The Effects of Cooperative Competition on Member Loyalty

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1. Introduction

Membership loyalty is the inherent challenge of the cooperative model. All forms of collective action must provide the right incentives for members to prevent defection and free-riders (Olson). The marginal benefits from cooperation for the individual must exceed the benefits gained from the alternative—non-cooperation. In the considerable body of literature that analyzes membership commitment to agricultural cooperatives, the non-cooperative alternative for farmers is to sell on a spot-market or patronize an investor-owned firm (e.g., Albaek and Schultz; M. Fulton; Fulton and Giannakas; Karantininis and Zago; Sexton 1986 and 1990; and Zeuli and King). In principle, cooperatives are not supposed to directly compete with each other. The concept of solidarity is as old as the cooperative model and is still promoted in internationally recognized cooperative principles.[1] However, the success of agricultural cooperatives in the US means that in many industries and markets cooperatives are competing with other cooperatives. For example, in the major dairy production states of California, Wisconsin, and Minnesota, more than 50 dairy cooperatives may compete annually for farmer's milk.[2] The effect of such cooperative competition on member loyalty has not yet been explored in the literature.

The findings from most of the studies analyzing the non-pecuniary determinants of cooperative membership loyalty are no longer relevant when cooperatives rather than investor-owned firms (IOFs) are testing that loyalty. For example, the degree of membership homogeneity, which is generally considered a primary factor in determining cooperative commitment (Fulton and Giannakas; Izraeli, Pizam, and Neumann), would be similar for most

[1] The sixth cooperative principle adopted by the International Cooperative Alliance in 1995 is "cooperation among cooperatives."
[2] The cooperatives that are competing include those incorporated in the state as well as those headquartered elsewhere that have national memberships (e.g., Land O'Lakes in Minnesota or DFA in Missouri).

cooperatives competing in a single industry. Likewise, these cooperatives would also be comparable in terms of other factors such as their locality and community involvement (Fulton). If the cooperatives are large firms (e.g., Land O'Lakes, it buys its milk from farmers of different states) and they are competing for non-local commodities, many members will not live in the same community in which the cooperative is located, thus negating the importance of these variables. Further, the idea that members are more likely to be loyal to a cooperative if they value the ideological concept of a cooperative business (M. Fulton) is only salient when the alternative is a non-cooperative. We know from standard game theory models of cooperatives that members will defect when the returns associated with such a strategy exceed the cooperative returns (Staatz, J. Fulton). Therefore, if another similar cooperative offers better financial returns than the member is receiving from their current cooperative, we would expect that member to defect. The financial returns would be the only differentiation between the alternative pay-offs.

We analyze the issue of membership loyalty in the presence of cooperative competition in the context of the dairy industry in Wisconsin. Cooperatives have a long, strategic history in the dairy sector and now capture a significant market share, which makes it a compelling industry to study the effects of their competition. In addition, since the commodity is perishable it is essentially marketed every day by the farmer yet there are few legally binding supply contracts. In general, farmers enter into annual supply contracts with a milk buyer but either party can terminate the contract before renewal with some advance notice, which may be as little as a few days. In markets with excess dairy manufacturing capacity (i.e., the demand for milk outstrips supply), the competition for milk can be intense; this has been the situation in recent years in both Minnesota and Wisconsin and may soon be happening in California as well. As a result, the opportunities for member disloyalty in such dairy sectors are high.

We use a unique data set collected from a comprehensive survey of 724 dairy farmers in Wisconsin in 2003 that is representative at the state level. The survey elicited responses about operator demographics as well as farm characteristics, including milk marketing patterns. Our data shows that 27 percent of the sample switched buyers at some point during 1997-2001. Of this group, 49 percent were co-op members. The co-op members who switched milk buyers generally chose another cooperative (68 percent of the sample of co-op members that switched). This suggests that there is a group of farmers that are more loyal to the cooperative model than to a single cooperative. We estimate three separate logit models that empirically explore the determinants of switching milk buyers. We are especially interested in finding out whether co-op members are less likely to switch milk buyers than non-co-op members and for those co-op members who are switching milk buyers, whether they are choosing another co-op or an IOF. The answers to these questions are important to the dairy industry as well as to cooperatives in general.

The remainder of the paper proceeds as follows. In the following section we present a simple theoretical model that explores the loyalty incentives dairy farmers confront in the presence of cooperative competition. We describe our empirical models in section three, followed by a description of the data in section four. The results are discussed in section five and we conclude with a brief summary of the article's findings on member loyalty with competing cooperatives.

2. Theoretical Hypotheses

Consider a single period duopsony model with a representative dairy farmer and two competing milk buyers. The firms provide the same goods and service to the farmer and offer

contracts that may only differ in terms of premium/discount schedules.[3] The contract is exclusive and requires the farmer to sell her entire milk supply to the firm but it is not binding. These contracting terms are consistent with standard dairy contracting protocol and justify the use of a single-period model. The farmer chooses a marketing strategy that maximizes her net profit function. We assume the dairy farmer produces a single commodity (milk) that can only be sold under contract to one of the two competing firms (i.e., there is no spot market).

