Journal of Co-operative Organization and Management 9 (2021) 100129

Contents lists available at ScienceDirect

Journal of Co-operative Organization and Management

journal homepage: www.elsevier.com/locate/jcom

Assessing the value of cooperative membership: A case of dairy marketing in the United States

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ARTICLE INFO

Keywords:
Cooperatives
Property rights
Discrete choice experiment
Membership value

ABSTRACT

The existence of cooperative organizations in today's business environment, particularly in agriculture, signals their continued ability to provide value to their member owners. However, due largely to data limitations, we know very little about the monetary value of ownership held by members and how value changes across members of differing characteristics. Through a discrete choice experiment with more than 200 dairy farmers in the United States, we examine these issues explicitly for dairy marketing cooperatives that purchase their members' milk and process it into finished dairy products. Results suggest that dairy farmers, on aggregate, are willing to accept lower per hundredweight compensation, 2.3% of the average milk price, to be cooperative members relative to selling to independent handlers. Results also suggest dairy farmers actively consider the industry wide impacts within pricing offers on preferences for other milk pricing attributes. The inclusion of demographic covariates highlights preferences important to understanding heterogeneous member interests and, thus, informing improved cooperative governance strategies and board decision making to address them.

1. Introduction

Cooperative organizations have maintained relevance and even demonstrated dominance in significant sectors of the modern-day business environment, particularly in agriculture. These organizations are traditionally characterized by the consolidation of member-owners who patronize the firm and express formal rights to the assets of the firm through control rights and the right to the firm's residual earnings (Chaddad & Iliopoulos, 2012). The goal of the cooperative is designed to further the collective well-being of its member-owners, which may include both pecuniary and non-pecuniary benefits (Iliopoulos & Theodorakopoulou, 2014; Iliopoulos & Valentinov, 2017). The choice of an individual to become a member of a cooperative is dependent on the perceived belief that membership will result in utility maximizing outcomes relative to alternative operational strategies.

The theory behind the structure and organization of transactional relationships within a firm is frequently discussed in terms of transaction cost economics (TCE); i.e., how transactions should be governed and structured to minimize waste (Ketokivi & Mahoney, 2017; Sykuta & Cook, 2001). Organizational structures that are most proficient at reducing transaction costs in their industry and market environment will become dominant in their field (Williamson, 1981). Hansmann (1996) explains the existence of different business forms by evaluating ownership costs faced by the patrons. Through implications of asset fixity, farmers generally face higher transaction costs because they are likely to encounter information asymmetries with bargaining partners and have limited relative market power. Having market access organized through a cooperative reduces uncertainty as the need for members to negotiate independently with buyers diminishes. In this manner, negative externalities that threaten independent producers are internalized within the cooperative's structure (Staatz, 1987).

Ownership and, with it, democratic control by farmers likely results in greater trust and less information asymmetries than with other non-cooperative firms (Sykuta & Cook, 2001). This reduces individual ownership costs in collective decision making given that member interests are relatively homogenous (Hansmann, 1996). However, a cooperative structure has the potential for high transaction costs if characteristics of heterogeneous members and diverse strategic goals are present (2018, Cook, 1996; Iliopoulos & Valentinov, 2017; Ménard, 2004). Heterogeneity in member interests and transactionary participation increases the cost associated with collective decision and blurring

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https://doi.org/10.1016/j.jcom.2021.100129
Received 8 October 2020; Received in revised form 5 February 2021; Accepted 7 February 2021
Available online 2 April 2021

the lines of defined property rights. A reduction in the confidence and/or trust of an organization to effectively represent owners' interests limits property right advantages and delegitimizes the collective value of the governance model (Chaddad & Iliopoulos, 2012; Grashuis & Cook, 2019).

Accordingly, representation and democratic governance principles are strongly relevant within the cooperative business form. While the cooperative's bylaws specify the structure and responsibilities of its board of directors, members hold the obligation to exercise control through active participation, including attending meetings, monitoring board decisions, and voting for directors and other large changes in the business. In this manner, members have direct roles in the management and strategic direction of the firm (GAO, 2019). It is a reasonable conjecture then that governance responsibilities, amongst other ownership rights, provide members a level of participatory satisfaction and value not shared in more traditional producer-buyer relationships (Chaddad & Iliopoulos, 2012). Due largely to data limitations, however, isolating the monetary value of ownership has been ill-explored, at least directly.

It has been shown that the level of social capital within a cooperative positively influences cooperative performance and/or member satisfaction, in both developing and developed country contexts (O'Brien, Banwart, & Cook, 2013). In particular, a number of studies have considered the level of member participation, transparency in communications, trust among members, and networking opportunities as key elements of social capital (Apparao, Garnevska, & Shadbolt., 2019; Bakucs, Fertö, & Szabó, 2007; Becchetti, Castriota, & Conzo, 2013; Cook & Burress, 2013; Franken & Cook, 2017; Grashuis & Cook, 2019; James & Sykuta, 2006; Jensen-Auvermann, Adams, & Doluschitz, 2018; Verhees, Sergaki, & Van Dijk, 2015). While careful examination of social capital over time provides insights into cooperative longevity (Chaddad, 2014; Cook, 2018; Iliopoulos & Valentinov, 2018), monetizing these factors can provide key information for boards in better understanding the preferences of their members.

A more common, albeit indirect, approach to assessing ownership value among members is by identifying the primary determinants of membership and/or level of patronage. Numerous studies examine the relationship of farm and/or farmer characteristics (e.g., age or experience, gender, education, farm size) to membership and/or the level of patronage, with varying results across studies (e.g., Agbonlahor, Enilolobo, Sodiaya, Akerele, & Oke, 2012; Bravo-Ureta & Lee, 1988; Gyau, Mbugua, & Oduol, 2020; James & Sykuta, 2006; Jitmun, Kuwornu, Datta, & Anal, 2020; Klein, Richards, & Walburger, 1997; Mojo, Fischer, & Degefa, 2017; Serra & Davidson, 2020; Wollni & Zeller, 2007; Zheng, Wang, & Awokuse, 2012). Less common demographics modeled include producers' perceptions of honesty and trustworthiness (James & Sykuta, 2006) and risk perceptions (Zheng et al., 2012).

Other approaches look to characteristics of the cooperative itself and their relationship to member satisfaction. In developing country contexts, the literature has shown that improved farm management practices and higher farm incomes are promoted through social capital development and educational efforts of the organization (e.g., Beber, Theuvsen, & Otter, 2018; Chagwiza, Muradian, & Ruben, 2016; dos Santos, Schmidt, & Mithöferc, 2020; Francesconi & Ruben, 2012; Ma & Abdulai, 2016; Serra & Davidson, 2020; Sultana, Ahmed, & Shiratake, 2020). In a developed country context, member surveys often point to the issue of stable market access. Alho (2015) finds that Finnish dairy and meat producers valued a stable channel for selling their products as the most important benefit of membership, while community values, decision making participation, and governance ranked among the least important. Similarly, Jensen (1990) finds that 65% of dairy farmers in Tennessee marketing cooperatives joined primarily because of the assured market, followed by 38% stating that services offered were better. Notably, 70% of non-members chose independent handlers because they paid the highest price (Jensen, 1990). Bravo-Ureta and Lee (1988) find that 70% of cooperative member dairy farmers in New England found membership helpful primarily because cooperatives offered a stable and guaranteed market for their milk.

To be sure, negotiated contingency agreements to accept and market all members' product is a benefit to member ownership (Ollila, 1994; Shaffer, 1987; Staatz, 1987), but the relative value (in monetary terms) of those benefits to others (e.g., pay prices) have not been explored sufficiently and are key in understanding producer decisions choosing where to market their products. Attention to valuation of contract attributes across firms of different business structures is minimal. Saitone, Sexton, and Malan (2018)) find that price premiums, payment delays, and default risk are important drivers to developing country farmers' decisions to market their goods through a cooperative or private trader. They consider contracts offered by a private trader that pays cash on delivery but may exercise market power and a cooperative that promises a price premium but delays payment with a risk of default. The farmer's optimal decision is expressed as a function of their discount rate, initial wealth, and degree of risk aversion (Saitone et al., 2018). While an important result, no elements in the conceptual model include utility value to ownership and democratic control.

To our knowledge, only Roe, Sporleder, and Belleville (2004) estimate the monetary value of cooperative ownership by estimating producer preferences for contract attributes within the U.S. hog industry. Results suggest respondents were more likely to choose contracts offered by a cooperative than a feed or packing company. In particular, producers would be willing to accept a $0.94 and $0.57 per hundredweight (cwt) reduction in their base pay rate by cooperatives before switching to a feed or packing company, respectively. This reduction corresponds to a base price approximately 2.2% below the regional average.

We make important contributions to the literature on measuring the value of cooperative ownership in four distinct, yet complementary ways. We are the first to estimate the monetary value of membership in dairy marketing cooperatives, a surprising result given that dairy marketing cooperatives handle strong majorities of the milk produced in the United States and major dairy countries in Western Europe, Australia, and New Zealand (Chaddad, 2007, 2014; GAO, 2019; Plunkett, Chaddad, & Cook, 2014). We develop and administer an innovative discrete choice experiment (DCE) to U.S. dairy producers regarding their preferences for milk pricing attributes and handler business structures. In doing so, we evaluate the values and strategic tradeoffs between price components and handler business structure (cooperative or independent). By controlling for handler pricing factors, we more accurately estimate the value of ownership to members. As discussed above, related prior work assesses cooperative value in an indirect (albeit valuable) way – primarily in what cooperatives do functionally to encourage membership – with very little focus on the value of governance control obligated to cooperative members itself. Understanding this value, particularly as it varies among members, is valuable to cooperatives in increasing member participation in governance activities.

Second, we improve on the experimental design of Roe et al. (2004) that was limiting in its experimental design and contract attribute variation. We utilize a Balanced Overlap fractional factorial experimental design where participants are shown six different choice sets to create the optimal variation across attributes needed to elicit a range in choice responses. Firth Bayes adjusted estimates and Hierarchical Bayes methods are employed to reduce bias and incorporate subject-level covariates.

Third, the sets of attributes included assess both preferences for individual farm activities and attention to market-based conditions. In particular, volume premium attributes include the consideration of payments conditional on overall market conditions to align value of additional product with payments to incentivize a production increase. Incorporating how member preferences within cooperatives are shaped or affected by overall market conditions is novel to this area of research inquiry. Milk balancing functions provided by dairy cooperatives may

also add value to cooperative owners given their associated market-wide benefits.[1]

Finally, we explicitly consider implications for cooperative governance under heterogeneous membership conditions. Preference trends between demographically similar farmer groups can inform improved cooperative governance practices to minimize the hindering effects of heterogeneous interests and member factions (Cook, 2018). Arguably, finding out what the (average) value of cooperative ownership is amongst the membership is less important in guiding future decision making than how that value varies among its members. A better understanding of the relative values is useful in assessing issues of member heterogeneity and factions within cooperatives.

We continue with a brief discussion of milk pricing structures in the United States to appropriately set the stage for our empirical approach and experimental design that follows. A summary of the survey data collected follows. We then discuss the DCE results and conclude with the implications of the results and directions for future research.

