United States Dairy Policy

Contemporary Crisis and Supply Management

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Years of farm and trade policy that allows commodity prices to plunge to historically low levels have devastated the fabric of family farm agriculture and rural communities in the U.S. and around the world. The resulting global food system, while abundant, fails to feed the hungry, fails to promote healthful diets, and fails to eliminate food safety risks like disease pathogens and chemical contamination. – National Family Farm Coalition

Introduction

The U.S. agriculture sector overproduces several commodities and U.S. policies systemically reinforce this state of excess. From 1948 to 2018, U.S. agricultural output has increased by 272% and these high levels of production have driven down farmgate prices (See Box 1 for definitions), so farmers earn less when they maintain the same levels of production ("Agricultural Productivity in the U.S.," 2018). To maintain cashflow, farmers increased production by incorporating more efficient practices, increasing inputs, and expanding their acreage. Furthermore, agribusinesses – input producers, processors, shippers, retailers – have consistently consolidated and gained greater control of the food system. Strong bargaining power combined with surplus agricultural production grants agribusinesses great control in determining prices, which they drive up when selling and they drive down when buying. Farmers are squeezed on both sides, with high input costs and low farmgate prices. This squeeze shows itself in the consistent loss of U.S. farms each year and the total loss over two-thirds of U.S. farms since the 1930s ("Farming and Farm Income," n.d.).

These same problems of oversupply, low prices, and ecological damage were evident when Congress instated the first U.S. Farm Bill in 1933. During and soon after World War I, American farmers produced surplus food for export to war-torn Europe. However, in the 1920s European agriculture revived and export markets diminished. In 1929, a time of great productivity and overproduction, the Great Depression hit and farm prices and incomes collapsed. In attempts to maintain cash flow and escape bankruptcy, many farmers increased their production, further depressing prices. Soon after, in the 1930s, the Dust Bowl ravaged the middle of the country and drove countless farmers from their land and into bankruptcy. The 1933 Agricultural Adjustment Act, the first Farm Bill, was passed in this time of overproduction, low prices, and ecological collapse. The goal of the first Farm Bill was to create a more stable market that could support farmers, manage overproduction, and conserve land. In order to achieve these goals, the act used a supply management system including price floors, production controls, and import restrictions for certain commodities (Graddy-Lovelace & Diamond, 2017).

However, this supply management system could not keep demand in line with supply. The support prices were based on bushels while the acreage restrictions were based on acres, incentivizing farmers to produce more on their allowed acres. As agricultural technology improved, farmers could producer more per acre and acreage restrictions became insufficient for managing overproduction. Political sentiments also moved towards free market ideologies over government protectionism. The 1954 the Farm Bill passed with weakened price supports. As mechanization, irrigation, chemical inputs, and genetically modified seeds dramatically improved efficiency, farmers were able to greatly escalate production. However, to fund these technologies farm debt increased dramatically in the 1970s and early 1980s. At the same time,

supply management was further weakened in the 1970s and 1980s as target prices, voluntary acreage reductions and payments for not using land were favored over price controls. Another farm crisis hit in the 1980s as exports decreased and farmers produced massive agricultural surpluses (Graddy-Lovelace & Diamond, 2017).

Price supports and production controls had been weakened from the 1950s until the 1990s and were fully removed in the 1996 Farm Bill. They were replaced with direct payments based on historic base acreage and decoupled from production. Combined with the 2002 counter-cyclical payments, government payouts dramatically increased. Due to political consensus on the inefficiency of these payments, both direct and counter-cyclical payments were repealed and replaced with two risk management programs that cover the deductible of crop insurance in the 2014 Farm Bill.

Today, as some farmers and concerned organizations are once again calling for a supply management system, it must be remembered that the U.S. once had a semi-functioning supply management system, that there was the political will to create and run such a system, and that such a political will can come again. Supply management can provide farmers fair prices, improve their bargaining power, and allow them to escape the cycle of overproduction, low prices, consolidation, and debt that has plagued them for over 100 years. Nowhere in farming is this plague currently being felt so hard as the dairy industry and no other sector calls for supply management as ardently. The National Dairy Producers Organization has been working for years to balance dairy supply with profitable demand, though mostly through coordination between dairy stakeholders instead of government mandate (Ebi, 2017). The American Farm Bureau

Association debated its stance on supply management tactics and also decided for marketplace supply management over government mandate (Newton, 2019). The Wisconsin Farmers Union, on the other hand, has created Dairy Together, a campaign that educates U.S. farmers and the public about Canadian Supply Management and how it could be used as a model for U.S. supply management tactics ("Dairy Together," n.d.). Furthermore, in 2018, 53 organizations signed an open letter to the USDA and the senate and house agriculture committees calling the implementation of price floors and a supply management system ("Addressing America's Dairy Crisis," 2018).

The principle aim of this paper is to analyze the benefits and disadvantages of U.S. and Canadian dairy policy to determine viable solutions to the contemporary dairy crisis in the U.S. The paper proceeds as follows. The following sections dive into the history of U.S. and Canadian dairy policy. The two dairy policy systems and environments are then compared to determine their relative advantages and disadvantages. In the final section, the history and the comparisons are used to construct recommendations for future dairy policy that will allow U.S. dairy farmers to thrive in the contemporary dairy landscape.

History of Dairy Policy in the U.S.

In the early 1900s, dairy farming was a primarily local business. As transportation and refrigeration technologies improved, more distant dairies came into competition. Processors took advantage of this competition to negotiate for lower prices. Improved transportation and refrigeration technologies grew processors' market regions and enabled processors consolidation.

As the number of processors decreased and the size of the surviving ones grew, their bargaining power grew relative to the dairy farmers. To combat dairy the dairy processors' consolidation of power, thousands of dairy cooperatives were established in the 1920s-1930s. Additionally, in the 1930s, Federal Milk Marketing Orders (FMMOs) were instituted to improve dairy farm income by setting minimum prices and a price pooling system (See Box 2) to ensure an adequate supply of dairy for consumers. There were originally 33 FMMOs representing farmers throughout the U.S. (Bylsma, 2018). The minimum prices were first set using the prices Wisconsin and Minnesotan manufacturers paid for manufacturing grade milk and adjusted using a formula incorporating the price those manufacturers received for cheddar cheese. This system changed when the 1996 Farm Bill tasked the Secretary of Agriculture to consolidate the 33 FMMOs to 10 (Bylsma, 2018) and tasked National Agricultural Statistics Service (NASS) with the weekly surveying of manufacturers' sales volumes and payments received for cheddar cheese, butter, dry why and nonfat dry milk (USDA-NASS, n.d.). Since then, the minimum prices are set monthly and are

Box 1: Dairy and Agriculture Terms

The following defines commonly used terms:

cwt – A unit of measure meaning one hundred pounds. The most commonly used metric for dairy production in the U.S. Commonly used for prices as $/cwt.