The farmer's net profit function contains two benefit streams: *X* and *Y*. The first, *X*, represents the revenue from selling all of her milk *Q* to either firm 1 or 2:

(1) $$X = \delta P^1 Q + (1-\delta) P^2 Q.$$

Therefore, P^1 represents the contract premium/discount schedule offered by firm 1 and P^2 represents the schedule offered by firm 2. The farmer's discrete marketing choice is represented by the binary variable $\delta = [0,1]$.

The farmer also receives some returns associated with their membership to a cooperative. We let *Y* represent the direct returns from the farmer's investment in cooperatives:

(2) $$Y = R + E,$$

where *R* represents the annual cash patronage refunds from the cooperatives and *E* the discounted future stream of equity returns. More precisely, the cash patronage refunds can be specified as follows:

(3) $$R = \delta \frac{Q_i^1}{\sum_j Q_j^1}(\Pi^1) + (1-\delta)\frac{Q_i^2}{\sum_j Q_j^2}(\Pi^2),$$

[3] Milk buyers compete on premiums and discounts because the base price is set by federal marketing policies. Premiums may be based on volume or quality attributes beyond those specified in the federal order, while discounts may be applied to fixed pick-up charges and quantity-based hauling costs (Hughes and Jesse). The supply contracts for milk include a guaranteed premium/discount schedule for the duration of the contract.

where Q_i^k represents our individual farmer *i*'s quantity of milk sold to cooperative *k* (*k* = 1, 2) and $\sum_j Q_j^k$ represents the total quantity of milk cooperative *k* purchases from all its members *J* (*j* = 1, 2, …, *J*) where $i \in J$. This patronage ratio is multiplied by cooperative *k*'s net profits allocated to cash patronage refunds Π^k to achieve the patronage refunds returned to farmer *i*. In the case of a mixed duopsony (cooperative competing with an IOF), let firm 1 represent the cooperative and firm 2 the non-cooperative. Therefore, when $\delta = 0$ the farmer will be selling her milk to the IOF, then R (the term that represents cash patronage refund) will not longer be relevant, since IOFs do not distribute profits with their milk providers.

The discounted future stream of equity returns *E* includes the hazard of losing all future annual equity redemption payments *TE,* where *TE* represents the total allocated equity member *i* has accumulated in the cooperative over time. More specifically, the equity return will be a hazard function with hazard rate *m* that is some decreasing function of the cooperative's total patronage level from all members; the more the members patronize the cooperative, the less likely it will fail. The equity return function has the following functional form:

$$(4) \qquad E = \int_0^s TE^k e^{-(m(\sum_j Q_j^k)+r)s}\, ds = \frac{TE^k}{m(\sum_j Q_j^k)+r}$$

where *r* is the discount rate and *s* the total number of years the member's equity is held by the local cooperative.[4] Our specification conveys a free-rider incentive; the farmer *i* will receive her annual equity redemption as long as all other members patronize the cooperative (assuming their patronage is large relative to *i*'s patronage).

The farmer's decision problem can be fully specified as follows:

[4] We assume first-in, first-out equity redemption policy. If we change this to an ad hoc redemption policy, e.g., based on retirement age, the results will change.

(5) $$\max_{\delta} \Pi = \max_{\delta} X + R + E - F,$$

where F represents the fixed costs associated with producing Q. We assume these are the only production costs and that the marketing decision does not convey any change in costs (e.g., a different hauling cost or pick-up charge based on the distance from the firm to the farm). The fixed cost assumption is justified because we are not considering any change in total milk production Q; it is also fixed. The costs associated with transporting milk are clearly a function of distance and thus, one might expect the costs to vary with the choice of milk buyer. However, in some markets, such as Wisconsin, there are still many milk buyers within a single trade territory meaning the change in distance (or hauling charges) would be negligible. Even in more spatially segregated markets, like California, many milk buyers may waive the transport fees as part of the incentive package they offer new customers.

In the case of a mixed duopsony, the farmer will only be enticed to switch to or continue patronizing a cooperative (firm 1) over the IOF under the following conditions:

(6) $$P^1 Q + \frac{Q_i^1}{\sum_j Q_j^1}(\Pi^1) + \frac{TE^1}{m(\sum_j Q_j^1) + r} > P^2 Q + \frac{TE^1}{m(\sum_{j-i} Q_j^1) + r}.$$

The farmer will not receive any patronage refunds from the cooperative if she does not sell any milk to it, however, they will still receive equity redemption as long as other members patronize the firm (i.e., as long as it is not dissolved and has sufficient profits to return allocated equity). Actually, that is the case in our model, since we assume that only the analyzed farmer switch milk buyer (the others do not switch). Since the hazard rate m is a decreasing function of total member patronage, the equity term on the left hand side of the equation is greater than the one on the right hand side. The relative weight of the equity term depends on the total equity (TE) member i has accumulated in the cooperative; i.e., it is a function of their historic loyalty. For

example, consider the case of a farmer who has never sold milk to a cooperative before. Equation (6) is reduced to the following:

$$(6a) \qquad P^1Q + \frac{Q_i^1}{\sum_j Q_j^1}(\Pi^1) > P^2Q$$

The weight of the equity term also depends on its marginal contribution to the member's profit function. For some farmers, this investment will be relatively small.

