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DAIRY FARMERS' EVALUATION OF SOUTHERN DAIRY COOPERATIVES

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ABSTRACT

Survey data of 2,538 dairy farmers located in 12 southern states was used to analyze the factors influencing farmers' degree of satisfaction with the overall performance of milk marketing cooperatives. Results from an ordered probit model indicate that a combination of factors influence dairy farmers' assessment of the overall performance of cooperatives.

Dairy marketing cooperatives play an important role in the Southern milk marketing industry. In 1987, 79 percent of Grade A milk in the South was marketed by cooperatives (Liebrand et al.). However, dairy marketing cooperatives in the South have been experiencing a decreasing trend in their role of milk marketing. The percentage of milk marketed by Southern cooperatives in 1987 was down from 83% of Grade A milk in 1980 (Ling and Roof). In the East South Central Region, the percentage of milk marketed by cooperatives decreased from 84% in 1980 to 67% in 1987. In the South Atlantic and West Central regions, however, the percentage remained at above 80%. The decrease in the percentage of milk marketed by Southern cooperatives indicates that some dairy farmers may have changed their buyer affiliation to proprietary milk handlers. Dissatisfaction with the overall performance of the cooperatives may be hypothesized to have caused dairy farmers to change milk handlers. If milk marketing cooperatives (MMC) expect to maintain viable and efficient operations in the South, they must offer services and perform to satisfy dairy farmer membership.

The performance of a MMC can be hypothetically measured by its farmer members' overall satisfaction with its operation. Satisfaction is a function of how well the farmer members believe the cooperative is performing in providing the services needed. Cooperatives not only market members milk, but provide many other services to the members. These may include field services, milk hauling services, supply balancing, and providing an assured market. Farmer members may value these services, individually and/or collectively, in assessing the overall performance of their cooperatives. Some may perceive the performance of their cooperative as being acceptable if prices are competitive. Others may trade off low prices for an assured market for their milk. A study of cooperatives in the Northeastern United States showed that farmers ranked prices, quality of services, management performance, and benefits received as important attributes of viable cooperatives (Wilkins and Stafford). Schrader et al. found that farmers perceived a cooperative to be a dependable outlet that provides better quality of products and services.

Several studies (Jensen) have analyzed the characteristics of cooperative members and non-members to determine what influenced the choice of a type of milk handler. This study, however, takes a different approach. It presents an analysis of the cooperative members' degree of satisfaction with the overall performance of their cooperatives. The primary objective is to evaluate, from cooperative members' perspective, the factors that may be important in maintaining membership and long-term efficient viable MMCs. Identification of the factors contributing to higher level of satisfaction with the overall performance of the cooperatives will provide beneficial information to managers and boards of directors of the MMCs as to the effectiveness of the operation.

DATA

Data for the study were obtained from dairy farmers located in 12 southern states. Agricultural economists from each state chose a random sample of Grade A dairy farmers. Early in 1989, a mail survey was conducted among 5,660 dairy farmers. Useable responses were obtained from 2,538 dairy farmers, representing a 44.8% response rate. The responses represented approximately 25% of the total Grade A dairy farmers in the 12-state region.

Respondents were initially asked to indicate whether they sell their milk through a milk marketing cooperative. Of the 2,538 responses, 2,080 indicated that they sell through MMCs. Of the farmers that sold through MMCs, about 68% sold through bargaining-operating cooperatives and

the rest through bargaining cooperatives. The dairy farmers were then asked to rate their degree of satisfaction with the overall performance of their MMCs in an ordered sequence of very satisfied; satisfied; unsatisfied; and very unsatisfied.

The dairy farmers were also asked a set of questions to assess the performance of their cooperatives in providing the needed services. For this analysis, farmers' responses to questions regarding five specific services were examined. In one question, dairy farmers were asked to review the performance of their MMCs in providing a better price and in holding down operating and marketing costs. In another question, respondents were asked to rate the performance of their cooperatives in offering milk hauling services, field services, and an assured market.

For this analysis of the degree of satisfaction with the overall performance of their MMCs, data were available for 1,799 dairy farmers. Based on the conceptual relationships, variables were identified to explain dairy farmers' satisfaction levels. For estimation, the responses for the degree of satisfaction variable were collapsed into three categories representing "very satisfied," "satisfied," and "not satisfied." Cooperative's performance in providing individual services were one set of explanatory variables. Other explanatory variables included number of years selling to the same handler, size of dairy herd, debt-asset ratio of the farm, and farmers' affiliation to the type of cooperative. In addition, the state location of the dairy farmer was included as a variable. Table 1 presents a summary of variable definitions and related descriptive statistics.

