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DIFFERENCES IN MILK PAYMENT STRUCTURES BY COOPERATIVE AND INDEPENDENT HANDLERS: An examination from New York State

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Abstract

Dairy cooperatives market 85% of the milk produced by U.S. dairy farmers, although independent handlers remain relevant in many areas. Using handler report data from New York State, we provide a comparative financial analysis of pricing behavior by form of handler organization. Cooperative handlers provided price advantages to producers in terms of higher overall premiums and lower hauling costs; however, the net milk price advantage was only $0.20/cwt (about 1 percent) when all pricing components were considered and suggesting the value of cooperative ownership in dairy marketing includes other nonfinancial performance measures to substantiate such a large market share.

Key Words: Cooperatives, Dairy, Milk Premiums, Milk Pricing, Milk Handlers

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Cooperative organizations have maintained relevance and even demonstrated dominance in significant sectors of the modern-day business environment. These organizations are traditionally characterized by the consolidation of member-owners who both patronize the firm and express formal rights to its assets through control rights and the right to the firm's residual earnings (Chaddad and Iliopoulos 2012). Control is generally expressed in the allocation of democratic voting rights, by the one-member one-vote rule (most common) or based on the level a member-owner utilizes the products or services offered by the cooperative firm (Hansmann 1996). The right to residual earnings resides in the combination of capital equity requirements set forth by a cooperative to its members and the respective level of use each member exercises (Bijman 2002). The goal of the cooperative business is designed to further the collective economic well-being of its member-owners and the choice of an individual to become a member of a cooperative is dependent on the perceived belief that membership will result in an economically preferable outcome to alternative operational strategies.

Prices offered to dairy farmers for their milk are dependent on numerous production and market conditions. Milk possesses unique qualities not frequently found in other commodity goods. It is a flow-commodity in that it is produced on a daily basis, is highly perishable, and requires transport at least every other day (USDA 2001). During short-run periods of low demand, milk supply cannot be reduced rapidly enough to match that low demand. Milk must be marketed irrespective of supply and demand behavior expressed on a specific day and seasonality in production and demand contributes to volatile price behavior.

Through technological advancements and economies of scale, farmers have drastically increased milk production per cow. Even from 2009 to 2018, production per cow increased 13%, the average number of milk cows increased 2%, and total milk production increased by 15% (USDA 2018). During the same period, farm-level milk prices fluctuated greatly. In New York State (NYS), for example, average farm-level prices peaked at $27.3 per hundredweight (cwt) in September 2014 and then dropped to $15.8/cwt in May 2016, over a 40% drop in less than two years (USDA 2018). Given the volatility in price and demand for dairy products, along with a positive trend in overall milk production, oversupply conditions have resulted at different times and the capacity for handlers and processors to market milk is ultimately limited in the short-run.

The more recent combination of low prices, reduced demand, and higher competition for marketing contracts creates financial uncertainty among farmers and, in many cases, unsustainable net margins. USDA reported the loss of 2,731 dairy farms in 2018, a drop of 6.8% nationally (Dickrell 2019). Tactics to hedge against price volatility and establish market access are highly sought-after for farmers to remain financially afloat. The structure of many dairy marketing cooperatives is designed to provide some form of these protections.

According to the 2017 Census of Agriculture, dairy marketing cooperatives handle around 85% of the milk produced in the United States, compared to 1997 when this percentage was over twenty percentage points lower (GAO 2019). Consolidation within the dairy industry has reduced the total number of existing marketing cooperatives. In 1964, there were 1,244 dairy marketing cooperatives; by 2017, that number had reduced to 118 (GAO 2019). As the name implies,

members of a marketing cooperative benefit through the many marketing services the firm provides, most of which can be more efficiently implemented on a level beyond the capabilities of an individual farm. In the case of a dairy marketing cooperative, this includes the assembly and processing of rawm milk and any actions leading up to and beyond the sale of the products. Packaging, advertising, brand development, gathering and processing the information needed to carry out a transaction, negotiating contracts, and policing and enforcing said contracts can all be part of a marketing cooperative's responsibilities (Staatz 1987).

Dairy marketing cooperatives have also assumed expanded operational responsibilities for procurement and distribution of milk in a manner called "balancing," where supply logistics are optimized in a method that all handlers (co-ops and independents alike) and contractual obligations are more efficiently filled (USDA 2001). Balancing is a technique where excess supply of raw milk for handlers processing more perishable products are diverted and sold to handers with facilities to process and store products with longer shelf life. Coordinating the manufacture and shipment of milk into more stable products based on current supply minimizes waste and dumping of product. Historically, independent processors sought to avoid the costly and daunting responsibility of obtaining, coordinating, and managing milk supply (USDA 2005). Dairy cooperatives generally agree to market all milk produced by their members. Cooperative handlers came to dominate balancing milk supplies from this commitment and streamlining the coordination of milk supply allocation across markets.

The dairy marketing cooperative is, as all other forms of cooperatives, collectively owned and governed by its members. Access to a secure market through their cooperative provides significant stability for producers of an economically volatile commodity. The ability of farmers to organize under the structure of a cooperative increases market power exertion capabilities. Market power provides various bargaining-type benefits especially those concerning contractual business proceedings and public policy-making. Representation of member interests can take place in the form of participation in federal rule-making efforts that influence dairy pricing policies and legal protections. Representation can also take the form of receiving more competitive prices from retailers or consumers based on supply control and brand strength.

Representation and democratic governance principles are also strongly relevant within the cooperative organization. A cooperative's bylaws will specify the structure of its board of directors, their composition, term dynamics, responsibilities, and power limitations. Farmer-members then hold the obligation to exercise continued control over their cooperatives through voting for directors and large changes in the cooperative business (e.g., mergers). In this manner, members have direct roles in the management and strategic direction of the firm. Though not an exhaustive list of properties that define a dairy marketing cooperative, the described features introduce operational factors that provide value to farmer-members. This value may come in the form of direct monetary benefits such as patronage payments or favorable premium structures reflective of cooperative members' interests. Alternatively, membership value may stem from non-direct monetary benefits such as democratic participation or access to a stable market.