In the case of two cooperatives competing for the farmer's milk, the farmer will only be enticed to switch to or continue patronizing the same cooperative (firm 1) over a different cooperative (firm 2) under the following conditions:

$$(7) \qquad P^1Q + \frac{Q_i^1}{\sum_j Q_j^1}(\Pi^1) + \frac{TE^1}{m(\sum_j Q_j^1) + r} > P^2Q + \frac{Q_i^2}{\sum_j Q_j^2}(\Pi^2) + \frac{TE^2}{m(\sum_j Q_j^2) + r} + \frac{TE^1}{m(\sum_{j-i} Q_j^1) + r}$$

In this case, the loyalty decision is also a function of the relative magnitude of the total equity built up in each cooperative and the cooperative's ability to redeem equity and the relative significance of member *i* to the total patronage of each cooperative. Note that we are assuming that the farmer has a history with firm 1 only. Indeed, to keep things simple, we are excluding the possibility that the farmer was a supplier of firm 2 at some moment in the past and switched to firm 1 and now is analyzing the possibility of switch to firm 2.

In both scenarios, the contract terms offered by the competing firms (P^1 and P^2) are clearly significant factors in the farmer's decision to switch milk buyers. We expect larger farmers (those with greater Q's) to receive more and better offers since the milk buyers are competing for product and, therefore, the most significant premiums they offer are based on volume.

3. Econometric Estimation

We estimate two models that test the influence of various farmer demographics and farm characteristics on the propensity to switch milk buyers. The first model uses a binary logit that explores the factors that determine switching regardless of firm structure. The second estimation employs a multinomial logit that separates the farms into three different switching categories to analyze the factors that affect switching to cooperative versus non-cooperative buyers.

We adopt a standard index model (Wooldridge) and assume the decision to switch buyers is a straightforward function of the farmer's cost-benefit comparison of the current buyer and the new buyer, or "suitor." This model formulation has been used to analyze other farm management decisions, e.g., technology adoption (Barham, Foltz, Jackson-Smith, and Moon, 2004). The marginal benefit associated with switching to a new buyer can be specified as an unobservable latent variable y_i^* :

(8) $$y_i^* = \beta' x_i + \varepsilon_i ,$$

where i signals the individual farmer ($i = 1, 2, \ldots, n$), the vector x^i represents the observed explanatory variables, β is a vector of parameters, and ε_i is an error term. We observe the farmer's decision to switch milk buyers, but not the actual marginal benefit y_i^* associated with the switch to the new buyer. Therefore, we define the index function as follows:

$$y_i = 1 \quad \text{if } y_i^* > 0$$
$$y_i = 0 \quad \text{if } y_i^* \le 0.$$

The probability of switching can thus be specified as function of the observed explanatory variables:

(9) $$\mathrm{P}(y_i = 1 \,|\, \mathbf{x}) = \mathrm{P}(y_i^* > 0 \,|\, \mathbf{x}) = G(\boldsymbol{\beta}'\mathbf{x}_i) ,$$

where $G(\beta' x_i)$ is a logistic function and ε_i has a standard logistic distribution.

If we let $s = 0, 1, \ldots, S$ represent the various unordered switching outcomes, we can define the binary outcomes as follows for our first model:

$$s = 0 \quad \text{if } y_i^* \leq 0 \quad \text{No switching}$$
$$s = 1 \quad \text{if } y_i^* > 0 \quad \text{Switch to a new buyer.}$$

We can define the outcomes for the multinomial logit in our second model in a similar fashion:

$$s = 0 \quad \text{if } y_i^* \leq 0 \quad \text{No switching}$$
$$s = 1 \quad \text{if } y_i^{c*} > 0 \quad \text{Switch to a new buyer that is a co-op}$$
$$s = 2 \quad \text{if } y_i^{f*} > 0 \quad \text{Switch to a new buyer that is an IOF,}$$

with the addition that in this model the marginal benefits are calculated separately for the situation where the new buyer is a cooperative *c* and where the new buyer is an investor-owned firm (IOF) *f*. The multinomial logit specification (versus a nested logit) appropriately models the non-sequential nature of the farmer's decision. A farmer typically does not decide to switch milk buyers in absence of an offer from a new firm, a suitor. In other words, they do not decide to switch first and then decide which type of firm to sell their milk to. Their decision to switch is inexorably linked to the type of firm making the offer to buy their milk.[5]

The vector of explanatory variables is consistent across both models and includes farmer and farm characteristics; descriptive statistics are provided in the following section. To avoid the endogeneity issue, when relevant we use explanatory variables from the first or baseline period (1997) to predict the probability of switching buyers any time over the next five years (1997-2001). The drawbacks associated with this method are minimal since the farm and farmer characteristics do not dramatically change between 1997 and 2002 or change only by a constant (e.g., age).