2. Milk pricing structures and trends

Since the early 1900′s, milk pricing in the United States has evolved in response to economic issues involving production, distribution, and processing of dairy products. In addition to asset fixity issues in production, the perishability of milk as a commodity introduces added considerations (Blayney & Manchester, 2001). Government and public policy has played a significant 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. Since cooperative handlers are owned by their farmer-suppliers, they are permitted to pay their members less than stated minimum order prices. Handlers can and often do purchase milk for higher than the minimum price if economic conditions are conducive (NFBF, 2019).

Minimum prices are set for classes of milk, defined by the final product or intended use of the milk. The price producers receive for their milk is a blend price or weighted average of class prices based on regional utilization of milk. MOs pool the value of milk in their specified region such that producers within an order 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 & Cropp, 2008).

Most MOs use multiple component pricing in their pooling calculations. In this mechanism, MOs value contributions to the milk pool based on three or four distinct milk components: butterfat, protein, other solids, and, occasionally, non-fat solids. Producer value is calculated using the USDA Agricultural Marketing Service announced component prices within the pool plus any Class I and II price differentials. The difference between the component value and handler value divided by the total number of pounds in the pool equals the Producer Price Differential (PPD). Combined, component values and PPD represent the minimum price producers can receive from handlers.

Milk checks received by farmers vary from the base price due to various pricing premiums and cost deductions offered/levied by handlers. Quality premiums reward or penalize producers for the quantity of somatic cells and/or bacteria present in milk. High somatic cell and bacterial content are linked to increased white blood cell production in a cow used to fight off potentially harmful pathogens and are undesirable due to their impact on the quality and yield of dairy products (Ruegg, 2011). Quality premiums provide producers a method to increase profits on their farms and differ from handler to handler over multiple quality compliance brackets.

Volume premiums are another common price incentive offered to producers. Though less common currently with milk supply growth outstripping demand, handlers historically offered volume premiums to incentivize larger milk outputs. Larger production provides handler cost benefits from economies of scale. Daily or monthly milk shipment brackets are set with associated per cwt payments. Other premiums exist such as for protein, marketing or competitive, organic or kosher production, and rBST free milk. How these premiums are defined, set, and reported varies from handler to handler. In the case of cooperatives, patronage refunds may also be included in a producer's milk check.

Deductions are also diverse in number and definition depending on characteristics of the handler. Hauling charges make up the most significant proportion of deductions and account for all associated costs with delivery and movement of milk. The structure and payment of hauling charges are linked to the organization of the handler purchasing the milk. Some handlers own their own trucking fleet, while others contract independent trucking businesses. Handlers may charge a flat rate 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, where applicable, include co-op dues, milk promotion, co-op equity payments, government assessments, and MO services.

3. Methods and experimental design

DCEs are widely utilized to quantify individuals' preferences when provided a distinct set of options (Louviere, Hensher, & Swait, 2000). DCEs force respondents to consider the consequences of the choices they make across choice sets. In this manner, participants are simultaneously considering multiple options and choose the option with most favorable cumulative benefit across attributes. Analyzing response data provides information on the relative importance of the attribute levels, and the rate at which respondents will trade between levels (Louviere et al., 2000).

3.1. Identification of attributes and attribute levels

Thorough research on milk pricing post MOs and handler organizational structures was conducted to inform attribute selection and levels. New York Department of Agriculture and Markets Payment Reports were utilized to provide a basis for determining which components of milk prices contribute most significantly to the net value of milk to producers (NYSAM, 2019). Combined, quality, volume, and marketing (or competitive) premiums made up the bulk (86%) of total premiums offered by handlers in New York State (NYS), excluding patronage refunds (Munch, Schmit, & Severson, 2020). Hauling costs made up the majority (74%) of deductions levied by handlers (Munch et al., 2020). Phone and in-person interviews with several cooperative and independent handlers in NYS were conducted to get a better sense of what historical and current premium and hauling structures look like in the state.

DCE are inherently limited by the number of attributes and levels that can be included. Too many attributes places a cognitive burden on respondents, while too few can lead to a misrepresentation of the product or contract. Ensuring participants thoroughly consider the economic implications of each attribute is necessary. Ultimately, five

[1] Dairy marketing cooperatives have 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 (Blayney & Manchester, 2001). 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.

Table 1
Experiment attributes and attribute levels.

Attributes(Abbreviation)	Levels(1 through 5 = Level codes)
Volume Premium ¢/CWT based on 1000 pounds of milk sold each month **(VOLPREM)**	1 200−400 = 10¢, 400−600 = 15¢, each additional 200 = 2¢, Max 30¢ 2 IF minimum order price ≥ average 3-month prior minimum order price THEN: 200−400 = 10¢, 400−600 = 15¢, each additional 200 = 2¢, Max 30¢; ELSE: No volume premium 3 No volume premium
Quality Premium ¢/CWT based on 1000 Somatic Cell Count **(QUALPREM)**	1 ≤ 200 = 30¢, ≤ 150 = 40¢, ≤ 100 = 50¢ 2 ≤ 250 = 20¢, ≤ 200 = 30¢, ≤ 150 = 40¢ 3 ≤ 300 = 10¢, ≤ 250 = 20¢, ≤ 200 = 30¢
Handler Business Structure (HANDS)	1 Farmer-owned cooperative handler 2 Independent (non-cooperative) handler
Hauling Cost Structure ¢/CWT **(HAUL)**	1 Same rate across all farms supplying milk to handler 2 Region-specific rates across all farms supplying milk to handler 3 Farm-specific rates based on milk volume and location to other supplying farms and processing plants
Gross Handler Pay Price $/CWT **(PRICE)**	1 $19.00 2 $19.25 3 $19.50 4 $19.75 5 $20.00

attributes were chosen (Table 1).[2]

To represent premium offerings, volume and quality premiums were included, each with three levels. For volume, the first level represents a traditional bracket system as described during handler interviews. This option does not take external market conditions into account and always rewards producers that produce the highest volumes of milk. The second level includes the same bracketed payment incentives of the first, but conditional on a market signal. Specifically, a volume premium is paid only if the current minimum order price is equal to or above the previous three-month average price. The third level represents the volume premium being used by most handlers currently – no volume premium. All handlers interviewed reported having volume premiums in the past five years, but only one reported paying a volume premium in the most recent year (2019) – a clear reaction to the oversupply of milk on the market. Farmers must evaluate their marginal costs of increasing milk production with volume premium levels that reward that increase.

Quality premium levels were constructed as somatic cell count (SCC) brackets that reward farmers for meeting higher thresholds of milk quality via lower SCC (Table 1). All options reward higher quality, but each level compensates farmers differently based on a threshold of strictness. While higher quality milk improves processed milk product production efficiencies (i.e., a benefit to the handlers), farmers are limited in their ability to increase milk quality and must consider their ability and cost to meet higher levels of quality in order to maximize on premium benefits.

The third attribute considers the handler's business structure: either a farmer-owned cooperative or an independent handler (non-cooperative firm). Each is assumed to act as a proxy for the cumulative perceived advantages and disadvantages a milk producer would experience by contracting with that business structure. The nature of a cooperative handler's business will necessarily affect the value of member ownership; e.g., whether the marketing cooperative simply bargains for improved prices on behalf of its members or whether it conducts processing functions. In our case, both handler types process milk into a set of finished products: fluid milk, cheese, and yogurt.

Many cooperative handlers have completed internal hauling studies to inform equitable charging mechanisms for their members. While often implemented by handlers in practice, the combination of a "stop charge" and "per cwt charge" was avoided in our DCE given its wide ranging conditions across handlers interviewed and to reduce respondent fatigue. Instead, hauling cost structures were more conceptually presented to respondents by how costs to the handler are allocated across farms. The attribute levels vary in how the burden of hauling costs for handlers are shared (or not) across producer suppliers. In so doing, the levels specified encompass the range of actual practices implemented by handlers.

The final attribute is the gross handler pay price (GHPP), with five distinct per cwt monetary levels based on recent market prices between $19 and $20. The GHPP represents the minimum price required by the milk MO and any other handler adjustments (e.g., deducts below the minimum price for cooperative handlers, milk promotion) prior to payment or assessment of quality premiums, volume premiums and hauling charges.

3.2. Experimental design

Choice options represent hypothetical contractual offers from handlers. Participants were asked to choose between two offers based on the attribute levels that define each offer. If a producer prefers one offer over another it is assumed that the producer would rather sell their milk to a handler with the chosen attribute levels. The Qualtrics® survey platform and conjoint add-on software were utilized to design the experiment and collect the data (Qualtrics, 2021). To limit cognitive strain, two contractual offers per choice set were presented. A randomized factorial design was utilized whereby respondents are randomly selected to receive different versions of choice sets using a Balanced Overlap design. Based on this method, the ability to evaluate the wide range of possible choice sets is performed using a much smaller participant pool (Elrod & Chrzan, 2000). Using computer optimization functions, Qualtrics® software assess thousands of potential designs and picks the most efficient (Kuhfeld, Tobias, & Garratt, 1994). These methods avoid choice sets in which one or multiple profiles dominate other profiles in attribute frequency and exposure increasing the efficiency of the experimental design.

The data collected in a DCE are limited in quality based on the ability for respondents to place themselves in a setting where they are behaving in a manner consistent to what would occur in a true willingness-to-accept scenario; i.e., hypothetical bias is present. Experimental designs that result in surveys taking over 15 min jeopardize the establishment of this setting and lead to increased rates of fatigue (Campbell, Boeri, Doherty, & Hutchinson, 2015). Based on our number of offers per question (2), six questions per respondent are recommended; i.e., each respondent sees six sets of two offers. Based on these settings, the recommended minimum sample is 208 respondents.[3]

3.3. Empirical model

Choice modeling estimates the probability of individuals making a choice from presented alternatives. The econometric task is to model the probability of choosing the various options, given the attribute characteristics of each option and, if desired, individual subject characteristics.

[2] A marketing/competitive premium was initially considered based on the NYSAM data (2019) where an annually increasing premium was included based on the number of years a farm supplied milk to the handler. However, comments received during pretesting of the survey with dairy farmers informed us that such a premium was not offered by their handlers or was unnecessary.

[3] Qualtrics suggests the Sawtooth Software equation to calculate a minimum sample size: $N = (m^*c)/(t^*a)$, where c is the largest number of levels across attributes, t is the number of tasks or questions, a is the number of alternatives or choice per question, and m is a multiplier value of 300 or 500 depending on whether the experiment is "small" or "large," respectively.

Sellers maximize utility by choosing the contractual offer that provides the most marginal utility via the perceived cost or benefits from the attribute characteristics. Individual choice probabilities can be expressed in logit form using multinomial logit regression models (McFadden, 1973).