METHODOLOGY

Given that the dependent variable is a discrete qualitative ordered variable, an ordered probit model was specified. The interest in this study is the probability that a dairy farmer will select a satisfaction level over a number of alternatives. The model is given as:

$$Y_i^* = \beta' X_i + u_i$$

where Y_i^* is the underlying response variable, β is the coefficient vector, X_i is a vector of explanatory variables, and u_i is the random error (Maddala). Y_i^* is not observed, but based on a farmer's degree of satisfaction S_i, we know the category to which he belongs. Satisfaction categories are very satisfied (C1), satisfied (C2), and unsatisfied (C3). It is thus postulated that

$$S_i = C1 \text{ if } \quad Y_i^* \le 0$$
$$S_i = C2 \text{ if } \quad 0 < Y_i^* \le \mu_2$$
$$S_i = C3 \text{ if } \quad \mu_2 < Y_i^* \le \mu_3$$

μ_i are unknown thresholds for the underlying response variables. The likelihood of the ith farmer being in the jth satisfaction category is

$$\Pr(S_i = C_j) = \Phi(\mu_j - \beta' X_i) - \Phi(\mu_{j-1} - \beta' X_i)$$

where Φ is the normal cumulative distribution function. The log-likelihood function is

$$\log L(\beta) = \sum_{1=1}^{n} \sum_{j=1}^{m} C_{ji} \log [\Phi(\mu_j - \beta' X_i) - \Phi(\mu_{j-1} - \beta' X_i)]$$

The β vector which maximizes the log-likelihood function was solved using the maximum likelihood algorithm available in the LIMDEP computer package. The estimates are consistent, asymptotically efficient, and normally distributed. The model also estimates the threshold values of the ordinal scale, i.e., the μ_j's as defined above. Estimation of the ordered probit model involves a normalization procedure such that $\mu_1 = 0$ and $\sigma = 1$.

EMPIRICAL RESULTS

The estimations from the ordered probit model are presented in Table 2. Several goodness-of-fit measures are also reported. One measure is the log-likelihood ratio. A second measure is the pseudo-R^2. A third measure examines how well the model classified the responses based on the estimated probabilities. These measures indicate that the model had satisfactory explanatory power

and predicted dairy farmers' degree of satisfaction reasonably well. Many of the estimated coefficients were statistically different from zero at the ten percent significance level.

The coefficient estimates for the state variables indicate that the satisfaction level of the dairy farmers in all the states, excepting Arkansas and Texas, are lower than those dairy farmers in Virginia. The dairy farmers' degree of satisfaction with the overall performance of their MMCs in Arkansas and Texas was not statistically different from Virginia. The positive sign for the price variable suggests that dairy farmers satisfied with the cooperative in providing a better price are likely to be more satisfied with the overall performance. Results also show that dairy farmers' degree of satisfaction with the MMCs is positively influenced by their assessment of how well the cooperative is performing in holding down operating costs, in providing field services, and in assuring a market for their milk.

The coefficient estimates of the variables representing the length of time for which a farmer has sold milk to the same cooperative (YR10 and YR20) indicate that longer term affiliation with a milk handler is more likely to generate higher level of satisfaction. The estimated negative sign for YR10 implies that farmers selling milk to a cooperative for up to 10 years were less satisfied than those who are affiliated for more than 20 years. The negative sign for the YR20 variable also supports the hypothesis that longer term affiliation generates higher level of satisfaction.

Results show that dairy farmers affiliated with bargaining cooperatives are likely to be more satisfied with their overall performance than the members of bargaining-operating cooperatives. In addition, results show that dairy farmers that changed a MMC (switch) during the last five years are more satisfied with their respective cooperatives than their counterparts.

For qualitative choice models, the estimated coefficients should be interpreted in the sense that they affect the probability that certain events would occur. This interpretation can be obtained by computing the probability derivatives from the estimated model and used to measure the change in probability of each choice with respect to a change in explanatory variable. The probability derivatives for binary variables, however, do not exist. Therefore, the predicted probability for a given binary variable was calculated by holding all other variables at the sample means. Estimated probabilities of dairy farmers' satisfaction levels with respect to all the state variables and the statistically significant explanatory variables are presented in table 3.