Farmgate or Farm Prices – The amount of money farms receives for their products. Referenced here in terms of prices received for raw milk.

Target Price – The price that a government attempts to induce through indirect methods, often through buying products at support prices.

Support Price – The price at which a government will buy a product under certain conditions.

Box 2: Dairy Pooling & Class Pricing System

Processors pay dairy producers minimum prices based on the end use, the class, of the raw milk. There are four classes of milk:

Class 1 – Fluid Milk
Class 2 – Cream, Yogurt, Cottage Cheese, Sour Cream, and Ice Cream
Class 3 – Cheese and Cream Cheese
Class 4 – Butter and Dried Dairy Products

Class 1 prices tend to be higher due to minimum price increases that account for the higher costs to farmers and their cooperatives to marketing liquid milk.

To ensure that all dairy farmers receive the same minimum prices despite the end use of their milk, the FMMO's implement a pooling system. Payments to farms are based upon a weighted-average blend price of all the class utilizations in the marketwide pool of milk.

The minimum blend price received by each farmer is further modified by the differences in milk content. FMMO's differ in content accounting, either using butterfat and skim milk content or butterfat, protein, and milk solids content.

Source: MacDonald et al., 2016

calculated using the aggregate weighted average price of these dairy commodity product prices, estimated processing costs, location and yield factors (MacDonald, Cessna, & Mosheim, 2016).

Under the Capper Volstead act of 1922, cooperatives were exempted from the minimum price requirement because the act's authors believed that farmers, the owners of the cooperatives, should be allowed to pay themselves less if they so choose. However, contemporary dairy cooperatives are no longer purely constituted of farmers. Since the 1930s, cooperatives have consolidated and vertically integrated. They bought dairy truckers, processors, and marketers, introducing conflicts of interest as many handlers profit when milk prices are low. Contemporarily, many cooperatives pay farmers below the minimum prices, to the detriment of

the farmer "owner" (Bylsma, 2018). Further eroding the protection of FMMO minimum prices are forward contracts that allow dairy farmers to contract with handlers below the minimum price. Congress authorized a dairy forward contract pilot program in 1999, and officially established the program in the Dairy Forward Pricing Program (DFPP) in 2008 (Greene, 2017). The program has been extended in the 2018 Farm Bill ("Federal Milk Marketing Orders," n.d.). These exceptions enable large dairy farmers, with lower costs of production, to go below the minimum prices and erode the market for smaller, less efficient dairies.

After World War II, the number of dairy producers steadily decreased. As surplus production drove prices down, the only ways to stay profitable were to specialize in certain products or utilize economies of scale. Larger dairies use resources more efficiently per unit of milk production, increasing overall profits (see Box 3). However, these larger dairies further increased overall national production, and subsequently lowered farmgate prices making it more difficult maintain small dairy profitability (MacDonald et al., 2016).

To combat low farmgate prices, Congress took action, once again, to support farmgate milk prices by establishing the Dairy Price Support Program (DPSP) in the 1949 Farm Bill. To achieve the support price, the Commodity Credit Corporation (CCC), a government agency established in 1933 to "stabilize, support, and protect farm income and prices" ("Commodity Credit Corporation," n.d.), purchased nonfat dry milk, cheese, and butter at prices that attempted to equate product prices with the prices processors paid farmers for their milk. The CCC purchased these dairy products as a market mechanism to increase demand and subsequently increase product prices. Since part of the FMMO minimum dairy price formula incorporates

product prices, higher product prices directly increased minimum farmgate prices. In conjunction with the DPSP, Congress passed tariff-rate quotas (TRQs) on dairy products to protect domestic production from low-priced dairy imports.

When the farm crisis struck in the 1980s, surplus milk production combined with low demand drove down milk prices. In an attempt to achieve support prices, the CCC spent $2.97 billion in 1983 purchasing dairy products (MacDonald et al., 2016). The 1982 New York Times Article, *Warehouses Bulge with Surplus Cheese, Butter, and Dried Milk,* reports the consequences of the government purchases as "a large part of the dairy surplus is brought each week into five gargantuan storage 'caves' carved from the limestone that underlies the area around Kansas City" (King, 1982). In an attempt to curb this oversupply and taxpayer burden, Congress passed the Dairy Diversion Program, the Dairy Termination Program, and the Dairy Export Incentive Program (DEIP). The Dairy Diversion Program paid producers to reduce milk production by 5-30% from a base year. The Dairy Termination Program paid farmers to eliminate their herd and not to start another for five years (Doyon, 2011). Both of these programs implemented supply-side mechanisms that attempted to reduce overall supply, however, these programs failed to decrease production growth because non-participating producers increased their production in response to the lower supply (MacDonald et al., 2016). The DEIP, on the other hand, was a market enhancing program that paid bonuses to exporters that bought U.S. dairy at domestic prices and sold it at the lower international prices. As U.S. dairy production became more efficient, farmers were able to compete with international prices and no payments were made under the DEIP after 2010 ("Policy," 2018).

Since the 1980s, farmgate dairy price volatility has progressively increased due to price's relationship with production levels and demand. As production increases, changes in demand cause greater fluctuations in price. For example, if demand drops, prices drop more dramatically in a market with high milk production than one with low milk production due to greater competition for the now smaller market. In addition to surplus induced volatility, international dairy trade and its related international competition has further increased price volatility for dairy farmers. Around 2000, U.S. dairy prices became competitive with international prices and commercial exports of dairy products surged from 2004 onward. On one hand, international trade expands the market for U.S. dairy and spurs on dairy production, but on the other, it greatly increases price volatility. International buyers buy the cheapest milk, and any change in international prices, due to international policy, weather, tariffs and many other possible factors, greatly increases or decreases demand for U.S. dairy. In order to encourage trade at this time of greater exports, Congress increased the amount of dairy that can be imported into the U.S. by expanding TRQ volumes. Furthermore, feed price volatility increased from 2005 on due to increased volatility in feed trade and production. Higher volatility in feed and farmgate prices elevates the financial risk of farmers that are, as a group, already heavily indebted in order to keep growing their dairy operations or keep their current operations running (MacDonald et al., 2016).

