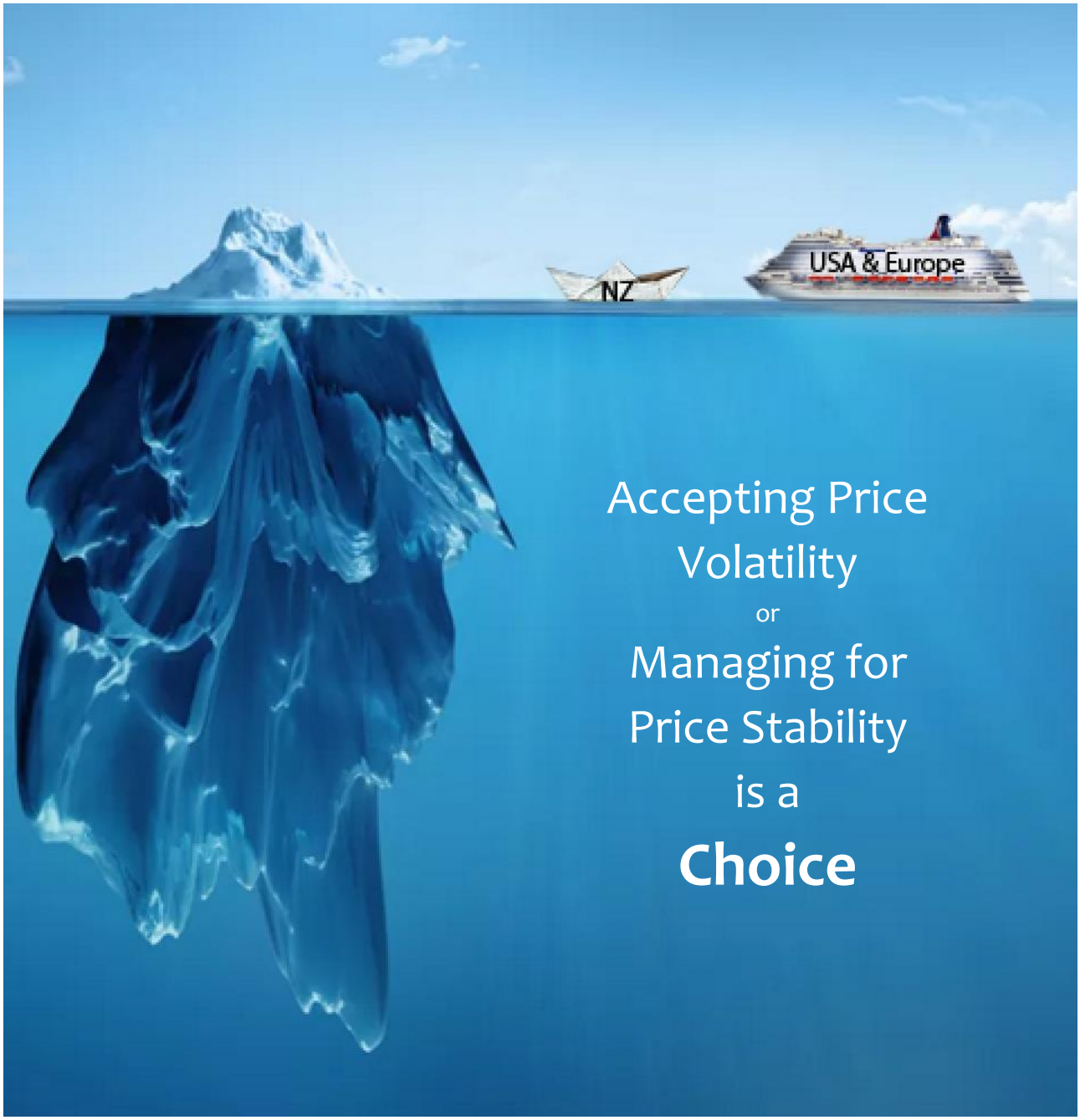
NUFFIELD
NEW ZEALAND
Global Vision, Leadership and innovation in Agriculture



Accepting Price Volatility
or
Managing for Price Stability
is a
Choice

Dairy Price Risk Management for Dairy Farmers

Satwant Kaur Singh

2015

Nuffield New Zealand
Farming Scholarship

Disclaimer

This publication has been prepared in good faith on the basis of information available at the date of publication without any independent verification. New Zealand Nuffield Farming Scholarship Trust (Nuffield NZ) does not guarantee or warrant the accuracy, reliability, or completeness of currency of the information in this publication nor its usefulness in achieving any purpose. Readers are responsible for assessing the relevance and accuracy of the content of this publication.

Nuffield NZ will not be liable for any loss, damage, cost or expense incurred or arising by reason of any person using or relying on the information in this publication.

Products may be identified by proprietary or trade names to help readers identify particular types of products but this is not, and is not intended to be, an endorsement or recommendation of any product or manufacturer referred to. Other products may perform as well or better than those specifically referred to.

Nuffield NZ encourages wide dissemination of its research, providing the organisation is clearly acknowledged.

For any enquiries concerning reproduction or acknowledgement contact the Secretariat of Nuffield NZ (Nuffield.org.NZ)

Authors Details:

Satwant Kaur Singh
+64 27 703 7150
nzsatwant@gmail.com

Table of Contents

Executive Summary

NZ dairy farmers are directly exposed to uncertainty and fluctuations in commodity pricing. Over the past ten years external factors have had a significant impact on dairy farming businesses, leading to increased financial pressure, delayed investment plans and solvency issues.

New Zealand (NZ) dairy farmers have been left behind. Sophisticated and diverse price risk management (PRM) tools are available to our competitor farmers in the USA and Europe. This will impact NZ's industries competitive advantage on the global market in the years to come. Farmers need to be prepared with a plan and strategies to manage price risk.

PRM tools are well advanced and diverse for farmers in parts of Europe and USA compared to tools available to NZ farmers. These tools vary from simple forward fixed prices in Europe to a variety of flexible hedging tools in USA. Processors, milk marketing companies, cooperatives, and/or financial brokers provide ease of accessibility to the tools and in depth information to help farmers utilise the tools, thus providing key competitive countries with an advantage.

These PRM solutions enable farmers to transfer the price risk to someone else via a processor or a futures exchange and experience the benefits of a stable profit margin. The choice to have stable or volatile profit margins has provided some farmers with different advantages. These include enabling new farmers to enter the industry with confidence, helping some farmers to grow their businesses with certainty and others to have the ability to manage debt and achieve their goals.

The introduction of PRM tools is relatively new to the NZ dairy scene and options are not readily available. PRM is a developing area and the availability and flexibility of the tools will depend on farmers understanding of the tools, demand for the tools and adoption of PRM. Further support by the industry is essential. Areas of support include more PRM tools, risk management decision making tools, margin calculators and or information that will help farmers understand their price risk and make an informed PRM plan suitable for their individual situation.

Accepting Price Volatility or Managing for Price Stability is a Choice

Foreword

Farming is not just a business. I was born and raised on a dairy farm and have spent my career to date in the dairy industry. I understand the joys and pains of the dairy industry. Farmers put their heart and soul into their farming business. To them, it is not just a job, but rather a core foundation of their family's lives.

During the financial crisis period of 2008 to 2011 I found working face to face with farmers a very challenging task. More than one hundred farmers have taken their own lives since the economic crisis of 2008 (Federated Farmers, 2015). When I was awarded the Nuffield scholarship in late 2014, it was reported that fourteen farmers had taken their lives in the past six months. Unfortunately, four of these were during the month of December (Edmunds, S., 2015, January 11), when the Milk Price payout reduction was announced. Financial pressures of such nature may contribute towards the mental health of dairy farmers. Financial pressure is a big burden. In light of this, I felt it important to further explore the area of PRM; to ensure that farmers are proactive, rather than reactive, in ensuring that their farming business is sustainably profitable.

Over the past few years, the dairy industry has focused on helping farmers improve productivity through pasture management, farm systems and techniques to reduce costs. Financial literacy and financial well-being has also been identified as areas that need further developing and support in the industry (Weir, 2013 as part of the financial literacy forum). There are also workshops and support material offered by Dairy Women's Network and DairyNZ on budgeting. The agITO educational programmes are available to help farmers improve their financial skills. While the dairy industry has focused on improving the financial literacy, I consider that further work is required in the area of risk management.

Many older and experienced dairy farmers are able to better cope with milk price volatility as they have the experience, low debt, efficiency and financial buffer to sustain them. We need to consider the implications for the next generation of farmers who do not have this head start and are entering the dairy industry fully exposed to the volatility of milk price.

I am an employee of Fonterra, in the Commodity Risk and Trading Team. My core focus for the past three years has been on the development and implementation of the Guaranteed Milk Price (GMP). This has been a very contentious matter in the Cooperative since its implementation. The farmers are concerned that it was creating a division in the supply base with members receiving different prices. Working in the Commodity Risk and Trading Team has provided me with a greater knowledge of PRM tools and their place in the dairy industry.

In September 2015, the GMP programme was discontinued. I was disappointed of this outcome. In my view, GMP is one tool that majority of NZ farmers had access to which truly managed price risk. The lack of understanding regarding the process for determining the Fonterra milk price has resulted in distrust in this tool and contributing to a feeling of inequality amongst the members of the Cooperative. Hence, further information and support is required on PRM tool, their function and the benefits they provide individuals and the industry as a whole. I hope that in due course, PRM tools will be introduced to the dairy industry. The conversation around GMP has begun, and in my view we need to critically consider PRM tools and their impacts on the industry.

I seek to assist dairy farmers to gain a better understanding of price volatility and the tools available to them to reduce the risk on their businesses. This will contribute towards improving their overall wellbeing. PRM tools provide farmers the choice to either accept or manage price risk, thus giving them greater flexibility to manage their farms at a level of comfort that is sustainable for them.

Acknowledgements

I would like to acknowledge the support of Nuffield NZ and the sponsors for providing me with this life changing opportunity. A special thank you to my husband and my parents throughout the Nuffield experience and also to my coach Matthew Pickering, my employers Arron Atkinson and Bruce Turner. A thanks to the following people who hosted and provided me with their expertise and knowledge.

Aishwarya Govil – Vault Technologies
Andrew Novakovic – Cornell University
Anne Krema – CME
Anuja Miner – NMPF
Anup, Gretchen Singh and family
Brian Fiscalni – CA Farmer
Brian Rice – Rice Dairies
John Pearce – CA Farmer
Curtis Bosma – High Ground
David and Holly Hardie – New York Farmers
Edward Gallagher - DFA
My Parents - Mohan and Jaspal Singh
Nuffield International and NZ
Jack Curtin – Farmer
James Kelleher DFA
John Labandeira – Dairymen CA
Mike McIntyre – FirstNZ
Kyle Schrad – FC Stone
Lawson Thalmann – Vault
Mark Ludteke – Investment Bank
My extended family around the world
Nick Vanderkolk
Richard Jelinek – FC Stone
Robert Chesler – FC Stone
Ryan Yonkman – Vault
Tammy Schaefle– Dairymen CA
Tom Bailey – Rabobank
William Hoover – Wellsfargo
Ron McDowall – Academic Adviser
My husband – Sunil Krishna and the family
Liam Fenton – FC Stone
Liam O'Faherty
My fellow Nuffield Scholars
David Campbell – Business Mentor
Fonterra commodity risk and Trading
Amy Su – Friend

Thank you to the many others who also supported me through my Nuffield journey.

Glossary and Abbreviations

Basis Risk	The price difference between the fixed milk price and the actual received milk price
CAP	Common Agricultural Policy
CME	Chicago Mercantile Exchange
Counterparty Risk	Counterparty risk is the risk to each party of a contract that the counterparty will not live up to its contractual obligations. [1]
DFA	Dairy Farmers America
Forward Contracts	A forward contract is an agreement between two parties, and is a financial or physical contract, where both parties agree on a price, time period and quantity.
Futures Contract	"Legally binding agreement to accept delivery of or make delivery of a standardized quantity and quality of a commodity to a standardized place during a standardized time period for a price discovered in an organized futures exchange" (Fenton, 2015).
Futures Exchange	A futures exchange, traditionally, is a term referring to a central marketplace where futures contracts and options on futures contracts are traded. It provides a mechanism for price discovery and risk management for anyone who has exposure to the commodity price. Since the development of the CME in 1994, more dairy exchanges have been created; NZX, Eurex and the Euronex.
Hedging	"A hedge is an investment to reduce the risk of adverse price movements in an asset. Normally, a hedge consists of taking an offsetting position in a related security, such as a futures contract".[2]
Margin Account	"A margin account is an account offered by brokerages that allows investors to borrow money to buy securities. An investor might put down 50% of the value of a purchase and borrow the rest from the broker. The broker charges the investor interest for the right to borrow money and uses the securities as collateral".[3]
Margin Call	A demand by a broker that an investor deposit further cash or securities to cover possible losses
Options	"An option is a financial derivative that represents a contract sold by one party to another party. The contract offers the buyer the right, but not the obligation, to buy (call) or sell (put) a security or other financial asset at an agreed-upon price (the strike price) during a certain period of time or on a specific date (exercise date)".[4]
OTC	Over The Counter (OTC) derivatives are a direct transaction between two parties and is transacted off the exchange and do not require managing a margin account. Over the Counter
PRM	Price Risk Management
SMP	Skim Milk Powder
USDA	United States Department of Agriculture
WMP	Whole Milk Powder

[1] Investopeida (2016) Definition of Counterparty Risk
[2] Investopeida (2016) Definition of Hedging
[3] Investopeida (2016) Definition of Margin Account
[4] Investopeida (2016) Definition of Options

Section 1: Introduction

"Being profitable and financially resilient to the volatility of both markets and climate is fundamental to sustainable dairy farming"(DairyNZ annual report 2015).

Dairy commodities are one of the most volatile commodities in the world. Whole Milk Powder prices has a volatility percentage of over 40% versus commodities such as oil (22%) and sugar (26%) (Fonterra, 2015). Global supply and demand for dairy are extremely sensitive to a wide range of external factors, including weather, geopolitical decisions, unprecedented demand from new markets, and food safety issues.

The risks facing New Zealand (NZ) dairy farmers are becoming more prevalent as the industry experiences greater price volatility in response to global supply and demand signals. A more sophisticated understanding of price risk and risk management is essential in helping farmers make better business decisions.

There is no 'one solution' or 'silver bullet' to solving or removing price risk exposure for a NZ dairy business. Each farmer's circumstances are unique and he/she will prioritise different factors when choosing the right strategy for the business. It is important to assess the effectiveness of the different options and ensure that these align with the farmer's needs. These needs can be influenced by a farmer's risk appetite, level of understanding of their business financials, debt levels, perception of the market and their ability to manage farm costs.