This paper contributes to the literature on cooperative value, at least with respect to member-level financial returns, in the investigation of differences in milk pricing practices for cooperative versus non-cooperative milk handlers. In particular, the paper provides a comparative financial analysis of milk pricing behavior by handler organizations in NYS to their farm suppliers. We use state-

level data to provide insight on past trends in milk pricing behaviors, patronage payments (for cooperatives), and the relative utilization of cooperative and independent milk handlers by dairy farmers. The data provide a rare and reputable source to analyze baseline compensation variations between dairy farmers that are members of cooperatives and those who are not. Understanding the conditions that lead to producers' decisions to leave or join a cooperative may be informed by a closer examination of the similarities and differences in their milk pricing structures. We continue with an overview of milk pricing practices and the data collected. We follow with an analysis of premiums and deductions by handlers differentiated by business organization, and conclude with some implications of the empirical results and directions for future research.

Milk Pricing Practices

Since the early 1900's, milk pricing in the United States has evolved in response to economic issues involving the production, distribution, and processing of dairy products. In addition to asset fixity issues in production, the perishability of milk as a commodity introduce added considerations to resulting market dynamics. Government and public policy has played an integral role in the establishment and changes in how milk is priced and organized regionally. Federal- and state-level marketing orders (MOs) play a fundamental role in the orderly sale and movement of milk between producers and consumers. MOs accomplish this by setting minimum raw, fluid-grade milk prices that handlers must pay to dairy farmers. However, since cooperative handlers are owned by their farmer-suppliers, cooperative handlers are permitted to pay their members less than stated minimum order prices. Handlers can, and often do, purchase milk for higher than the minimum set price if economic conditions are conducive (NFBF 2019).

Minimum prices are set for numerous classes of milk, defined by the final product or intended use of the milk sold. The price producers receive for their milk is a blend price or weighted average of class prices based on regional utilization of milk in each market. MOs pool the value of milk in their specified region such that producers within the order to receive a uniform price for their milk regardless of the end use. MO prices are calculated and specific to predetermined geographic areas where specific handler competition is isolated (Jesse and Crop 2008). Currently there are 11 federal MOs and an array of state MOs with jurisdiction where federal MOs do not exist.

Most MOs (including those within NYS) use multiple component pricing in their pooling calculations.[1] In this pricing mechanism, MOs value contributions to the milk pool based on handler utilization on three or four distinct milk components: butterfat, protein, other solids, and, occasionally, non-fat solids. Producer value is then calculated using the USDA-AMS announced component prices within the pool plus any Class I and II producer price differentials (PPD). The difference between the component value and handler value divided by the total number of pounds in the pool establishes the level of the PPD. Combined, component values and PPD represent the minimum base price producers can receive from handlers. Existing legislation provides cooperatives the ability to be more flexible in retuning the announced blend price to their members. By taking advantage of voting rights through an order referenda, cooperatives may also re-blend milk receipts across MOs they operate in (Jesse and Johnson 1985).

Milk checks received by farmers (i.e., the mailbox price) vary from the base value determined by monthly MO calculations based on various pricing premiums and cost deductions depending on competitive offerings from the handler, the location and size of a handler, and other differentiating characteristics.

Quality premiums are often offered by handlers to reward or penalize producers for the quantity of somatic cells and/or bacteria present in milk. High somatic cell count (SCC) is linked to increased white blood cell production in a cow used to fight off potentially harmful pathogens such as mastitis and are undesirable due to their impact on the overall quality and yield of dairy products (Ruegg 2011). Quality premiums provide producers a method to increase marginal profits on their farms and differ from handler to handler over multiple quality compliance brackets with price advantages to increasingly reward producers who reach the strictest levels. Farmers choose to invest in equipment or livestock management improvements to reduce the presence of unwanted microbes if they believe the investment will provide net positive returns through higher quality premiums (Ruegg 2011).

Volume premiums are another common form of price incentive offered to milk producers. Though less common as milk supply continues to grow beyond demand, handlers historically offered volume premiums to incentivize larger milk outputs per farm to capture economies of scale. Generally, daily or monthly milk shipment brackets are set with an associated per cwt payments. Numerous other premiums exist such as protein premiums, marketing or competitive premiums, premiums for organic or kosher production, and rBST free milk. How these premiums are defined, set, and reported varies greatly from handler to handler. In the case of cooperatives, patronage refunds may also be included in a producer's milk check.

Milk price deductions and marketing expenses impact the bottom line paid from handlers to farmers. Like premiums, deductions can be diverse in number and definition depending on the characteristics of each individual handler. Hauling charges make up the most significant proportion of the deductions reported and account for all associated costs with delivery and movement of milk (e.g., fuel, trucks, maintenance, drivers). The associated structure and payment of hauling charges is linked to the organization of the handler purchasing the milk. Some handlers own their own trucking fleet, while others contract independent trucking businesses. Additionally, handlers may choose to charge flat rate hauling charges across their producer base or an altered system based on farm or region specific factors such as proximity to processing plants, farm density, or farm size. Other deductions commonly include co-op dues, milk promotion, co-op equity payments, CCC assessments, and federal order marketing services.

Handler Data

NYS handler data, by year and handler type, were collected for calendar years 2000 through 2017 from the NYS Department of Agriculture and Markets (NYAM) Division of Milk Control and Dairy Services. NYAM collects milk pricing data from required monthly Payment Report filings (Schedule G) by milk handlers operating in the state (Figure 1).[2] NYAM uses the data in informing their work, including reporting on market conditions (e.g., NYAM 2018).

According to NYAM, line item G0006 (PPD) is reported by handlers in a method different from what is defined by MOs. Handlers are aware of the component pricing values for butterfat, protein, and other solids (G0041, G0045, and G0005) based on corresponding MO statistics. They are also aware of how much they paid producers in gross value excluding premiums (G0007). Therefore, for convenience, most handlers subtract component values from G0007 to get their cumulative PPD value paid to all farmers.

