

JACOBY



INTRODUCTORY GUIDE TO DAIRY SUPPLY BALANCING

I INTRODUCTION

Dairy markets are some of the most volatile agricultural commodity markets. Unpredictability comes in the form of changes in herd population and health, changes in weather, changes in trade policy and changes in consumer demand.

Farmers, handlers, processors and end users alike rely on trading firms to help balance supplies and manage risk in an industry with many moving parts.

This educational guide will show how dairy traders can benefit buyers and sellers in the industry by:

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- 03** Providing a foundational understanding of dairy markets.

 - 07** Explaining the factors affecting milk production and quality.

 - 10** Explaining how milk classification impacts the dairy industry.

 - 12** Introducing dairy industry risk management tools and strategies.



| DAIRY MARKET BASICS

In a perfect world, dairy markets are balanced when supply matches demand and there is no shortage or surplus of product. While no market can be perfectly balanced, traders help get as close to it as possible, allowing producers to avoid wasting product and processors to keep their plants running.

One of the biggest keys to understanding dairy markets is understanding the many ways balance is achieved.

Methods of balancing

Balancing the industry begins by having a broad network of buyers and sellers, both domestically and globally. That allows traders to match organizations who have more product than they need with those who don't have enough. It's a matter of striking a deal and setting up **the logistics**.

That's the simplest balancing method, but it's also critically important. In the case of fluid milk, the alternative to finding a home for surplus product if a local milkshed is at capacity is to pour it down the drain.

More options are available for products that are better fit for storage, such as cheese, butter or powders. In those cases, traders will purchase these products and store them until a later date when demand is strong and prices are potentially better.

By trading one kind of capacity for another, surplus milk is turned into something that's sold instead of wasted.

Storage is an important balancing option for handlers, too. Because milk has such a limited shelf life, handlers are forced to convert excess milk into something more storable. By trading one kind of capacity for another, surplus milk is turned into something that's sold instead of wasted.

On the other side of the coin, processors who have extra capacity after meeting their obligations turn to traders to find excess milk they can process. That maximizes the efficiency of their processing plants. When plants stay at capacity, they stay profitable.

Another balancing option is to export. Traders watch worldwide industry signals just as closely as they do domestic ones so that, should the circumstances arise, their customers have yet another balancing option.

Simply put, understanding dairy markets allows stakeholders to make decisions that keep the wheels turning.

Market cycles, time and place

While the industry is unpredictable, recognizing a few important truths about how dairy products are made and consumed goes a long way to maintaining an even keel. Consider the following:



Seasonality – Milk production in the U.S. peaks in May during the spring flush. It drops off steadily during the summer months and typically bottoms out in late October or early November. As you'll read below, a quirk of the dairy industry is that greater demand for products occurs when milk production is naturally low.



Weather and climate – Severe weather events can alter milk production. For example, extended heat waves, widespread flooding or major snowstorms negatively impact herds and destroy feed crops, affecting production in both the short and long term. Climate plays a role, too, especially in North America where it varies from region to region. For example, the spring flush arrives a bit earlier in the West and Southwest. It comes a bit later in the upper Midwest and Mid-east, and later still in the northeastern U.S. and southern Canada.



Production problems – Dairy traders are especially valuable when regional problems put the supply chain in jeopardy. For example, droughts can compromise herds. Snowstorms can halt milk transport. In the case of a drought or extended heat wave, cows get exhausted and produce much less milk. In the case of a snowstorm or other significant weather event, impacted transport lanes keep trucks from collecting milk, forcing producers to waste it.

With supplies suddenly short, demand for dairy products elsewhere will surge, and traders will need to keep processors supplied with milk from elsewhere until things get back to normal.



Consumption trends – The way we consume dairy products throughout the year changes. Here are some classic examples:

- Obviously, far more ice cream is consumed in the hot summer months than at any other time.
- Per capita butter consumption in November and December is almost twice what it is the rest of the year due to holiday baking.
- Fluid milk consumption dramatically increases during the traditional school year as milk is included in more meals at school and at home.
- Demand for cheese destined for pizza spikes during college semesters and drops off during breaks; demand for processed cheese for burgers surges in the summer months when more people grill out.

As the examples clearly show, consumption trends are quite independent of milk production trends. Traders help keep **inventories balanced** in both the short and long term.

Observing federal and state milk marketing orders

Another important job for traders is observing the minimum fluid milk prices set by the **Federal Milk Marketing Orders** (FMMOs) and individual state orders.

Different Federal Orders have different rules. Variations in pooling and qualification rules in the different orders require milk traders to understand the advantages and disadvantages of moving milk between orders at a given time. Traders use this knowledge to do business between certain Federal Orders with the goal of increasing the milk price for their customers.