With many parts of the world already utilising sophisticated price risk management (PRM) tools and with the NZ Exchange (NZX) soon to introduce fresh milk futures, it is inevitable that more tools will become available to NZ farmers over the next few years. It is important that farmers are prepared before considering their options. The purpose of this report is to introduce farmers to PRM.

NZ dairy farmers face the same risks as farmers around the world, and receive great advice and support on how to remove operational risk and increase efficiency on farm, for example such as, weather (sheds and irrigations), pest control (herbicides and pesticides) and animal health (drenches and vet checks). However there is an opportunity to provide more flexible financial tools that allow them to manage their revenue, and complimenting their operational costs to allow for greater control to manage their farm margin.

PURPOSE: The report provides dairy farmers with the choice to manage stable profit margins with insights into PRM strategies and tools utilised by farmers in the USA and parts of Europe. It explores the benefits and limitations of these tools, with a focus on key learnings for NZ dairy farmers.

METHOD: The findings are based on the author's observations and learnings from conversations, interviews and on site tours of organisations, institutes, farms and businesses during her travels through parts of Europe and USA. She was able to gain an international perspective on the current state of dairy PRM.

The people visited were limited to the author's network and connections at the time of travel. Hence the findings may not be a true representation of the regions.

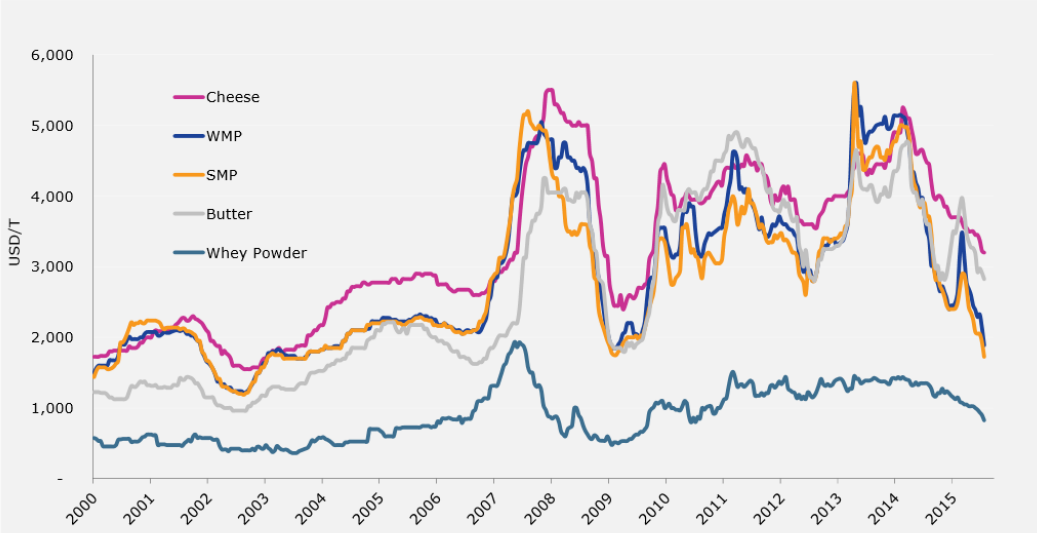
Section 2: Global Dairy Market – Volatility is here to stay

The long term prospects for dairy are strong and demand is growing globally (Bellamy, 2015). However, the journey for farmers to meet this growing demand will not be straight forward. Price is uncertain and the future of global markets is unpredictable. These have become the characteristics of current dairy business.

Price volatility for NZ farmers is relatively new. Before 2008, milk price and dairy commodity prices were stable. The global financial crisis in 2008 coincided with the reduction of market intervention in two major dairy markets, the EU and USA. This opened the global dairy market to more realistic supply and demand signals based on market pressures.

Over the past ten years events have occurred which have had a significant impact on the global price for dairy products. These events include abnormal weather patterns, government interventions, geopolitical decisions, trade regulations and product safety issues.

Figure 1, presented by Kevin Bellamy from Rabobank at the World Dairy Summit 2015 in Lithuania, illustrates the impact these events have had on dairy prices. In his opinion any attempt to predict global dairy prices is a pure guess.



Source: USDA

Figure 1: Rabobank – Historical Dairy Commodity Prices

Price volatility was a global concern at the World Dairy Summit in 2015. Dairy prices have an impact on the entire supply chain; from banks, farmers, cooperatives, processors to retailers and consumers.

Dairy farmers around the world are experiencing fluctuations caused by price volatility. Discussions with government agencies, cooperatives, farmers and support bodies during this research found price volatility for dairy farmers to be a key issue.

There is growing concern and agreement that better tools must be developed to help farmers manage volatility to ensure the sustainability of farming into the future. The graph below from Bellamy's presentation shows similar price volatility dairy farmers around the world have been experiencing.

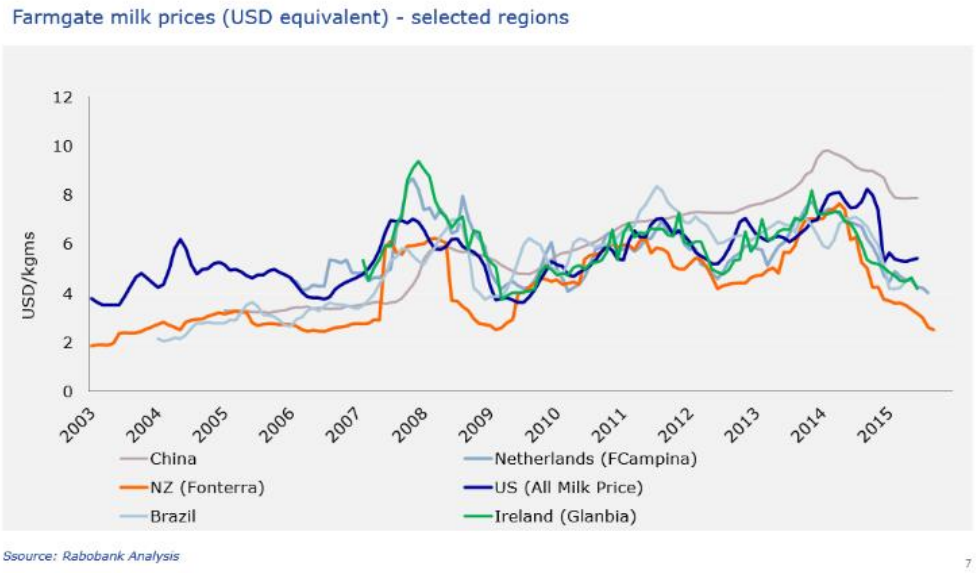


Figure 2: Rabobank – Global Farmer Milk Prices

Section 3: Price Risk Management

Torsten Hemme (IFCN – Diary Research Network) presented on Risk Management for Dairy farmers at the IDF World Dairy Summit in Lithuania (2015). He opened with the quote:

> *"Risk itself is not really the problem but not knowing your risk profile and not having a risk management strategy can become a problem"*

Risk management is a common practice used by businesses to evaluate and manage risks. This section defines price risk and risk management and describes how it can help farm businesses.

What is Price Risk?

Price Risk is the uncertainty of the price a farmer will be paid for their milk in the future. The risk is the combination of the chance of an adverse change in milk price and the impact it could have on a farmer's business and welfare.

What is Risk Management?

Commodity Ingredients Hedging (CIH), a Chicago based dairy margin management services company, defines risk management as:

> *"the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and impact of them. Risk has many forms, but in the business of food and agriculture, shifts in supply or demand and natural causes like weather or disease create significant risk. Since profits and sustainability depend on whether you sell or buy at or above break-even values, PRM is a crucial discipline in any successful business" (CIH, 2016).*

There are many internal and external risks to a dairy business. Internal risk factors include things such as production, people, financials, assets and liabilities. The external factors include market, climate, policy and any other risks (figure 3).

Given that each farm has its unique strategy for business, it is important to assess the effectiveness of different options and ensure they align with needs of the strategy.

Needs are determined by risk appetite, level of understanding business financials, debt levels, perception of the market and the ability to manage farm costs.

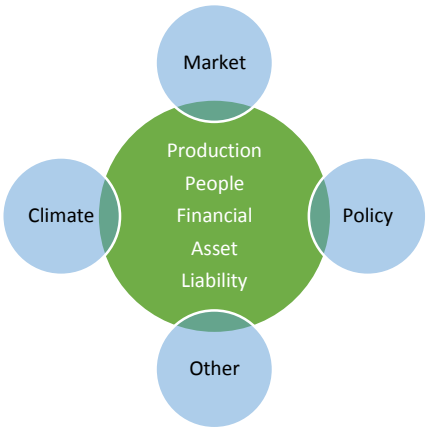


Figure 3: Farmer's Circle of Risk

The current top three negative perceptions of risk farmers' mention are: policy and government regulations; input prices and availability; and global economic and political situation (Duranovich, 2015). Global economic and political situations drive the price volatility in the milk price farmers receive. PRM tools provide a solution for farmers to be able to stabilise their revenue and align with expenses. Risk management strategies are unique to every farm and outline the risk, what it means to that individual and their business and how they will manage the risk. As part of that strategy the key question is to assess whether the business wants to achieve stable profits or if it is able to withstand the volatility to achieve its goals.

Stability and Predictability or Volatility and Uncertainty

The profitability of a business is the underlying driver that determines a business's survival. There are three key components in a dairy business that contribute to its profitability.

- Revenue,
- Expenses (farm running expenses; fixed and variable, and debt) and,
- Production (figure 4).

A farmer's decisions are a balancing act of these components to drive the operating profit.

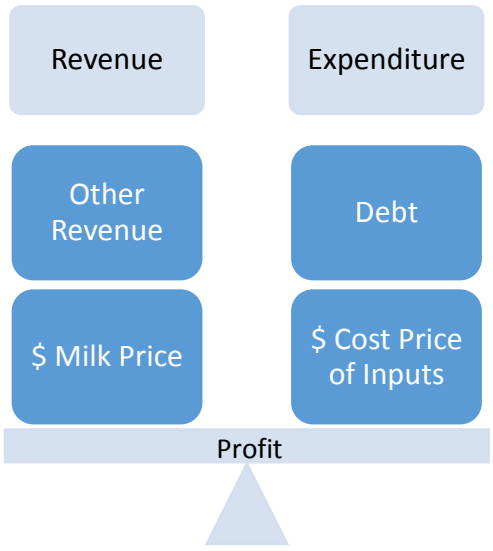
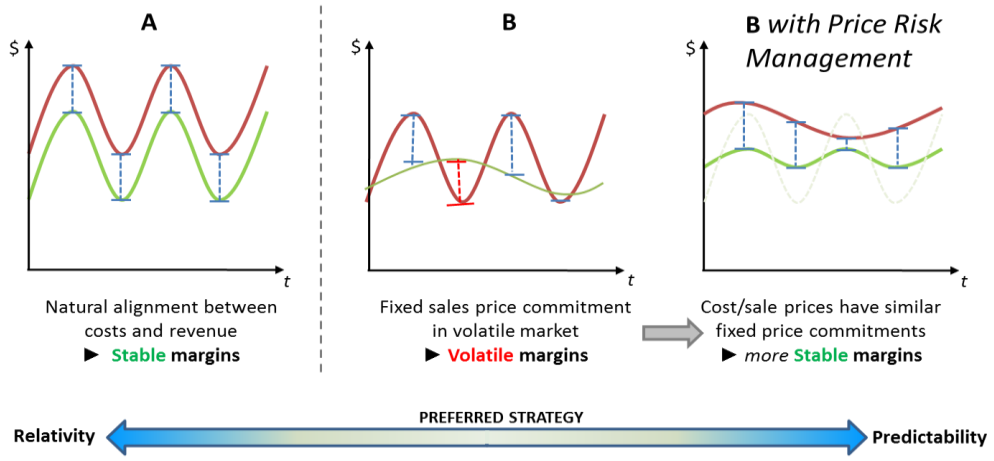


Figure 4: Farmers Profit a Balancing Act

Stability provides a level of predictability and enable farmers to have greater control to plan, budget and borrow. The difference between a volatile and stable margin is explained in figure 5 below. In example A, the business' income aligns with its expenses. This business does not have price risk because it is able to pass on its risk to the next party and maintain a stable margin. This can be typical of businesses like petrol stations; when oil prices move, the petrol station's price also moves, transferring the price risk onto the customer. In example B, the business has stable costs but the income is volatile, creating moments when the income doesn't cover the costs, hence, similar to a NZ dairy business.

If the business is not comfortable with the volatility, applying a PRM tool or strategy to the price can help smooth the income from the extreme lows and highs, providing a more stable margin. Stable margins could provide farmers with greater certainty and confidence to meet budgets, make investment decisions, manage debt obligations and take advantage of low milk price environments.

Figure 5: Fonterra - Price Stability or Volatility



Source: Fonterra

PRM provides farmers with an option to stabilise profit margins. The increasing level of milk price volatility globally has made farmers consider and utilise alternative financial tools to traditional cost management practices with managing price risk.

Section 4: Regional Experiences

The USA and Europe are well advanced in PRM tools for farmers. The two case studies below outline the common strategies and financial PRM tools they had available.

Table 1: Country Comparison Chart

	USA	Europe	NZ
Milk Price	Government regulated minimum milk price based on market prices (except some states) for the following four classes of milk; 1. Beverage and liquid milk, 2. Soft manufactured products (yogurt, cream, cottage cheese), 3. Hard cheeses and cream cheese and 4. Dry milk products and butter.	No market price but use a index which is a survey of all milk prices offered by dairy companies across Europe	Government regulated milk price calculated based on Fonterra Farmgate Milk Price Manual using the market prices for five products • Whole Milk Powder • Skim Milk Powder • AMF • Butter Milk Powder • Butter
Production Curve	Predominately flat	Combination of flat and curved	Seasonal curved
Farming Systems	Majority farmers purchase feed and high intense farming	Combination of grass based farming and imported feed	Predominately grass based farming
Government Support	Margin Protection Programme Forward Pricing Programme Dairy Indemnity Programme	Intervention Single Payment Scheme	Income equalisation scheme
Net trade Surplus[5]	5.2million tonnes	13.1 million tonnes	20.1 million tonnes
Production	91 billion litres[6]	156 billion litres	21 billion litres[7]
# Farmers	65,000 farms [8]	878,000[9]	11,400 farms[10]
# Cows	9 million	23 million	5 million
Price Risk Management tools			
PRM Tools	Forward Fixed Price Contracts Futures Contracts OTC	3 Year Forward Fixed Price Futures Contracts	Limited Forward Fixed Price Futures Contracts
Avenues	Cooperatives Processors Brokers	Cooperatives Processors Brokers	Processor Brokers
Accessibility	Widespread	Moderate to low	Low and limited
Years available	10-20 years	6 years	3 years

[5] IFCN Dairy Report 2014 – many of the above figures are from this report
[6] Fonterra, The global Dairy Industry.
[7] DairyNZ QuickStats about dairying – New Zealand
[8] USDA Economic Research Service
[9] AHDB Market Information
[10] Get a Head Dairy

USA Leading the Way

USA leads the way with financial PRM solutions for farmers. Visits were made to six states, meeting brokers, farmers, processors and rural professionals during the months of August and September 2015. The case study discusses the strategies adopted and explains the tools available based from the author's visits and observations.