[5] Alternatively, we could model a multinomial logit with six separate outcomes (non switch, switch to a dairy farmer cooperative, switch to an independent cheese plant, switch to other independent milk processor, switch to an independent milk hauler/handler, switch to other typo of milk buyer), but insufficient data for each option prevented such an analysis.

The explanatory variables include herd size, quality of milking facilities, herd growth, and retirement, which all serve as proxies for *Q*. Given our simple theoretical exposition in section two, we expect all of these variables, to have a positive influence on the farmer's decision to switch because they will all entice better offers (higher *P*'s) from competing firms. We expect the farmers who retired during the period they reported switching milk buyers to have a negative effect on the decision to switch. The explanatory variables also include farm debt and a history of selling to cooperatives, which serve as proxies for the relative importance of the returns on equity to the farmer. History of selling to cooperatives also serves as a proxy of ideology (M. Fulton). We expect farmers with a history of selling to cooperatives to be less likely to switch from a cooperative to a non-cooperative since they would want to ensure their allocated equity (which would be greater than if they had no history of selling to cooperatives) would be returned and they may have ideological reasons to keep selling to cooperatives. The importance of price in the farmer's decision to switch milk buyers is also included. We expect this to be a positive and significant variable in the generic switching decision, but to be less significant in the decision to switch from a cooperative to another firm. We include several other variables (e.g., farmer age and gender) to explore their possible influence on the decision to switch buyers.

In order to test the significance of some variables identified by cooperative scholars as determinants of members un-loyalty (defect decision in a simple prisoner's dilemma game, see Staatz and J. Fulton), we limit our sample to those farmers who used to sell to cooperatives (i.e., cooperative members) and estimate a binary logit model that analyzes the determinants of the switching decision. Therefore, instead of using the full set of explanatory variables, we only include those variables most commonly identified as significant predictors of loyalty in the

literature: farm size, farm debt, milk price, and the location of the cooperative in the farmer's community. We expect debt to positively affect the decision of co-op members to switch milk buyers, since the hypothesis is that highly indebted farmers discount more heavily the future, considering primarily present returns and not the long run benefits of their membership. We also expect that those farmers that want to patronize their local cooperative (indicator of ideology) will be less likely to switch their milk buyer. On the contrary, those that mostly care about the current price will be less likely to switch milk buyer (this variable may be an indicator of a high discount rate, and then play the same role as debt, or a proxy of lack of ideology regarding cooperatives). Finally, size is assumed to positively affect the switching decision, since the largest farmers are probably less dependent of their local economy and more tempted by non-local milk buyers.

4. Data Collection and Descriptive Statistics

We use a unique data set collected from a comprehensive survey of 762 dairy farmers in Wisconsin in 2003.[6] The survey elicited responses about operator and household demographics as well as farm characteristics, including technology adoption, management practices and financial returns. Several questions specifically addressed milk marketing patterns at the farm level and most questions covered 1997 and 2002. Basic summary statistics for the sample, which is representative at the state level, are provided in table 1. The average farmer in our sample is 48 years old and has completed 12.5 years of school. Nearly the entire sample (93 percent) is male and married (84 percent) and comes from a farm family (89 percent).

[6] The survey was conducted by the Program on Agricultural Technology Studies (PATS) at the University of Wisconsin – Madison. Surveys were mailed to 1,694 randomly selected Wisconsin dairy farms; 45 percent (762) were completed by active dairy farmers (i.e., those milking cows on their farm in 2002). We only include data from the surveys completed by the primary farm operator (724). The sample represents farms where dairy is the primary enterprise (on average for the sample, dairy accounted for 87% of farm cash receipts in 1997) and farming is the main source of household income (on average for the sample, farm enterprises also accounted for 87% of household income in 1997).

The average farm had a 66-cow dairy herd in 1997, which was typical for Wisconsin at the time, although the sample also captured extremely large and small farms. On average, the herds in the sample grew by 234% percent during 1997-2002. Note that this variable is highly affected by some farmers who went from practically no herd in 1997 to significant herd in 2002 (those may be called new operators). Almost 32 percent of the sample reported that they had made some improvement in their milking facilities since 1997. However, 24 percent said they expected to retire before 2007. The average farm reported an annual household income (pre-tax) of nearly $62,000 and over 20 percent of the sample reported a debt-to-asset ratio that exceeded 40 percent.