Using maximum likelihood (ML) estimation for DCEs in smaller data sets can cause problems related to separation and bias (Kessels, Jones, & Goos, 2019). However, bias-corrected ML estimators can be obtained in a penalized ML estimation method (Firth, 1993). The Firth method allows fitting of a multinomial logit model to individual-level data and exploration of heterogeneity in respondent's preferences (Kessels et al., 2019). This is achieved by modifying the score function using a non-informative prior distribution that is proportional to the square root of the determinant of the Fisher information matrix of the model being used (Jeffreys, 1946). This method has been shown to produce improved estimates than ML estimators without bias correction (Kessels et al., 2019). JMP choice modeling statistical software was utilized to estimate all models (JMP, 2021). This choice modeling platform employs a conditional logistic (CL) regression to estimate the probability that a specific attribute configuration is preferred and estimates Firth-adjusted parameters.

One drawback to traditional CL models is that they only examine within-subject variation but ignore between-subject variation. Hierarchical Bayesian (HB) estimates can provide relief from this problem. They are referred to as hierarchical because they model participants' preferences as a function of an-upper-level model (pooled across responses) and a lower level (within-responses) individual-level model (Orme & Howell, 2009). These estimates are based on a HB fit that includes subject-level covariates into the underlying likelihood function and estimates their effects on the parameters directly. The Bayesian procedure is combined with the Metropolis-Hastings algorithm to estimate subject-level covariates (Train, 2001). Bayesian procedures do not require the maximization of any function. Given a distribution of data, they use an iterative process that converges to draws from the distribution to simulate relevant statistics (Train, 2001). HB output is in the form of posterior means, or the average of subject specific coefficient estimates after each iteration period. In this case, HB estimates are generated utilizing the underlying ML estimates of the CL model. Both the Firth-bias-adjusted CL approach and Firth-bias-adjusted HB approach were conducted.

Statistical testing for HB estimation requires the examination of the distribution of posterior draws of coefficients to see if a strong majority of draws falls on either one side or the other of the null hypothesis (Orme & Howell, 2009). This credible interval (CrI) is the HB equivalent of a classical confidence interval (CoI). The CrI identifies the range in which there is a 95% probability that the true parameter value falls (for a 95% significance level). Analyzing the CrI within the HB output is the leading way to confirm statistical significance. Parameter estimates generated through ML methods of the CL represent numerical scores that measure how much each attribute influences a respondent's choice. Similarly, posterior mean estimates generated through HB can be interpreted simply as average effects of each attribute level on the respondent's choice between offers.

Across both approaches, effect coding (which constrains partworth utilities to be zero-centered) suggests finding one or more "middle-level" partworth utilities close to zero should not be surprising and such a result would not necessarily mean that the "middle-preference" attribute was being ignored by respondents (Orme & Howell, 2009). Observance of a low *t*-value or CoI/CrI containing zero for a middle attribute level may make an attribute level seem statistically unimportant when the attribute may, in fact, be relevant to individuals' decisions.

4. Survey administration and data

The study was limited to active dairy farmers in the United States. On December 11, 2019, the survey went live via an anonymous online link provided by Qualtrics®. Responses were collected until March 31, 2020. University and industry contacts were utilized to help disseminate the survey across a number of handler organizations. State farm bureaus, agricultural associations, College social media platforms, farmer's unions, industry associations, and dairy related media outlets were utilized to advertise the survey. Four reminders were sent during the survey period. In addition to the discrete choice component of the survey, three instructional pages are provided at the start of the survey and demographic questions are included at the end. Instructions provided respondents with information on why the survey was being conducted, what the results would be used for, how the survey was structured, and several baseline assumptions about handler characteristics (Appendix A).[4]

Prior to the submission of a response, Qualtrics® monitors for the completion of all presented choice sets, six in our case. If participants failed to complete all six choice set questions, the response is rejected.

Table 2
Demographic statistics of farm respondents.

Variable	Count	% Sample	% U.S.
Farm Location (Division, Region):	201		
New England, Northeast	9	4.8	3.6
MidAtlantic, Northeast	97	48.3	25.2
East North Central, Midwest	62	30.8	36.8
West North Central, Midwest	12	6.0	16.6
South Atlantic, South	6	3.0	4.6
East South Central, South	3	1.5	3.1
West South Central, South	4	2.0	2.2
Mountain, West	3	1.5	3.2
Pacific, West	5	2.5	4.9
Current Handler Type:	209		
Cooperative	165	78.9	85.0
Independent	44	21.1	15.0
Dairy Herd Size:	203		
1−99 cows	81	39.9	74.3
100−499 cows	66	32.5	19.4
500−999 cows	24	11.8	2.8
1000+ cows	32	15.8	3.6
Education:	200		
High School graduate or less	38	19.0	NA
Some college, Associate's degree	66	33.0	NA
Bachelors degree	81	40.5	NA
Masters or Doctoral degree	15	7.5	NA
Years Dairy Farming:	203		
< 10 years	29	14.3	27.0
10−30 years (> 10 years Census)	75	36.9	73.0
31+ years	99	48.8	
Number of farms supplying to your handler	209		
Under 250	66	31.6	NA
250−750	30	14.4	NA
Over 750	69	33.0	NA
Not sure	44	21.1	NA
Opportunity to sell to other handler(s)?	209		
Yes	78	37.3	NA
No	102	48.8	NA
Not Sure	29	13.9	NA
If sell co-op, sold independent in last 10 yrs?	160		
Yes	29	18.1	NA
No	131	81.9	NA
If sell independent, sold co-op in last 10 yrs?	43		
Yes	10	23.3	NA
No	33	76.7	NA

Note: NA = Comparable figure not available.

[4] As the survey was administered to and about farm business decisions it does not meet the definition of "human participant research" as defined by the Department of Health and Human Services Code of Federal Regulations 45CFR 46. Therefore, the research was not subject to review and oversight by Cornell University's Human Research Protection Program, and Institutional Review Board approval was not required.

Therefore, of the 218 collected responses, all choice questions were completed. Demographic questions asked after the choice sets were not required for a response to be collected and response rates varied modestly among them. Demographic characteristics included farmer age, education level, dairy herd-size, and years of experience dairy farming. These questions allow for subject (interaction) effects to be included in the modeling of utility values across farm characteristics. Understanding preferences toward cooperative membership may be influenced by these external characteristics. Information was also collected at the end of survey to better understand a farmer's ability to sell to alternative handler organizations. In particular, we asked whether farms have an opportunity to sell to a handler other than their current handler, how many farms their current handler purchases from, and whether they had sold their milk to a different type of handler within the last 10 years.

Table 2 summarizes the farm respondent pool. Survey distributions are compared with national averages based on the 2017 U.S. Agriculture Censusk, where comparable statistics exist (USDA, 2017). In general, farms in the Midwest are under-sampled, while farms in the Northeast are over-sampled (particularly NYS). That said, the reported handler type is representative of the national average; given our focus on valuing cooperative ownership, this is an appealing result. Nearly one-half of respondents (48.8%) reported not having the opportunity to sell to a handler different than they currently do. Notably, an additional 13.9% were unsure if they could.

At the end of the survey, we asked respondents to provide a numerical value to them of their ownership rights or of not having ownership rights, depending on which type of handler they currently sell to. Specifically, we asked those selling to a cooperative handler: "What is the numerical value to you (in $/cwt) of your member ownership rights, responsibilities, and risks by selling to a cooperative?" For those selling to independent handlers we asked: "What is the numerical value to you (in $/cwt) of not having ownership rights, responsibilities, and risks by selling to an independent handler?" While recognizing these are difficult to answer, a baseline of self-reported values provides a useful comparison to the conjoint-estimated values. Further, since the range of base milk prices included in the experiment was one (i.e., $19 to $20), the estimated value of cooperative ownership from the experiment is bounded at $1 from above. Evaluating the range and mean of self-reported values will help support or refute that assumption.

As seen in Table 3, the number of respondents that answered this question was far fewer than other questions (i.e., only 115 of 166 respondents that sold to cooperatives, and only 28 of 44 that sold to independents), adding support to the DCE approach in estimating value. On average, answers to both questions were positive; i.e., there is value to some in having ownership ($1.01/cwt) and to others in not having ownership ($0.23/cwt), which one expects given their revealed preference. A crude approximation to a DCE estimated value of cooperative ownership is the difference between them, or $0.78. That said, the range of responses were substantial. For those selling to independents, responses ranged from $0 to $2, and for those selling to cooperative handlers, from −$0.25 to $80.00. How producers calculated their responses is unknown, but the ranges suggest the values are somewhat questionable. Alternatively, the wide range is consistent with the concept of a heterogeneous member base where member needs can be quite different. For cooperatives, the value should not include patronage refunds as respondents were instructed to assume that the expected value of patronage refunds is equal to the annualized value of their capital investment (Appendix A).

5. Discrete choice experiment results

Given the existing organization of the dairy industry, it was clear that upon deployment of the DCE, a higher proportion of respondents would be members of farmer-owned cooperatives. At first, this appears to suggest that any results to such an experiment will correspondingly favor cooperatives. However, doing so equates current membership with satisfaction in that membership. Without further knowledge, there is no way to confirm farmers generally prefer cooperative handlers to their independent counterparts, something especially relevant given that nearly 64% of respondents have no opportunity to or are unsure if they can sell to a different handler than they currently do. Producers with no other option than to sell to a cooperative handler had the opportunity to select hypothetical offers from independent handlers over those from cooperative handlers. In this manner, participants expressed their individual preferences for milk handler pricing attributes and business structure regardless of their current handler type.

For ease of exposition, summary results of the CL models are presented first to illustrate the importance of the various attributes without (main effects model) and with (interaction effects model) subject-level covariates. In the context of our research objectives, the main effects model results (CL and HB) serves to inform handler decision making on contractual offers that maximize the collective benefits to their milk suppliers. The interaction models then identify where preferences differ over supplier characteristics. Put differently, the main effects model results identify the overall utility maximizing contract offers and willingness-to-accept levels across attributes, while the interaction effects models evaluate preferences for alternative attribute levels across farm characteristics. Full estimation results are available in Appendix B (Tables B1, B2, and B3).

Table 3
Self-reported value of chosen handler business structure ($/cwt).

Statistic	Cooperative $N = 115$	Independent $N = 28$
Average	1.01	0.23
Standard Deviation	7.57	0.43
Minimum	−1.50	0.00
Maximum	80.00	2.00

Note: For farms currently selling to cooperatives, value represents the value to them of having ownership in their handler. For farms selling to independents, value represents the value to them of not having ownership in their handler.

Table 4
Conditional logit results summary, Main Effects and Interaction Effects models.

	Main Effects Model		Interaction Effects Model	
Model Effects	LogWorth	p value	LogWorth	p value
PRICE	24.21	0.00	23.69	0.00
VOLPREM*HERDSIZE			11.05	0.00
HANDS	8.20	0.00	3.68	0.00
HAUL*HERDSIZE			3.29	0.00
QUALPREM*EDUCATION			2.40	0.00
VOLPREM*EXPERIENCE			2.00	0.01
HANDS*EDUCATION			1.68	0.02
HANDS*EXPERIENCE			1.29	0.05
QUALPREM	2.79	0.00	0.87	0.13
VOLPREM*EDUCATION			0.42	0.38
VOLPREM	1.66	0.02	0.41	0.39
HANDS*HERDSIZE			0.37	0.43
QUALPREM*EXPERIENCE			0.34	0.46
HAUL*EXPERIENCE			0.27	0.54
HAUL	0.64	0.23	0.25	0.56
HAUL*EDUCATION			0.24	0.57
QUALPREM*HERDSIZE			0.20	0.63
N	2616		2400	
−2LogLikelihood	−820.05		−755.72	
AIC	1,662.30		1,637.31	

Note: Order of model effects are based on relative importance and statistical significance from the interaction effects model. LogWorth = (-log10(*p*-value)). Full model results, including Hierarchical Bayes Adjusted estimates, are shown in Appendix B.