Observations and Key Learning's

USA dairy farmers are experiencing price volatility (figure 6) and have been experiencing it for a longer time than NZ farmers. However, the magnitude of the volatility is not as extensive as that experienced by NZ farmers. The primary reason for this is that the USA dairy farmers' exposure to the global dairy market is minimal (but significant). USA produces enough milk for its own consumption, but in recent years it has begun to increase production and export product into the global market.

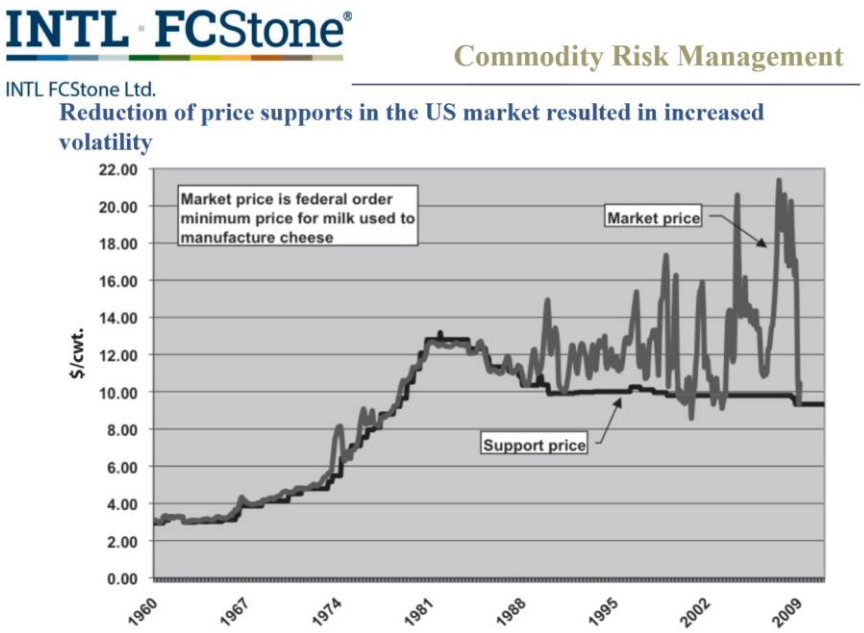


Figure 6: Reduction of price supports in the US resulted in increased volatility (Source: FCStone)

The combination of a large domestic market, government support programs and the access to flexible PRM tools has allowed USA farmers to withstand price volatility at a greater level than NZ farmers. This is a concern for NZ, given that USA is a large dairy market and a small increase in their production can have a significant impact on the global dairy market.

The tools available to farmers in the USA are:

- Flexible and diverse forward contracts
- Futures contracts
- Government support (MPP)

Why were farmers not utilising the forward or futures contracts?

The government support programme MPP provides farmers protection from an extremely low milk price event from happening. MPP low joining fee has driven the high participation, providing farmers with the safety financial PRM tools would provide. Therefore, many farmers do not have the need for additional tools.

Also due to the complexity in transacting financial contracts (understanding and managing basis risk, and maintaining a margin account), and the change from traditional farming practices of maximising production to a more formal business practices with a focus on margin. Many brokers mentioned that this change was a fundamental shift in the way farmers made decisions, and the barrier prevented them from wanting to learn how the tools could help.

In saying that, other strategies worked well for farmers as well. Farmers used a combination of practices to suit their business needs depending on the resources they had available. They analysed their business against their business goals and then chose the appropriate management practice or tool to suit. For example, the farmers in Vermont primarily focused on procurement and on farm strategies to manage price risk. The spending decision to prepay as many of their farm working expenses in 2014 and some in 2015 alleviated their tax obligations and reduced their spending requirement for the current season with milk prices dropping.

Famers with low cost systems with break-even points below average did not need hedging tools to maintain a margin. A farmer mentioned that historically, those who utilised futures to hedge their milk price received a lower than average milk price over time. This led him to stay with traditional practices of a low cost system, which he was confidant would allow the business to weather the downside but still capture all the upside. He also stated if the business was unable to achieve this, they would consider utilising the forward and futures contracts.

Why were farmers using forward or futures contracts?

Even though USA has a large domestic market and government support programmes, farmers were still using financial tools available to achieve stable profit margins. Approximately a thousand DFA farmers utilise a forward contract out of a total of 14,000 farmers. Exact numbers on how many farmers utilise the futures are not known due to the amount of speculators or traders that also use the exchange, but the number of contracts on the exchange have been increasing (Hoover, W. pers.comm., September 14, 2015).

Some of the reasons mentioned why farmers considered hedging strategies were:

- Start-up or new entrant dairy farming
- Larger farming businesses
- Farmer is not comfortable with price volatility
- Planning a large capital investment
- High debt levels
- Not enough liquid reserves
- Higher than average fixed cost of production

Farmers utilised forward or futures contracts when they felt they were most exposed to the risk of low milk prices. It did not mean that they were bad or inefficient farmers, but they required certainty at a particular time when alternative strategies were not feasible.

Also, some used forward and futures contracts on a regular basis as a permanent business management practice. This allowed farmers to optimise hedging and purchasing decisions to reduce and maintain cost of production when conditions were favourable.

What was the industry doing to help farmers?

Education and Support tools

- Education was the most important element. 'Farmers should understand their milk price and how fixing their price could help them manage margin volatility. All the brokers, processors and cooperatives had invested in education material and support to assist farmers in their understanding' (Gallagher & Jelinek , pers.comm., August 21, 2015).
  A key point made by Jelinek, is that the "how" and "to what extent" a farmer manages price risk "depends" on many factors. As discussed previously, there are many variables that will influence the decision, such as business goals, debt levels, risk appetite, farming skills and personal health.
- The margin calculators provided farmers real information to help them make more informed hedging decisions. The combination of the information provided the farmer with more control to be able to achieve a stable margin.

Business Consultant and Financial Advice

- Brokers mentioned that it is important for farmers to set objectives for their hedging strategies. For example, the goal may be to target profit margin and or to achieve an average milk price over the season. It is essential that a farmer understands his/her business financials before the right decision for them could be made. Hence, many of the brokers also provided tools and calculators. These ensured farmers were not entering into forward contracts at the wrong time or reason (figure 7).
- Hedging and locking away a margin simultaneously was not always seen as the right decision (Ludtke, Investors Community Bank, pers. Comm. August 15, 2016). Farmers should monitor the market, use their knowledge and experience, and seek expert advice to help them decide when it is the right opportunity to lock or not to lock. Ludtke also mentioned, "but if you have doubt, then why leave it to fate". The liquidity on the USA futures market allows farmers greater flexibility to enter and exit locked price positions and have more history in understanding how the market operates to capture opportunities.

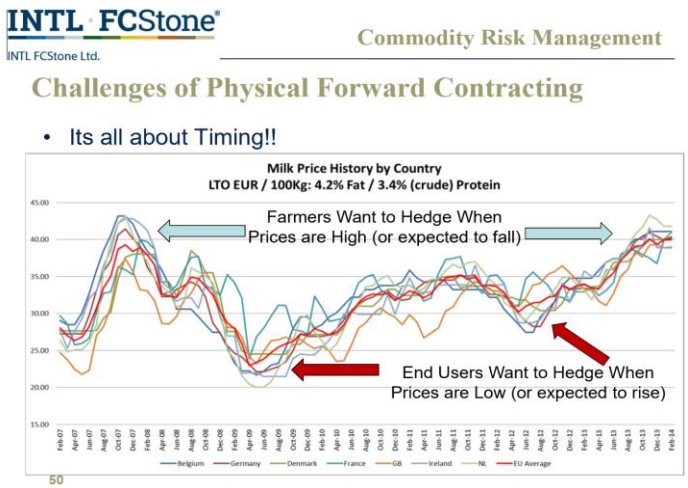


Figure 7: Challenges of Physical Forward Contracting (Source: FC Stone)

Price Risk Management Strategies used by farmers

USA farmers used a combination of tools and practices in their PRM strategies to manage price risk. The tools available included physical and financial solutions. The strategies and tools used by the farmers are outlined below.

Transfer or Share the Price Risk - Hedging

USA farmers utilised hedging strategies to share or transfer their price risk with someone else on the futures market or with a customer. They were able to transfer the risk through forward contracts with processors or share the risk through hedging onto futures market. The extent of the ability for farmers to hedge was unique to USA farmers. Below are the avenues and tools farmers had access to:

- Forward contracts via cooperatives or processors
- Futures exchange markets via brokers
- Over the counter derivatives market (OTC) via brokers
- Government programmes (MPP)

Other Strategies

Other PRM strategies used by farmers included procurement techniques and cost management. Farmers were focused on:

- reducing or removing costs from their cost of production,
- prepay costs into the next season, and or
- maintain feed reserves six to nine months forward.

The strategy was to align farm working expenses with the milk price. This allowed farmers to also manage their tax obligations by having higher amounts of tax deductible expenses relative to the high milk price and lesser expenses in low milk price seasons.

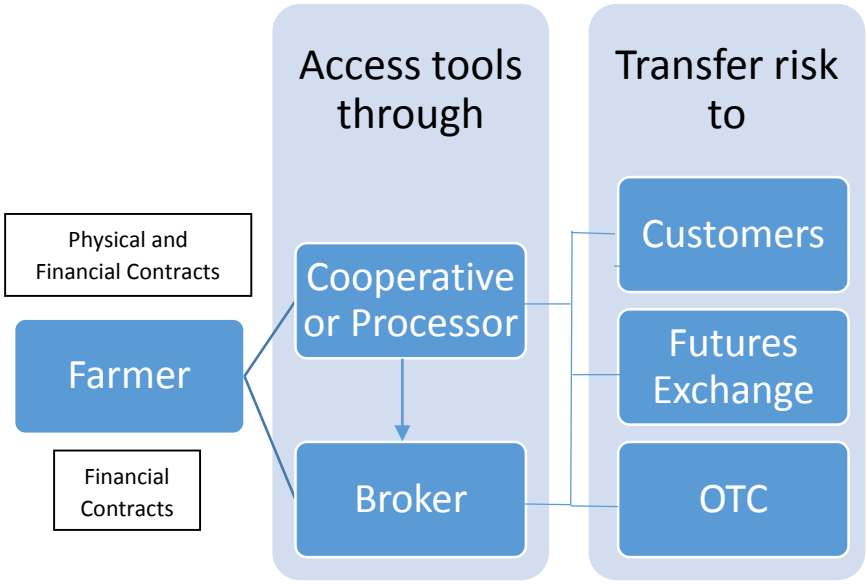
Other strategies adopted were:

- Diversification or off farm investments
- Dairy Company portfolio – farmer selecting which company they supply based on its strategy
- Maintaining liquid assets – excess cows or bulls to sell, cash buffers, reduced debt creating an equity buffer and or shares in processors that were easily liquefied.
- Supply chain integration – farmers manufacturing and selling their own milk products
- Speciality Milks – producing premium products such as organic or liquid milk

PRM Tools available to farmers

Edward Gallagher from DFA and Richard Jelinek (worked for CME for over 30 years educating farmers on PRM and is now Vice President of Global Education at FC Stone, pers.comm., August 21, 2015) stated that the purpose of PRM is not to help farmers' break-even but to protect them from volatile movements. They illustrated this by comparing PRM tools to things that were relevant or well known to farmers, such as to compare it to a form of 'income protection', fix some of the production but not all of it at a fixed price, similar to fixed interest rates.

Farmers had multiple avenues to access tools that would provide them price certainty into the future. Farmers were able to access the contracts via their cooperatives/processors or through a financial broker. The price risk is transferred to the customer directly or through the exchange or OTC markets. Jon August, Producer Relations Specialist (pers.comm., August 26, 2015) at Grande milk marketing company in Wisconsin, stated that providing risk management tools (for over ten years) to farmers helped build and retain relationships with farmers and that it was a common service provided by most USA dairy processors.



Forward Contracts

Dairy Farmers America (DFA), one of the larger dairy cooperatives in USA with more than 14,000 farmer members has been offering their farmers 'risk management services' since the 1990's. The service is one out of the seven farm service divisions they provide their farmers. Edward Gallagher, President of DFA Risk Management, (pers.comm., September 9, 2015) stated that they provide standard fixed products as well as customised programmes, depending on the farmer's needs.

"Profitable farm management is not an option – it's a requirement in the volatile dairy industry. That's why DFA created its Farm Services division. The business units within the division can help members better manage their operations, optimize productivity and increase profit margins. We strive to provide members with services they need at the quality and price they want" (DFA, Risk Management, 2015)

Figure 8: DFA Information Booklet (Source – DFA)

Three standard types of forward fixed price contracts were found, forward fixed price, collar or fenced price and a forward fix covered price. Outlined below are the three contracts and images from the DFA Risk Management website to help illustrate the contracts (2015).

1. A flat **forward fixed price** was a common contract offered by processors. This allowed farmers to lock in a known milk price for future milk production and provided farmers with certainty. This tool is somewhat similar to Fonterra's Guaranteed Milk Price programme.

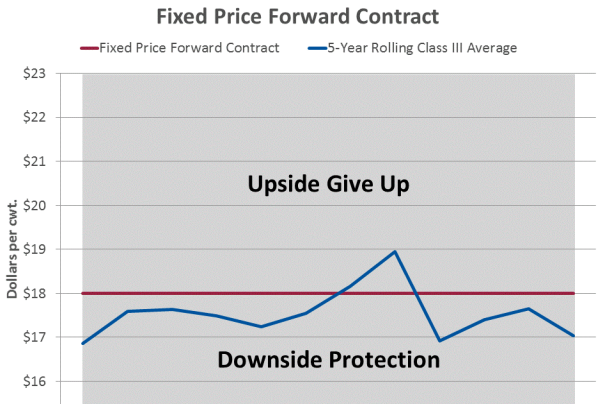


Figure 9: Fixed Price Forward Contract (Source – DFA)

2. Another option farmers had were **minimum cash price and or minimum/maximum price** (which was also referred to as Option, Collar or Fence contract) contracts. This was similar to having insurance, providing farmers with assurance that the milk price will not go below a set price. The farmer is able to lock in profit without giving up upside potential.