In the 2002 Farm Bill, Congress authorized direct payments to dairy operations through the Milk Income Loss Contract (MILC). When farm prices fell below $16.94/cwt MILC paid farmers the difference ("Policy," 2018). Payments were capped at 2.985 million pounds, the annual milk production of about 149 cows, subsequently providing relatively more aid and relief to smaller

farms than larger ones (MacDonald et al., 2016). In 2008, the Farm Bill updated the 1949 Dairy Price Support Program and renamed it the Dairy Product Price Support Program (DPPSP). DPPSP set support prices for dairy products instead of the farmgate price of milk ("Policy," 2018). In 2003, the CCC made $2.494 billion in payouts to the dairy industry with MILC and DPPSP accounting for $1.795 billion and $685 million respectively. In 2009, the CCC made $994 million in payouts to the dairy industry with MILC accounting for $757 of those payments. Over the 12 years of its existence, before its repeal in the 2014 Farm Bill, the average annual payouts under MILC were $474 million ("CCC Budget Essentials," n.d.).

In 2009, milk prices dropped worldwide, and feed prices rose to abnormally high levels resulting in extremely low margins for most dairy producers. Overall production decreased, but some dairy farmers increased production in an attempt to outlast the downturn and the market was slow to correct itself (Doyon, 2011). The financial stress drove thousands of farms into bankruptcy. From 2007 to 2012, the number of farms that specialized in milk production, those with milk representing half their sales, declined by 20% from 57,318 farms to 46,005 farms (USDA-NASS, 2014). The 2014 Farm Bill responded to this crisis by replacing the MILC, DPPSP, and DEIP programs with the Margin Protection Program for Dairy (MPP-Dairy) and the Dairy Product Donation Program (DPDP). MPP-Dairy provided financial protection to farmers when the difference between feed and milk prices droped below a farmer-determined threshold. Farmers could choose to pay premiums on a share of their milk production history, from 25%-90%, for protection against margins from $4/cwt to $8/cwt, choosing in increments of $.50. Alternatively, for a one-time fee of $100 they could gain catastrophic coverage when margins fall below $4/cwt. The program offered two tiers of coverage. Tier I covered up to 4 million

pounds of milk and tier II covered production over 4 million pounds of milk. Tier I had a much lower premiums per cwt than tier II (MacDonald et al., 2016; "Policy," 2018). For much of the formulation of this program there was an associated supply management-esque system, the Dairy Market Stabilization Program (DMSP), that would have disincentivized overproduction, but not prohibit it, in times of low margins. However, this program was eliminated in conference and replaced with the DPDP – a demand enhancing program (Schnepf, 2012, 2014). The DPDP requires the purchase of dairy products at market prices to be donated to food distribution organizations when dairy margins fall below the catastrophic levels of $4/cwt as calculated by MPP-Dairy ("Policy," 2018). From 2014 to 2016, the average annual payments to dairy farmers from the CCC and FCIC was less than $4 million. Payouts to farmers were less than the premium payments made into the MPP-Dairy program (Schnepf, 2017).

After years of extremely low farmgate dairy prices and the continuous exit of dairy farmers from the industry, the federal government again altered dairy policy in 2018. The MPP-Dairy program was renamed to the Dairy Margin Coverage Program (DMC) and provided a larger range of margin coverage options adding $8.50/cwt, $9/cwt, and $9.50/cwt at lower premiums. It also increased the production cap for admittance into Tier I coverage to 5 million pounds, the annual production of about 250 cows. The program also expands the range of the share of production history the farmer can choose to cover to 5%-95% and repays farmers for the premiums they paid into MPP-Dairy from 2014-2018 that were in excess of the payouts they received during that time. Furthermore, in 2018 the DPDP was replaced with the Milk Donation Program which makes it easier to donate fluid milk to food assistance non-profits. Mandatory funds of $9 million

were provided to the Milk Donation Program for 2019 and $5 million each succeeding fiscal year (Zulauf & Wolf, 2018).

From 1970 to 2017, the number of dairy operations across the U.S. decreased by 92% from 648,000 to 54,599 operations (Economic Research Service, 2006; USDA, 2019). A dramatic increase in dairy herd size has accompanied this decrease in dairy operations. Half of U.S. dairy cows were on farms of 80 or fewer cows in 1987. In 2012, that number rose to 900. Costs of production and economies of scale have driven this structural change (See Box 3). Farms with over 2,000 cows have per unit milk production costs 24% below farms with 500-599 cows, and the costs per unit rise greatly on farms lower than 500 cows (MacDonald et al., 2016). Larger

Box 3: Dairy Farm Size

The U.S. has a wide range of dairy operations in regard to size, efficiency, production practices, location, etc. In general, large dairies are able to use production practices that decrease costs of production, increase the output per cow, and maximize net returns. These practices include exclusively buying feed, milking three times per day, hiring fewer people per cow, negotiating for inputs, using nutrition services and vet services, and using computers for feed delivery and milking. There are still many more small dairy farms, but they make up a very small share of the total U.S. dairy production (MacDonald et al. 2016).

With production practices and outputs so different between small and large dairy operations, should there be different policies regarding the support and management of the two?