Table 5
Optimal offer (utility maximizing bundle), Main Effects models ($N = 2616$).

		Conditional Logit		Hierarchical Bayes Adjusted	
Attribute	Attribute Level	Marginal Utility	Relative Importance	Marginal Utility	Relative Importance
Gross handler pay price	PRICE5: $20.00	0.59	0.51	0.54	0.48
Handler business structure	HANDS1: Farmer-owned cooperative	0.23	0.18	0.24	0.22
Quality premium	QUALPREM1: ≤200 = 30¢, ≤150 = 40¢, ≤100 = 50¢	0.14	0.13	0.14	0.14
Volume premium	VOLPREM3: No volume premium	0.15	0.11	0.13	0.11
Hauling cost structure	HAUL2: Region-specific rate	0.10	0.07	0.06	0.06
	Total	1.22	1.00	1.11	1.00

5.1. Main effects model results

In the main effects CL model, all attributes except hauling cost structure (HAUL) are statistically significant at the 95% significance level (Table 4). Based on the logworth estimates and absent gross handler pay price (PRICE), the most important attribute was handler business structure (HANDS), followed more distantly by quality (QUALPREM) and volume (VOLPREM) premiums.

An alternative representation of attribute importance is provided in Table 5, comparing the CL and HB estimates. Given the estimated partworths, an optimal offer based on attribute levels with the highest marginal utilities is constructed. Similar to partworths, the marginal utility represents the gain from "consuming" the attribute level of focus. In this case, the optimal bundle includes the cooperative handler type, the highest and strictest paying quality level, no volume premium, and a region-specific hauling cost structure. The relative importance values measure how much each attribute contributes to total producer utility of the selected offer.

Partworths can also be converted to willingness-to-accept (WTA) values relative to a base attribute level. In our case, WTA refers to the monetary benefit a person is willing to forgo in exchange for the attribute level under consideration. As such, the higher the WTA the lower the GHPP a farmer is willing to accept in return for that attribute level. WTA estimates in dollars per cwt are displayed in Table 6, whereby the attribute level with the lowest marginal utility was used as the base.[5] The WTA of $0.45 in the HB model for HANDS1 corresponds to a farmer willing to forgo $0.45 per cwt in return for marketing their milk through a cooperative relative to an independent handler.

Table 6
Willingness to accept (WTA), Main Effects models ($N = 2616$).

	Conditional Logit			Hierarchical Bayes Adjusted		
Attribute Level	WTA	CI Lower	CI Upper	WTA	CI Lower	CI Upper
Volume Premiums:						
VOLPREM1	BASE	BASE	BASE	BASE	BASE	BASE
VOLPREM2	$0.06	$0.06	$0.05	$0.08	$0.08	$0.06
VOLPREM3	$0.21	$0.21	$0.20	$0.22	$0.29	$0.19
Quality Premiums:						
QUALPREM1	$0.26	$0.27	$0.25	$0.29	$0.39	$0.22
QUALPREM2	$0.20	$0.21	$0.19	$0.18	$0.24	$0.15
QUALPREM3	BASE	BASE	BASE	BASE	BASE	BASE
Handler Business Structure:						
HANDS1	$0.36	$0.37	$0.35	$0.45	$0.61	$0.32
HANDS2	BASE	BASE	BASE	BASE	BASE	BASE
Hauling Cost Structure:						
HAUL1	$0.04	$0.04	$0.04	$0.08	$0.10	$0.08
HAUL2	$0.14	$0.14	$0.13	$0.12	$0.17	$0.10
HAUL3	BASE	BASE	BASE	BASE	BASE	BASE

Note: Base attribute levels assigned as least preferred (lowest marginal utility). CI = Confidence Interval for Conditional Logit model and Credible Interval for Hierarchical Bayes model (20,000 iterations), each based on a 95% significance level.

5.2. Interaction effects model results

Table 4 summarizes the *p*-values and associated LogWorths for all main and interaction subject effects, arranged in order by statistical significance. While VOLPREM is no longer statistically significant on its own, it remains important through its interactions with HERDSIZE and EXPERIENCE. Similar to the main effects model, HAUL is not statistically significant on its own; however, preferences for hauling cost structures clearly differ by farms of different sizes (HAUL*HERDSIZE). QUALPREM is less important than VOLPREM in the interaction effects model and with preferences varying significantly by the level of farmer experience (QUALPREM*EXPERIENCE).

The HANDS attribute remains strongly significant on its own, as well as with changes years of farmer education and years of dairy farming experience (HANDS*EDUCATION and HANDS*EXPERIENCE). With respect to education, the results are consistent with Klein et al. (1997) and James and Sykuta (2006) that found a positive relationship between education and cooperative use. Specific marginal utilities for each attribute level and interaction term are shown in Appendix B (Tables B2 and B3). The monetary equivalents ($/cwt) in the HB model for VOLPREM*HERDSIZE, HAUL*HERDSIZE, HANDS*EDUCATION, and HANDS*EXPERIENCE are presented in Fig. 1 through 3.[6]

Not surprisingly, for smaller farms, VOLPREM3 (i.e., never pay on volume) is preferred to VOLPREM1 (i.e., always pay on volume); the opposite is true of larger farms (Fig. 1). However, all farm sizes prefer VOLPREM2 (i.e., pay on volume conditional on a strong market signal) over VOLPREM1. Recall that not paying on volume (VOLPREM3) is part of the utility maximizing offer bundle (Table 5), attributed to a large number of (small) farm respondents preferring this option (Fig. 1).

In the case of hauling cost structures, larger farms demonstrate clear preference for levying farm-specific rates (HAUL3) (Fig. 2). In comparison, the two smaller herd sizes assign much lower monetary values across all cost alternatives, but prefer regional cost sharing (HAUL2). Again, even though the monetary values are lower, the relatively high percentage of farm respondents in the two smallest categories (72.4%, Table 2) results in HAUL2 in the optimal offer bundle in the main effects model (Table 5).

Model results indicate increasing value of cooperative ownership by farmers with more years of education and farming experience (Fig. 3). Cooperative value decreases slightly after 16 years of education, indicating that some college education is important, but not beyond a traditional undergraduate program of four years. A stronger trend in ownership value pertains to years of dairy farming experience. Here, values of cooperative ownership show over a three-fold increase from

[5] Note that the "upper" and "lower" CI values appear to be switched. Since the WTA is the willingness to forgo a lower price, the lower bounds are equivalent to a higher value (higher reduction) in price while the higher bounds are equivalent to a lower value (lower reduction) in price.

[6] As presented in the JMP software, marginal utilities in Table B3 include both the direct effect and the indirect effect of the demographic interactions.

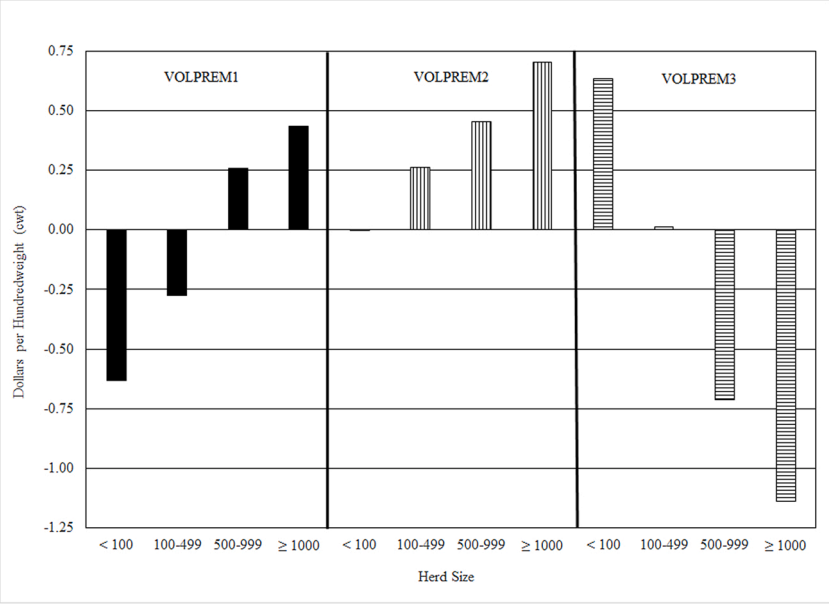

Fig. 1. Monetary values of alternative volume premium structures by herd size (number of cows on farm), Hierarchical Bayes Adjusted estimates.
Notes: VOLPREM1 = always pay, VOLPREM2 = conditional pay, VOLPREM3 = never pay.

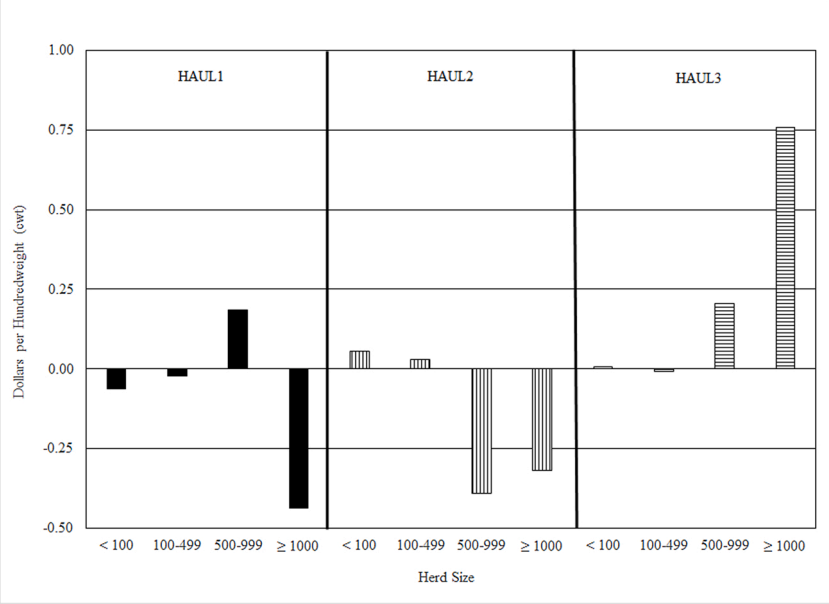

Fig. 2. Monetary values of alternative hauling cost structures by herd size (number of cows on farm), Hierarchical Bayes Adjusted estimates.
Notes: HAUL1 = same rate for all farms, HAUL2 = same rate by farm regions, HAUL3 = farm-specific rate.

the lowest to the highest categories.