DIS 423 PR (1/07)

STATE OF NEW YORK
DEPARTMENT OF AGRICULTURE & MARKETS
DIVISION OF DAIRY INDUSTRY SERVICES
I0B AIRLINE DRIVE, ALBANY, NY 12235

PAYMENT REPORT

For Month of:

This report properly prepared and signed must be submitted to the above address not later than the 28th day following the month to which the report applies.

If you have any questions, please call (518) 457-3169.

SCHEDULE G - ALL PAYMENTS MADE DIRECTLY TO NEW YORK DAIRY FARMERS THIS MONTH

Line	For Milk Receipts Reported in Line 9998, Schedule A of Your Plant Report Form DIS 423 or Schedule R of Your BTU Report		
G0002	Number of New York Dairy Farmers		
G0003	Pounds of Milk		
G0004	Butterfat Test __.___ ___ ___	Protein Test __.___ ___ ___	Other Solids Test __.___ ___ ___
G0041	Pounds of Butterfat	Butterfat Price $	Butterfat Value $
G0045	Pounds of Protein	Protein Price $	Protein Value $
G0005	Pounds of Other Solids	Other Solids Price $	Other Solids Value $
G0006	Total Producer Price Differential Value		$
G0007	Total Gross Value of Milk (Exclusive of Special Premiums)		$
G0008	Average price (Exclusive of Special Premiums) (Line 0007 divided by Line 0003 then multiplied by 100)		$ ___ __.___ ___ ___
G0009	Special Premiums Paid This Month:	(Total G0905 through G0930)	$.
	G0905 Volume $	G0920 Competitive $	
	G0910 Protein $	G0925 **RBST FREE** $	
	G0915 Quality $	G0930 Other $	Identify:
G0010	Cooperative Associations Report Cash Dividends Paid This Month.		$.
G1010	Adjustment for Cooperative Forward Contract Agreement		$
G0011	Gross Value of Milk(INCLUDING SPECIAL PREMIUMS & COOP. DIVIDENDS)		$.
	Deductions from Gross Value: POUNDS	(If different from line 3)	AMOUNT
G0012	Hauling (Include stop charges)	$	.
G0013	Coop. dues	$	.
G0014	Milk Promotion (Both N.D.B. & Local)	$	.
G0015	Coop. Equity Payments	$	.
G1505	C.C.C. Assessment	$	.
G1510	Federal Order Marketing Services	$	.
G0016	Other (Identify)	$	.
	NOTE: Do not include advance payments, 3rd party assignments, insurance, supplies, loans & similar items.		
G0017	Total Deductions		$.
G0018	Net Value of Dairy Farmers Milk (Line G0011 minus Line G0017)		$.

I hereby certify that the information in this report is correct to the best of my knowledge.

Signature of Person Preparing Report: | Title: | Date:

PLEASE PRINT NAME OF PERSON TO CONTACT ABOUT THIS REPORT | Phone No:

Figure 1. Schedule G payment report (NYAM 2018).

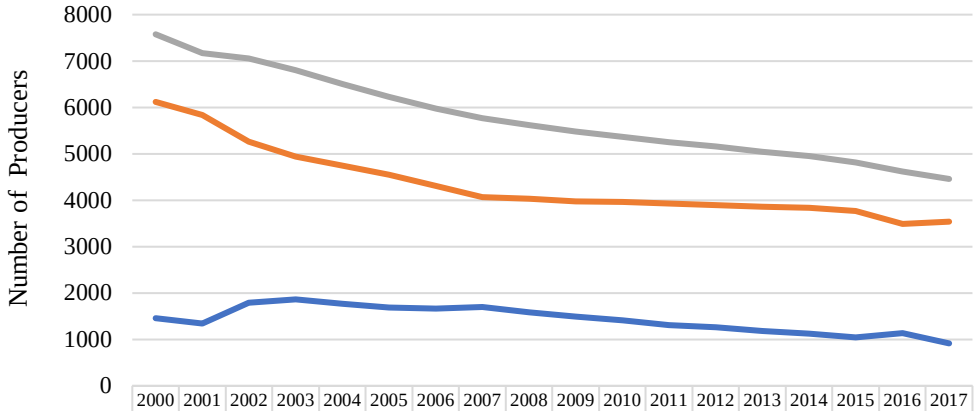
One section of the payment report that deserves clarification are line items G0925 (RBST FREE), G0930 (Other), and G0920 (Competitive) within G0009 (special premiums paid this month). NYAM has clarified to us that the former two sections are "catch-all" categories for any premium that does not fall under the other four categories (i.e., G0095 - volume, G0010 - protein, G0015 - quality, or G0020 - competitive). Over the last few years, NYAM has attempted to focus G0930 (Other) on premiums paid for organic/kosher attributes and shifted G0925 to rBST free premiums.[3]

The G0920 (Competitive) premium also has a loose definition from the perspective of NYAM, but generally refers to any premium provided to producers as an incentive to continue to sell to a specific handler; i.e., to make a handler's pricing more "competitive". These premiums are often referred to under the alternate title of "marketing" premiums and depend on the flexibility of a handler's operating expenses. Competitive premiums can be considered benefits to suppliers for their continued loyalty. Often unreported on their own, competitive premiums are thought to be included in certain base price figures, possibly contributing to unexplained variations within a MO region. Patronage refunds are not considered a form of competitive premium. The complexity and sheer number of premium types across handlers provides a unique challenge to understanding their structure and implications to producer interests.

Line item G0010 (cooperative cash dividends paid this month) represents patronage or payments made to cooperative members given an association decides to distribute a proportion of their annual profits. Historically, NYAM had handlers report monthly equivalents of this value. In the last five years NYAM has ceased collection of monthly cash dividend statistics and instead collects data on the annual check (known as the 13th check) paid to farmers. A cooperative's decision to distribute patronage refunds to members is a distinguishing factor from independent handlers.