In terms of marketing, 62 percent of the sample sold their milk to a cooperative during 1997-2001. Price was reported as one reason for switching milk buyers by 60 percent of the sample, while the location of the existing or new milk buyer was one reason for only 22 percent of the sample. When comparing the sub-samples of the farmers who switched milk buyers during 1997-2001 (27 percent of the sample) with those who did not switch (73 percent), there are only a few substantial differences. As expected, the farmers that switched milk buyers had larger herds on average and reported higher growth rates, but surprisingly fewer made improvements in their milk facilities. This may be explained by the fact that many in this sub-group had already modernized their facilities prior to 1997 (i.e., they comprise more modern dairy farms).

For the sub-sample that did not switch, a higher percentage previously sold to cooperatives and not surprisingly price was a significant factor for fewer of the group's farmers while location of the firm was a significant factor for more of the group when compared to the farmers who did switch buyers. The details on who farmers sold to and switched to are reported in table 2. Over half the sample (63 percent) sold their milk to a dairy cooperative in 2002,

compared to 62 percent in 1997.[7] Therefore, on the surface, this seems to be a fairly loyal group of dairy farmers. However, a fairly substantial proportion of the cooperative members who switched, switched from one cooperative to another (68 percent). The farmers reported selling to 92 different firms; roughly one-third (32) of which are cooperatives (table 3).

Why did they switch buyers? Our data suggests that farmers were largely induced to switch by competing firms (i.e., they were pulled rather than pushed). The farmers that switched were asked to mark all of the reasons they switched buyers as well as the single most important reason (table 4). The most important factor was clearly "better prices." This response captured nearly 30 percent of all responses and was listed by 38 percent of the sample as the single most important reason. The farmers who did not switch buyers were asked the reasons behind their loyalty and here as well price was the predominant factor (table 5). The response "My current buyer offers very competitive prices" comprised 36 percent of all responses and 40 percent of the sample reported that it was the single most important reason for their loyalty. The two binary explanatory variables "price relevance" and "local relevance" (table 1) were created based on the responses reported in tables 5 and 6. Indeed, "price relevance" is a dummy variable that takes the value 1 when the farmer checked price as a reason to switch milk buyer (if he did switch) or to be loyal (if he did not switch milk buyer). In the same fashion, "local relevance" is a dummy variable that takes the value 1 when the farmer checked location of the milk buyer as a reason to switch milk buyer or to be loyal.

[7] Although not reported, we tested the difference in means for the variables reported in table 1 between two sub-samples: the farmers who usually sold their milk to a co-op and those who usually sold to non-cooperatives. There were no significant differences between the two groups for most of the variables. The only significant variables were "switch" and "switch specified."

5. Results and Discussion

The results from the binomial logit model that analyzed the decision to switch milk buyers regardless of firm structure are reported in table 6. The most interesting finding is that the farmers who previously sold their milk to a cooperative were significantly less likely (by a factor of 13 percent) to switch milk buyers than the dairy farmers who normally sold their milk to IOFs, as we expected. Also, as we predicted, farms with larger herds were significantly more likely to switch milk buyers, although the magnitude of the marginal effect is quite small (less than 1 percent). Farmers that consider price as an important reason to switch or to be loyal to their milk buyers are significantly more likely to switch. Finally, age is weakly significant but has a different sign than we expected; older farmers are more likely to switch milk buyers. This may be explained by reasoning that as farmers near retirement they will want to maximize their returns.

The results from the multinomial logit model that analyzed the decision to switch accounting for different firm structure (Y=0 not switch milk buyer, Y=1 switch to a milk buyer that is a co-op, Y=2 switch to a milk buyer that is an IOF) are reported in table 7. Our results show several significant differences between the farmers that do not switch and those that do. We also find significant differences between the farmers that switch to a co-op and those that switch to an IOF. The farmers that don't switch have significant smaller dairy herds than those that switch to a cooperative. Further, those that don't switch are significantly more likely to have a history of selling to cooperatives, are older, have lower herd's growth rates and are more likely to be indebted than the farmers who switch to an IOF buyer. Perhaps the most interesting finding is that a history of selling to cooperatives is only a significant factor in determining switching to a non-cooperative. The coefficient estimate is also negative for switching to a cooperative, but

the magnitude is substantially smaller and it is not significant at the normal confidence levels. This result suggests that a history of selling to cooperatives leads to greater loyalty with milk buyers.