Table 1: Herd Size-Related Metrics

Herd Size	<50	50-99	100-199	200-499	500-599	1,000-1,999	>1,999
Number of Farms[1]	34,332	15,351	7,351	3,712	1,537	1,807	
Share of Production (%)[1]	6.4	11.1	10.6	12	11.3	48.7	
Output Per Cow (lbs)[2]	15,614	17,255	18,966	19,754	22,296	24,135	22,430
Cost of Production ($/cwt)[2]	39.11	30.24	24.25	22	18.09	16.37	13.8
Net Returns ($/cwt)[2]	-20.05	-11.25	-5.72	-3.61	-0.05	0.36	2.82

Source: MacDonald et al., 2016
[1] 2012 Data, [2] 2010 Data

farms are able to produce more milk per cow by using techniques and technologies that are only economically viable on large scales. Altogether, larger farms increase total U.S. dairy production and reduce farm milk prices. This systemically decreases the viability of smaller farms and drives future consolidation, overproduction, and low prices. The FMMOs still set minimum dairy prices, however, dairy is consistently bought and sold below these prices due to the Capper Volstead act that exempted cooperatives from paying the minimum prices. As with the trajectory of dairy farms, cooperatives have also consolidated. In 1943, there were 2,270 dairy cooperatives that handled about 50% of total dairy production. In 2002 there were 196 cooperatives that handled 86% of the total dairy production (USDA, 2005). In theory, larger cooperatives could give farmers stronger bargaining power, however, as cooperatives consolidated many took on ventures that benefited from lower milk prices. Due to these conflicts of interest, many cooperatives compete against each other, lower milk prices, and impose strict, costly terms on dairy farmers all to the detriment of their owner-members (Held, 2019).

Dairy farms, especially family-run farms, contribute to the health of rural communities. Dairy farms contribute to a thriving economy by buying goods and services from the local businesses and by hiring local labor. Small and family-run dairies especially help with keeping money within the local economy. With the mass loss of small dairy farms over the last 30 years there has been an associated hollowing of rural communities as stores and services go out of businesses (McCoy, 2018).

Currently, U.S. dairy farmers are undergoing years of low dairy prices caused by overproduction and trade disputes. Hundreds to thousands of dairies are going out of business each year, and

many of those that don't are going deeper and deeper into debt. Many farmers are claiming that the current system is economically unsustainable, and they are calling for new dairy policies. They are looking towards the Canadian supply management system that has been able to provide fair, consistent prices to its farmers for over 40 years.

History of Dairy Policy in Canada

Since the first national dairy commissioner was appointed in 1980, the Canadian government has supported its dairy industry. In the early 1900s, the federal government provided services such as cow testing, butter grading, and low-temperature transportation services. Canada began providing price supports, opening export markets and limiting dairy imports in the 1940s and 1950s. However, the federal government and the provinces lacked coordination in their policies, and no entity had yet solved the consistent problem of dairy overproduction (Western Dairy Digest, 1999).

An example of provincial dairy action before provincial-federal cooperation can be seen in Ontario. In 1960, the Ontario government sought to mitigate inefficiencies caused by Ontario milk producers' competition and lack of coordination. Ontario passed the Milk Act in 1965, creating a farmer managed Ontario Milk Marketing Board that bought and sold all the milk produced in Ontario. This board decreased the cost of marketing, shipping, and competition for the Ontario farmers and is now Ontario's provincial marketing board under the National Milk Marketing Plan (NMMP) (Dietrich & Sherk, 2018). However, without federal action, other

processors could buy milk from farmers in other provinces and undercut the Ontario Milk Marketing Board's bargaining power.

In 1965, the federal government created the Canadian Dairy Commission (CDC) to interface with the provinces and oversee national dairy policy. The CDC continued the earlier price support programs for butter, skim milk powder and cheese. In 1975, the price support program was redefined and a new formula was used to better estimate dairy cost of production (Western Dairy Digest, 1999). When milk production exceeds Canadian demand, the CDC buys butter and skim milk powder from processors at the support price. Buying at the support price keeps prices higher, takes surplus out of the market, and provides both producers and processors acceptable margins ("Canadian Dairy Commission," 2019). The formula was replaced in 1988 with one that took into account farm level production data. The federal government instructed the CDC to establish support prices for industrial milk in 1990 and since then the CDC posts the product support price, producer target prices, and the processor margin annually (Doyon, 2011; Western Dairy Digest, 1999).

In 1951, there were 451,000 dairy operations in Canada, and by 1971 the number dropped to 55,400 operations (St-laurent, 2015). This 88.7% decrease in dairy farms occurred in a time of changing trade relations, increased efficiency and before the implementation of supply management. At the end of the 1960s, the United Kingdom joined the European Economic Community, cutting off Canada's privileged access to the United Kingdom dairy market. In a situation not unlike the U.S. system, milk surpluses abounded throughout the country resulting in low farm dairy prices and costly financial support from the federal government (Doyon, 2011).

In 1971, Canada passed an Interim Comprehensive Milk Marketing plan that was replaced with the NMMP in 1983. These plans implemented supply management strategies that keep supply in line with demand, provide fair prices to farmers, and ensure a consistent, high-quality dairy supply for the population (Dietrich & Sherk, 2018).

Canadian supply management is upheld by three pillars: production controls, pricing mechanisms, and import restrictions. Production controls are determined differently for fluid milk, Class 1, and industrial milk, all other classes. Permitted fluid milk production levels are determined by each province according to provincial demand for fluid milk, established by provincial fluid milk quotas and distributed to farmers by the provincial dairy marketing board (Mussell, 2015). Industrial milk production levels are determined by the aggregate national demand for processed butterfat at a target price based on a processing margin plus the cost of production (Doyon, 2011). The CDC monitors the fluctuations in the butterfat supply and demand and monthly updates the national production target, the Marketing Share Quota (MSQ). The NMMP determines each province's share of the MSQ based on a proportion of provincial historical production and population change. The provincial milk marketing boards distribute the MSQs to farmers based predefined rules ("Dairy Supply Management In Canada," 2010). Dairy producers cannot sell milk in excess of their quota, so they are disincentivized from producing over their quota limit. Quota owned by farmers is a market share. In the event that increased demand increases the overall MSQ by 2% all farmers can sell 2% more. However, if MSQ decreases by 2%, farmers must sell 2% less. Producers can buy and sell quota at their discretion (Doyon, 2011).

Setting minimum farm prices begins with the CDC's declaration of butter and skim milk powder support prices. Provincial marketing boards use these support prices along with final uses of the milk, as determined by the Harmonized Milk Classification System, a classification system similar to the U.S. dairy classification system, as references in price negotiations with processors ("Dairy Supply Management In Canada," 2010). These negotiated prices are minimum prices at which processors can buy dairy though individual farmers can negotiate for higher prices. The quota system combined with minimum prices essentially bar farmers from increasing their production in order to undercut other farmer's prices. However, since minimum prices keep incomes above costs of production, farmers are not as compelled to overproduce and decrease prices to compete and stay profitable.