Empirical Results

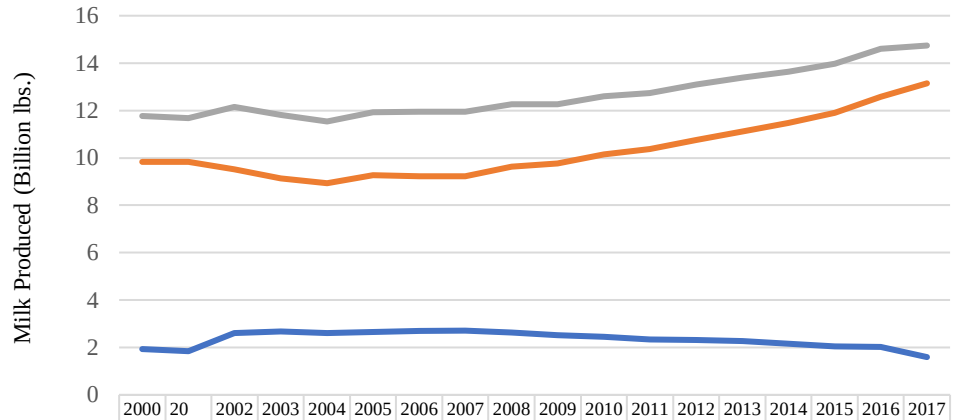
Between 2000 and 2017, an average of 76% of NYS producers were identified as a member of a dairy cooperative (hereafter referred to as cooperative members); the balance sold to independent handlers (hereafter referred to as non-cooperative members). The proportion of cooperative to non-cooperative producers has remained relatively stable with the cooperative proportion increasing by an average of 0.3% annually (Figure 2).



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Non-Coop Members	1457	1342	1796	1863	1767	1689	1666	1704	1584	1497	1411	1313	1260	1179	1122	1046	1135	915
Coop Members	6119	5833	5265	4937	4741	4545	4311	4068	4038	3979	3959	3933	3894	3865	3834	3771	3490	3544
Total Producers	7576	7175	7061	6800	6508	6234	5977	5771	5622	5475	5370	5246	5154	5044	4955	4817	4624	4459

Figure 2. Number of New York dairy producers by handler type (NYAM, 2018)

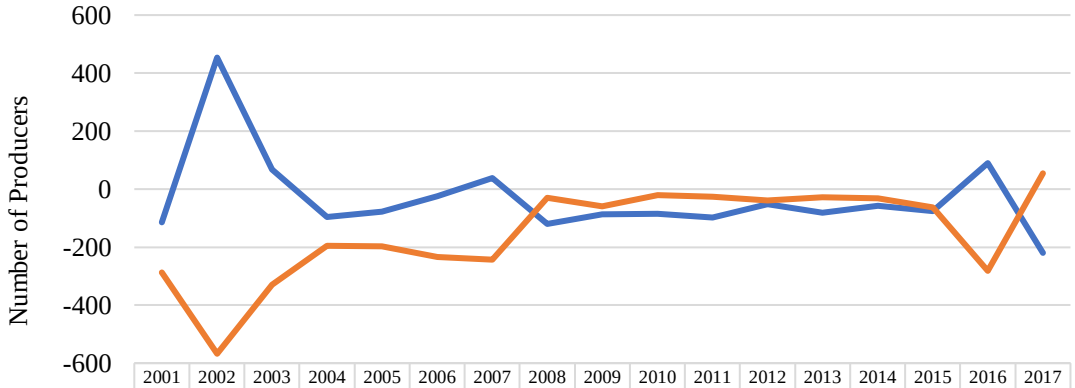
Likewise, an average of 82% of the milk in NYS was produced by cooperative members, implying, at least on average, that the size of farms that sell to cooperatives are only slightly larger than those selling to independent handlers (Figure 3). Similar to producer counts, the proportion of milk produced by cooperative members increased by an average of 0.4% annually over the 18-year period. In 2017, cooperative member milk made up the highest proportion (91%) of milk produced over the last 18 years. Figures 2 and 3 match industry norms where the number of producers and total production of milk are inversely related. For the time period evaluated, an average of 186 dairy producers each year left the industry or exited the state.



	2000	20	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
NON-COOP MILK	1.9	1.8	2.6	2.7	2.6	2.7	2.7	2.7	2.6	2.5	2.5	2.3	2.3	2.3	2.2	2.1	2.0	1.6
COOP MILK	9.8	9.8	9.5	9.1	8.9	9.3	9.2	9.2	9.6	9.8	10.1	10.4	10.8	11.1	11.5	11.9	12.6	13.1
TOTAL MILK	11.8	11.	12.1	11.8	11.5	11.	11.9	11.9	12.3	12.3	12.6	12.7	13.1	13.4	13.6	14.0	14.6	14.7

Figure 3. New York State milk production by handler type (NYAM, 2018)

Though the total number of producers has decreased, some of the changes in suppliers is a result of joining or leaving the opposite group. Each increase or decrease in non-cooperative producers is matched with a relatively equal but opposite effect in cooperative producer rates (Figure 4). It is likely that in years 2001-2007 and 2016 more cooperative members left their organization and became independent producers while in years 2008-2015 and 2017 more independent producers joined cooperative associations. The overall net change is still negative.

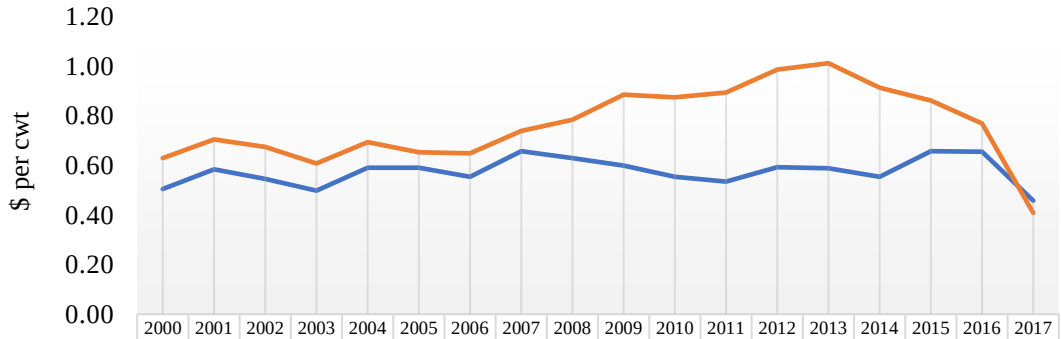


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Non-Coop Members	-115	454	67	-97	-78	-24	38	-120	-87	-86	-98	-52	-82	-57	-76	89	-220
Coop Members	-287	-568	-329	-196	-196	-234	-243	-29	-59	-20	-26	-39	-29	-31	-62	-282	54