The results from the estimation of the binomial logit with the co-op member sub-sample are reported in table 8. The only significant variable is price relevance, which has a positive effect on the probability of switching, as expected. Neither debt nor size nor location were significant.[8]

6. Conclusion

The success of dairy cooperatives in the US has bred aggressive cooperative competition in some markets, including Wisconsin and Minnesota. We analyzed the effects of such competition on member loyalty using a unique data set from Wisconsin dairy farmers. We find that indeed, cooperatives are competing against each other for member business. The farmers in our sample reported selling to 92 different firms; roughly one-third of which are cooperatives and the majority of the sample (60 percent) sells to a cooperative. Interestingly, in spite of the competition, a relatively small portion of the sample (27 percent) reported switching milk buyers during 1997-2001, a time when competition for milk was especially fierce in Wisconsin. This supports previous studies (McDonald) that suggest that milk producers are effectively under contract because of the prohibitive costs associated with marketing their commodity on a daily basis. However, of the co-op members that switched firms, 68% percent chose another cooperative.

Our empirical results show that co-op members who have historically sold their milk to cooperatives are less likely to switch milk buyers in general, while older farmers with larger farms (in terms of herd size) are more likely to switch. When we consider the type of firm they

[8] Reduced forms of the regression were also estimated but none produced any additional significant variables.

switch to (cooperative or IOF), different factors affect their switching decision. Again, larger farms are more likely to switch to a cooperative. Farms that grew during 1997-2002 and have a farm debt-to-asset ration greater than 40 percent were more likely to switch to an IOF, while those who had a history of selling to cooperatives were less likely to switch to an IOF. These results suggest that cooperative members are loyal to the cooperative model but not necessarily to a specific cooperative. Cooperative members are less likely to switch milk buyers than non-co-op members in general. Further, they are less likely to switch when the firm that is trying to lure them away is an IOF and not a cooperative. When analyzing the sub-sample of cooperative members, the only significant determinant of loyalty was the importance of price to the member. If price was an important variable in their decision to switch milk buyers, the co-op members were more likely to switch.

For cooperatives interested in increasing member loyalty, our findings suggest that they should cooperate with other cooperatives. This would have the added benefit of decreasing their input prices. Further, they should replace general education about co-op benefits with education about their specific co-op benefits. Future research should analyze the effect of firm specific characteristics such as their equity redemption policies and size. As the dairy sector continues to grow while the number of dairy farms decreases, we can only expect more competition.

7. References

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Table 1: Descriptive Statistics for Explanatory Variables (mean and std. deviations)

Variable	Description	Total (N =724)	Switch (N=188)	Not Switch (N=497)
Age	Farmer's age (years)	48.5407 (11.0526)	49.8933 (11.5771)	48.0195 (10.8547)
Gender	=1 if farmer is female; =0 if male	0.0682 (0.2524)	0.0514 (0.2215)	0.0734 (0.2611)
Education	Farmer's education (total years)	12.5406 (2.3351)	12.5843 (2.3134)	12.4881 (2.3894)
Married	=1 if farmer is married; =0 if single	0.8388 (0.3680)	0.8708 (0.3364)	0.8225 (0.3825)
Parents farmed	=1 if parents farmed when farmer was a teenager; =0 otherwise	0.8963 (0.3051)	0.8927 (0.3104)	0.8939 (0.3082)
Herd size 1997	Number of cows 1997	66 (63.8946)	75 (89.3278)	62 (49.2712)
Herd growth[1]	% change in herd size 1997-2002	2.4324 (15.5501)	3.2433 (21.1336)	1.8859 (10.2725)
Milk facility improvement	=1 if made any improvements to milking facilities after 1997; =0 otherwise	0.3195 (0.4666)	0.2697 (0.4450)	0.3290 (0.4704)
Farm debt	=1 if farm debt/asset ratio > 40%; =0 otherwise	0.2212 (0.4154)	0.2515 (0.4352)	0.2127 0.4097
Household income	Total annual income (pre-tax) 2002 ($1,000)	61,946 (55,310)	60,405 (55,797)	61,164 (55,001)
Co-op history	=1 if previous milk buyer in 1997-2001 was a cooperative	0.6222 (0.4852)	0.5111 (0.5013)	0.6626 (0.4733)
Price relevance	=1 if price was given as a reason for switching; =0 otherwise	0.6015 (0.4900)	0.6543 (0.4769)	0.5815 (0.4938)
Local relevance	=1 if location was given as a reason for switching; =0 otherwise	0.2219 (0.4158)	0.1862 (0.3903)	0.2354 (0.4247)

1. Lower bound = -100%. No upper bound; only 4.3% of the sample reported no cows in 1997 (i.e., they were new farmers). On average, the farmers in the sample had 26.4 years of farming experience (age-age when started farming). The experience variable was highly correlated with age (89%) and therefore not included in the regression analysis.