6. Implications and conclusions

As evidenced by the growing volume of milk handled through cooperatives, the role cooperatives play in the management of milk markets remains prominent. However, heterogeneous member interests become more prevalent and costly the longer a cooperative exists. Correspondingly, the board of directors of these cooperatives is tasked with increased responsibility in managing the representation of these interests. The weaker a board is at achieving this task, the more blurred the lines become in defining member property rights. Understanding differences in member preferences is a necessary condition to addressing them through board communications and/or policy.

As expected, our results generally show disagreement between small and large farms when it comes to paying on volume and, by proxy, managing the market supply of milk. However, paying volume premiums conditional on the strength of existing milk markets was preferred irrespective of farm size category to always paying on volume, and, notably, most strongly by larger farms. From a governance perspective, this suggests that a board of directors can limit conflict between small and large farms by going with the more compromise-based option. This outcome is consistent with base-excess programs many cooperatives are implementing to limit milk supply that only pay full price on a base level of milk production to some historical average. Based on our results, conditional volume premium payments may be another option for consideration.

Larger farms express clear preference for charging farm-specific rates

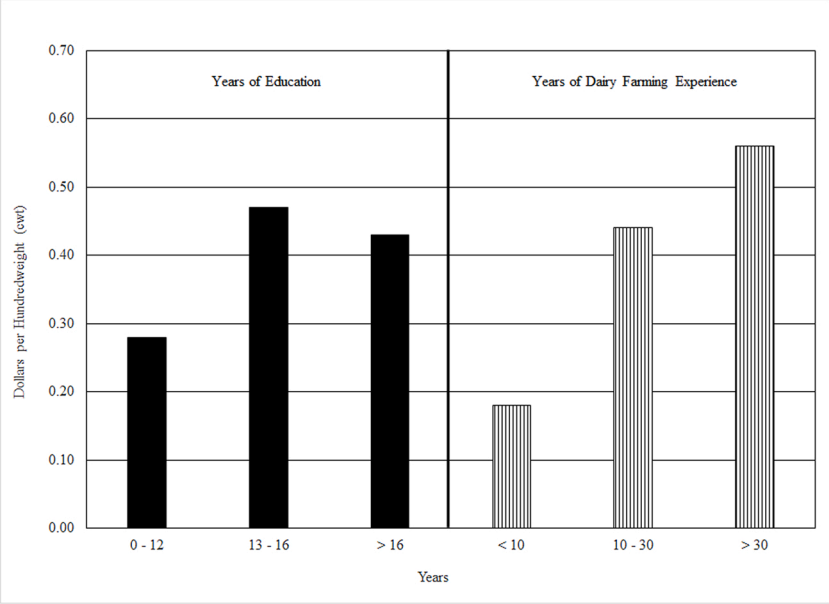

Fig. 3. Monetary values of cooperative ownerships by years of education and years of dairy farming experience, Hierarchical Bayes Adjusted estimates.

on hauling costs; not an unexpected result as they likely have the lowest unit costs of hauling to the handler and, therefore, would take on the bulk of monetary impact of more subsidized hauling options. Given that small farms (less than 100 cows) made up the largest segment of dairy farms in the respondent pool (as is the case in most milk marketing cooperatives in the United States), region-specific hauling costs provided the most equitable solution in terms of collective benefit.

Specifically to the value of cooperative ownership, farmers were willing to forgo $0.45/cwt on their milk check to remain with a cooperative handler over an independent; i.e., the average value of cooperative ownership is $0.45/cwt. This value was indifferent across farm size, a result consistent with the mixed reviews in the literature on farm size and its relation to cooperative membership (Klein et al., 1997; Wollni & Zeller, 2007; Zheng et al., 2012). The relative size of ownership value exposes a level of rigidity in farmers' commitment towards cooperative business structures in that members need to be comfortably compensated to give up their ownership rights. Even if respondents considered expected patronage refunds when selecting preferred handler offers, $0.45/cwt is more than three times the average annual level of $0.12/cwt paid by cooperative handlers through patronage refunds in NYS in recent years (Munch et al., 2020).

Furthermore, positive relationships between the value of cooperative ownership and years of education and dairy farming experience highlight the importance for cooperatives in communicating the value they bring to their members. Increasing value with years of farmer education may relate to the ability of cooperative members to comprehend complex issues surrounding cooperative operations and firm governance (Iliopoulos & Theodorakopoulou, 2014), as well as to understanding other benefits dairy cooperatives in aggregate provide to the milk market (e.g., lobbying efforts and milk balancing). To the degree that members with more education are also those that participate more actively in governance, doing so provides validation of the democratic components of cooperative businesses (Chaddad & Iliopoulos, 2012).

Increasing ownership value with dairy farming experience likely implies that ownership value grows the longer a farmer remains a member. Years of experience could also reflect the ability of members to obtain management roles in the cooperative. Farmers with the most experience may have more influential roles within the cooperative and the dairy industry that increase their preference for cooperative handlers. At the same time, the result suggests importance in member education efforts by cooperatives to communicate the value they bring to existing younger members for long-term member retention and in recruiting new members to the cooperative.

Individual cooperatives with different distributions of members by farm size, relative to our respondent pool, may come to different conclusions in terms of collective benefit. Even so, the differences in results across farm and farmer demographics remain informative. The robustness of our results beyond our sample is limited by the over-sample of farms in the Northeast U.S. relative to other areas. To the degree that regional differences in ownership value exist, be it through cultural norms, cooperative longevity, or other factors, this remains an issue ripe for future research by expanding respondent pool in other regions and considering other cooperative distinctions. Utilization of the online software program simplified the collection of survey data and allowed for the employment of more advanced analytical techniques (DCE); however, it also contributed to sample diversity issues, particularly with dairy farmers over 65 years of age.

The handler business structure attribute included in this choice experiment consisted of two types and where each provided the same marketing functions that included purchasing, processing, and sales activities. Employing similar research approaches across alternative cooperative functions (e.g., bargaining, marketing, supply, service) and different industries would inform a better understanding of member value. Notably, $0.45/cwt value estimated here corresponds to a 2.3 % of the average pay price, a level nearly identical to that observed by Roe et al. (2004) in the hog industry (2.2%).

Numerous types of cooperatives exist from the more traditional structure assumed here with respect to member responsibilities and governance functions; e.g., voting rights, investment requirements, board structures (Chaddad and Cook, 2004; Iliopoulos, 2013). For example, would a traditionally organized cooperative compared with a "new generation" structure that ties investment to delivery rights yield any difference in value? Further, cooperatives using proportional voting systems (based on patronage) are becoming more common to the traditional one-member, one-vote principle. Does member value of the cooperative change under different voting structures? Finally, does a larger cooperative instill a similar value of governance control to members than those with less members? Adopting similar frameworks to what is implemented here would assist in understanding the value of alternative mechanisms and cooperative characteristics. Indeed, doing so addresses current research priorities for agricultural cooperatives in expanding data collection efforts with implications for governance and

strategic decision-making (Boland et al., 2020).

CRediT authorship contribution statement

Daniel M. Munch: Methodology, Software, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing, Visualization. **Todd M. Schmit:** Conceptualization, Methodology, Validation, Investigation, Resources, Writing - review & editing, Visualization, Supervision, Project administration, Funding acquisition. **Roberta M. Severson:** Conceptualization, Investigation, Writing - review & editing.

Declaration of Competing Interest

The authors report no declarations of interest.

Acknowledgements

This work was supported by a joint research under 1013677 and extension program funded by the Cornell University Agricultural Experiment Station (Hatch/Multistate funds) and Cornell Cooperative Extension (Smith Lever funds) received from the National Institutes of Food and Agriculture (NIFA)U.S. Department of Agriculture (USDA). The authors thank Loren Tauer for his critique and review of previous versions of this manuscript and the NCERA-210 Multi-state Research Committee on valuable comments received from presentation of this material at their 2020 annual conference. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of USDA.

Appendix A

Dairy Producer Survey
Introduction and Instructions, Page 1 of 3

Hello and welcome to the Dairy Farmer Pricing Survey!

This survey has been developed to better understand farmers' willingness to accept alternative premium programs, related milk premium adjustments, and milk handler business structures. The survey is not specific to any particular federal or state milk marketing order as our focus is on price adjustments made by the handler after the required minimum price is determined by the relevant milk marketing order. Your answers will be used to determine preferred premium structures under a range of market conditions. The results will serve as valuable guidance to dairy farmers and milk handlers when considering alternative pricing structures beyond the milk marketing order and the expected results therefrom.

The survey is limited to current dairy farmers and should be completed by the primary owner/operator in charge of the milk production portion of the farm business. Only one survey should be completed per farm. The survey should take approximately 15-20 minutes to complete.

Your participation in this study is completely voluntary. There are no foreseeable risks to you or your business associated with this project. However, if you feel uncomfortable answering any question, you can withdraw from the survey at any time. The responses collected will be kept strictly confidential and maintained in a secure location. Any sort of report made public will not include any information that will make it possible to identify you.

Participants who complete this survey have the opportunity to enter into a raffle for one of **five $100 Visa gift cards**. Simply enter an email address at the end of the survey where directed to be included in the drawing.

The survey is being offered through the Charles H. Dyson School of Applied Economics and Management at Cornell University. Please contact Dr. Todd M. Schmit (tms1@cornell.edu, 607.255.3015) or Roberta M. Severson (rmh27@cornell.edu, 607.255.1987) with any questions or concerns.

Click the red arrow button on the right to continue!

DAIRY PRODUCER SURVEY
Introduction and Instructions, Page 2 of 3

You will be provided offers from two hypothetical milk handlers. Carefully analyze both offers and select the one you would prefer to sell to. Offers are not necessarily representative of current market conditions or offerings.

Elements not specified are assumed the same across offers. All handlers are assumed to contract for milk hauling services. Hauling costs charged to each farm cover the total costs to the handler charged by the transport firm.

Offers are displayed in a table format containing 5 attribute/level combinations. For each attribute only one level is included in any specific offer. Numerical attributes are based on hundredweights (CWT) of milk. The possible levels for each attribute are presented here for your information. Please familiarize yourself with this information before proceeding.

ATTRIBUTES	LEVELS
Volume Premium ¢/CWT based on 1,000 pounds of milk sold each month	• 200-400 = 10¢, 400-600 = 15¢, each additional 200 = 2¢, Max 30¢ • IF minimum order price ≥ average 3-month prior minimum order price then: 200-400 = 10¢, 400-600 = 15¢, each additional 200 = 2¢, Max 30¢; ELSE No volume premium • No volume premium
Quality Premium ¢/CWT based on 1,000 Somatic Cell Count	• ≤ 200 = 30¢, ≤ 150 = 40¢, ≤ 100 = 50¢ • ≤ 250 = 20¢, ≤ 200 = 30¢, ≤ 150 = 40¢ • ≤ 300 = 10¢, ≤ 250 = 20¢, ≤ 200 = 30¢
Handler Business Structure	• Farmer-owned cooperative handler • Independent (non-cooperative) handler
Hauling Cost Structure ¢/CWT (**HAUL**)	• Same rate across all farms supplying milk to handler • Region-specific rate across all farms supplying milk to handler within a region (as defined by handler) • Farm-specific rate based on milk volume and location to other supplying farms and processing plants
Gross Handler Pay Price $/CWT (**PRICE**)	• $19.00 • $19.25 • $19.50 • $19.75 • $20.00

The Gross Handler Pay Price represents the minimum price required by the milk marketing order with any handler adjustments prior to payment of quality and volume premiums, less hauling charges. The Net Handler Pay Price equals the Gross Handler Pay Price plus any volume and or quality premiums, less hauling charges. The Net Handler Pay Price is comparable to the mailbox price to farmers.