Figure 4. Annual difference in number of producers by handler type (NYAM 2018)

Milk Premiums

Figure 5 illustrates the total premiums paid to producers by cooperative and non-cooperative handlers annually from 2000 through 2017, excluding patronage refund payments by cooperative handlers. On average, non-cooperative handlers paid $0.57/cwt while cooperatives paid $0.76/cwt in total premiums. In fact, 2017 is the only year where cooperatives paid less premiums per cwt than non-cooperatives. In performing a difference of means t-test on average annual premiums paid, the p-value is < 0.05, rejecting the null hypothesis and supporting the fact the differences between these two means are, in fact, statistically significant.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Non-Coop	0.50	0.58	0.54	0.50	0.59	0.59	0.55	0.65	0.63	0.60	0.55	0.53	0.59	0.59	0.55	0.66	0.65	0.46
Coop	0.63	0.70	0.67	0.61	0.69	0.65	0.65	0.74	0.78	0.88	0.87	0.89	0.98	1.01	0.91	0.86	0.77	0.41

Figure 5. Total premiums paid by handler type (NYAM 2018)

Table 1 summarizes the individual and aggregate premiums paid by type of handler. Non-cooperative handlers had lower coefficient of variation (CV) values for five of the six premium categories (all but protein). Additionally, non-cooperative handlers had a lower total premium CV (i.e., 25% versus 38%), implying that farmers selling to independent handlers experienced lower variability in premium payments year over year when compared to cooperatives.

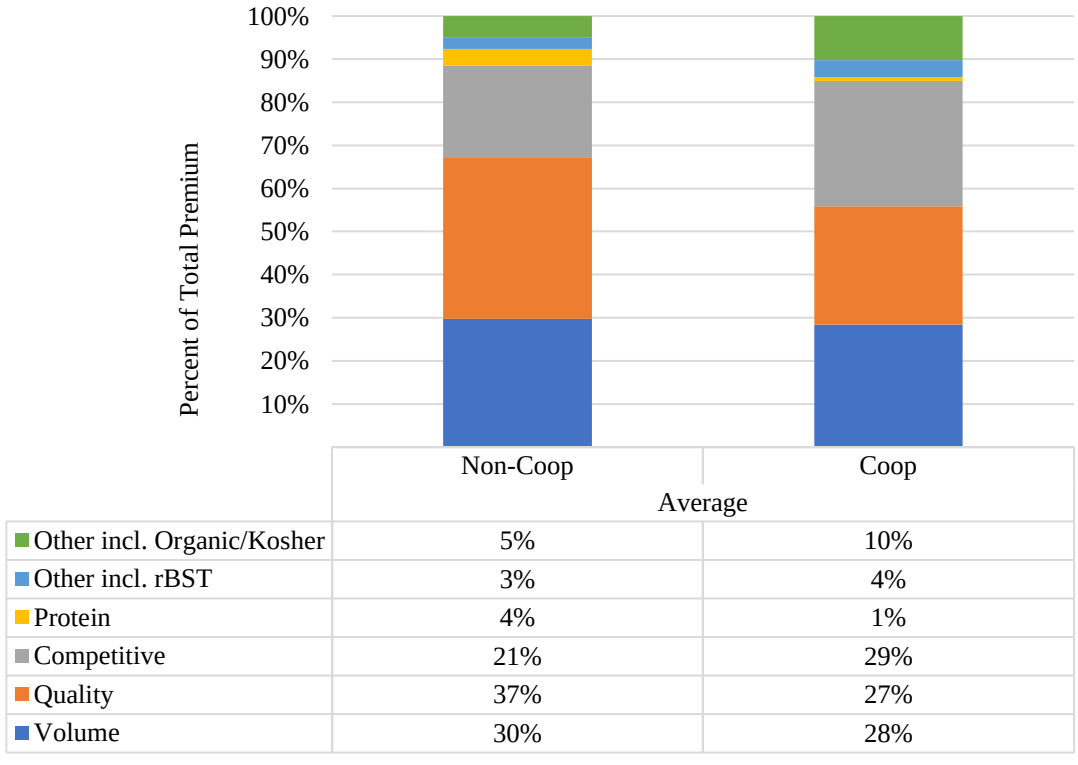
Cooperative handers gave higher premiums, on average, for organic/kosher and competitive, while non-cooperative handlers gave higher quality and protein premiums (Figure 6). Quality premiums made up the largest percentage for non-cooperative handlers (37%) while competitive premiums made up the largest percentage for cooperatives (29%). Higher quality premiums need not necessarily imply higher quality milk, but may reflect larger premium rates for similar levels of quality. The higher proportion of competitive premiums offered by cooperative handlers may relate to offering enhanced benefits to member-owners. The user-oriented governance structure may lend itself to increasing payments to producer members who remain loyal to the cooperative.[4]

It is also useful to consider whether handlers alter their premium structures to changes in market conditions. A crude, but effective, way to consider this is in the comparison of premium structures during high and low price years.[5] Both cooperative and non-cooperative handlers gave higher total premiums during high milk price years, but the differential varied considerably (Figure 7). Specifically, non-cooperative handlers increased average total premiums in high price years by only $0.03/cwt while cooperative handlers paid an additional $0.18/cwt relative to low price years. This suggests cooperatives may be quicker to respond to higher (lower) demand years through raising (reducing) premiums beyond that reflected in MO minimum price changes and, perhaps, influenced by differences in governance policies between the two groups.