Table 2: Milk Marketing Disloyalty

		Total Sample	Switch	Not Switch
Variable	**Description**	**Mean** (std.deviation)	**Mean** (std.deviation)	**Mean** (std.deviation)
Co-op buyer 2002[1]	=1 if sells milk to a cooperative; =0 otherwise	0.6316 (0.4827)	0.5455 (0.4993)	0.6633 (0.4731)
Co-op buyer 1997	=1 if sells milk to a cooperative; =0 otherwise	0.6222 (0.4852)	0.5111 (0.5013)	0.6626 (0.4733)

1997 buyer—2002 buyer	**N**	**% of Sample**
Non-cooperative→ No switch	167	25%
Non-cooperative→ Non-cooperative	52	8%
Non-cooperative→ Cooperative	35	5%
Cooperative→ No switch	328	49%
Cooperative→ Cooperative	63	9%
Cooperative→ Non-cooperative	29	4%
Total	685	100%

1. The company that purchased most of the farm's milk in 2002.

Table 3: Milk Buyers in Wisconsin

Dairy firm	N	Cooperative?
Ag Price	1	No
Alaska Farmer Co-op	1	Yes
ALTO	45	Yes
AMPI	63	Yes
Antigo Cheese	4	No
Arpin (Simplot)	1	No
Badger Dairies/Swiss Valley Farms	1	No
Baker Cheese	4	No
Belgioioso	5	No
Berner Foods Corp	1	No
Bunkow	1	No
Burnett Dairy	5	Yes
Carr Valley	1	No
Cascade Cheese	3	No
Cassel Garden Co-op	2	Yes
Cedar Grove Cheese	1	No
Cedar Valley Cheese	4	No
Chalet Cheese Coop	2	Yes
Chula Vista	4	No
Clarco Co-op	1	Yes
Con Agra	5	No
Dairy Farmers of America	53	Yes
Dairy State Cheese	6	No
Davisco Co. - LeSueur Cheese, Le Sueur, MN	1	No
Dean	19	No
Decatur Dairy	2	Yes
Dupont Cheese	3	No
Eau Galle Cheese	2	No
Edelweiss	11	No
Ellsworth Co-op	18	Yes
F & A Dairy	4	No
Family Dairies	11	Yes
Fennimore Branch Cheese Coop	1	Yes
Foremost	115	Yes
GAD Cheese	1	No
Grand Meadow Co-op	3	No
Grande	23	No
Grassland	5	No
Hastings Co-op Creamery	2	Yes
Hill Valley Cheese	1	Yes
Hillside Lagranders Dairy	1	No
Hustler Co-op	3	Yes
Independent Butter & Cheese Plant	1	No
K and K Cheese	1	No
Kemps	2	No
Klondike Cheese/ Monroe	1	No
Kraft	10	No
Krohn Dairy	6	No
Lagraders Hillside Dairy	5	No
Lake y Lake	1	Yes
Lamer's Dairy	1	No
Land O' Lakes	38	Yes
Le Sueur Cheese Company	3	No
Liberty Milk	2	No
Linden Cheese	2	No
Lynn Dairy	12	No
Manitowoc Milk Producers Co-op	1	Yes
Marathon Cheese	2	No
Mid AM	1	Yes
Midwest	2	Yes
Mullins	20	No
Nasonville Dairy	10	No
National Farmers Organization	26	Yes
North Herden	1	Yes
Oak Grove Cheese	2	No
Oberweis Dairy	1	No
Old Country Farmers Co-op	7	Yes
Organic Valley	3	Yes
Park Cheese	6	No
Plainview	2	Yes
Prairy Farmers of America	1	Yes
Rosewood Dairy	1	No
Salemville Cheese Co-op	1	Yes
Sartori Foods	2	No
Scenic Central Milk Co-op	1	Yes
Scenic Valley Protein Milk Producers	1	No
Schneider Cheese Inc.	2	No
Sorrento	2	No
Springside Dairy	1	No
Suttners Cheese	1	No
Swiss Valley	31	Yes
Torkelson Cheese	2	No
Trega Foods	14	No
Uplands Cheese	1	No
Verifine	6	No
Wapsie Valley	4	Yes
Weawega Milk Products	1	No
Westby Co-op Creamery	6	Yes
Weyauwega Milk Producers	10	No
White Clover Dairy	9	No
Wisconsin Dairy State	4	No
Zimmerman Cheese	4	No
Total	714	
Total Number of Co-ops		32

Note: the responses (N) represent the entire sample.

Table 4: Reasons for Switching Milk Buyers

All Reasons	**%**
Old buyer was bought out or merged with another business	12%
New buyer is located closer to my farm	5%
New buyer offered better prices	29%
New buyer offered better premiums	20%
New buyer offered lower hauling charges	13%
New buyer was local business I wanted to support	7%
Other	14%
Total	**100%**
Most Important Reason	**%**
Old buyer was bought out or merged with another business	18%
New buyer is located closer to my farm	4%
New buyer offered better prices	38%
New buyer offered better premiums	8%
New buyer offered lower hauling charges	4%
New buyer was local business I wanted to support	6%
Other	22%
Total	**100%**