Price certainty and risk management

Traders working to balance supply inevitably are aware of how that impacts prices. That knowledge is critical for customers whose profitability depends a great deal on their ability to limit risk and secure stable prices for products.

Traders help secure stable prices for products by trading in commodity futures markets like the Chicago Mercantile Exchange.

Certainty is good for industry stakeholders, but it's also good for end users. The stability achieved through stable prices over time ensures consumers are insulated from the day-to-day swings in price inherent in commodity markets. Risk management is explained in greater detail below.

A comparison of average price paid by consumers for one pound of cheddar cheese against the share of that price earned by dairy farmers.

Cheddar cheese, one pound ¹

Year	Retail price	Farm value <i>Dollars</i>	Farm share <i>Percent</i>
2000	3.83	0.98	26
2001	4.03	1.28	32
2002	4.22	1.04	25
2003	3.95	1.17	30
2004	4.27	1.55	36
2005	4.38	1.39	32
2006	4.25	1.14	27
2007	4.23	1.66	39
2008	4.73	1.77	37
2009	4.67	1.14	24
2010	4.71	1.40	30
2011	5.42	1.72	32
2012	5.63	1.60	28
2013	5.56	1.66	30
2014	5.54	2.07	37
2015	5.38	1.54	29
2016	5.23	1.49	28

¹ Estimates of farm value are based on minimum prices reported by USDA's Agricultural Marketing Service for Class III products. They do not account for over-order payments.

Source: Calculated by ERS, USDA, using data on retail prices from the Bureau of Labor Statistics and data on farm-gate prices published by USDA agencies.



MILK PRODUCTION AND QUALITY

A driving factor in the volatility of the dairy industry is that the quantity and quality of milk produced over time cannot be guaranteed. It depends too much on factors farmers can't control — though they do try.

Industry and government agencies both try their best to accurately predict milk production, and everyone hopes that the milk will be of superb quality. But neither is assured, and that uncertainty has shaped how the industry has evolved and how **products are marketed**.

Factors affecting milk production

The amount of milk a cow produces depends largely on the environment she's in. It's all about comfort: The more comfortable the cow, the more milk she will produce. The less comfortable the cow, the less productive she is. Environmental factors include:

- **Weather, climate and geography** – Temperate climates with milder seasons put less stress on cows than climates with more extreme weather. Geography is closely tied to weather and climate. For example, cows in Wisconsin and Michigan tend to be more productive than cows in Florida due to heat in that region. Heat and humidity are the factors with largest impact. If night time temperatures cool, cows get a chance to recover even in hot seasons. However, if they don't have a chance to cool down, they will eat less feed and produce less milk.
- **Feed** – Weather and climate can also affect the abundance and quality of feed, which translates to quantity and quality of milk produced. Feed prices and availability can have a large impact on what farmers can use.
- **Accommodations** – When cows have comfortable places to rest, space to graze and farmers who work to keep everything clean, they're more productive.

PRODUCTION / QUALITY

Biology and the way farmers interact with it also affects milk production. Factors include:

- **Species** – Different **cow breeds** naturally produce different quantities of milk. Composition of milk varies slightly among breeds, too.
- **Age** – Younger cows generally produce more milk than older ones. Farmers constantly face the decision of letting a cow give milk versus when it's economically better to slaughter for beef and let a younger cow replace it.
- **Milking frequency** – Farmers are very precise about how frequently cows are milked. The amount of milkings per day adds to labor and equipment costs. But waiting too long between milkings means quantity and quality will suffer.
- **Health** – Sick cows produce less milk — and poorer quality milk (which is discussed below) — than healthy ones.
- **Dry period** – How long a cow is allowed to be “dry” in between calvings can impact how much milk it will give during lactation.

Factors affecting milk quality

The quality of milk a cow produces can directly affect how much a farmer is paid for it. That's why farmers go to such great lengths to assure quality of milk. Factors impacting the quality of milk a cow gives include:

- **Cow health** – A cow's health has the biggest impact on the quality of the milk it produces. Just like humans, cows can catch illnesses similar to a cold or flu. They're also susceptible to **irritation or inflammation** of their udders if stall conditions are poor. Exposure to mud, manure and runoff can expose the herd to more pathogens, increasing incidents of infection. Rainy seasons can predictably lead to higher somatic cell counts.
- **Somatic cell counts** – These are the best markers of cow health. High somatic cell counts in milk indicate an increased presence of white blood cells — a signal that the cow is fighting an illness. Other types of somatic cells can degrade the fat and protein content in milk. This hurts the quality of the milk and can lead to deduction in pay.
- **Diet** – Just as a cow's diet impacts the quantity of the milk it produces, it also affects the quality composition. In times of food scarcity, both will suffer. When feed is plentiful, farmers have more room to adjust feed to enhance the components of milk. Better composition means a better paycheck.
- **Milk handling** – Another factor affecting milk quality is how it's treated once it leaves the cow. Because milk is a naturally good place for bacteria to thrive, bacteria counts taken during processing can show whether milk was taken with clean equipment and cooled quickly. The cleaner the equipment and the faster the milk is cooled, the lower the bacteria count will be.