Figure 10: Minimum Price Forward Contract (Source: DFA)

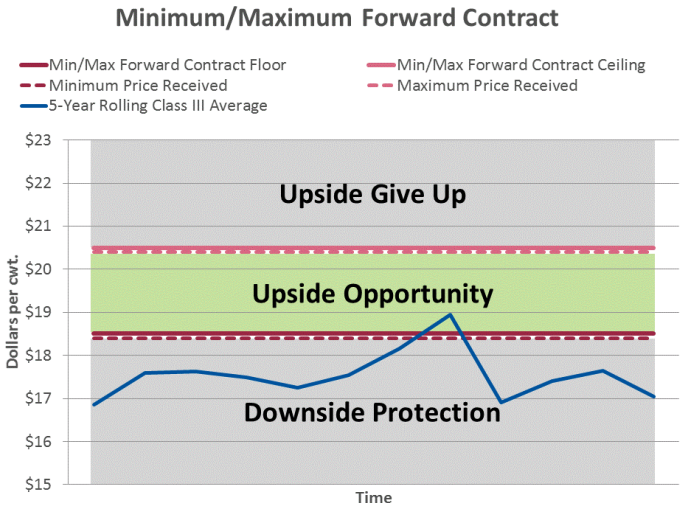


Figure 11: Min/Max Price Forward Contract (Source:

3. **Covered fixed forward price** was also another option (DFA called this a Capped Upside Rider), which was a fixed forward milk price with an additional cap above it. If that cap was triggered by the market spot price hitting that cap price, then farmers would be able to participate in the upside above the cap. This option was slightly more expensive than the fixed forward milk price for this additional optionality. It allows farmers to preserve upside potential.

The advantages farmers stated for going through their processor versus a broker included reduced basis risk, no margin account requirement, longer tenure contracts, easier payment management, and simplicity.

- **Reduced basis risk:** Companies acted as a median between farmers and the exchange, providing fixed prices directly linked from the futures, or provided a blend price off the futures that aligned with the milk price paid to farmers. These meant farmers had reduced risk of a difference between what they received for their milk and the fixed price if it was a price linked to the futures. However, the companies also provided other forward contracts where they offset the risk with long fixed price contracts with customers which meant there was no basis risk. Hence, DFA was able to provide a selection of different options to create specific blends suitable for farmers in different regions.

- **No margin account requirement:** For farmers to be able to hedge on futures market, they must have a margin account. For forward contracts the processors managed the margin account on behalf of farmers and typically worked with a group of brokers to offset the risk onto the CME. Processors are able to manage a margin account because it holds the value between the farmer's milk cheque (spot market price) and the fixed futures price, which is that amount the margin account requires.

- **Longer forward contracts:** Farmers were able to fix flexible time periods to suit their needs, as long as it was aligned with contracts available on the CME. Some processors were able to provide farmers longer forward fixed contracts than on the futures exchange through backing the contracts with customers. DFA was able to offer contracts as far as two or three years, which was a lot further than what was available on the CME. Edward Gallagher from DFA stated, there are customers that are not interested in using the futures to hedge their dairy exposure and especially when there is not enough liquidity out far enough to hedge what they want. Hence those customers are willing to pay a premium to fix with the Cooperative and DFA is able to offset that with farmer fixed price contracts. This is how Fonterra's Guaranteed Milk Price Programme was managed.

- **Easier payment management:** Farmers were still paid the market price for their milk, but an additional adjustment was made at the same time when the milk was paid, which included an administration fee, option fee (if required) and the adjustment difference between the market and fixed price (positive or negative). This adjustment was made the month after the fixed milk had been delivered and the adjustments were clearly stated on their statements to reduce confusion and ensure farmers understood how the milk price was derived.

- **Simplicity and ease of use:** The milk processors are a channel that allowed for the most coverage and access for farmers to be able to utilise forward contracts. They provided simple, easy to use and support tools. DFA farmers have access to a specific website dedicated to risk management that provides flexible tools, such as feed linked pricing,

product linked pricing and forward pricing. They also had support tools to help farmers calculate their cost of production and show their margin, and provide consultancy advice to larger farmers. They also provided a greater amount of flexibility for farmers with innovative solutions than the standard three options mentioned above. For example, 'feed rider' which allows farmers to lock in feed prices along with their milk price. DFA provides farmers with choice even after a farmer has signed a contract to fix their price.

There were a few drawbacks for farmers utilising forward contracts with processors but these varied between processors and cooperatives:

- Farmers from Grande Milk marketing were unable to get out of a fixed position once they had signed a PRM contract. This was to ensure farmers were not using these tools to trade or speculate but were utilised for risk management reasons,
- DFA stated they did not provide majority farmers with advice on hedging however they offered advice to larger farmers.
- There is still a level of basis risk in some of the contracts that are offset through the processor onto the exchange. Also, other variances could occur between the contracted fixed price and actual farm gate price received due to individual farmer's milk quality, fat and protein adjustments and other adjustments.
- Farmers had an obligation to produce the milk that was fixed, because the processor is then managing that risk against the milk they will receive, and
- Counter Party Credit Risk for processors.

Larger corporates used futures or forward contracts to secure margins as they were less inclined to take risk on behalf of their shareholders, whereas smaller family farms were more willing to ride the market and put operational strategies in place.

Futures and Options

Futures contracts have been available to the USA farmers for over twenty years through the CME. The exchange offers farmers the avenue to offset their milk price risk (through the four classes of milk) and their feed cost prices. The numbers of contracts completed on the exchange have been steadily increasing (figure 12) showing a growth in the use of PRM tools by both customers and farmers.

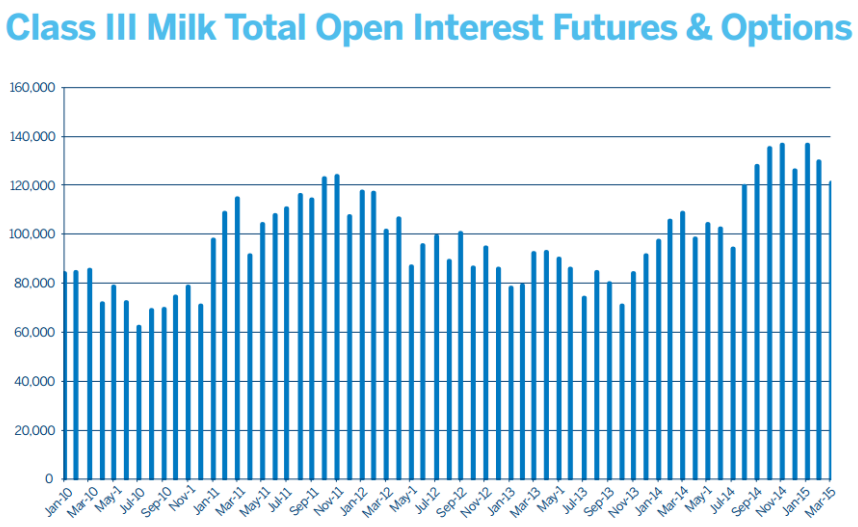


Figure 12: Class III Milk Total Open Interest Futures and Options on the CME (Source: CME)

For a farmer to be able to use the futures market, they must enter a financial contract with a broker. From the discussions, key challenges or drawbacks for utilising the futures were:

- **Basis risk:** This was a significant concern for many farmers. The contracts available on the futures are standardised products, and may not align with the farmers received milk price. Different locations and different processors mean that farmers all receive different prices. USA farmers taken on some level of basis risk when they enter into futures contracts. There is a level of basis risk between the futures contract prices and the actual milk price due to the tailored combination that can vary slightly for processors (Jelinek. R. A. pers.comm., August 21, 2015).

- **Requirement of a margin account or margin calls**. Farmers are required to place a performance bond to start trading on the futures which is not a down payment but a quoted amount per contract that is there to protect the exchange from credit risk. There is also an initial and maintenance margins. Initial margins are an amount of money that is required per contract to initiate a futures position. Maintenance margin is a minimum balance that must be maintained at all times. If the margin account goes below the required maintenance level, then a margin call is made and the farmer must top up the account by the end of the day otherwise they would lose their futures positions which made up their fixed price.

- From farmer conversations, margin calls became significant cash flow burden and they were not comfortable providing cash top ups at short notices, even though the futures would settle to the agreed fixed price. Wells Fargo, a large bank in California offered some farmers a margin account where they would manage the maintenance level, but this was not offered to all farmers.

The Over the Counter market (OTC) was another avenue for farmers and processors to offset risk as an alternative to using the futures exchange. Hoover and Gallagher mentioned that the OTC market represented a significant amount of the total trades completed by USA farmers (Hoover. pers.comm. September 14, 2015 and Gallagher. pers.comm. September 8, 2015). It is through the OTC market DFA has been able to offset majority of their risk. This is still a financial transaction. The reason why farmers and companies used the OTC market was due the lack of liquidity on the exchange and hence was seen as an alternative to the exchange without the requirement for a margin account.

Brokers also offered additional services such as, market information and advice on trading. Some provided margin calculators to help farmers' measure risk and assist them in making greater informed hedging decisions that are tailored to their farming business. The following section outlines the margin calculators provided by the brokers.

Margin Calculators

USA farmers utilised margin calculators provided to them by brokers or industry risk management experts.

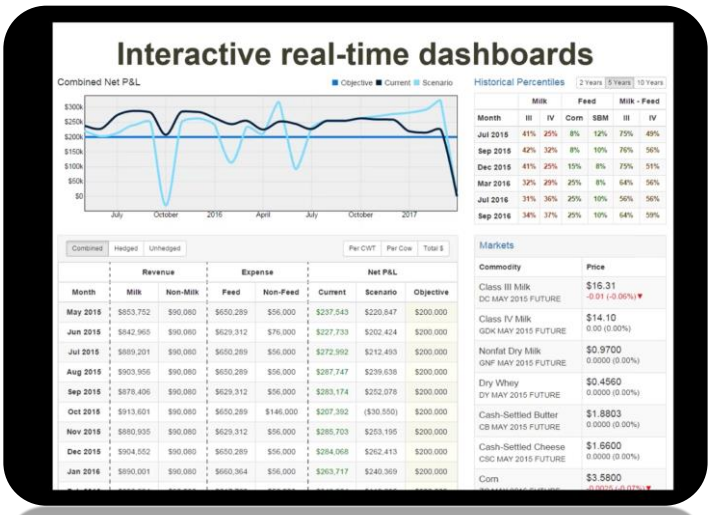


Figure 13: Vault Dashboard (Source: Vault Technology)

These tools provided farmers a simple and accessible calculator that allowed them to break down their individual margin into revenue (fat and protein) and expenses (exact feed quantities) to ensure the right combination of commodities for hedging represented the individual's actual finances. It also allowed farmers the ability to build scenarios with interactive graphs of different hedging plans without entering any actual contracts and visually see the impact those decisions could have on their margin (stress test). Farmers are then able to monitor their breakeven, profit and loss statements and operating profit margin on a regular basis.

The uniqueness of these calculators is that they also include real time prices from the CME exchange for milk and various feed commodities. In the figure 13, this shows the Vault software's dashboard developed by Rice Dairy for their clients.

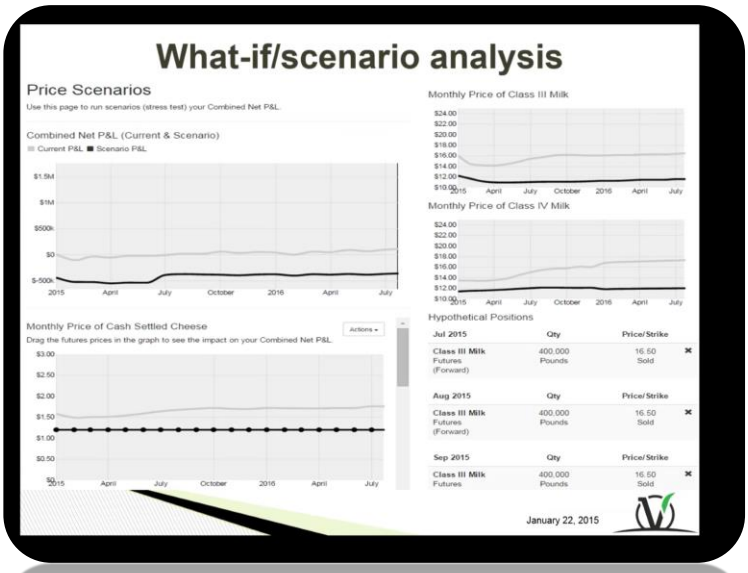


Figure 14: Vault Scenario (Source: Vault Technology)

The adoption of these calculators were typically by larger farmers with more than a thousand cows (Schrad, K. pers.comm., August 21, 2015). They were Excel or cloud based tools with varying annual subscriptions between $7-10k. This did make the tools expensive for smaller farmers. Companies providing these tools were Rice Dairy - Vault Technologies, CIH Margin, Progressive Farmers - DTN and FC Stone – Margin Watch.

These tools were created to help farmers measure their individual farm margins and provide relevant information to make accurate decisions on how much of their costs or milk price they need to protect. The individual farmers information combined with market intelligence enabled farmers to confidently and effectively make decisions by either utilising the futures market or forward contracts or no contracts.

Government Support

USA farmers have historically had significant support and protection from government but as previously mentioned, have reduced intervention into the dairy market. In the latest Farm Bill (USA government regulation on agriculture), an insurance programme was introduced called the Margin Protection Programme (MPP). They continued the dairy forward pricing programme and the dairy indemnity programme.

The purpose of MPP is to protect farmers from a 2009-type catastrophic losses and experiencing low margins as seen in 2012 as explained by Shawna Morris, Vice President of trade policy from National Milk Producers Federation presented at the Dairy World Summit (2015). Farmers pay $100 registration fee to join the programme and are unable to de-register for the term of the programme. MPP defines a margin to be all the milk prices minus average feed costs of the national benchmarked prices of corn, soybean meal and alfalfa hay. Farmers are able to choose a floor milk price from four to eight dollars per hundredweight and are able to protect between 25 to 90 per cent of their production history. The four-dollar floor price protection is free and was the most common level farmers signed up for, and anything above that an additional fee applied. To date, the programme generated the government more money than payments to farmers. The top eight-dollar floor milk price was triggered in late September 2015 when dairy prices began to drop. Currently 55 per cent farms and 80 per cent of the estimated 2015 milk production have enrolled in MPP.