Click the red arrow button on the right to continue!

DAIRY PRODUCER SURVEY
Introduction and Instructions, Page 3 of 3

Choosing to sell to a cooperative handler implies a joint decision to sell your milk and join the co-op as a member-owner. As a member, an at-risk capital investment is required (determined by the co-op's board of directors (BOD)), you are eligible for patronage refunds (in cash and/or equity) from the profits of the co-op each year based on your level of milk sales and approval by the BOD, you are expected to actively participate in the co-op through member input and meeting attendance, you have voting rights (one member, one vote) on decisions that come to the full membership (including large financial decisions and election of the BOD), and you have the opportunity to serve in various leadership positions in the cooperative. For the purposes of this survey, you should expect that the annualized value of your capital investment is equal to the expected annual patronage refunds received.

Contracting with an independent handler implies a single decision on the milk sales transaction. You do not make an at-risk capital investment in the handler's business, you do not have any governance responsibilities or voting rights, and you do not receive a share of the profits earned by the handler.

For either type of handler, there are recognized volume efficiency gains in terms of reduced transaction costs in hauling and in reductions in the average cost of producing finished milk products. All handlers produce the same set of finished products; i.e., a selection of fluid milk, yogurt, and cheese products, branded under the handler's business name.

Please keep these conditions in mind when making decisions on the offers presented.

Click the red arrow button on the right to begin!

[6 Generated Choice Sets Follow]

[Example Choice Set is Shown Below]

(1/6) Please select your preferred milk payment offer below.

	Payment Offer 1	Payment Offer 2
Volume premium: ¢/CWT based on 1,000 pounds of milk sold each month	No volume premium	200-400= 10¢, 400-600= 15¢, each additional 200 = 2¢, Max 30¢
Quality premium: ¢/CWT based on Somatic Cell Count (000)	≤ 200 = 30¢, ≤ 150 = 40¢, ≤ 100 = 50¢	≤ 200 = 30¢, ≤ 150 = 40¢, ≤ 100 = 50¢
Handler Business Structure	Farmer-owned cooperative	Independent (non-cooperative)
Hauling costs: ¢/CWT of milk	Farm-specific rate based on milk volume & location to other supplying farms & processing plants	Region-specific rate across all farms supplying milk to handler within a region (as defined by handler)
Gross Handler Pay Price: $/CWT	$20.00	$19.75
	○	○

DAIRY PRODUCER SURVEY
Demographic and General Questions after Choice Set Handler Offers Completed

Q1: How many farms does your current handler purchase from?
1. Under 250
2. Between 250 and 750
3. Over 750
4. I am not sure

Q2: Do you have the opportunity to sell your milk to a different handler than you currently do?
1. Yes
2. No
3. I am not sure

Q3: Do you currently sell your milk to a cooperative milk handler?
1. Yes
2. No

Q3a: (if Yes is selected in Q3) What is the numerical value to you (in cents per CWT) of your member **ownership** rights, responsibilities, and risks by selling to a cooperative?
Q3b: (if Yes is selected in Q3) Did you previously sell to an independent handler in the last 10 years?
1. Yes
2. No

Q3c: (if No is selected in Q3) What is the numerical value to you (in cents per CWT) of not having **ownership** rights, responsibilities, and risks by selling to a cooperative?
Q3b: (if No is selected in Q3) Did you previously sell to a cooperative milk handler in the last 10 years?
1. Yes
2. No

Q4: What age category do you fall under?
1. Under 35
2. 35-44
3. 45-54
4. 55-64
5. 65+

Q5: How many consecutive generations has your dairy farm been in operation?
1. 1st
2. 2nd
3. 3rd
4. 4th
5. 5+

DAIRY PRODUCER SURVEY
Demographic and General Questions Post Choice Set Handler Offers (continued)

Q6: How long has the dairy farm been in operation (across generations, if applicable)?
1. Under 10 years
2. 11-30 years
3. 31-50 years
4. More than 50 years

Q7: How long have you been dairy farming?
1. Under 5 years
2. 5-10 years
3. 11-20 years
4. 21-30 years
5. 31+ years

Q8: What is the highest level of school you have completed?
1. Less than high school degree
2. High school graduate (high school diploma or equivalent including GED)
3. Some college no degree
4. Associate degree in college (2-year)
5. Bachelors degree in college (4-year)
6. Master's degree
7. Doctoral degree
8. Professional degree (JD, MD)

Q9: In which state do you currently farm? (drop down of all states, D.C. and Puerto Rico)

Q10: How large is your milking herd? (Number of cows)
1. 1-29
2. 30-49
3. 50-99
4. 100-199
5. 200-499
6. 500-999
7. 1000-1999
8. 2000+

Q11: How many owner operators of your farm have primary management responsibilities?
1. 1
2. 2
3. 3
4. 4
5. 5+

DAIRY PRODUCER SURVEY
Final Raffle Page

You're almost done! If you would like to be entered into a raffle for one of five $100 Visa gift cards please enter your preferred email address below. Emails will be used solely for conducting the raffle and will be discarded after completion of the survey and remuneration of gift cards.

Appendix B

Table B1

Table B1
Main Effects model results: Conditional Logit and Hierarchical Bayes Adjusted, in order of importance and statistical significance ($N = 2616$).

	Conditional Logit (CL)					Hierarchical Bayes (HB)		
Attribute Level	Parameter Estimate	Standard Error	CI Lower 95%	CI Upper 95%	t-Value	Parameter Estimates	CI Lower 95%	CI Upper 95%
Gross Handler Pay Price (CL p value = 0.00)								
PRICE1	−0.70	0.08	−0.87	−0.53	−8.25	−0.51	−0.80	−0.35
PRICE2	−0.19	0.08	−0.35	−0.04	−2.45	−0.16	−0.28	−0.06
PRICE3	−0.00	0.08	−0.16	0.15	−0.05	−0.03	−0.13	0.07
PRICE4	0.31	0.08	0.15	0.47	3.88	0.16	0.08	0.26
PRICE5	0.59	0.08	0.43	0.75	7.06	0.54	0.46	0.89
Handler Business Structure (CL p value = 0.00)								
HANDS1	0.24	0.04	0.16	0.32	5.68	0.24	0.15	0.41
HANDS2	−0.24	0.04	−0.32	−0.16	−5.68	−0.24	−0.43	−0.20
Quality Premiums (CL p value = 0.00)								
QUALPREM1	0.14	0.06	0.03	0.24	2.42	0.14	0.06	0.24
QUALPREM2	0.06	0.06	−0.05	0.17	1.08	0.03	−0.04	0.10
QUALPREM3	−0.20	0.06	−0.31	−0.08	−3.43	−0.17	−0.32	−0.11
Volume Premiums (CL p value = 0.02)								
VOLPREM1	−0.11	0.06	−0.22	−0.00	−2.00	−0.10	−0.19	−0.03
VOLPREM2	−0.04	0.06	−0.15	0.08	−0.65	−0.03	−0.11	0.04
VOLPREM3	0.15	0.06	0.04	0.26	2.59	0.13	0.06	0.27
Hauling Cost Structure (CL p value = 0.23)								
HAUL1	−0.02	0.06	−0.13	0.09	−0.41	0.01	−0.07	0.01
HAUL2	0.09	0.06	−0.02	0.21	1.64	0.06	−0.01	0.14
HAUL3	−0.07	0.06	−0.18	0.04	−1.22	−0.07	−0.22	−0.00

Note: CI = Confidence Interval for the Conditional Logit model and Credible Interval for the Hierarchical Bayes model.

Table B2
Interaction Effects model results, Conditional Logit, in order of importance and statistical significance ($N = 2400$).

Attribute Level	Marginal Utility	Parameter Estimate	Standard Error	CI Lower 95%	CI Upper 95%	*t*-Value
Gross Handler Pay Price (p value = 0.00)						
PRICE1	−0.71	−0.71	0.09	−0.89	−0.54	−7.94
PRICE2	−0.19	−0.19	0.08	−0.35	−0.02	−2.24
PRICE3	0.01	0.01	0.08	−0.16	0.18	0.11
PRICE4	0.27	0.27	0.09	0.11	0.44	3.19
PRICE5	0.62	0.62	0.09	0.45	0.80	6.98
Volume Premium*Herd Size (*p* value = 0.00)						
VOLPREM1*[< 100 Cows]	−0.44	−0.52	0.10	−0.72	−0.32	−5.15
VOLPREM1*[100−499 Cows]	−0.10	−0.19	0.10	−0.39	0.02	−1.81
VOLPREM1*[500−999 Cows]	0.46	0.37	0.15	0.09	0.66	2.54
VOLPREM1*[≥ 1000 Cows]	0.42	0.34	0.16	0.03	0.64	2.14
VOLPREM2*[< 100 Cows]	−0.09	−0.13	0.10	−0.33	0.07	−1.28
VOLPREM2*[100−499 Cows]	0.08	0.04	0.11	−0.17	0.25	0.35
VOLPREM2*[500−999 Cows]	−0.11	−0.15	0.16	−0.46	0.16	−0.98
VOLPREM2*[≥ 1000 Cows]	0.29	0.25	0.13	0.00	0.49	1.99
VOLPREM3*[< 100 Cows]	0.52	0.65	0.11	0.44	0.86	6.20
VOLPREM3*[100−499 Cows]	0.02	0.15	0.11	−0.06	0.36	1.43
VOLPREM3*[500−999 Cows]	−0.35	−0.22	0.16	−0.52	0.09	−1.40
VOLPREM3*[≥ 1000 Cows]	−0.71	−0.58	0.13	−0.83	−0.33	−4.59
Handler Business Structure (p value = 0.00)						
HANDS1	0.25	0.25	0.08	0.11	0.40	3.37
HANDS2	−0.25	−0.25	0.08	−0.40	−0.11	−3.37
Hauling Cost Structure*Herd Size (p value = 0.00)						
HAUL1*[< 100 Cows]	0.02	0.11	0.10	−0.09	0.31	1.10
HAUL1*[100−499 Cows]	0.14	0.23	0.11	0.03	0.44	2.20

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Table B2 (*continued*)