Use of RBST

A touchy subject in the dairy and food industries is the use of synthetic hormones to boost milk production. Specifically, the use of **recombinant bovine somatotropin (RBST)** has been controversial. This synthetic version of a hormone naturally occurring in cows causes them to produce more milk, but some believe it is linked to an increased instance of bacterial infection in cows that results in an increased presence of antibiotics or antibiotic-resistant bacteria in milk. Note that all milk is tested before it enters the food supply. Milk that tests positive for antibiotics is always discarded.

Studies on the matter have shown mixed results and remain ongoing, but the industry has largely moved away from RBST use due to consumer backlash. More and more plants refuse to buy milk from cows they know receive RBST supplements.



MILK CLASSIFICATION

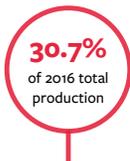
Because dairy markets are so naturally volatile, the reaction among industry stakeholders and the government has been to try to limit the volatility. Methods meant to achieve orderliness have increased — and become more complex — over the last century.

The milk classification system is one such example of the industry trying to fend off commodity market chaos. Class prices ensure that plants are given consideration of usage of the products they make. Plants that sell higher-priced end products pay more for raw milk, and those selling less expensive product pay less. The idea came about during the 1930s, when fluid milk was nearly two-thirds of the demand use for milk in the U.S. To ensure that high demand would be met, the classification system set higher prices for fluid milk and descending prices for milk destined for other products.

Milk classes and the FMMOs

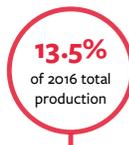
Most milk in the U.S. is produced within Federal Milk Marketing Orders.

In 2016, nearly 134 billion pounds of **producer milk** was pooled in Federal Orders. Here's a breakdown of milk classes in the Federal Orders and the milk produced within them.



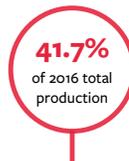
Class I

The milk we drink or use in cereal makes up this class. In 2016, 41.14 billion pounds of milk went for Class I use, or 30.7% of that year's total production.



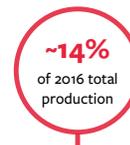
Class II

Milk in this class is used to make soft dairy products like yogurt, ice cream or sour cream. 18.14 billion pounds of milk went into Class II in 2016, or 13.5% of the year's total.



Class III

Milk used for most types of **cheese** and whey makes up this class. In 2016, 55.92 billion pounds of milk was utilized in Class III, or 41.7% of the year's total.



Class IV

Butter, butter-based spreads and **dry products** like whole milk powder and nonfat dry milk comprise Class IV. In 2016, 18.65 billion pounds of milk was utilized in Class IV, or just under 14% of the 2016 total.

These production totals only reflect milk sold within the Federal Order system. According to the **National Agricultural Statistics Service**, an additional 78.4 billion pounds of milk was sold in the U.S. in 2016 outside of the Federal Orders.

California, which produces the most milk of any U.S. state (40.47 billion pounds in 2016), operates its own state order and milk classification system. Montana has its own state order, too.

Pricing and pooling

Formulas based on average dairy product commodity prices set the price for each of the milk classes within the Federal Orders. Different variables drive prices in each class:

- Class IV milk is priced based on a formula taking into account the prices of butter and nonfat dry milk.
- Class III milk prices are derived from a formula based on the prices of cheese, whey, sweet whey and other solids.
- Class II prices are based on a variance of the formula that calculates the Class IV price plus 70 cents.
- Class I prices are calculated using a formula driven by the prices of Class II, III and IV milk.

The Class I price for a given month is announced prior to the start of that month. Class II, III and IV milk prices are announced in the following month. That means processors of milk in Class II, III or IV won't know what they will pay for their milk until the month after they received it.

The concept of pooling is another key part of reducing volatility. Federal and State Orders dictate that individual producers associated with the Order are paid based on a weighted blend price of all the milk in the Order. This way farmers participating in the pool collectively benefit from the proceeds of all milk sold rather than some earning more and others earning less due to the type of plant they deliver to. Pooling also ensures a mutually beneficial level playing field for plants in the Order. This arrangement keeps balancing plants in the area for when Class I use is low by providing pricing support to manufacturing plants throughout the year.