The government also provides a programme called the dairy Forward Pricing Program. Under the federal order (government regulations), processors are required to pay farmers the minimum price, however, this programme allows processors to enter into forward contracts with farmers and agree on an alternative pricing mechanism. This removes the risk between forward or futures contracts that farmers may be exposed to and allows processors to provide forward milk price contracts to farmers with minimal risk to them. DFA utilises this programme to allow farmers to forward contract their milk based on any class milk.

The Farm Credit was another initiative supported by the US government. The farmers interviewed in Vermont and California stated that government provided funding facilities specifically for farmers through a programme called the Farm Credit. It is a bank like facility that provides farmers with access to credit with the government acting as the guarantor. This provides farmers access to lower interest rate funding and was seen as a source of additional funds.

Europe Following Fast

PRM was front of mind for industry leaders in Europe. Discussions and interviews were held with various Cooperatives, brokers, dairy boards, rural professionals and farmers; predominantly across Ireland and the Netherlands.

Observations and Key Learning's

Milk price volatility is relatively new to European farmers. This is primarily due to the reduction of price support mechanisms set by the Common Agricultural Policy (CAP). Over the past ten years they have reduced intervention levels, phased out the production quota regulations and reduced trade tariffs (figure 15).

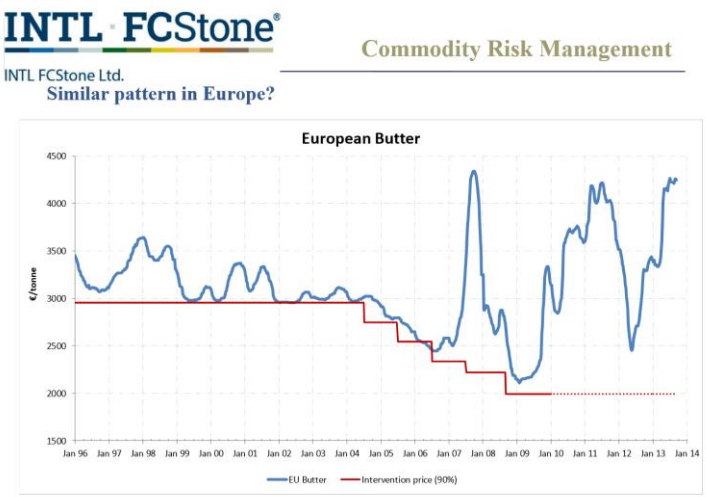


Figure 15: European Commodity Price (Source: FC Stone)

They have historically produced enough for their own consumption. But with the removal of the production quotas, it has driven farmers to increase production leading to Europe exceeding their domestic requirement. This has meant that Europe is now a key player in the export market and similar to America, a small increase in production impacts the global prices and the milk prices their farmers now receive.

This has meant that their farmers have now got a greater level of exposure to global prices and increased the level of price volatility. This was a growing concern by farmers, government agencies and processors as a consequence of removing the quotas.

However, similar to the USA, Europe still has a large domestic market compared to what they export, and still have government support programmes to help farmers, thus reducing the level of volatility farmer's experience.

In addition, there is no true market price for milk in Europe, but a reference is made to an index which is a survey of all milk prices offered by dairy companies across Europe. However, not all prices were considered accurate or provided on a timely manner as stated by some people in the industry therefore the index did not accurately reflect the market milk price. This meant that farmers did not have a market reference to benchmark their milk price and many referred to gDT for market indication. Not having a market reference makes it difficult to provide PRM tools that are relevant and aligned with the actual farm gate price.

The combination of an increase in global volatility in milk prices and high input costs, has created a need for farmers to achieve greater stability in profit margins to withstand price shocks and sustainably continue farming. This change has encouraged the industry to consider innovative and less intrusive intervention solutions such as PRM tools. Tools available to farmers were:

- Three year forward contracts
- Futures contracts
- Government support – intervention and single payment subsidies
- Cooperative and processor support funds

Why did farmers utilise the forward or futures contracts?
Farmers used the forward contracts to remove price risk. The key advantages outlined by farmers were:

- The tools were easily accessible through their cooperatives
- The tools were seen as simple and easy to use.
- The fixed prices were for three years and not for all of their production. This allowed for a smoothing effect of their income.
- Glanbia's forward contract indexed to three key cost indices (Fertiliser, feed and electricity) and with a number of adjustment mechanisms, ensuring the farmer was aligned with the market.

The tools provided farmers with certainty to budget and plan their business. The farmers spoken to had either recently expanded and or made capital investments into new sheds, in anticipation of the production quotas being removed. They stated that they had no choice but to fix their price to ensure they would be able to meet and fund their investments. The certainty was critical where there was significant investment and commitment by the farmer to grow their farms to capture the no production restriction opportunity.

Why did farmers not utilise the forward or futures contracts?

Price volatility is a new challenge facing many farmers in Europe hence, many farmers are only starting to consider PRM tools to manage price volatility. Liquidity rather than solvency has been the main concern for many farmers due to the low gearing ratio held by farmers. Also, the banks have been supportive with assisting with working capital through times of low pricing. Amongst farmers, there was still an expectation that price risk would be managed for them rather than considering the impacts of volatility on their businesses and acting themselves.

In addition, many farmers adopted other strategies to help manage price volatility, but some were starting to consider a combination of strategies which included hedging the milk price.

The futures market was near non-existent in Europe but the development was progressing. Some of the key concerns mentioned were:

- The lack of a transparent market price for milk. A futures market that would work for all European farmers was seen to be difficult to achieve as there was no accurate market price however, the EUREX and EURONEXT exchanges are attempting to do so.

- Direct hedging for farmers was difficult, due to basis risk aligning milk price to a basket of dairy commodities that would equate to their actual milk price. Also the similar concerns as the USA with margin accounts and broker commission.

- Farm size is typically smaller in Europe and creates a challenge for farmers to access the markets. For most dairy farmers the challenge was in the complexity of the futures market. This required time and effort to understand and manage the tools, and also the quantity of milk to make the effort worthwhile.

- Due to the markets still developing, there were concerns regarding the liquidity on the market to adequately hedge the milk price risk.

- A study done by Steinmann and Thiele (2015) on farmers utilising the futures market found that farmers can have profitable and unprofitable results from using futures depending on the tenure, kind of hedge the farmer enters into, and the liquidity of the market. The larger the milk output of the farm, the higher the costs of wrong decisions, and also the profit of right decisions. The results of hedging activities depend on the management and market analysis skills of the farmers or their experts.

- Futures markets do not reduce the actual market volatility; their function is to allow hedgers to manage the volatility. There were concerns however, that there may be risk of increased speculation taking place following the introduction of futures markets leading to an increase in volatility.

- It was noted that the futures cannot help farmers increase the average milk price they receive, but it assists with reducing the fluctuations the farmer receives through the smoothing/averaging effect of the milk price received verses the market price.

What was the industry doing to help farmers?

Increase in the development of PRM tools:

- PRM was a priority discussion at the World Dairy Summit and the Farmers Forum 2015. There were presentations and discussions from government officials and industry members from Germany, Netherlands, USA and England. This shows the growing need and commitment by Europe in assisting farmers and the industry to develop tools to help farmers.

- The removal of the quotas has increased competition amongst cooperatives and processors because farmers are no longer held to a dairy processor with quota allocation. PRM tools were a competitive advantage amongst processors. Since the development of the forward contract by Glanbia, another five of the eight dairy processors in Ireland have introduced similar PRM tools. Cooperatives and other industry companies in the Netherlands and Germany were also investigating PRM solutions for farmers.

- It has also encouraged the development of more sophisticated and flexible PRM solutions. The development of the tools has been sustainably introduced with farmers understanding of PRM tools. Glanbia is an example of how they have continued to improve their tools, adding more complexity to suit the farmer's needs and understanding.

- It was mentioned serval times that cooperatives or processors were the best avenue for farmers to have access to the most flexible PRM tools. The processors have direct access to customers and have the scale to work with banks to access the futures. The processors are able to provide either, physical (alternative payment to the milk cheque) or financial solutions (indexed to the futures prices and then a cash payment of the difference). The processor manages the portfolio between the commodities on the futures and or customer's contracts and the milk price paid to farmers. Also, processors would know best what commodities make up the milk price and hence are able to manage the basis risk on behalf of the farmer.

Education and Support tools:

- Education was ongoing as more and more farmers experience the impacts of a volatile milk price. The cooperatives to date, had spent time on educating farmers on the benefits of the tools to the farmer and the cooperatives.

- Farmers were aware of how the risk was managed. For example, farmers who did not participate did not see any concerns with the forward contracts. There was a level of understanding on how the cooperatives managed the risk and that the cooperative was not putting its members at risk or unfairness. Farmer were aware that the cooperatives had backed the forward contracts with customer agreements and thus allowed the cooperative to secure more customers and provide some farmers with PRM solutions.

- Some farmers understood the benefits of hedging. The growing participation rate of the forward contracts proves the level of understanding and need for the tools. Farmers understood they would be exposed to a greater level of price risk once the quotas were removed and hence used the fixed prices to gain certainty for budgeting and securing lending.

- Brokers were beginning to enter the market and provide farmers with more structured advice and support around hedging. For example, FC Stone recommended that farmers have a price risk strategy plan with set goals and objectives first before considering a hedging strategy. This takes into account the farmers risk tolerance, financial situation and physical assets before a plan is developed as to how to best manage the price risk.

Price Risk Management Strategies used by farmers

Transfer or Share the Price Risk - Hedging

In Ireland, farmers were able to hedge their milk price through securing their milk price in a forward contract with their cooperatives. This provided farmers certainty to grow and also enabled them to smooth their average milk price over seasons and manage the price volatility. The futures market has only recently been established, hence there was not a high level of adoption or awareness of the futures contracts. Below are the avenues and tools farmers had access to:

- Three year forward contracts via cooperatives, processors or private financial entities
- Futures exchange markets via brokers (limited)
- Over the counter derivatives market (OTC) via brokers (limited)

Other Strategies

The other common strategies found used by Irish and Dutch farmers were diversification, cost management, maintaining liquid assets and supply chain integration. There was a high level of diversity through secondary incomes from spouses or family members and tourism businesses. However, maintaining liquid assets was by far the main strategy by farmers. Over the years, the restriction in production and the smaller average herd size (70 cows) has allowed farmers to accumulate equity buffers due and consider alternative sources for income.

PRM Tools available to farmers

Forward Contracts

Glanbia, Kerry, Aurio, Dairygold and Carbery dairy cooperatives in Ireland are offering three years physically linked fixed price contracts to their farmers. Glanbia has been offering these contracts for

the past six years and many of the other cooperatives begun to offer the contracts over the past two years. There has been a growing interested and demand for the tools by the cooperatives and farmers.

The Glanbia contract covers approximately 15% -30% of their milk production and 40% of their farmers are on the contract (Brian Hanafin, pers comm, June 23, 2015). Many of the cooperatives have been oversubscribed for their fixed milk price offers (Glaniba, Carbery and Dairygold) showing a strong interest by farmers for these tools.

The benefits of the tools as stated by Glanbia for a forward contract are (Index-linked fixed milk price Phase 5 Scheme booklet):

- Dairy Farmers are unique in terms of having an ability to secure a margin for milk supplied under the GFMP for a three year period.
- It allows a farmer to plan with margin certainty
- It limits the farmers exposure to milk price volatility, especially in an non quota environment
- It gives greater certainty of meeting loan repayment obligations, especially in cases where a significant investment was made in growing milk output
- It addresses the challenges of cash flow planning, that price volatility presents to farmers.

The price risk is managed by the cooperatives offsetting the price with customers (similar to how the risk was managed with Fonterra's GMP programme). The cooperatives rely on customer agreements to be able to offer these tools to farmers as they are not utilising the futures markets in the EU.

Over the six year, Glanbia have been evolving the tool to meet farmer needs. The first year Glanbia offered the forward fixed price contract, it was not successful. Farmers stated that the fixed price was too blunt and that they could be out of the market over the three years. Hence, Glanbia adjusted the tool to align revenue with costs for a more stable margin. The later version indexed the fixed price to government indexes for fertiliser, electricity and feed prices. The fixed price has an additional protective price range around the fixed price, so if the milk price goes outside of that range, the farmer gains or losses the amount that the price has gone outside of the range. This allows the price to adjust up or down depending on significant movements in key farm costs. This ensures the price is relative to the market.

Farmers are becoming more aware and comfortable with fixed price contracts and understanding how they can use them on farm. Hence, this season Glanbia released a contract where farmers are able to lock in key costs when they lock in the fixed milk price, allowing farmers to lock away an actual margin instantly. This tool provides farmers with greater control and flexibility to manage their margins.

However, the other cooperatives forward contracts do not include the cost based indexing adjustments as in the Glanbia version. They are simple forward fixed prices to allow for ease of use and higher adoption. The simplicity did not impact farmer interest in the tools as the applications have been oversubscribed.

In Netherlands, there was a small start-up company called Dairy Trading Online (DTO), providing similar forward contracts except the contracts were financial. The contracts were backed with customers, independent to a physical milk supply or the dairy processor.

Futures and Options

In Europe there are two dairy financial exchanges and a OTC market; the European Energy Exchange (Eurex) and the Euronext. Eurex is based in Germany and started in 2011 which provides hedging for

Butter, SMP and Whey Powder. The products are cash settled based on an index of German, Dutch and French quotations. The Euronext is based in the Netherlands and started a dairy contract in 2015 which provides hedging for SMP and is physically settled.

The futures exchange market is a new alternative and in its early development stages hence lacks liquidity to offer flexible solutions. However, the market has been increasing in activity (refer to figure 16).