Table 1. Average premium components by handler type (2002-2017)

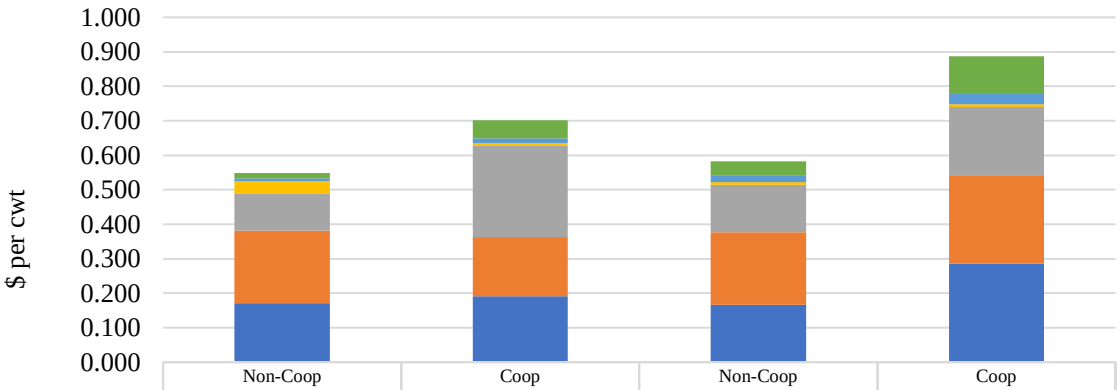
Premium Component	Mean ($ per cwt)	Standard Deviation	Coefficient of Variation
Cooperative Handler			
Volume	0.22	0.073	34%
Quality	0.21	0.057	27%
Competitive	0.22	0.077	35%
Protein	0.01	0.002	28%
Other incl. rBST Free	0.03	0.032	107%
Other incl. Organic/Kosher	0.08	0.046	60%
Total Premiums	0.76	0.068	38%
Non-Cooperative Handler			
Volume	0.17	0.037	22%
Quality	0.21	0.018	8%
Competitive	0.12	0.036	29%
Protein	0.02	0.024	110%
Other incl. rBST Free	0.02	0.013	79%
Other incl. Organic/Kosher	0.03	0.015	55%
Total Premiums	0.57	0.027	25%

Source: NYAM (2018)



	Non-Coop	Coop
Other incl. Organic/Kosher	5%	10%
Other incl. rBST	3%	4%
Protein	4%	1%
Competitive	21%	29%
Quality	37%	27%
Volume	30%	28%

Figure 6. Average premium composition, percent of total, by handler type (NYAM 2018)



	Non-Coop	Coop	Non-Coop	Coop
	AVG LOW		AVG HIGH	
Organic/Kosher	0.016	0.053	0.039	0.106
rBST	0.008	0.015	0.021	0.034
Protein	0.037	0.007	0.007	0.007
Competitive	0.106	0.265	0.138	0.199
Quality	0.211	0.171	0.211	0.256
Volume	0.171	0.191	0.166	0.285

Figure 7. Average premium composition, high versus low price years, by handler type (NYAM 2018)

Considering these recent trends, and assuming that demographic characteristics of the farm suppliers are similar, cooperative handlers in NYS tend to provide more monetary value to producers through premiums than non-cooperatives. Paying higher premiums may be a relevant incentive for producers to join cooperative associations. Pricing behavior within specific premium categories could appeal differently to farmers with varying production characteristics.

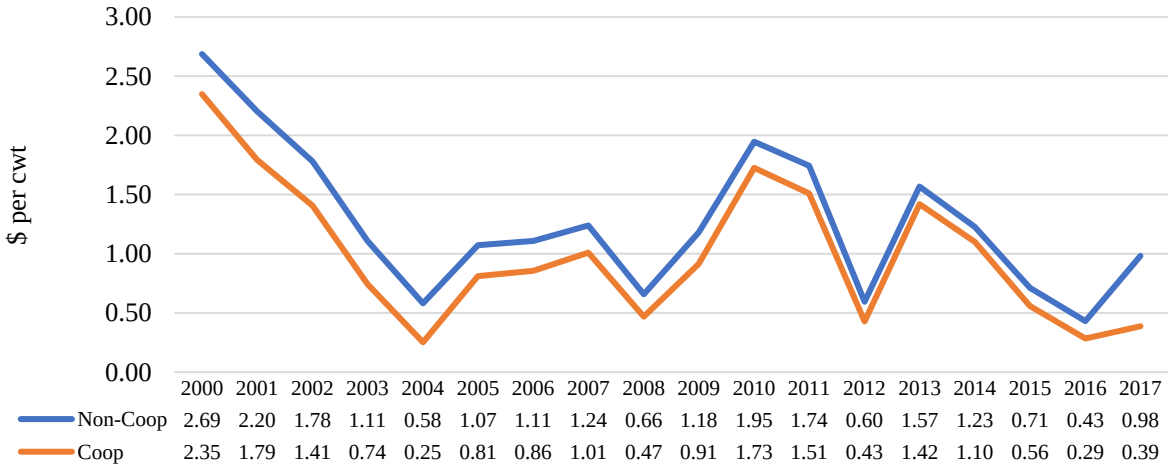
Patronage Dividends

Since the collection of monthly cash dividend data by NYAM ended, patronage refunds have been recorded annually through the reporting of the "13th check." Over the 18-year period, over $223 million have been paid to NYS dairy producers through patronage payments with an average of $0.12/cwt paid annually. Adding the $0.12/cwt to the composite total of premiums paid by cooperative handlers increases the difference between average annual total premium payments to $0.31/cwt more for cooperative handlers. This extra income source for producers would appear to make the decision between cooperative and non-cooperative membership obvious. Any strategy that would provide a milk producer an average of $0.31/cwt more than is a clear economic advantage. That said, premiums and patronage are not the only components that make up the net value of milk.

Base Component Pricing & Producer Price Differential

The pricing of base components in milk is set based on minimum prices regulated by the relevant MOs (in the case of NYS, both federal and state MOs are contained within its boundaries). This means, regardless of being a member of a cooperative or not, the price received for these components is equal for all producers located within the same MO.[6] The average total component price for both cooperative and non-cooperative handlers was $15.65/cwt between 2000 and 2017, and reached a maximum at $23.51/cwt in 2014.