Virginia dairy farmers had the highest probability of being very satisfied with the overall performance of their MMCs. The probabilities of farmers of being very satisfied in Arkansas, Texas, and Florida closely followed that of Virginia. The dairy farmers of Mississippi, Kentucky, North Carolina, Georgia, Louisiana, Alabama, and Tennessee had considerably lower probabilities of being very satisfied with their MMCs. The estimated probabilities of not being satisfied in these states ranged between 8% to 14%. The probability of farmers of not being very satisfied with the overall performance of their MMCs in South Carolina was as high as .252.

With respect to the price variable, the estimated probabilities suggest that those farmers who were satisfied with the performance of their cooperatives in providing a better price had a much greater probability of being very satisfied with the overall performance of the MMCs. For example, farmers who were not satisfied with prices had a probability of .171 of being very satisfied in comparison to a probability of .314 for farmers who were satisfied with the prices, a difference of 46%. Similarly, estimated probabilities of being very satisfied between those who were satisfied with the ability of the cooperative in holding down costs and who were not, differed by about 60% (.331 versus .132). Dairy farmers who were satisfied with field services and market assurance had probabilities of .321 and .281 of being very satisfied with the cooperative. In contrast, farmers who were not satisfied with field services and market assurance had probabilities of .206 (a difference of 36%) and .197 (a difference of 30%) of being very satisfied.

A close look at the probabilities associated with price, cost, field, and market variables clearly suggest that the relative importance of these specific services differ significantly in generating farmer satisfaction with the overall performance of the cooperatives. Although all these services are found to be important, a MMC's ability to hold down operating and marketing cost appears to be relatively most important. To rank the importance of these services in generating higher levels of farmer satisfaction, providing a better price, field services, and market assurance appear to follow in that order.

The estimated probabilities suggest that the longer the dairy farmer sold to the same cooperative, the higher is the probability of being very satisfied with the overall performance of the MMC. In particular, farmers who had been selling to the same MMC for more than 20 years (YRG20) had a probability of about .31. This compares with probabilities of .26 and .22 for those who had been selling for 11 to 20 years (YR20) and up to 10 years (YR10), respectively, to the same cooperative. Dairy farmers selling to bargaining cooperatives had a probability of .41 of being very satisfied with the overall performance of their cooperatives. In contrast, farmers selling to bargaining-operating cooperatives had a considerably lower probability (.20) of being very satisfied. Furthermore, dairy farmers who changed their milk handler during the last five years tend to be more satisfied with the performance of their MMCs than those who did not.

CONCLUSION

An ordered probit model was formulated and used to estimate the probabilities of Southern dairy farmers' degree of satisfaction with the overall performance of MMCs. The analysis suggests that Southern dairy farmers perceive cooperatives' ability to hold down operating and marketing costs, to provide higher price and competent field services, and to assure a market as important attributes, in that order, of efficient viable cooperatives. Furthermore, the study found that longer term affiliation of dairy farmers with a cooperative and affiliation with bargaining operating cooperatives resulted in a higher degree of satisfaction. The estimated probabilities further suggest that there are significant differences in the degree of satisfaction with the cooperatives among the dairy farmers located in 12 Southern states.

If MMCs expect to maintain viable and efficient operations, in addition to holding down costs and providing competitive prices, they must offer competent field services and assure a market for their members' milk. While MMCs should encourage new members, they should also strive for longer term affiliation with the dairy farmers. Furthermore, the bargaining cooperatives may need to investigate the possibility of incorporating services typical to bargaining operating cooperatives.

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Table 1. Variable definition and sample statistics.