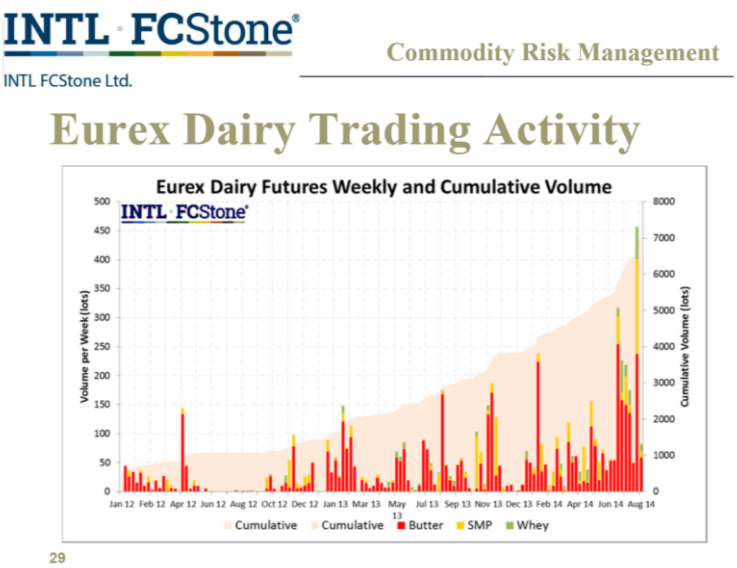


Figure 16: European Commodity Price (Source: FC Stone)

Government Support

The EU still exercises public intervention through CAP. During discussions with Simon Coveney, the Minister for Agriculture in Ireland (pers.comm., July 14, 2015), he stated that there were three options for government intervention to prevent low milk prices. Firstly, powdered product can be stored while ensuring a minimum commodity and milk price which was 21 cents a litre. A second option is to provide aid to private storage for butter and powders, but not cheese and the third option he mentioned was export refunds. These measures artificially maintain the commodity price up. Since the visit in June, Ireland has begun to exercise intervention and has been removing butter and SMP from the market into storage.

Also, farmers throughout the EU still receive the single payment subsidies from the government. In Ireland this equated to approximately 15-20% of a farmer's profit if they were entitled to it.

The government support provides farmers with protection from extremely low milk prices. The Irish Dairy Board, jointly with the government and EU are working on developing strategies to help farmers manage price volatility, through encouraging more value added product development, forward fixed price schemes, development of a functioning futures market with a true market price and banking facilities.

Cooperative and Processor Support

In Ireland, many cooperatives provided farmers with cash top ups in the year 2015 from cash reserves held. The cooperatives hold funds specifically for paying farmers during low milk price years. For example, Glanbia has a milk price stability fund of over five million dollars to support the milk price. The fund is created out of value generated from the sports and nutrition sector, and also from the shares sold when they reduced their percentage of ownership in their brands company, PLC.

Section 5: Implications to NZ Dairy

What is the Price Risk for a NZ dairy Farmer?

Over the past decade, NZ dairy operating profits have been increasing, but at the same time the extremity of volatility in that profit has also been increasing (figure 17, DairyNZ Economic Survey 2012/13).

Farm working expenses have stayed fairly consistent over the past ten years with the major moving component of the equation being the revenue (net dairy cash, figure 18, DairyNZ Economic Survey 2013/14). The revenue line drives the farm's discretionary cash at the end of the season, which is used to either reduce debt, capital development, purchases and most importantly, drawings (family, living and the farm).

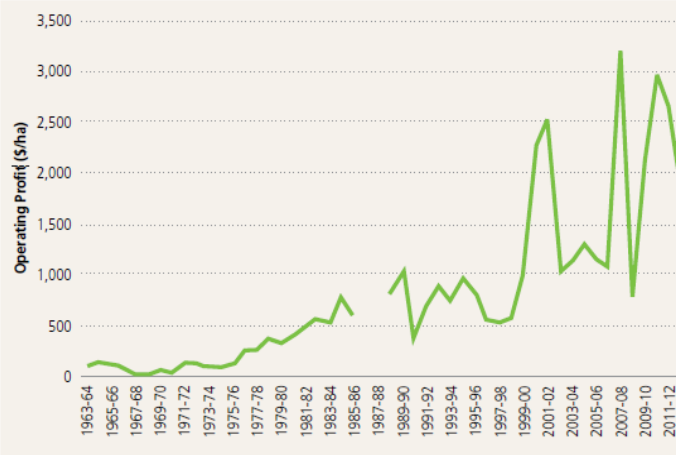


Figure 17: DairyNZ Economic Survey 2013/14 – Trend in Operating Profit (Source DairyNZ)

NZ has gained efficiency through the low cost farming system, but over the past few years, productivity and efficiency has been decreasing. Figure 19 shows the volatility in operating profits and the portion contributed by Milk Price verses on farm efficiency.

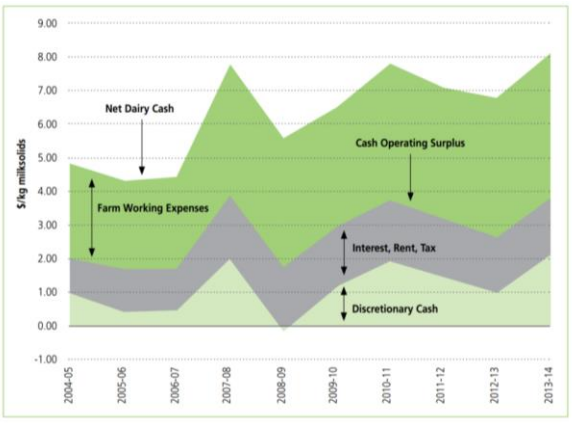


Figure 18: DairyNZ Economic Survey – Cash Revenue and Expenditure per Kg Milksoilds Sold (Source DairyNZ)

Figure 19: DairyNZ Economic Survey 2013/14 – Profit from Productivity (Source DairyNZ)

Farmers rely on the Milk Price to drive profitability; however milk price is neither stable nor predictable. The milk price drastically moves from season to season, as well as within a season. The below graph shows the range of volatility in the average Fonterra milk price experienced over the past eight seasons, which illustrates the volatility farmers are exposed to.

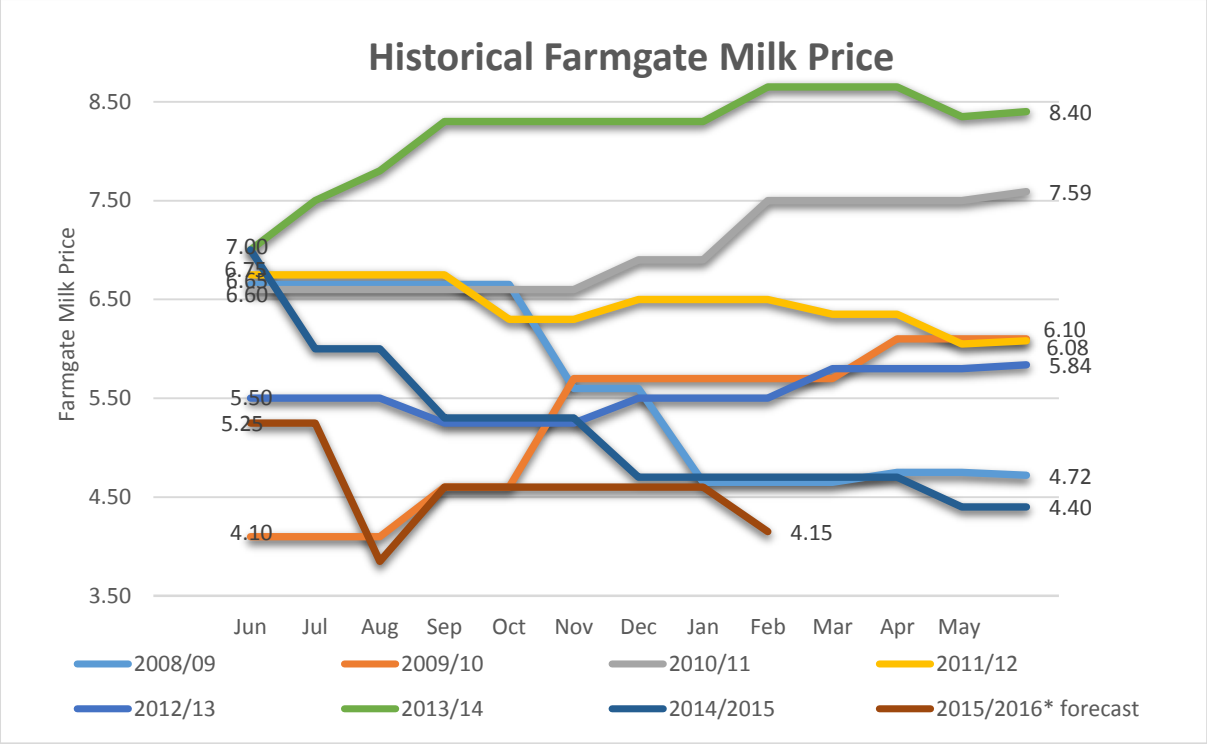


Figure 20: Historical Farmgate Milk Prices (Source: Fonterra)

There have been three seasons where the final milk price has been below the opening farm gate milk price, and in 2012/13, the milk price dropped from the opening in September and then increased over the remaining of the season to a final milk price above the opening price. This graph shows the extreme volatility and the unpredictability of the milk price. Even Fonterra is unable to predict the price with certainty.

There is a high probability that the opening milk price will vary from the final milk price. The variance between the opening milk price and the final milk price is of +/- $2.50 at the 95% confidence interval based on historical milk prices (Arron Atkinson, pers.comm., 15 April, 2015). Last season 2014/15, there was a 60% drop in milk price and 2009/10 season where there was a 33% increase in the final milk price from the opening forecast.

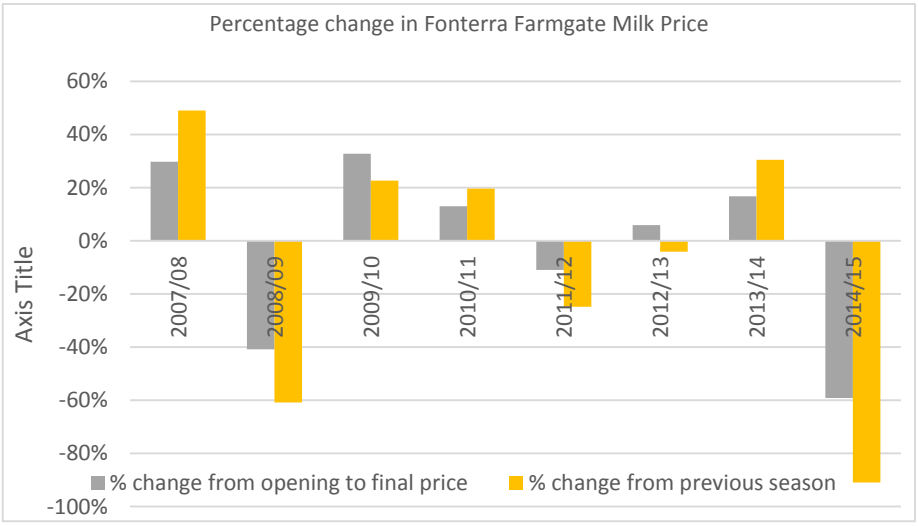


Figure 21: Percentage Change in Fonterra Farmgate Milk Price (Source: Fonterra)

Fonterra Farmgate Milk Price

The milk price regime aims to pay farmers the maximum sustainable price for their milk. The milk price is calculated in accordance to the Milk Price Manual which is calculated by an independent Milk Price Group. The calculation is a theoretical calculation outlined below.

The milk price manual was developed when Fonterra was formed as part of the Dairy Industry Restructuring Act (DIRA) regulations. It is a basis for setting the raw milk price or closest price to market price for a 'bucket' of milk. Below is a basic diagram to show a high-level overview on how the milk price is calculated.

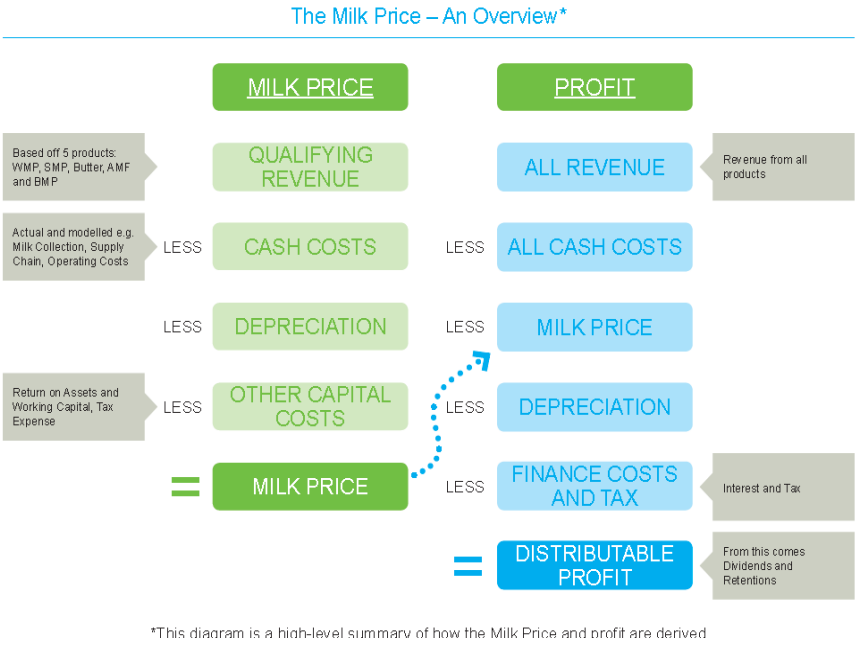
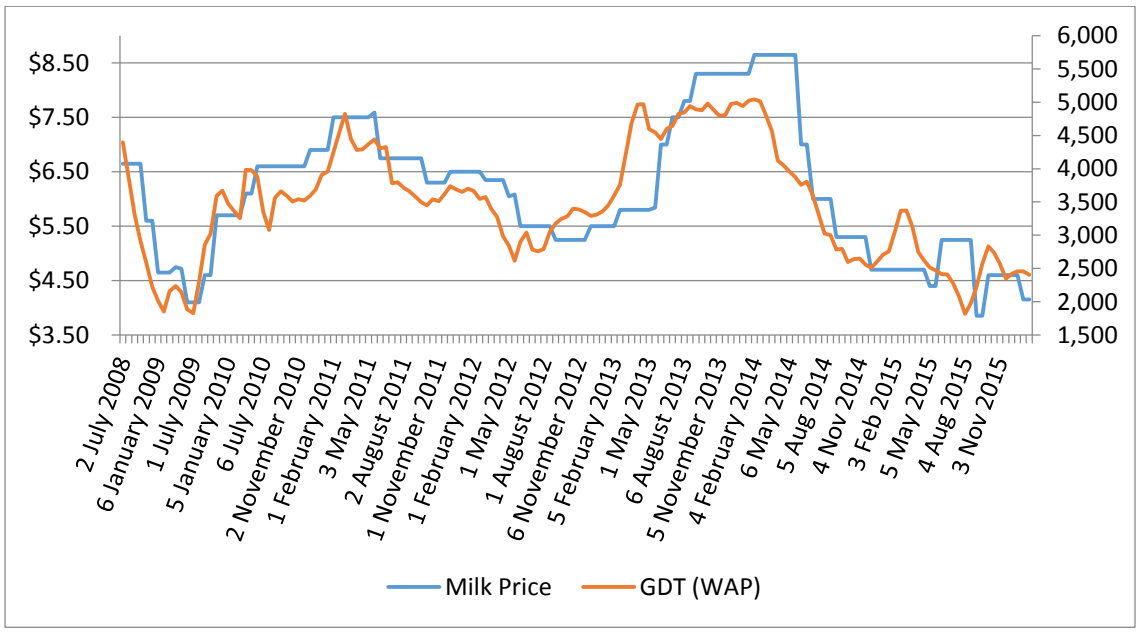


Figure 22: Fonterra Fargate Milk Price (Source: Fonterra)

The key component is the five drivers of milk price revenue, the prices of whole milk powder, skim milk powder, butter, butter milk powder and anhydrous milk fat on the Global Dairy Trade (GDT).