In order to maintain higher domestic prices, Canada uses dairy import restrictions to protect dairy farmers from the import of cheaper dairy from international producers. Before 1995, Canada used quota-based import controls that denied import access after a certain level of dairy imports. After the 1995 Uruguay Round trade agreement, Canada replaced the quota-based import controls with tariff rate quotas (TRQs) that gave international market access of up to 5% of domestic consumption after which tariffs ranging from 200% to 290% on dairy products trigger (Doyon, 2011).

From 2001 to 2010, the MSQ grew by less than 1% as demand for dairy products stagnated. At that time, producers could only increase their quota by buying quota from other farmers. Before 2008, quota prices were reasonable because enough farmers were retiring from the dairy sector to keep quota supply in line with demand. However, after 2008, retirements decreased, and quota

prices rose up to $40,000 for the equivalent of the annual production of one cow. In response, some provinces implemented price caps of $25,000 for the equivalent of the annual production of one cow. Once the price cap is reached, provinces distribute the quota equally among those buying for at or above $25,000. This has slowed herd size growth at the time (Doyon, 2011).

Due to the high demand for butterfat in 2014-2015, the MSQ increased by nearly 5%. However, skim milk demand was not as high, and many provinces experienced large skim milk surpluses. To incentivize skim milk processing and use, the CDC lowered the butter support price and increased the skim milk powder price. Furthermore, the Dairy Farmers of Ontario initiated a new provincial class of milk, Class 6, that priced skim components at world prices. They also created Class 6 because Canadian processors and cheesemakers were using a product called diafiltered milk that, due to the fact that it was invented after NAFTA, had no import tariffs into Canada. Diafiltered milk can partially replace skim milk components in cheese and other processed dairy products. Class 6 provided an outlet for Canadian skim milk through competitive pricing of Canadian skim milk with diafiltered milk (Mussell, 2015). Ontario's Class 6 motivated Canada to nationally adopt the similar Class 7 dairy class. Class 7 made skim milk competitive with diafilitered milk imports aggravating diafilitered milk exporting countries including the U.S. In USMCA trade talks the U.S. negotiated the removal of Class 7 and access to 3.59% of the Canadian dairy market. However, the USMCA has currently not been passed by the U.S., Mexico, and Canada (Johnson, 2018). If passed, Canada will have opened nearly 10% of its dairy market to imports within the last three years due to the USMCA, the Comprehensive Economic and Trade Agreement (CETA) with the EU, and the Trans-Pacific Partnership (TPP) (Dairy Farmers of Canada, 2017). In order to help their farmers stay profitable as part of their

market opens to other nations, the federal government passed the $250 million CA ($187.5 million USD) Dairy Farm Investment Program in 2017. The program provides up to $100,000 CA ($75,000 USD) for eligible farmers to improve their equipment, become more efficient and lower their cost of production ("Dairy Farm Investment Program," 2017).

Canada's supply management system is domestically oriented. It calculates demand based on domestic demand and therefore does not produce large amounts for export. In 2016, Canada imported $971 million of dairy products, mostly from the United States, with a total dairy trade deficit of $734 million. The United States' dairy trade surplus with Canada was $445 million (Dietrich & Sherk, 2018). Even with supply management in place, Canada is a robust trading partner and U.S. dairy farmers are finding market opportunities to the north. However, supply management still comes under pressure in trade talks, including NAFTA and UMSCA. Trade partners call for the dismantling of supply management, claiming it distorts the market and restricts free trade. These claims might be true, but if Canada wishes to protect its domestic dairy supply, its farmers, and the benefits they bring to rural communities it should have the ability to maintain its supply management practices. Certainly supply management is a divisive issue and the future will tell if Canada keeps the political and social will to protect it in the face of international criticism.

Comparison of U.S. and Canadian Dairy Policy

The U.S. and Canada have taken very different policy approaches to supporting their dairy industries with very different outcomes in each nation. The U.S. currently uses risk management

systems and demand-side support to protect farmers from low prices and margins while Canada uses supply management to control supply and keep farm prices above cost of production. Each set of policies creates different advantages and disadvantages for farmers, processors, consumers and international markets. The following compares the impacts of each system on the various dairy stakeholders.

First, each dairy system has different responses changes in demand. It is very difficult in the dairy industry to alter supply when demand or prices change. In order to increase supply, farmers either have to buy adult cows or undergo multiple years of breeding new cows, raising them to maturity, and breeding them to produce milk. To decrease supply, farmers can milk their cows fewer times per day, alter feeding rations, or slaughter them. In either direction it is difficult to alter supply (MacDonald et al., 2016). In response to changes in demand, the Canadian supply management system alters provincial milk quota and the national MSQ. Farmers cannot sell milk in surplus of their quota and are thus incentivized to reduce their production if quotas decrease. When quotas increase, farmers are permitted to sell more milk and thus have incentives to increase production. In the U.S., when domestic or international demand changes, prices sharply change. When prices drop, some farmers choose to increase their production in an attempt to increase cash flow and outlast the price downturn. When prices rise, most farmers choose to increase their production to take advantage of the upturn in the market. There are no coordinating mechanisms that incentivize all farmers to decrease their production when demand is low to improve prices or to keep their production steady when demand is high. Even though it would benefit most farmers if all farmers were to coordinate production, without a coordination mechanism it is too risky for individual farmers to choose to decrease production. Furthermore,

with the Dairy Margin Coverage Program and the Milk Donation Program farmers are paid when their margins are low. These programs can potentially decrease their supply response to prices and lengthen periods of low margins and shorten those of high margins.