Attribute Level	Marginal Utility	Parameter Estimate	Standard Error	CI Lower 95%	CI Upper 95%	*t*-Value
HAUL1*[500−999 Cows]	0.03	0.12	0.14	−0.15	0.40	0.88
HAUL1*[≥ 1000 Cows]	−0.56	−0.48	0.14	−0.75	−0.20	−3.44
HAUL2*[< 100 Cows]	0.11	0.10	0.10	−0.11	0.30	0.93
HAUL2*[100−499 Cows]	0.11	0.09	0.11	−0.12	0.30	0.85
HAUL2*[500−999 Cows]	−0.11	−0.12	0.14	−0.40	0.15	−0.88
HAUL2*[≥ 1000 Cows]	−0.04	−0.06	0.12	−0.30	0.18	−0.49
HAUL3*[< 100 Cows]	−0.14	−0.21	0.11	−0.41	−0.00	−1.98
HAUL3*[100−499 Cows]	−0.25	−0.32	0.11	−0.53	−0.11	−3.04
HAUL3*[500−999 Cows]	0.07	0.00	0.15	−0.29	0.29	0.00
HAUL3*[≥ 1000 Cows]	0.60	0.53	0.13	0.28	0.78	4.09
Quality Premium*Education (p value = 0.00)						
QUALPREM1*[< 13 Years Education]	0.02	−0.16	0.10	−0.36	0.04	−1.56
QUALPREM1*[13−16 Years Education]	0.37	0.19	0.10	−0.01	0.38	1.88
QUALPREM1*[>16 Years Education]	0.15	−0.03	0.10	−0.22	0.17	−0.27
QUALPREM2*[< 13 Years Education]	0.01	0.06	0.11	−0.15	0.28	0.57
QUALPREM2*[13−16 Years Education]	0.08	0.13	0.11	−0.08	0.34	1.24
QUALPREM2*[>16 Years Education]	−0.24	−0.19	0.09	−0.37	−0.02	−2.19
QUALPREM3*[< 13 Years Education]	−0.03	0.10	0.13	−0.15	0.35	0.78
QUALPREM3*[13−16 Years Education]	−0.45	−0.32	0.09	−0.49	−0.15	−3.62
QUALPREM3*[>16 Years Education]	0.09	0.22	0.13	−0.03	0.47	1.76
Volume Premium*Experience (p value = 0.01)						
VOLPREM1*[< 10 years]	0.28	0.20	0.11	−0.01	0.41	1.88
VOLPREM1*[10−30 years]	−0.08	−0.16	0.09	−0.34	0.01	−1.82
VOLPREM1*[> 30 years]	0.05	−0.04	0.10	−0.22	0.15	−0.38
VOLPREM2*[< 10 years]	0.21	0.17	0.11	−0.04	0.38	1.59
VOLPREM2*[10−30 years]	−0.07	−0.11	0.09	−0.29	0.06	−1.28
VOLPREM2*[> 30 years]	−0.01	−0.06	0.09	−0.23	0.13	−0.60
VOLPREM3*[< 10 years]	−0.50	−0.37	0.10	−0.56	−0.18	−3.75
VOLPREM3*[10−30 years]	0.15	0.28	0.10	0.08	0.47	2.78
VOLPREM3*[> 30 years]	−0.04	0.09	0.09	−0.09	0.27	0.97
Handler Business Structure*Education (p value = 0.02)						
HANDS1*[< 13 Years Education]	0.10	−0.15	0.08	−0.30	0.00	−1.91
HANDS1*[13−16 Years Education]	0.35	0.10	0.08	−0.05	0.25	1.30
HANDS1*[> 16 Years Education]	0.30	0.05	0.09	−0.13	0.23	0.58
HANDS2*[< 13 Years Education]	−0.10	0.15	0.07	0.01	0.29	2.14
HANDS2*[13−16 Years Education]	−0.35	−0.10	0.06	−0.23	0.02	−1.58
HANDS2*[> 16 Years Education]	−0.30	−0.05	0.09	−0.22	0.12	−0.56
Handler Business Structure*Experience (p value = 0.05)						
HANDS1*[< 10 years]	0.19	−0.06	0.08	−0.22	0.10	−0.74
HANDS1*[10−30 years]	0.17	−0.08	0.07	−0.21	0.05	−1.19
HANDS1*[> 30 years]	0.39	0.14	0.07	0.00	0.28	1.96
HANDS2*[< 10 years]	−0.19	0.06	0.06	−0.06	0.17	1.00
HANDS2*[10−30 years]	−0.17	0.08	0.07	−0.06	0.22	1.12
HANDS2*[> 30 years]	−0.39	−0.14	0.07	−0.27	−0.01	−2.07
Quality Premiums (p value = 0.13)						
QUALPREM1	0.18	0.18	0.10	−0.01	0.36	1.86
QUALPREM2	−0.05	−0.05	0.10	−0.25	0.15	−0.49
QUALPREM3	−0.13	−0.13	0.09	−0.30	0.05	−1.45
Volume Premium* Education (p value = 0.38)						
VOLPREM1*[< 13 Years Education]	0.22	0.14	0.11	−0.07	0.35	1.29
VOLPREM1*[13−16 Years Education]	0.04	−0.05	0.11	−0.25	0.16	−0.44
VOLPREM1*[>16 Years Education]	−0.01	−0.09	0.10	−0.28	0.10	−0.92
VOLPREM2*[< 13 Years Education]	0.04	−0.01	0.10	−0.21	0.19	−0.09
VOLPREM2*[13−16 Years Education]	−0.01	−0.05	0.10	−0.26	0.15	−0.52
VOLPREM2*[> 16 Years Education]	0.11	0.06	0.12	−0.17	0.30	0.52
VOLPREM3*[< 13 Years Education]	−0.26	−0.13	0.09	−0.30	0.04	−1.48
VOLPREM3*[13−16 Years Education]	−0.03	0.10	0.09	−0.07	0.27	1.14
VOLPREM3*[> 16 Years Education]	−0.10	0.03	0.12	−0.21	0.27	0.23
Volume Premiums (p value = 0.39)						
VOLPREM1	0.08	0.08	0.10	−0.12	0.29	0.81
VOLPREM2	0.05	0.05	0.10	−0.16	0.25	0.44
VOLPREM3	−0.13	−0.13	0.09	−0.31	0.05	−1.43
Handler Business Structure*Herd Size (p value = 0.43)						
HANDS1*[< 100 Cows]	0.26	0.00	0.07	−0.14	0.15	0.04
HANDS1*[100−499 Cows]	0.31	0.06	0.08	−0.10	0.21	0.71
HANDS1*[500−999 Cows]	0.34	0.09	0.11	−0.13	0.31	0.82
HANDS1*[≥ 1000 Cows]	0.10	−0.15	0.10	−0.35	0.05	−1.50
HANDS2*[< 100 Cows]	−0.26	−0.00	0.08	−0.16	0.16	−0.04
HANDS2*[100−499 Cows]	−0.31	−0.06	0.08	−0.21	0.10	−0.71
HANDS2*[500−999 Cows]	−0.34	−0.09	0.11	−0.30	0.12	−0.83
HANDS2*[≥ 1000 Cows]	−0.10	0.15	0.09	−0.02	0.32	1.70
Quality Premium*Experience (p value = 0.46)						
QUALPREM1*[< 10 years]	0.23	0.05	0.11	−0.15	0.26	0.51
QUALPREM1*[10−30 years]	0.20	0.02	0.09	−0.15	0.20	0.27
QUALPREM1*[> 30 years]	0.10	−0.08	0.10	−0.27	0.11	−0.80
QUALPREM2*[< 10 years]	0.07	0.12	0.11	−0.09	0.34	1.12

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Table B2 (*continued*)

Attribute Level	Marginal Utility	Parameter Estimate	Standard Error	CI Lower 95%	CI Upper 95%	*t*-Value
QUALPREM2*[10−30 years]	−0.15	−0.10	0.09	−0.28	0.09	−1.03
QUALPREM2*[> 30 years]	−0.08	−0.03	0.09	−0.20	0.15	−0.31
QUALPREM3*[< 10 years]	−0.30	−0.18	0.10	−0.37	0.01	−1.81
QUALPREM3*[10−30 years]	−0.06	0.07	0.10	−0.12	0.26	0.74
QUALPREM3*[> 30 years]	−0.02	0.115	0.09	−0.07	0.28	1.15
Hauling Cost Structure*Experience (p value = 0.54)						
HAUL1*[< 10 years]	0.05	0.14	0.11	−0.07	0.35	1.29
HAUL1*[10−30 Years]	−0.21	−0.12	0.09	−0.30	0.06	−1.28
HAUL1*[> 30 years]	−0.11	−0.02	0.09	−0.19	0.16	−0.22
HAUL2*[< 10 years]	−0.11	−0.13	0.09	−0.32	0.05	−1.40
HAUL2*[10−30 Years]	0.15	0.13	0.09	−0.05	0.30	1.45
HAUL2*[> 30 years]	0.02	0.00	0.10	−0.20	0.21	0.03
HAUL3*[< 10 years]	0.07	−0.01	0.09	−0.18	0.17	−0.06
HAUL3*[10−30 Years]	0.06	−0.01	0.10	−0.20	0.18	−0.11
HAUL3*[> 30 years]	0.09	0.02	0.09	−0.16	0.19	0.18
Hauling Cost Structure (p value = 0.56)						
HAUL1	−0.09	−0.09	0.10	−0.28	0.10	−0.94
HAUL2	0.02	0.02	0.10	−0.18	0.22	0.19
HAUL3	0.07	0.07	0.09	−0.10	0.24	0.85
Hauling Cost Structure*Education (p value = 0.57)						
HAUL1*[< 13 Years Education]	−0.13	−0.04	0.103	−0.245	0.158	−0.424
HAUL1*[13−16 Years Education]	−0.03	0.06	0.101	−0.136	0.261	0.613
HAUL1*[> 16 Years Education]	−0.11	−0.02	0.118	−0.249	0.212	−0.157
HAUL2*[< 13 Years Education]	−0.03	−0.05	0.109	−0.260	0.168	−0.419
HAUL2*[13−16 Years Education]	0.08	0.06	0.107	−0.147	0.272	0.583
HAUL2*[> 16 Years Education]	0.00	−0.02	0.123	−0.258	0.224	−0.135
HAUL3*[< 13 Years Education]	0.16	0.09	0.087	−0.081	0.260	1.028
HAUL3*[13−16 Years Education]	−0.05	−0.12	0.088	−0.297	0.048	−1.416
HAUL3*[> 16 Years Education]	0.11	0.04	0.123	−0.207	0.277	0.285
Quality Premium*Herd Size (p value = 0.63)						
QUALPREM1*[< 100 Cows]	0.07	−0.11	0.10	−0.31	0.09	−1.12
QUALPREM1*[100−499 Cows]	0.14	−0.04	0.10	−0.24	0.17	−0.34
QUALPREM1*[500−999 Cows]	0.39	0.21	0.14	−0.07	0.49	1.46
QUALPREM1*[≥ 1000 Cows]	0.12	−0.06	0.10	−0.27	0.14	−0.58
QUALPREM2*[< 100 Cows]	0.08	0.13	0.10	−0.08	0.33	1.22
QUALPREM2*[100−499 Cows]	0.04	0.09	0.11	−0.12	0.29	0.85
QUALPREM2*[500−999 Cows]	−0.19	−0.14	0.15	−0.42	0.15	−0.92
QUALPREM2*[≥ 1000 Cows]	−0.13	−0.08	0.13	−0.33	0.17	−0.62
QUALPREM3*[< 100 Cows]	−0.14	−0.01	0.14	−0.30	0.27	−0.08
QUALPREM3*[100−499 Cows]	−0.18	−0.05	0.11	−0.26	0.15	−0.52
QUALPREM3*[500−999 Cows]	−0.20	−0.07	0.14	−0.35	0.21	−0.52
QUALPREM3*[≥ 1000 Cows]	0.01	0.14	0.13	−0.11	0.39	1.11

Note: CI = Confidence Interval for Conditional Logit Model.