Like base component pricing, PPDs are set by federal or state MOs. MOs calculate the PPD each month after all the details of milk receipts and utilization have been reported. However, on NYAM Payment Reports, as described above, handlers tend compute their PPD as a residual term. Non-cooperative handlers reported an average annual PPD $0.30/cwt higher than that for cooperative handlers; i.e., $1.30 versus $1.00 (Figure 8). Without knowing the location of handlers and producers, we cannot define the particular source for this wide differential, but it certainly is influenced by location factors within a state that contains more than one MO.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Non-Coop	2.69	2.20	1.78	1.11	0.58	1.07	1.11	1.24	0.66	1.18	1.95	1.74	0.60	1.57	1.23	0.71	0.43	0.98
Coop	2.35	1.79	1.41	0.74	0.25	0.81	0.86	1.01	0.47	0.91	1.73	1.51	0.43	1.42	1.10	0.56	0.29	0.39

Figure 8. Average producer price differential by handler type (NYAM 2018)

When component prices are combined with PPD, premiums, and patronage refunds, the value is defined as the gross value of milk (line item G011 on the Payment Report). Since component prices are the same between cooperative and non-cooperative handlers, PPD payments are $0.30 higher for non-cooperative handlers, and premium payments plus patronage are $0.31 higher for cooperative handlers, the gross value of milk is nearly identical (and statistically indifferent) between cooperative and non-cooperative handlers; i.e., $17.50 and $17.49, respectively. The result is intuitively appealing to the argument of relatively competitive markets between handlers.

Deductions

To calculate the net value of dairy farmer's milk, handlers include marketing cost deductions on their Payment Reports. Seven different marketing expense categories are included as described above. Table 2 summarizes the individual and aggregate deduction values by handler type, while the relative composition of deductions is illustrated in Figure 9.

Cooperative handlers averaged $0.76/cwt in deductions, while non-cooperative handlers averaged $0.95. [7] This $0.19 difference is largely explained by higher hauling costs charged by non-cooperative handlers ($0.74 versus $0.53). A difference of means t-test on hauling costs confirms that they are, in fact, statistically different from one another, with a p-value < 0.05. While some anecdotal evidence suggests that cooperative handlers "subsidize" the cost of hauling for their members, if true, this would simply result in a reduction in patronage refunds received, such that the full cost of hauling is still reflected in the net value of milk to members, albeit with possible distributional implications.

Table 2. Average deduction components by handler type (2002-2017)

Deduction Component	Mean ($ per cwt)	Standard Deviation	Coefficient of Variation
Cooperative Handler			
Hauling	0.53	0.062	12%
Dues	0.03	0.014	41%
Milk Promotion	0.15	0.002	1%
Cooperative Equity Payments	0.03	0.009	28%
Other Deductions	0.01	0.021	132%
CCC Assessment	0.01	0.008	69%
Federal Order Marketing Services	0.00	0.001	49%
Total Deductions	0.76	0.088	11%
Non-Cooperative Handler			
Hauling	0.74	0.043	6%
Dues	0.01	0.004	56%
Milk Promotion	0.15	0.008	5%
Cooperative Equity Payments	0.00	0.001	232%
Other Deductions	0.03	0.054	198%
CCC Assessment	0.00	0.000	201%
Federal Order Marketing Services	0.03	0.004	15%
Total Deductions	0.96	0.064	7%

Source: NYAM (2018)

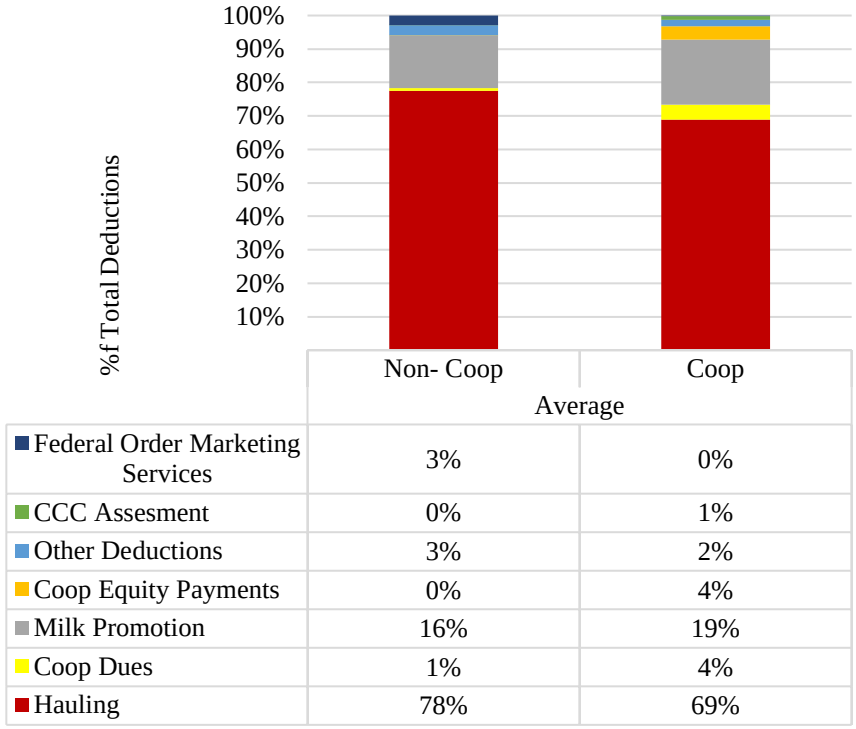


Figure 9. Average deduction composition, percent of total, by handler type (NYAM 2018)

A lower level of deductions (on average) for cooperative handlers suggests that cooperatives may hold an advantage in minimizing marketing expenses for their members over independent handlers. To the degree that cooperative members are more geographically proximate to each other and to processing facilities (relative to those for independent handlers), lower hauling costs per cwt would result. Line item G0018 of the Payment Report subtracts total deductions from the gross value of milk to calculate the net value of dairy farmer's milk (inclusive of patronage). Cooperatives had an average net value of $16.74/cwt compared to $16.54 for non-cooperative handlers. Years for which cooperative values are higher correspond to relatively stronger market years and likely reflect higher than average patronage refund payments (Figure 10).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Non-Coop	12.29	15.12	11.94	12.21	16.09	15.11	13.05	19.37	18.32	12.67	16.52	20.36	18.31	20.23	24.49	17.26	16.21	18.16
Coop	12.42	15.15	12.17	12.28	16.10	15.11	13.06	19.53	18.51	13.39	16.90	20.81	18.98	20.67	24.69	17.58	16.43	17.60