In regard to dairy price volatility, Canada's dairy policy has succeeded in lowering dairy farmgate price volatility compared to the U.S.. Cycles of overproduction and the ensuing drop in prices are less apparent in the Canadian dairy system than in the U.S dairy system. For example, in 2009, during the Dairy Crisis, worldwide prices dropped dramatically. In the United States prices that were over $20/cwt in 2007 and 2008 rapidly dropped 40% to almost $12/cwt in 2009. Conversely, in Canada, in 2007 and 2008 dairy prices were around $22.5/cwt and in 2009, when a majority of dairy prices around the world collapsed, Canadian prices increased to $23.5/cwt in 2009 (Dietrich & Sherk, 2018; Graddy-Lovelace & Diamond, 2017). In the cases when Canadian prices move relatively rapidly, the change is much less drastic. One of the largest contemporary drops in prices occurred from 2011 to 2012 when in 2011 prices were $25.7/cwt and dropped 15% to $21.7/cwt in 2012. Even without the 2009 Dairy Crisis, it is not unusual for the U.S. farm dairy prices to increase or decrease 25% from the previous year (Dietrich & Sherk, 2018). However, since the introduction of the Class 7 pricing system and the partial opening of the dairy market to imports, Canadian dairy prices have grown more volatile. Nearly 30% of farm milk price is determined by world prices, versus 21% before the introduction of Class 7 (Grieg, 2018). Higher price volatility increases dairy operating risks. When volatility leads to bouts of low or negative incomes, it potentially leads to higher farmer stress, more conservative spending, and more farm bankruptcies. Expenses including debt payments, employee wages, feed costs, and all other necessary costs to running a dairy operation and making a living can become impossible to

pay during periods of especially low prices and high costs. High volatility makes long term planning more difficult and the risk can make farmers only invest in and take debt on for activities that directly increase cashflow, leaving conservation, animal and human welfare, and rural development and engagement practices behind.

In addition to fostering lower price volatility, Canada's dairy policy has also produced consistently higher farmgate dairy prices than U.S. policy (see Table 2). Canada's higher farmgate prices allow less efficient dairies, oftentimes smaller dairies, to remain profitable and subsequently reduces consolidation within the sector compared to the U.S. In general, only dairies utilizing economies of scale can remain profitable when dairy prices are low. In recent years, in the U.S., prices have been low enough that only the largest dairies stay consistently profitable, not considering those that marketing specialized products (ie organic, local, etc) (MacDonald et al., 2016).

Table 2: Average Annual Farm Dairy Prices in Canada and the U.S.

Year	Canada Farm Dairy Price (USD/cwt)[1]	US Farm Dairy Price (USD/cwt)[2]
2008	26.24	18.32
2009	26.70	12.81
2010	27.02	16.29
2011	28.09	20.15
2012	27.86	18.57
2013	28.30	20.04
2014	29.15	23.98
2015	27.71	17.10
2016	27.43	16.24
2017	27.46	17.66

[1]("Prices Received by Month Milk United States," 2019).
[2](Food and Agriculture Organization of the United Nations, 2019). Data in Local Currency Unit (LCU) converted to 2019 USD.

Canada's supply management system keeps farm dairy prices high by giving farmers the government-backed ability to collective bargaining. Provincial Milk Marketing Boards, run by farmers, negotiate minimum prices with processors on behalf of all the farmers in the province. Farmers can't undercut each other below the minimum price and processors can't shop around for prices lower than the minimum price. Tariff-rate quotas protect farmers and processors from competition from international dairy producers and processors. Indeed, the U.S. has mechanisms in place to improve farm prices, but loopholes have made them mostly ineffective. Federal Milk Marketing Orders guarantee minimum prices for farmers, and cooperatives can improve farmers bargaining power and create markets for their milk. However, milk is primarily bought below the minimum prices since cooperatives and processors with forward contracts are not beholden to the minimum prices. Many dairy cooperatives have conflicts of interest that encourage them to buy dairy at low prices in order to make their manufacturing arms more profitable. In 2002, manufacturing/processing cooperatives, those with potential conflicts of interest, handled three-fourths of the milk handled by dairy cooperatives (Bylsma, 2018; USDA, 2005). Consistently low farmgate prices result from these exceptions and conflicts of interest that weaken price protections and collective bargaining for U.S. dairy farmers.

Since small farmers do not benefit from the efficiencies of larger dairy farms, they are dependent on higher farm prices for profitability. They also have fewer assets compared to larger farms and have less to fall back on or use as collateral for loans in times of low farm dairy prices. Canada's supply management provides higher prices and lower price volatility that allow small farmers to stay profitable and thrive. The average herd size in Canada in 2011 was 76 cows, while in the U.S. the average herd size was 139 cows. However, the difference is more dramatic when

considering the midpoint herd size. In 2011, half of all cows in the U.S. were in herds larger than 800 cows, while in Canada in 2016 that number was closer to 150 cows (Doyon, 2011; "Production efficiency and prices drive trends in livestock," 2017).

Despite the Canadian dairy system's protections for smaller farmers, the industry is still undergoing consolidation. From 2007 to 2017, the Canadian dairy industry lost nearly 22% (3084) of its farms, with the remaining farms growing larger and more efficient ("Number of Farms with Shipments of Milk by Province," 2019). During the same time period, the U.S. lost 32% (18,911) of its dairy farms (*2017 U.S. Dairy Statistics*, n.d.). The greater efficiencies of larger dairy herds drive consolidation in both nations, however, Canada's quota and pricing systems make it impossible for larger, more efficient dairies to use their economies of scale to undercut less efficient, smaller dairy farm prices. The only way to grow in the Canadian system is for the demand to grow, or to buy quota from other farms. In the U.S., the larger dairies produce more per cow, increase supply, further drive down prices, and make small dairies less profitable.

Both Canada and the U.S. have extremely high costs of entry for new dairy farmers. As mentioned in the prior section on Canadian supply management, high demand for quota and fewer exiting dairy farms have caused quota prices to soar in recent years. Prohibitively high quota prices could potentially block new farmers from entering the industry as large investments would be needed to start even a small farm. A small farm that would be less cost-efficient than the average farms in the sector. However, even though there is no similar set cost of entry for a U.S. dairy farm, given the low and volatile price of milk, most farms aren't profitable until they

have over 1,000 cows (MacDonald et al., 2016). High capital input and usually debt are necessary to buy the cows and land, set up the housing and milking facilities and hire farm laborers. Neither system creates an accessible environment for new dairy farmers to enter into the sector.

In regard to the costs of each nation's dairy programs, Canada's supply management requires much less government financial support than the U.S. dairy system. The Congressional Budget Office of the U.S. estimates that dairy program spending in 2019 will be $184 million and that the average annual dairy program spending over the next five years will be $146.8 million. Most of that expense will come from the Dairy Margin Coverage program despite predictions that milk/feed margins will stay above $8/cwt (Congressional Budget Office, 2019). In contrast, for much of the history of the Canadian supply management system, Canada has made no payments to support its dairy sector. Supply management keeps dairy prices high enough that dairy farmers do not need government payments to stay profitable. However, since about 6.5% of the dairy market has been opened to trade partners in recent years and more might open upon the potential passage of the USMCA, Canada has committed $250 million to improving the efficiency of dairy farms. However, unlike U.S.'s dairy support annual expenses, the program is intended to be a one-time installment ("Dairy Farm Investment Program," 2017; Dairy Farmers of Canada, 2017).