Table 5: Reasons for Staying with the Same Milk Buyer

All Reasons	**%**
I have too much equity invested in my co-op	14%
My current buyer is a local business I wanted to support	10%
I am loyal to my buyer; we have a good business relationship	11%
Figuring out the benefits of switching is too costly	4%
My current buyer offers very competitive prices	36%
My current buyer offers very competitive services	20%
There have not been any other options	6%
Total	**100%**
Most Important Reason	**%**
I have too much equity invested in my co-op	11%
My current buyer is a local business I wanted to support	14%
I am loyal to my buyer; we have a good business relationship	18%
Figuring out the benefits of switching is too costly	4%
My current buyer offers very competitive prices	40%
My current buyer offers very competitive services	4%
There have not been any other options	9%
Total	**100%**

Table 6: Binomial Logit Analysis of Switching Milk Buyers

Switch Milk Buyer		
Variables	**Coefficient**	**Marginal Effects**
Constant	-2.0443 (-2.278) **	-0.4012
Age	0.0189 (2.0090) **	0.0037
Gender	-0.1516 (-0.3320)	-0.0298
Education	-0.0215 (-0.4880)	-0.0042
Married	0.4047 (1.3650)	0.0794
Parents farmed	0.1226 (0.3490)	0.0241
Herd size 1997	0.0035 (2.0990) **	0.0007
Herd growth	0.0139 (1.5690)	0.0027
Milk facility improvement	-0.1850 (-0.8010)	-0.0363
Farm debt	0.2827 (1.1840)	0.0555
Household income	0.0000 (-0.8700)	0.0000
Co-op history	-0.6368 (-3.0630) ***	-0.1250
Price relevance	0.3727 (1.7360) *	0.0732
Local relevance	-0.1396 (-0.5540)	-0.0274
N		512
Percent correctly predicted		0.7324
Log likelihood function		-288.5581
Chi-squared		29.3867
Significance level		0.0058
Note: "No switch" is the comparison group. T-statistics are in parentheses. *indicates significance at the 10% level; ** indicates significance at the 5% level; and ***indicates significance at the 1% level.		

Table 7: Multinomial Logit Analysis of Switching Milk Buyers by Firm Structure

	Switch to Co-op		Switch to IOF	
Variables	**Coefficient**	**Marginal Effects**	**Coefficient**	**Marginal Effects**
Constant	-2.9278 (-2.5790) ***	-0.3294	-3.0260 (-2.3320) **	-0.2276
Age	0.0142 (1.2100)	0.0015	0.0229 (1.7460) *	0.0018
Gender	0.0941 (0.1800)	0.0211	-0.6042 (-0.7750)	-0.0556
Education	0.0011 (0.0190)	0.0009	-0.0491 (-0.8120)	-0.0044
Married	0.6283 (1.5440)	0.0762	0.2846 (0.7070)	0.0161
Parents farmed	-0.2417 (-0.6140)	-0.0429	0.7974 (1.2840)	0.0752
Herd size 1997	0.0042 (2.2780) **	0.0005	0.0028 (1.3170)	0.0002
Herd growth	0.0069 (0.5430)	0.0006	0.0206 (2.1120) **	0.0017
Milk facility improvement	0.0656 (0.2380)	0.0163	-0.5247 (-1.4900)	-0.0481
Farm debt	0.0601 (0.1940)	-0.0017	0.6220 (1.9450) *	0.0549
Household income	0.0000 (-1.3110)	0.0000	0.0000 (0.1110)	0.0000
Co-op history	-0.0509 (-0.1860)	0.0130	-1.3003 (-4.4830) ***	-0.1159
Price relevance	0.3908 (1.4440)	0.0436	0.4278 (1.4010)	0.0325
Local relevance	-0.0990 (-0.3160)	-0.0088	-0.2586 (-0.7090)	-0.0217
N				511
Percent correctly predicted				0.7260
Log likelihood function				-372.8449
Chi-squared				53.7284
Significance level				0.0011

Note: "No switch" is the comparison group. T-statistics are in parentheses. *indicates significance at the 10% level; ** indicates significance at the 5% level; and ***indicates significance at the 1% level.

Table 8: Binomial Logit Analysis of Switching Milk Buyers for Co-op Member Sub-Sample

Switch Milk Buyer		
Variables	**Coefficient**	**Marginal Effects**
Constant	-1.6018 (-5.9480) ***	-0.2899
Herd size 1997	0.0010 (0.4390)	0.0002
Farm debt	0.1661 (0.5540)	0.0301
Price relevance	0.5462 (2.0620) **	0.0989
Local relevance	0.0378 (0.1250)	0.0068
N		361
Percent correctly predicted		0.7590
Log likelihood function		-196.8731
Chi-squared		4.9615
Significance level		0.2913
Note: "No switch" is the comparison group. T-statistics are in parentheses. *indicates significance at the 10% level; ** indicates significance at the 5% level; and ***indicates significance at the 1% level.		