Table B3
Interaction Effects model results, Hierarchical Bayes Adjusted, in order of importance and statistical significance ($N = 2400$).

Attribute Level	Marginal Utility	Posterior Mean [a]	CI Lower 95 % [b]	CI Upper 95 % [b]
Gross Handler Pay Price				
PRICE1	−1.15	−1.15	−1.50	−0.84
PRICE2	−0.48	−0.48	−0.88	−0.11
PRICE3	−0.05	−0.05	−0.42	0.34
PRICE4	0.46	0.46	0.15	0.85
PRICE5	1.23	1.23		
Volume Premium*Herd Size				
VOLPREM1*[< 100 Cows]	−0.94	−0.87	−1.42	−0.37
VOLPREM1*[100−499 Cows]	−0.41	−0.33	−0.86	0.27
VOLPREM1*[500−999 Cows]	0.39	0.47	−0.48	1.25
VOLPREM1*[≥ 1000 Cows]	0.65	0.73		
VOLPREM2*[< 100 Cows]	−0.00	−0.53	−1.01	0.02
VOLPREM2*[100−499 Cows]	0.39	−0.14	−0.92	0.62
VOLPREM2*[500−999 Cows]	0.68	0.15	−0.96	1.15
VOLPREM2*[≥ 1000 Cows]	1.05	0.52		
VOLPREM3*[< 100 Cows]	0.95	1.39		
VOLPREM3*[100−499 Cows]	0.02	0.47		
VOLPREM3*[500−999 Cows]	−1.06	−0.61		
VOLPREM3*[≥ 1000 Cows]	−1.70	−1.25		
Handler Business Structure				
HANDS1	0.57	0.57	0.207	1.020
HANDS2	−0.57	−0.57		
Hauling Cost Structure*Herd Size				
HAUL1*[< 100 Cows]	−0.09	0.03	−0.50	0.52
HAUL1*[100−499 Cows]	−0.04	0.09	−0.50	0.91

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Table B3 (*continued*)

Attribute Level	Marginal Utility	Posterior Mean [a]	CI Lower 95 % [b]	CI Upper 95 % [b]
HAUL1*[500−999 Cows]	0.28	0.40	−0.36	1.14
HAUL1*[≥ 1000 Cows]	−0.65	−0.53	−0.18	0.85
HAUL2*[< 100 Cows]	0.08	0.31	−0.23	0.85
HAUL2*[100−499 Cows]	0.05	0.28	−1.08	0.27
HAUL2*[500−999 Cows]	−0.58	−0.35		
HAUL2*[≥ 1000 Cows]	−0.48	−0.24		
HAUL3*[< 100 Cows]	0.01	−0.35		
HAUL3*[100−499 Cows]	−0.01	−0.37		
HAUL3*[500−999 Cows]	0.31	−0.05		
HAUL3*[≥ 1000 Cows]	1.13	0.77		
Quality Premium*Education				
QUALPREM1*[< 13 Years Education]	−0.17	−0.46	−01.00	0.30
QUALPREM1*[13−16 Years Education]	0.82	0.53	−0.17	1.07
QUALPREM1*[> 16 Years Education]	0.22	−0.07		
QUALPREM2*[< 13 Years Education]	0.06	0.29	−0.31	1.00
QUALPREM2*[13−16 Years Education]	0.11	0.35	−0.36	0.94
QUALPREM2*[> 16 Years Education]	−0.88	−0.64		
QUALPREM3*[< 13 Years Education]	0.12	0.17		
QUALPREM3*[13−16 Years Education]	−0.93	−0.88		
QUALPREM3*[> 16 Years Education]	0.66	0.71		
Volume Premium*Experience				
VOLPREM1*[< 10 years]	0.13	0.21	−0.31	0.83
VOLPREM1*[10−30 years]	−0.25	−0.17	−0.67	0.34
VOLPREM1*[> 30 years]	−0.12	−0.04		
VOLPREM2*[< 10 years]	1.05	0.52	−0.23	1.17
VOLPREM2*[10−30 years]	0.26	−0.27	−0.71	0.21
VOLPREM2*[> 30 years]	0.28	−0.25		
VOLPREM3*[< 10 years]	−1.18	−0.73		
VOLPREM3*[10−30 years]	−0.01	0.44		
VOLPREM3*[> 30 years]	−0.16	0.29		
Handler Business Structure*Education				
HANDS1*[< 13 Years Education]	0.41	−0.16	−0.67	0.41
HANDS1*[13−16 Years Education]	0.68	0.11	−0.44	0.58
HANDS1*[> 16 Years Education]	0.62	0.05		
HANDS2*[< 13 Years Education]	−0.41	0.16		
HANDS2*[13−16 Years Education]	−0.68	−0.11		
HANDS2*[> 16 Years Education]	−0.62	−0.05		
Handler Business Structure*Experience				
HANDS1*[< 10 years]	0.27	−0.30	−0.84	0.21
HANDS1*[10−30 years]	0.63	0.06	−0.37	0.57
HANDS1*[> 30 years]	0.81	0.24		
HANDS2*[< 10 years]	−0.27	0.30		
HANDS2*[10−30 years]	−0.63	−0.06		
HANDS2*[> 30 years]	−0.81	−0.24		
Quality Premiums				
QUALPREM1	0.29	0.29	−0.17	0.81
QUALPREM2	−0.24	−0.24	−0.70	0.31
QUALPREM3	−0.05	−0.05		
Volume Premium*Education				
VOLPREM1*[< 13 Years Education]	0.19	0.27	−0.22	0.84
VOLPREM1*[13−16 Years Education]	0.10	0.18	−0.46	0.75
VOLPREM1*[> 16 Years Education]	−0.53	−0.45		
VOLPREM2*[< 13 Years Education]	0.27	−0.26	−0.82	0.22
VOLPREM2*[13−16 Years Education]	0.25	−0.28	−0.89	0.33
VOLPREM2*[> 16 Years Education]	1.07	1.51		
VOLPREM3*[< 13 Years Education]	−0.47	−0.02		
VOLPREM3*[13−16 Years Education]	−0.35	0.10		
VOLPREM3*[> 16 Years Education]	−0.53	−0.09		
Volume Premiums				
VOLPREM1	−0.08	−0.08	−0.64	0.39
VOLPREM2	0.53	0.53	0.15	0.88
VOLPREM3	−0.45	−0.45		
Handler Business Structure*Herd Size				
HANDS1*[< 100 Cows]	0.62	0.05	−0.50	0.52
HANDS1*[100−499 Cows]	0.34	−0.23	−0.81	0.50
HANDS1*[500−999 Cows]	1.05	0.48	−0.28	1.11
HANDS1*[≥ 1000 Cows]	0.27	−0.30		
HANDS2*[< 100 Cows]	−0.62	−0.05		
HANDS2*[100−499 Cows]	−0.34	0.23		
HANDS2*[500−999 Cows]	−1.05	−0.48		
HANDS2*[≥ 1000 Cows]	−0.27	0.30		
Quality Premium*Experience				
QUALPREM1*[< 10 years]	0.53	0.24	−0.26	0.82
QUALPREM1*[10−30 years]	0.24	−0.04	−0.43	0.29
QUALPREM1*[> 30 years]	0.10	−0.19		
QUALPREM2*[< 10 years]	−0.22	0.02	−0.45	0.50

(*continued on next page*)

Table B3 (*continued*)

Attribute Level	Marginal Utility	Posterior Mean [a]	CI Lower 95 % [b]	CI Upper 95 % [b]
QUALPREM2*[10−30 years]	−0.41	−0.17	−0.55	0.23
QUALPREM2*[> 30 years]	−0.09	0.14		
QUALPREM3*[< 10 years]	−0.31	−0.26		
QUALPREM3*[10−30 years]	0.16	0.21		
QUALPREM3*[> 30 years]	−0.00	0.05		
Hauling Cost Structure*Experience				
HAUL1*[< 10 years]	−0.03	0.09	−0.43	0.55
HAUL1*[10−30 Years]	−0.24	−0.12	−0.68	0.46
HAUL1*[> 30 years]	−0.10	0.03		
HAUL2*[< 10 years]	−0.38	−0.15	−0.77	0.54
HAUL2*[10−30 Years]	−0.04	0.19	−0.33	0.68
HAUL2*[> 30 years]	−0.28	−0.05		
HAUL3*[< 10 years]	0.41	0.06		
HAUL3*[10−30 Years]	0.28	−0.08		
HAUL3*[> 30 years]	0.38	0.02		
Hauling Cost Structure				
HAUL1	−0.13	−0.13	−0.68	0.46
HAUL2	−0.23	−0.23	−0.69	0.22
HAUL3	0.36	0.36		
Hauling Cost Structure*Education				
HAUL1*[< 13 Years Education]	−0.12	0.01	−0.64	0.54
HAUL1*[13−16 Years Education]	0.27	0.39	−0.24	0.98
HAUL1*[> 16 Years Education]	−0.53	−0.40		
HAUL2*[< 13 Years Education]	−0.13	0.10	−0.55	0.79
HAUL2*[13−16 Years Education]	0.09	0.32	−0.25	0.84
HAUL2*[> 16 Years Education]	−0.66	−0.43		
HAUL3*[< 13 Years Education]	0.25	−0.11		
HAUL3*[13−16 Years Education]	−0.36	−0.71		
HAUL3*[> 16 Years Education]	1.18	0.83		
Quality Premium*Herd Size				
QUALPREM1*[< 100 Cows]	0.33	0.04	−0.54	0.59
QUALPREM1*[100−499 Cows]	0.25	−0.04	−0.65	0.72
QUALPREM1*[500−999 Cows]	0.44	0.15	−0.73	0.92
QUALPREM1*[≥ 1000 Cows]	0.15	−0.14		
QUALPREM2*[< 100 Cows]	−0.17	0.07	−0.48	0.59
QUALPREM2*[100−499 Cows]	0.15	0.39	−0.29	1.11
QUALPREM2*[500−999 Cows]	−0.90	−0.67	−1.36	0.07
QUALPREM2*[≥ 1000 Cows]	−0.03	0.21		
QUALPREM3*[< 100 Cows]	−0.16	−0.11		
QUALPREM3*[100−499 Cows]	−0.40	−0.35		
QUALPREM3*[500−999 Cows]	0.47	0.52		
QUALPREM3*[≥ 1000 Cows]	−0.12	−0.07		

Note: CI = Credible Interval for Hierarchical Bayes (HB) models.

[a] Posterior means estimated using 10,000 iterations.

[b] HB models including multiple interaction terms are more sensitive across the iterative process thereby limiting the ability to obtain CI ranges for all variables. It does not impact the estimation of marginal utility values or posterior means. Statistical significance can be approximated by evaluating the confidence intervals within the conditional logit results (Table B2), while recalling the interpretation of significance for "middle category" attributes as discussed in the main text.

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