Although the U.S. spends more on financial support for its dairy farmers, its system produces retail dairy prices that are generally lower for U.S. consumers than the Canadian system produces for Canadian consumers (see Table 3). Liquid milk, cheese, and yogurt are 27%, 17%,

and 17% less expensive respectively than similar products in Canada, though Canada does have slightly cheaper butter than the U.S. Yet, food only accounts for about 10% of Canadian household incomes, and dairy accounts for about 15% of expenditures on food (Doyon, 2011). Assuming the U.S. has similar spending patterns, its cheaper dairy decreases the total percent of income spent on dairy by less than half a percent. Households that spend higher proportions of their income on food, often low-income households, would be impacted more by higher prices. Additionally, Canadian taxpayers do not fund dairy support programs, so they are not paying for dairy at both the store and in their taxes. However, American taxpayers are paying only about $1.00 per 1500 gallons of milk produced in U.S. Dairy programs (Congressional Budget Office, 2019; "USDA ERS - Dairy Data," 2019).

Table 3: Average Retail Dairy Prices in the U.S. and Canada

Dairy Product	2019 U.S. Retail Price (USD)[1]	2018 Canada Retail Price (USD)[2]
Liquid Milk (1 gal)	$2.45	$3.38
Butter (1 lb)	$3.31	$3.11
Cheese (1 lb)	$3.61	$4.39
Yogurt (32 oz)	$2.79	$3.38

[1](Agricultural Marketing Service, 2019)
[2]("Prices and Expenditures," 2019) Data in CA converted to USD

Low U.S. dairy prices also allow U.S. dairy to be competitive in international markets. Historically, the U.S. was not a major exporter of dairy, but in the early 2000s exports grew as dairy prices became more competitive in international markets. Dairy exports rose to $1 billion in 2003, grew to $7.2 billion in 2014 and dropped to $5.5 billion in 2017. In 2017, 14.7% of U.S. milk production was exported ("Historical Data," 2018; MacDonald et al., 2016). Conversely, in 2017, Canada exported just below $400 million of dairy with skim milk powder representing

43% of exports (“Canadian Dairy Exports,” 2019). Skim milk is the product Canada’s supply management system systemically overproduces, leading to the creation of milk pricing classes that allow for the sale and export of skim milk powder at international prices (Doyon, 2011).

Supply management adjusts dairy production to match domestic demand. Some argue that Canada’s supply management inhibits farmers from exploiting export markets and improving their sales. However, the current major exporters of dairy, the U.S., Australia, and New Zealand, have structural and feed capabilities that support highly efficient dairy production. Canada’s feed growing and pasture feeding seasons are shorter and dairy production is inherently more expensive. Expensive infrastructure and capacity building would be necessary to make Canada competitive in the current global dairy market (Doyon, 2011).

Since Canada’s dairy farms are less efficient, have higher costs of production, and do not benefit from subsidies like other nations, they are highly vulnerable to being undercut by international players if import restrictions are removed. CETA, TPP and potentially USMCA all negotiated increased market access into the Canadian dairy market. International access directly decreases dairy farm incomes which come primarily from domestic sales. Currently, most dairy farmers in Canada would be unable to stay profitable if tariffs were removed and the market opened completely. If future trade deals open up the Canadian dairy market, dairy farms would have to consolidate and use economies of scale to stay competitive and survive.

One way U.S. dairy operators have made their operations more efficient is by running Concentrated Animal Feeding Operations (CAFOs). CAFOs are one of the most efficient ways

to produce milk since most of the inputs and animal handling are precisely controlled. As prices remain low, CAFOs are one of the only ways to stay profitable as a dairy farm. The number of dairy CAFOs is rising in the U.S. due to consistently low prices and the need for efficiency. However, CAFOs are often more environmentally harmful and can cause problems for public health and safety for nearby communities. Due to the concentration of cows in dairy CAFOs, manure must be stored in manure lagoons. Manure from manure lagoons it is often used as fertilizer on agricultural lands as a method of disposal. Groundwater contamination can result from leaching from manure-sprayed fields or breaches in the manure lagoons. Contamination can cause serious threats to public health through the spread of pathogens and toxic chemicals. Furthermore, harmful emissions detrimental to air quality spread with the application of manure to agricultural lands and from the decomposition of manure (Hribar & Schultz, 2010). CAFO operators also buy most of their feed which can be cheaper than growing feed for cows on a smaller, diversified farm (MacDonald et al., 2016). CAFOs are economically more efficient per unit of dairy produced, but they can harm the environment and public health. Additionally, their aggregate high dairy production drives down prices and make smaller, often more sustainable, dairies less economically viable.

Finally, producing cheap dairy for export potentially erodes other countries' food sovereignty. Currently, the U.S. dairy sector requires export markets to purchase the massive surpluses of dairy produced in the U.S. Whenever a country, such as Canada, closes off their markets in order to protect domestic dairy farmers, U.S. dairy proponents claim protectionist policies harm U.S. dairy farmers. However, a nation should be allowed to protect its food sovereignty and food

security. Import restrictions allow countries to protect their domestic production capabilities from international competition that often benefits from subsidies and more efficient practices.

In sum, supply management keeps the dairy supply in line with domestic demand. This system creates higher, more stable dairy prices that allow smaller farms to thrive. The Canadian dairy sector is still undergoing consolidation, but not as severely as the U.S. dairy sector. The U.S. dairy sector creates competition that drives down prices and though prices are not high enough to keep many small dairies profitable they are lower for U.S. consumers. The low U.S. dairy prices compete in international dairy markets, but dependence on international markets also increases price volatility. Furthermore, since low prices drive smaller farms out of business, the U.S. dairy industry is undergoing serious consolidation. Due to the economic benefits of high-efficiency production, there is an increasing number of concentrated dairy operations that have higher rates of environmental and public health harms than smaller farms.