These streams were selected because they represent the most likely streams that an efficient competitor for NZ milk would most probably build milk powder plants. Foreign Exchange (FX) also plays a part. The old saying that for every 1cent movement in FX, equates to ten cents in Milk Price, no longer applies. Most of Fonterra's FX is hedged reducing the FX movement impact.

Figure 23: Milk Price verses GDT Weighted Average Price (Source: Fonterra)

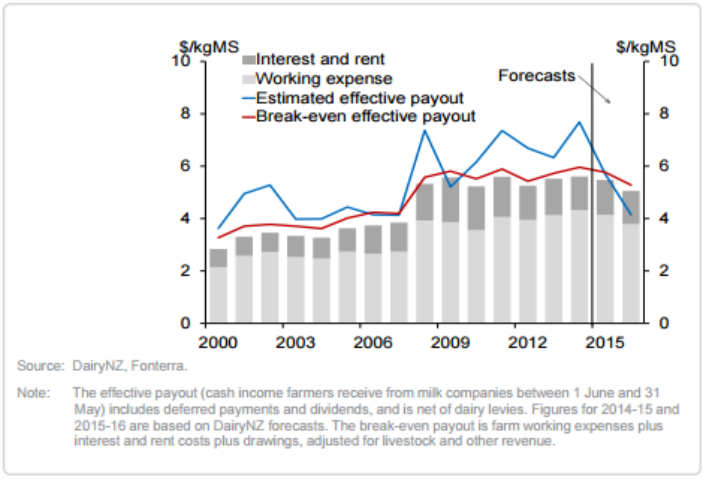


Farm Expenses

Maintaining a low cost of production per ha and kgMS and striving for efficiency were the two attributes of a resilient farmer (Shadbolt, Olubode-Awosola, and Rutsito, 2013).

Historically, working expenses did not vary from season to season, but since 1990, there has been an increasing trend and volatility in expenses. Farm working expenses have increased 58% in nominal terms over the last ten years, a rate of 16 cents per kgMS per year.

The DairyNZ economic survey outlined that farm working expenses were 53.4% of net dairy cash income in 2013-14 (milk price $8.40), and in 2012/13 it was 61.0% (milk price $5.84). Over the past ten years, farm working expenses as a percentage of cash income averaged at 57.6%. Farm expenses shift with the milk price and are extremely volatile in recent years. The below graph illustrates this.



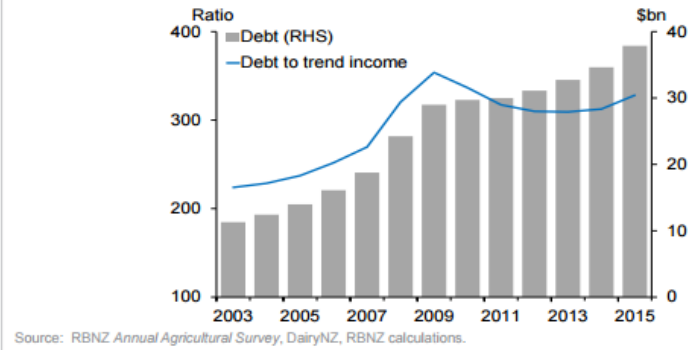
Source: DairyNZ, Fonterra.

Note: The effective payout (cash income farmers receive from milk companies between 1 June and 31 May) includes deferred payments and dividends, and is net of dairy levies. Figures for 2014-15 and 2015-16 are based on DairyNZ forecasts. The break-even payout is farm working expenses plus interest and rent costs plus drawings, adjusted for livestock and other revenue.

Figure 24: Actual and break-even dairy payout (Source: Reserve Bank)

Research has found there is no variation in farm working expenses based on farm system per kgMS. If the farm is a system 1, all grass system, the likelihood is that the farm would not be producing that much and hence costs will be relative to production. With a system 5 farm, their costs will be higher, but their production will also be relatively higher, so per ha or kgMS the cost is the same (Shadbolt, Rutsito, and Gray, 2011).

The main three expenses for farmers is debt, feed and labour. Feed is becoming a larger portion of working expenses over the past 10 years, increasing from 22% of operating expenses to 31.8% in 2013/14 season. Farm debt was approximately $1.50per kgMS for an average farmer (DairyNZ, 2014). This is currently a growing concern for the dairy industry as mentioned in a recent report from The Reserve Bank (2015). The bulletin stated that as at June 2015, dairy debt was at $37.9 billion, which represented around 10% of total bank lending in NZ (figure 25).



Source: RBNZ *Annual Agricultural Survey*, DairyNZ, RBNZ calculations.

Note: Dairy income is constructed using effective payout multiplied by milk production. Trend income is used to adjust for volatility in commodity prices and milk production, and is estimated using a Hodrick-Prescott filter with judgement imposed to ensure the trend payout is $6.25 per kilogram of milk solid (kgMS) in the 2015-16 season.

Figure 25: Dairy Sector Debt (Source: Reserve Bank)

A study done by H. M. Firth (2007) into NZ farmer stress indicators found that farmers "where the farm did not make a profit in the last 12 months were significantly more likely to have higher stress levels in the 'other areas' where the common thread was financial stress". The key indicators were, worried about owing money, not having enough ready cash to liquidity and concerns about the farms viability.

Price volatility is not going away and it is becoming harder to sustain. NZ farmers need options to manage stable profits to increase the opportunities for more farmers to enter dairy and provide choice to the ones who are farming today to innovate, grow and control their businesses.

Price Risk Management Strategies

Solutions for farmers to hedge their milk price are near non-existent in NZ. The only option some farmers have today is the futures market, which come with its own barriers for most NZ farmers. Many of the other strategies utilised by USA, Irish and Dutch farmers are also common strategies adopted by NZ farmers. Particularly the focus on farm efficiency and reducing cost of production.

PRM Tools available to farmers in NZ

Forward Contracts

'The Fonterra Guaranteed Milk Price (GMP) scheme, which was available to all Fonterra farmers (except directors) was similar to that available to farmers in USA and Ireland. It was introduced as a pilot in 2013 and run for additional two seasons. GMP allowed farmers to fix their milk price twice in the season for a portion of their milk solids for that season.

During the three years, over 5% of shareholders participated in the programme. The findings stated that the distribution of the programme was proportionate to Fonterra's shareholder supply base by size and geography.

Key benefits outlined from the participants in the programme were that it provided certainty, control and peace of mind. The tool provided farmers with the ability to hedge their milk price for the season, smoothing the price volatility experienced within the season.

However, this season GMP was discontinued due to shareholder concerns the contract created a division amongst members with some farmers receiving different prices and also the misperception that farmers not on the programme were subsiding those on the programme.

Open Country Dairies (OCD), the second largest dairy company in NZ is still offering its farmers a similar product, where they pay their farmers a fixed price for the season and pay the fixed price in full at the time of supply.

Futures and Options

The NZ Exchange (NZX), was developed in 2010 and has been increasing in activity since it started as shown in figure 26 (NZX, 2015). Products currently available on the futures are SMP, WMP, AMF and Butter. They also have an options market for all these products.

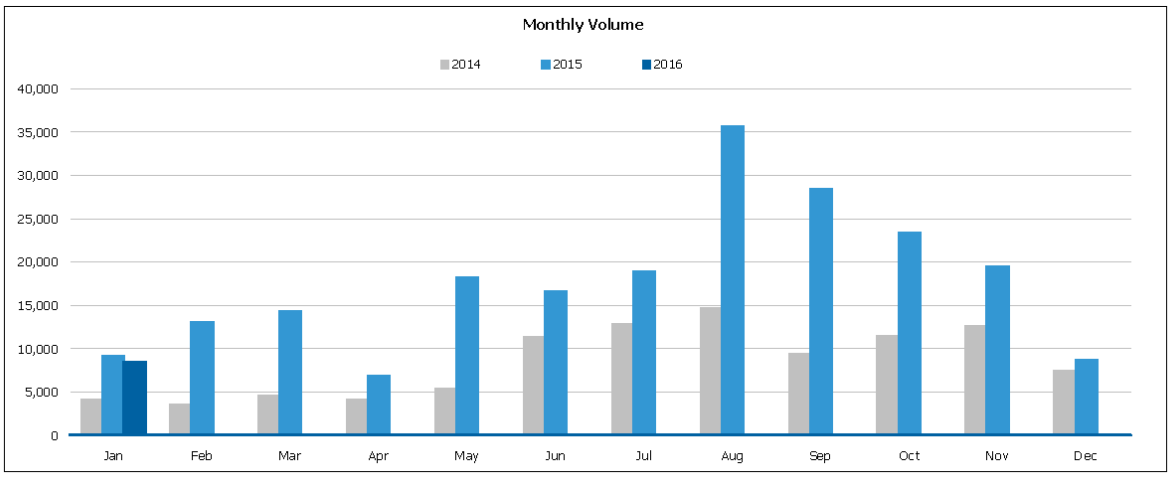


Figure 26: NZX Global Diary Futures and Options Cumulative Volume (Source: NZX)

Farmers are able to share their price risk through the futures market today. A blend of NZX dairy commodity products can create a similar price to the farm gate milk price. This is possible because the NZX settles to the GDT prices, which drives the Fonterra milk price. However, a level of basis risk still exists because not all the products are available on GDT and the percentage of each commodity that makes up the final milk price is unknown until the end of the season. Calculations can be made based on historical milk prices, but this can vary season to season. Farmers have access to multiple brokers such as OMF and FirstNZ, who are able to assist farmers with hedging strategies and provide access to the futures market.

Government Support

The NZ Income equalisation scheme is unique to NZ. It allows farmers to even out fluctuations in income by spreading their gross income from one year to the next. It includes discretionary relief for any significant extreme or adverse events. This scheme helps farmers smooth their tax obligations as a result of a volatile milk price.

Milk price volatility is a concern for NZ dairy farmers and tools need to be developed to help farmers manage their price risk.

Key learning's from USA and Europe for NZ Dairy Farmers

USA, European and NZ farmers had many elements in common such as:

- Exporting dairy products and exposure to global prices
- Challenges with price risk and volatility
- Succession and aging farmers
- Traditional farming practices to manage price risk
- Lack of confidence in financial tools
- Farmers with grass based production systems
- Farmers are price takers

All the farmers are on the same journey incorporating PRM tools into their farming business; however, the approaches and the speed of development of PRM tools in each region was different; the tools were diverse and the participation varied. Farmers in the USA and Europe had a choice to either accept volatility or manage price stability, whereas NZ dairy farmers do not.

What made NZ different to Europe and USA?

- NZ has greater exposure to the global dairy markets.
- NZ has no government support
- Small domestic market compared to export

NZ dairy farmers are 30% of the global dairy market. The total global exports is only 7% of the global production, hence a small change in one of the key producing countries (USA and EU) can have significant impact on the imbalance of supply demand for dairy.

NZ's two largest export competitors have government support programmes that help farmers withstand low milk prices. This is a significant disadvantage in competitiveness to NZ farmers as the European and USA farmers will be able to weather the downturns better than NZ farmers. Also, both the other markets have large domestic markets, sheltering the farmers from extreme external factors. Thus strengthening their farmers and dairy industry to continue growing and expanding onto the export market. This is a true threat for the NZ dairy industry long term.

The magnitude of the price volatility is difficult for many farmers to manage, and either farmers are able to sustainably capture the upside or they are able to weather the downside. It is difficult for NZ farmers to experience both.

The lack of PRM tools also places pressure on banks to continue to support NZ farmers. Price volatility is a risk for NZ bank and questions will be raised if they can continue to support NZ farmers with high levels of uncertainty in milk price.

For NZ farmers to continue to grow sustainability and compete on the global market, additional innovative diverse PRM tools need to be developed to ensure solutions are available to meet different farmer needs (certainty, assurance or control). This will enable farmers to better utilise cash, stabilise margin and increase productivity to keep up with global competition.

Can NZ provide dairy farmers with PRM tools?

NZ has the elements to enable PRM tools to be available:

- Market Price for milk - Fonterra farmgate milk price
- A Futures market that is linked to the market price
- Price volatility

NZ has the making for flexible PRM tools to be developed and relevant for NZ farmers. NZ's farmer's milk price is linked to the market price (gDT), they have a futures market that settles to the market price (NZX). Linking all the key components together to provide NZ farmers with better aligned PRM tools than Europe.