Figure 10. Net value of dairy farmers' milk by handler type (NYAM, 2018)

Discussion and Conclusions

Dairy producers make conscious decisions on their cooperative association membership status. The innate need for these decisions suggests that advantages offered by cooperative business organizations and independent handlers have varied over time. Handler payment reports over the last 18 years suggest that cooperatives, on average, provide a larger price advantage to producers when solely considering premium structures. In years where cooperatives paid substantially higher total premiums, the rate of loss of cooperative producers shrunk while the rate of loss in non-cooperative members increased. It is conceivable that during these years, producers shifted to cooperative handlers to take advantage of higher premiums.

Handler pricing data also revealed that non-cooperative handlers had a lower premium level variation over time. Cooperative organizations, by nature, must balance the financial needs of their members with the financials needs of the organization itself (i.e., balancing cooperative-level and member-level returns). Therefore, a cooperative association may be more reactive to market changes by more quickly passing on advantageous pricing changes to their members. Cooperatives generally agree to accept and market all milk produced by members without limitation. However, this also implies that premiums, like volume premiums, may change more frequently depending on member production changes, market demand, and the fiscal strength of the organization. Such evidence would seem to currently exist based on growing implementation of base-excess programs

by cooperative milk handlers.[8] Independent handlers, may be more restricted in their operational strategy resulting in less variable premium payments over time.

Patronage refunds provides additional price advantages for cooperative members based on the downstream success of cooperative activity post farm gate, albeit they are not guaranteed and, in some years, could be negative. That said, an added monetary benefit of $0.12/cwt, on average, was found during the time-period evaluated. Deductions were also lower, on average, for cooperative handlers. Since cooperatives are often formed explicitly to provide marketing efficiencies for a group of dairy farmers through pooled resources, lower marketing costs may be a natural result of the organizational model. That said, deduction rates remained relatively stable from 2000 through 2017 for both cooperative and non-cooperatives implying producers are likely not basing member status decisions on these costs.

The cumulative net value of dairy farmer's milk was, on average, $0.20/cwt higher for cooperative members. This pricing advantage may contribute to an already proportionally high number and growing percentage of NYS dairy farmers that are members of cooperatives. The extent that farmers individually forecast deduction and premium rates, however, is unknown. Whether a producer has the resources to accurately predict future trends in these pricing components would impact the rate at which this information would be used in determining member status. Additionally, considering the entire average net value of milk, $0.20/cwt is a relatively small percentage of farm mailbox prices (around 1%) and inertia effects will also likely influence moving to different handlers.

Year over year MO minimum price fluctuations are far larger than those reflected in premium, patronage, and deduct net effects. To that end, it is likely that producers may also evaluate other structural qualities offered by handlers beyond pricing features when deciding on cooperative membership status. It is known that farmers prefer cooperative business structures for perceived market access and efficiency gains and the obligation to purchase all milk produced. However, other factors like democratic governance, voting for the board of directors, and voice to the direction of an association should also be considered. Nonetheless, the data presented here provide an objective perspective on pricing factors that influence the bottom line of a producer's milk check.

Considering the use of NYS handler payment data in this analysis, the extent to which the implications can be applied in a national context are limited. Without analysis of other state level data it is unclear whether these pricing structures and trends are unique to NYS or not, albeit some handlers in NYS have multi-state or national footprints. Additionally, the analysis performed was based on aggregate cooperative and non-cooperative handler data. Comparative breakdowns based on, for example, handler size could not be completed.

Presumably milk pricing structures employed by cooperative handlers reflect the interests of their member owners. Given the observed differences in deduction and premium trends, further research isolating producer preferences towards alternative payment structures is necessary to support this claim. Furthermore, measurement of the value of cooperative membership relative to the importance of pricing attributes would positively supplement our understanding of producer level preferences towards milk handler selection. Discrete choice methods are commonly utilized to reveal individual level preferences towards attributes of products, services, and contracts and

would serve as an appropriate econometric method to observe these preferences. A careful examination of these issues is a top priority for our continuing research.

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[1] The other pooling mechanism is skim-fat pricing and limited to the Appalachian, Arizona, Florida, and Southeast federal MO's. It relies on higher valuation of Class 1 and II skim and fat due to regional utilization differentials.

[2] Line items are filled out at the discretion of handlers with little definition provided. Accordingly, it is likely that procedural methods in how handlers report values vary. However, it is expected that individual handlers will report information in a consistent manner over time, which provides some stability to collected information. It is NYAM's policy to take handlers at their word as long as they report all payments and deductions made to farmers.

[3] Handlers sometimes place other types of premiums in these categories such as signup/contract, other SCC, seasonal, and technical assistance premiums, as well as cost plus adjustments and transportation credits. Handlers are asked to identify these other premiums but often default to writing "other" to encompass the wide range. In any event, the values are relatively small.

[4] Notably in related research, comments received from dairy producers that marketed their milk through a cooperative (and served on the cooperative's Board of Directors) indicated that that such a premium was not offered or was deemed unnecessary.

[5] The highest (lowest) milk price years were defined as those at least one standard deviation above (below) the mean federal MO statistical price. Years 2002, 2003, 2006, and 2009 were allocated as low-price-years, while 2007, 2011, 2013, and 2014 were allocated as high-price-years.

[6] Since western NYS is regulated by a state MO, there may be some variation in component prices year over year relative to federal milk MO number 1 that comprises the rest of the state.

[7] Note, milk promotion costs are identical regardless of handler as they are based on mandatory federal ($0.05) and NYS ($0.10) check off assessments.

[8] Base-excess programs allow full prices paid based on some average production level over a base period. Deliveries beyond the base, while allowed, are priced far lower.

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