Variable Name	Variable Definition	Mean	Standard Deviation	Max	Min
SATISFY	Degree of satisfaction	1.167	0.630	2	0
STATE					
AL	1 = Alabama; 0 otherwise	0.239	0.153	1	0
AR	1 = Arkansas; 0 otherwise	0.102	0.302	1	0
FL	1 = Florida; 0 otherwise	0.068	0.252	1	0
KY	1 = Kentucky; 0 otherwise	0.118	0.322	1	0
LA	1 = Louisiana; 0 otherwise	0.114	0.318	1	0
MS	1 = Mississippi; 0 otherwise	0.066	0.248	1	0
NC	1 = North Carolina; 0 otherwise	0.102	0.303	1	0
SC	1 = South Carolina; 0 otherwise	0.041	0.199	1	0
TN	1 = Tennessee; 0 otherwise	0.072	0.258	1	0
TX	1 = Texas; 0 otherwise	0.098	0.298	1	0
GA	1 = Georgia; 0 otherwise	0.063	0.244	1	0
VA	1 = Virginia; 0 otherwise	0.132	0.338	1	0
SIZE	1 = up to 150 cows; 0 otherwise	0.779	0.415	1	0
PRICE	1 = if agree or tend to agree that the cooperative provides a better price; 0 otherwise	0.576	0.494	1	0
COST	1 = if agree or tend to agree that the cooperative does a good job in holding down cost; 0 otherwise	0.640	0.480	1	0
HAULING	1 = if milk hauling service is rated to be excellent; 0 otherwise	0.520	0.500	1	0
FIELD	1 = if field service is rated to be excellent; 0 otherwise	0.391	0.488	1	0
MARKET	1 = if market assurance is rated to be excellent; 0 otherwise	0.628	0.483	1	0
YEARS					
YR10	1 = up to 10 years; 0 otherwise	0.503	0.500	1	0
YR20	1 = 11 to 20 years; 0 otherwise	0.331	0.471	1	0
YRG20	1 = more than 20 years; 0 otherwise	0.166	0.372	1	0
BARG	1 = if selling to bargaining-only cooperative; 0 otherwise	0.260	0.439	1	0
SWITCH	1 = if changed cooperative during last five years; 0 otherwise	0.133	0.340	1	0
DEBT	1 = if debt exceeds or equals asset, 2 = if debt asset ratio = .9 to .76, 3 = if debt asset ratio = .75 to .51, 4 = if debt asset ratio = .50 to .26, 5 = if debt asset ratio = .25 to .01, 6 = if free of debts	4.057	1.470	6	1

Note: Sample size = 1799.

Table 2. Maximum likelihood results from the ordered probit model explaining factors affecting degree of satisfaction of dairy farmers with the overall performance of their milk marketing cooperatives, 12 southern states.

Variables	ß	t-ratio	Significance Level
CONSTANT	.6886	4.558	0.000
STATE[a]			
AL	-.6923	-2.531	0.011
AR	-.1770	-1.492	0.136
FL	-.2373	-1.618	0.105
KY	-.4841	-4.324	0.000
LA	-.6012	-5.115	0.000
MS	-.4487	-3.153	0.002
NC	-.4962	-4.112	0.000
SC	-1.1558	-7.547	0.000
TN	-.7265	-5.500	0.000
TX	-.1088	-.879	0.380
GA	-.5267	-3.521	0.000
DEBT	.0293	1.467	0.142
PRICE	.4652	6.228	0.000
COST	.6784	8.919	0.000
HAULING	.0125	.192	0.847
FIELD	.3523	5.131	0.000
MARKET	.2719	3.822	0.000
YEARS[b]			
YR10	-.2707	-3.110	0.002
YR20	-.1567	-1.835	0.066
BARG	.6231	8.075	0.000
SWITCH	.1735	1.967	0.049
SIZE	.0009	.011	0.991
μ_2	2.1033	37.081	0.000

Summary statistics

Sample size	1799
Pseudo-R^2	.33
-2 x Log-Likelihood ratio	38.33[c]
Percent correctly classified	65

[a] Virginia is the base.
[b] YRG20 is the base.
[c] The likelihood ratio statistic is distributed as Chi-square with 22 degrees of freedom and is significant at the .05 level.

Table 3. Estimated probabilities by degree of satisfaction of dairy farmers with the overall performance of milk marketing cooperatives, 12 southern states.

Variables	Degree of Satisfaction		
	Very Satisfied	Satisfied	Not Satisfied
STATES			
AL	.165	.706	.129
AR	.324	.626	.050
FL	.302	.641	.056
KY	.222	.687	.090
LA	.189	.700	.111
MS	.233	.682	.085
NC	.219	.689	.092
SC	.075	.672	.252
TN	.157	.707	.136
TX	.349	.608	.043
GA	.210	.693	.097
VA	.390	.576	.034
PRICE=1	.314	.633	.053
PRICE=0	.171	.704	.124
COST=1	.331	.621	.048
COST=0	.132	.706	.162
FIELD=1	.321	.629	.051
FIELD=0	.206	.694	.100
MARKET=1	.281	.655	.064
MARKET=0	.197	.697	.105
YEARS			
YR10	.223	.687	.090
YR20	.258	.669	.073
YRG20	.311	.635	.054
BARG=1	.413	.557	.030
BARG=0	.200	.696	.104
SWITCH=1	.298	.644	.058
SWITCH=0	.241	.678	.081