Table 2: PRM strategies for NZ dairy farmers

Strategy	Key Learnings/Comments
Hedging – Forward or Futures Contracts	• Hedging tools transfer or share the price risk to smooth price volatility, • Provide flexible alternative solutions to managing milk price risk securing a margin to traditional practices, • Strategies were adopted before trading on the futures. Having a plan ensured decisions are made based on the plan and not subjective or impulsive, • Strategies consisted of either aiming to average the milk price over the season or to target a profit margin. • Farmers who speculated without a PRM plan felt regret if the market went against them, • Traditional other strategies were incorporated into the management plan, such as buying or delaying physical purchasing of feeds dependant on prices and the agreed parameters, • Combination of futures and options can be adopted in hedging strategies, • Hedge a portion of the milk not 100% • Farmers hedged on a regular basis for a particular amount or were actively watching the margin opportunities • Margin calculators helped identify hedging/margin opportunities, • NZ Farmers can hedge a basket of dairy commodity prices that make up the milk price on the NZX futures market through a broker, • There are mentions that the NZX will introduce a Milk Futures contract. The details are not yet public. • The Financials Market Authority (FMA) hold restrictions on financial instruments. This will be of higher importance due to issues with farmers being misled with interest rate swaps, • A margin account will be required and there will be a level of basis risk that farmers must incorporate
Operational on farm practices	• NZ is one of the lowest cost producers in the world. Efficiency on farm should always be the main goal no matter what strategy is adopted, and • Not everyone is capable of achieving the lowest cost of production every season.
Diversification	• Spreading risk over a portfolio of businesses helps reduce exposure to dairy prices. • Examples, tourism, other agricultural businesses etc. • The drawbacks are that it may require additional skills and expertise and impact efficiency on farm. But the opportunity cost of this could outweigh the advantage.
Processor Profile	• Dairy companies with multiple product streams are able to flex between products to achieve the greatest value, this spreads the milk price risk exposure for farmers. • The additional value is passed through to profit. • For example, farmers invest in Fonterra for its potential to earn more than the commodity price via a return in dividend. This investment spreads the price risk.

Maintaining liquid assets	• As the saying goes, 'farmers are asset rich and cash poor'. • Liquidity on farm can be in a variety of formats, such as cash, shares, equipment etc. • Relying on equity buffer may not always be a practical solution or best utilisation of money.
Supply chain integration	• NZ farmers have been entrepreneurial in this space previously with raw fresh milk at the farmgate. Farmers could consider producing their own local cheeses. • This strategy maybe challenging to enter the market and can be difficult to execute on a NZ spring production curve to ensure constant supply to customers.
Speciality Milks	• NZ farmers already have multiple avenues to speciality milks such as Stolle, winter milk and organic supply. • The underlying base price is still the farmgate milk price, hence does not remove the risk. Cost of production to produce the speciality milks also incur additional costs.
Government Support	• Tax obligations were a concern in many USA and European farmers had as a result of a volatile milk price. They did not have many solutions to overcome this, but to align expenses with revenue where possible. • NZ has the income equalisation fund that helps smooth out volatile profits from a tax obligation perceptive.
Cooperative and Processor Support	• Fonterra Supplier Loan • Farm Source retail deferred payments • Farm Source Cooperative discounts

Section 6: Conclusion

The milk price will remain to be a concern for NZ farmers as long as we continue to produce a commodity. NZ's global competitors are leading the way in PRM solutions for their farmers, equipping them to withstand the global price volatility better than NZ farmers, strengthening them to advance and outpace NZ in the export market.

NZ must respond now or prepare for the consequences and get left behind. There is a gap in the NZ dairy farmers' toolbox for an alternative solution to traditional farm PRM practices. There are solutions available today used by the European and USA farmers. NZ has the ideal infrastructure to implement these solutions as well and there is a strong need to do so.

NZ dairy farmers need access to diverse PRM options to provide them flexibility to choose the right approach for the right time to strengthen their businesses through volatile milk prices. Farmers need to be prepared and understand the tools to make better informed decisions.

Figure 27: Risk Decision (Source: FC Stone)

Limitations

The visits did not explore in depth the reasons for the strategies adopted by farmers, nor did it look into other commodities. The findings are also subjective to the many variables specific to each country that may have influenced the farmers PRM decisions that have not been considered.

Section 7: Recommendations

Farmers can only mange or control things that are in their realm of influence. Anything outside of that circle is not controllable and therefore unmanageable (figure 28). PRM is a decision inside their realm.

More tools will begin to enter the market to assist farmers with managing price risk. It is important that farmers are prepared, and understand why they should manage their price risk before they look at which solution to go with. Many farmers already have strategies in place to a certain level and do not require any change, but no two farms are the same and not every year is the same.

For farmers who are interested in stabilising their margin, the below recommendations have been outlined to help achieve this.

Figure 28: A farmer's circle of influence

NZ Dairy Industry – We should have a choice?

As an industry, more needs to be done to provide farmers with tools and the support to analysis the choice to manage a stable profit margin.

More solutions required

- Greater flexible tools are required similar to that in USA, allowing farmer's greater flexibility to manage price risk that suit their particular circumstances and business needs,
- Multi season solutions to help with smoothing long term volatility,
- Solutions need to be accessible, hence a variety of tools from different avenues would provide farmers with the greatest benefit,
- Fonterra and other dairy processors are the ideal avenue to provide all farmers with access to at least some PRM tools. Guaranteed Milk Price Programme was an ideal tool that achieved this, and should be re-introduced, along-side other solutions such as a minimum milk price contracts.
- Futures are currently the only hedging option for farmers. Traditionally farmers are known to be cash poor and asset rich, hence their ability to manage or fund a margin account will be difficult without the support of a bank.

Education and support tools development

- Areas for greater information are:
    - How to identify price risk and the benefits of PRM to a farmers business,
    - How the milk price is calculated and the impact on their business,
    - Understand the implications of forward contracting on their business,
    - How the tools work and function,
    - How the risk is managed by the farmer and the organisations
- Education on how to best use the tools and hedging strategies,
- These will need to be provided continuously as more and more farmers consider the tools.
- It will be important to ensure farmers are aware of the implications and consequences of the tools before participating or considering them. This is to prevent and minimize bad experiences,
- Education needs to be face to face with real farmer examples and scenarios,

- Development of support tools that assist PRM decision making and allow easier access to utilise and manage PRM strategies. These tools can be linked to the NZX live prices to provide farmers with on time information to make informed decisions,
- Rural Professionals, brokers and DairyNZ are a key channel used by farmers for information. It would be important they are informed and prepared to provide this support.

NZ Dairy Farmer - Prevention is better than a cure?

The dare to be average

- Accepting volatility or managing a stable profit margin should be a choice,
- There is no right or wrong answer to which solution a farmer chooses to manage their milk price risk, but some tools are a better and more efficient use of resources,
- A farmer's risk appetite has a large bearing on the management approach adopted, and to the level each management tool is incorporated into the business, and
- A goal, a plan and a risk management strategy will help the business run smoother and help farmers face new situations in a better and clearer position. The four step risk management process will assist in developing a price risk management plan (refer to next section for a simple outline of the process).

Identify, Plan and Measure

- Price volatility is here to stay hence understand the milk price and how it impacts the business,
- Developing a business plan first with set goals and objectives helps provide clarity and will assist with making better informed decisions,
- Develop a PRM plan,
- Document the decisions made and the reason for them, this will help later when reviewing decisions,
- Regular budgeting and monitoring of financials, included testing sensitivity scenarios,
- The use of technology and software programs assist with accessing financials on regular bases thus helping make greater informed, relevant and timely decisions. There are tools to manage finances such as, Xero, Cash Manager, Quick Books and Bank Link. Also farm management programs such as Figured and Farmmax. However, these are not as sophisticated as the USA margin calculators,
- KPI focus on operating margin over maximising production, and
- Include experts and professionals for advice and information.

Managing Price Risk

- Choice of either accepting price volatility or managing price risk for stability,
- The solutions are to either;
    - Do nothing and accept the risk. This can be a valid management solution for some farmers. For examples, farmers with low breakeven costs, low debt or access to other strategies such as flexible liquid assets.
    - Alternative tools are forward or futures contracts. Financial tools can provide more suitable and feasible solutions, but it is important to be aware of the implications as hedging is not designed to maximise profits, but to protect margin. NZ has limited forward contract options, however the futures market is available and accessible to some farmers.
- Encourage the development of PRM tools to help provide more choice and flexibility.

Reassess and evaluate

- Reassess the PRM plan at the end of the season because circumstances change, such as family, lifestyle, other business risks, different opportunities or solutions.
- Professor from Cornell University, Andrew Novakovic (pers.comm., 3 September, 2015) stated that farmers should ask the question "how did it impact my business and how comfortable was I with the outcome?". Every strategy has an opportunity cost. If the outcome was outside the farmer's comfort zone, then revaluate and consider another solution combination.

Four step PRM decision making process

Identify – What is Price Risk?

Identify the primary drivers of your business by understanding the revenue, farm working expenses and profit and then identify where the movements are.

- Understand how the milk price is calculated and what drives it.

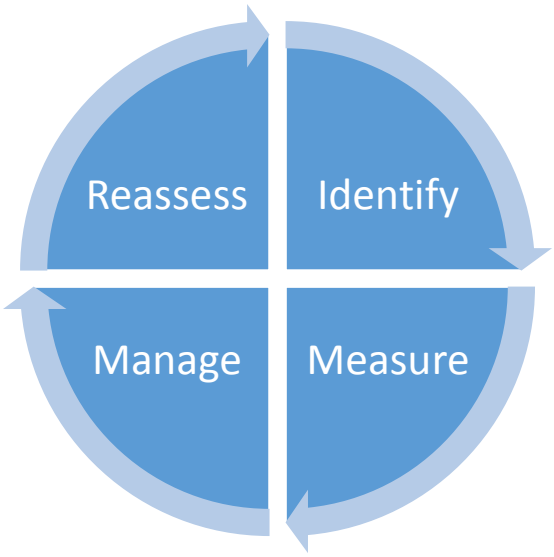


Figure 29: Risk management decision making process

Measure: Why is Price Risk Important to me?

Measure the impact the milk price movements have on your business, such as on budgets, profit, business goals and individual well-being.

- For example, use the Dairybase business templates for business planning and budgeting. The annual budget also includes a sensitivity chart (production, farm working expenses and milk price variances)

Manage: How to manage price risk?

Plan and create a strategy on how the price risk will be managed to the level that you are comfortable so that you can achieve your goals.

- Traditional operational strategies, or consider hedging strategies by using forward or futures contracts to average input and output prices and secure a margin for a portion of the production.

Reassess: Did my business achieve its goals?

Revaluate the PRM plan and goals set to ensure it is still aligned with the business plan and readjust if required.

- Prevent regret. Plan and monitor all decisions. PRM is not about maximising profits but stabilising.

References

AHDB (2015). *Market information.* Retrieved from http://dairy.ahdb.org.uk/market-information/farming-data/producer-numbers/uk-producer-numbers/#.Vs6PUn19670

Bellemy, K. (2015, September*). Managing risk in the continuing global dairy expansion?.* Conducted at a meeting of IDF World Dairy Summit 2015, Vilnius Lithuania.

Commodity Ingredients Hedging. (2016). *What is Risk Management?.* Retrieved January 1, 2016, from http://www.cihedging.com/education/basics/

DairyNZ. (2014). *DairyNZ Economic Survey 2013/14.* Hamilton, New Zealand: DairyNZ

DairyNZ. (2016). *Quick Stats about dairying – New Zealand*. retrieved Feb 25, 2016 from http://www.dairynz.co.nz/media/1357994/quickstats-new-zealand.pdf

Duranovich, F. N. (2015). *Resilience attributes of New Zealand Dairy Farmers*. Retrieved from http://mro.massey.ac.nz/bitstream/handle/10179/7099/02_whole.pdf?sequence=2&isAllowed=y

Edmunds, S. (2015, January 11). Stress too much for farmers. *NZ Herald.* Retrieved from http://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=11384751

European Commission. (2015, December). *EU Agricultural Outlook, Prospects for EU agricultural markets and income 2015-2025*. Retrieved from /markets-and-prices/medium-term-outlook/2015/fullrep_en.pdf

Federated Farmers. (2015). *New Zealand's Farmer suicide disgrace*. Retrieved January 1, 2016, from Octoberhttp://www.fedfarm.org.nz/publications /media-releases/article.asp?id=1879#.VsZDeo9OIww

Fenton, L. (2015, June). *Commodity Risk Management. [Powerpoint slides].* Presented at the meeting with FCStone, Ireland.

Fonterra, (2016).*The global Dairy Industry*. Retrieved February 25, 2016 from http://www2.fonterra.com/our-financials/the-global-dairy-industry

Fonterra. (2015). *Guaranteed Milk Price*. Auckland, New Zealand: Fonterra

Get a head.(2016). The *facts about Dairy Farming*. Retrieved February 25, 2016 from www.getahead.co.nz/the-lowdown/the-facts/dairy/

Glanbia Ingredients Ireland. (2015). *Index-linked fixed milk price phase 5 scheme*. Ireland.

Hemme, T. (2015, September). *Risk Management*. Conducted at a meeting of IDF World Dairy Summit, Vilnius Lithuania.

IFCN. (2015). *Dairy Report 2014*. Germany: IFCN

Investopeida. (2016). Definition of Counterparty Risk retrieved February 25, 2016 from http://www.investopedia.com/terms/c/counterpartyrisk.asp

Investopeida. (2016). Definition of Hedging retrieved February 25, 2016 from http://www.investopedia.com/terms/h/hedge.asp

Investopeida. (2016). Definition of Margin Account retrieved February 25, 2016 from http://www.investopedia.com/ask/answers/200.asp

Morris, S. (2015, September). *The Dairy Farmer Margin Protection Program*. Presented at a meeting of IDF World Dairy Summit, Vilnius Lithuania.

NZX. (2016). *NZX Dairy Derivatives Volume Report*. Retrieved from http://www.nzxfutures.com/system/downloads/42 /NZX%20Dairy%20Derivatives%20Volume%20Report.pdf?1452225729

Shadbolt, N., Olubode-Awosola, F. & Rutsito B. (2013). *Resilience to Bounce without breaking in New Zealand Dairy Farm Businesses*. Retrieved http://ifmaonline.org /wp-content/uploads/2014/08/13_Shadbolt_etal_P92-105v2.p

Shadbolt, N.M. & Olubode-Awosola, F. & Lawn. J. (2015). *Resilience Risk and Entrepreneurship*. Retrieved from www.onefarm.ac.nz/assets/Uploads/Resilience-risk-and-entrepreneurship2.pdf

Shadbolt, N.M., Rutsito B. and Gray D.I. (2011). *Resilience of New Zealand dairy farms in a turbulent environment: Definition and measurement*. Retrieved from http://www.ifama.org/files/conf/2011/Symposium%20Papers/311_Symposium%20Paper.pdf

Steinmann, L. & Thiele, H. D. (2015, September). *Milk Futures - Lessons learned from European dairy farmers experience.* Conducted at a meeting of IDF World Dairy Summit 2015, Vilnius Lithuania.

USDA Economic Research Service Retrieved February 25, 2016. From http://www.ers.usda.gov/topics/animal-products/dairy/background.aspx

Weir, F. (2013). *Financial Literacy and Rural NZ* [PowerPoint slides]. Retrieved from http://www.onefarm.ac.nz/resources/webinars/showrecent/15#sthash.M2cqSavc.dpuf