Future of U.S. Dairy Policy

Dairy farmers must be part of the conversation in revamping U.S. dairy policy. Farmers are the ones that work with the cows, understand the markets, put their livelihoods on the line to produce milk for the country and their voices need to be heard. Farmers unions, cooperatives that truly represent the voices of farmers, and individual farmers must be included in conversations crafting the future of dairy policy.

The future of dairy policy should create a system that allows dairy farmers to make a living. Farm prices should cover the costs of production with a margin for sustaining farmers' lifestyles. Canadian supply management isn't perfect, but it gives a model of a different type of dairy policy that can create these outcomes. Currently, the structure of U.S. dairy production is very different from the Canadian structure, so supply management strategies would have to be modified for the U.S.'s system.

The following will discuss a few dairy sector management strategies that could improve the viability of small dairy farms without immoderately burdening larger dairy farms. These systems don't restructure the current system with interventions such as breaking up large cooperatives or equalizing farm sizes, though these could be other methods for improving the viability of small dairy farms in the U.S. However, all of these systems require national coordination to function. Without national coordination they are bound to fail like previous supply side strategies in the U.S like the Dairy Diversion Program and the Dairy Termination Program. An effective way to use the current system to enable national coordination would be to consolidate the existing Federal Milk Marketing Orders into a national Federal Milk Marketing Order that implements the following management strategies throughout the nation.

Dairy Market Stabilization Program (DMSP)

The DMSP was originally paired with MPP-Dairy in 2014 Farm Bill negotiations but was removed in an amendment in the final vote ("Dairy Provisions in the 2014 Farm Bill (P.L.Â 113-79)," 2014). The DMSP is more precisely a production disincentive program rather than a supply

management program. In its original conception, the DMSP was mandatory with participation in MPP-Dairy. The DMSP triggered when margins declined below established thresholds, originally $6.00/cwt for two months or $4.00/cwt for one month, however in a newer form the thresholds could be updated to work with the current Dairy Margin Coverage Program. When the DMSP triggered, processors would have to redirect a portion of their payments, ranging from 2% to 8%, to the USDA with the rest going to the producer. The USDA funds would be used for demand-increasing programs. No production limits or quotas were included with the DMSP, so farmers could continue choosing their production levels. However, the reduced farm payments were anticipated to incentivize farmers to voluntarily decrease production (Schnepf, 2012).

Since the DMSP would apply to all farms equally, the program could negatively impact small farms to a greater extent. During times of low margins, small farms are already harder hit than larger ones because of their higher costs of production. If a program removes more of their income, it can make surviving the downturn even more difficult. Furthermore, small farms produce a relatively small portion of the nation's milk, so their production reductions or bankruptcies would induce a relatively small and ineffective decrease of overall production. Larger dairies, which would presumably be less burdened by this program, would have less incentive to decrease production. Thus, even if the program succeeded in stabilizing the market more quickly than the status quo, smaller dairies might suffer more greatly during times of low margins.

Canada-Derived Supply Management System

In order to rein in systemic overproduction, a national quota system could be implemented that allocates quota based on historic production. Quota would be determined by U.S. demand for dairy at prices that incorporate the cost of production and margins for each player in the supply chain. The singular Federal Milk Marketing Order would enforce a national minimum price that incorporates the costs of production and the necessary margins. The singular Federal Milk Marking Order will also enforce a national pooling system that allows farmers to be paid similar amounts no matter the final use of their milk.

Since the U.S. currently exports about 15% of its milk production, exports must be taken into account. Either a separate export quota system could be implemented that dairies opt into, or dairies could choose to opt out of the national supply management system and only produce dairy for export. They would negotiate their own prices with processors making goods for export.

Similar to the Canadian supply management system, producers would not be able to increase production without buying quota from other producers or by selling milk to be exported. Dairy production might slow or even decline to match domestic demand. Consumers would have to pay more for dairy, but there would be lower government spending on dairy programs. Furthermore, in this system all dairies would be paid the same amount for their milk despite the lower costs of production for larger dairies. Therefore, the larger dairies benefit more than small dairies from the price minimum because their margins would be even higher and there would subsequently still be an incentive for structural movement towards larger operations.

Two-Tier Pricing System

The two-tier pricing system is disseminated by the National Farmers organization, an agricultural marketing cooperative. The two-tier pricing system is not a so much a supply management system as it is a structural change management system. The purpose of the system is to level the margins made per cwt for different sized dairies. Under the current system, all dairy operations receive the same pooled price for milk no matter their sales quantity, so those with lower costs of production have higher margins. Low-cost, larger dairy operations' relative advantage, combined with the current unprofitability of smaller farms, is one of the main drivers of the dairy farm consolidation. The two-tier pricing system proposes the implementation a $4.00/cwt, near the difference in production cost per cwt between a 500 cow dairy and a 2000 cow dairy, adjuster on up to the first one million pounds of milk sold each month. The first monthly million pounds of milk sold by any dairy operation would receive an extra $4.00/cwt, however, since all milk would be pooled under a national federal marketing order, those that sell over one million pounds of milk receive less per cwt than those selling under one million pounds of milk. Under the two-tier pricing system smaller dairies would receive more per cwt than larger dairies, but their margins per cwt would converge. (Blysma, n.d.; *Structure Dairy Pricing Program - Two Tier Pricing*, n.d.).

The two-tier pricing system would redistribute the national dairy pool money to partially address structural differences in costs of production. Overall, it would improve the potential profitability of smaller farms, allow larger farms to remain profitable and would not increase the cost to consumers or processors. Additionally, though its proponents claim that it is not supply

management mechanism, the system provides higher payment per cwt at lower production levels. These higher payments could incentivize producers to reduce production to achieve higher prices per cwt, especially if they could maintain their lower costs of production.

Conclusion

There are other dairy management strategies and policies not touched upon in this paper that have the potential to rein in oversupply and improve the viability of dairy farming in the U.S. Unfortunately, all potential interventions have costs and benefits that can seem prohibitive to various stakeholders. However, an increasing number of farmers organizations and individual farmers are calling for supply management because the current system is not working for a vast majority of dairy farms. If the U.S. wishes to preserve small dairy farms and all of the benefits they bring to their communities and the nation as a whole, it must act soon. Small dairy farmers need a solution soon or there might not be enough dairy farmers for whom a solution is necessary.

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