Note that while proprietary handlers must follow minimum payment rules (generally that producers must be paid at least the blend price for the order minus a reasonable charge for hauling), Cooperatives are exempt from these rules.



RISK MANAGEMENT IN THE DAIRY INDUSTRY

Commodity markets are naturally volatile. It's especially true in the dairy industry, where milk and its derivative products are produced, bought, sold and moved on an intercontinental scale based on the ever-changing demands of modern consumers.

Add to that the fact that success in the industry depends on favorable weather, healthy livestock and sensible regulation. None of those is guaranteed.

Sellers in the industry want to remain profitable despite the chance that prices could dip. Buyers want to keep their expenses in check despite the chance that prices could surge. It's risky business for everyone involved, from the farmers who produce the milk, to the processors who must decide what to make, to the end users who expect stable prices for the products they want.

In short, industry stakeholders need to manage risk if they hope to survive.

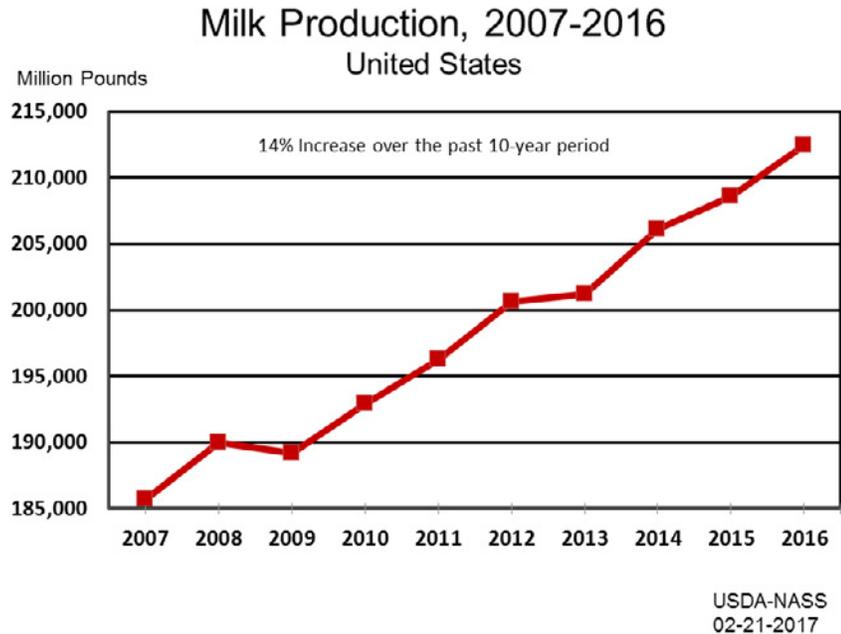
Dairy risk management strategies

While agricultural commodity market trading is nothing new, dairy trading on the **Chicago Mercantile Exchange** began rather recently in 1996. But markets have since matured rapidly, and that's opened the door to sophisticated dairy risk management tools aimed at limiting risks for stakeholders participating in a risky and competitive business.

Futures trading – Most dairy trading is conducted in the futures market because it allows buyers and sellers to secure prices forward in time. This lessens the price risk inherent in an industry where day-to-day prices can vary greatly. Stakeholders on both sides benefit: Sellers can secure ongoing profitability by getting favorable prices that protect

them against market price declines in the future. Buyers can get lower prices for products, protecting them against price upswings that add to expenses and put profits in danger.

Milk production in the U.S. has grown steadily. As this chart shows, production decreased year-over-year only once since 2007



Options trading – Options are similar to futures in that they give someone the right (but not the obligation) to buy or sell products within a set timeframe. Call and put options are the simplest types of options traded in commodity markets. A call option buyer will exercise the option if the spot price of a commodity rises above the strike price set out in the agreement. It means he or she can buy the product at the strike price but then sell it right away at the spot price for a profit. A put option buyer will exercise the option to sell when the spot price sinks below the strike price. It allows him or her to offload products at the strike price instead of at the lower spot price.

It's thanks to these markets and the hedging tools used within them that end users pay relatively stable prices for dairy products despite market conditions.

Our role as dairy traders is to use the available **risk management** tools in conjunction with our intimate knowledge of how the industry works to help customers benefit in any market, whether it's up, down or stagnant.



| Partnership with T.C. Jacoby & Co.

Our roots in the dairy industry date back to 1949, when we began balancing fluid milk supplies in the Midwest. With a strong commitment to our industry partners and a keen eye kept on the future, we grew to become the nation's leading dairy product trading firm. We've been building trusted relationships across the country and around the world for almost 70 years, **catalyzing change in the industry** along the way.

If your business can benefit from outside-the-box thinking backed by the expertise of professionals well-versed in every facet of the dairy industry, we're the right fit. **Contact us** now to get the conversation started.

