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An Analysis of Dairy Farmer Participation in Cooperatives in the Northeast USA

A paper presented at "Rural Cooperation in the 21st Century: Lessons from the Past, Pathways to the Future," an International Workshop, Rehovot, Israel, June 15-17, 2009.

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ABSTRACT

Past research has established the necessity of farmer participation for a cooperative's success. However, there is a lack of study on whether participating in cooperatives benefits farmers. The aim here is to address that important issue using the 2005 ARMS data for the Northeastern USA. Dairy farming is still an integral part of the agricultural economy of the Northeast. Dairy contributed about 37% of total farm receipts for the region in 2007. The majority of the dairy farmers in the region are either members or patrons of dairy cooperatives. Therefore, this region is ideal for such a study. Overall, this study is expected to provide useful information on the performance of dairy farms in the Northeast in general, and more specifically provide a useful comparison between cooperative participants and non-participants in the region.

Key words: cooperatives, dairy, financial performance, profitability, Northeast

JEL Classification: Q12, 14

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1. INTRODUCTION

The Northeast has a large share of dairy cooperatives (66 or over 38% of total dairy cooperatives in the US) with a membership of 6,900 and a gross business volume of $2.53 billion.[1] Some of the well-known dairy cooperatives in the region include the Dairylea Coop of Syracuse, New York, and the Central PA Milk Marketing Cooperative of Reedsville, Pennsylvania. Organic Valley out of LaFarge, Wisconsin, is a major player in the organic dairy sector in the Northeast and uses local dairy cooperatives as its agents.

Dairy farming is still an integral part of the farming community and economy in the Northeast.[2] Nearly all dairy farmers in the Northeast are smaller than those in the Western milk-producing regions of the United States. However, many of these small and mid-size farms are financially not viable and thus, are in a precarious position. The number of dairy farms in the United States has been declining gradually over the years. Such decline is most prevalent in the dairy producing states in the Northeast, once the bastion of dairy production in the country. The dairy cooperatives in the region play an important role in providing some solutions to the problem of the survival and prosperity of dairy farms in the Northeast. Solutions could be in the form of providing market access to these dairy farmers for both raw and value-added dairy products and by bargaining with milk processors in the region for a better fluid milk price, among others.

We know that active participation by members and non-members is vital and integral for the success of any cooperative, including agricultural cooperatives (Hakelius, 1996; Bhuyan, 2007). Such participation by farmers may occur in various ways and is likely to be highly variable among farmers. For instance, some farmers who patronize a cooperative may not be members, some farmers may commit a large portion of their product to the cooperatives regardless of their membership, patronage may vary by farm size, or while some farmer members may be active in holding offices and serving in various committees, others members may stay away from such democratic participation in their cooperative's affairs.[3] While researchers have clearly established the necessity of farmer (member and non-member) participation for a cooperative's success, there

[1] States with less than three cooperatives were not mentioned in the cooperative statistics report (USDA, 2008).

[2] While they account for less than 25% nationally, small and mid size farmers make a far greater contribution in the Northeast agriculture, and therefore, are crucial to local economies. These farms also serve as buffers to urban encroachment, help preserve open spaces, and contribute toward tourism, which are of high importance in the Northeast states (Woods et al., 2000).

[3] Farmers are likely to become members when they see benefits, such as access to market, better price, etc. Unless there's a restriction, non-members are allowed to sell through coops, i.e., allowed to participate, and enjoy similar benefits except patronage refund.

is a lack of study on whether such participation benefits the participating farmers. For instance, compared to non-participants (i.e., those dairy farmers who do not sell their milk to dairy cooperatives), do participating dairy farmers (i.e., those dairy farmers who sell their milk to dairy cooperatives) receive a better price, or are they more profitable, or do they make better farm management decisions? These are some of the questions we want to examine here.

The purpose of the study, therefore, is to address several interrelated questions: (i) to examine if dairy farmers who participate in cooperatives to market their milk are benefitting from their participation in cooperatives in terms of higher prices and more risk management options, such as using forward contracting with cooperatives, (ii) to identify and analyze factors that influence dairy farmers' decision to sell their raw milk to cooperatives, and (iii) to identify and analyze factors affecting dairy farms profitability in the Northeast United States. While the first objective is accomplished by comparing various farm and farm operator characteristics of participants and non-participants, the latter two objectives are fulfilled by conducting multivariate regressions.

Overall, this study is expected to provide useful information on the performance of dairy farms in the Northeast in general and provide a useful comparison between cooperative participants and non-participants in the region. Such information would be of interest to dairy farmers and cooperative members and managers as well as to researchers and practitioners of cooperatives and dairy farming.

2. THE DAIRY SECTOR IN THE NORTHEAST

The dairy sector is a major component of agricultural production in the Northeast, and accounted for about 37% of total farm receipts for the region or about $5.5 billion in 2007 (USDA, 2008). Dairy farming ranked as the top source of farm income for New York (49.7% of total farm receipts), Pennsylvania (33.9%), and Vermont (70.7%), and was the second most important source of farm income in Maine (17.6%), Connecticut (11.5%), New Hampshire (27.4%), and Rhode Island (5%). The Northeast had 19,660 dairy operations (defined as those operations with one or more milk cows) in 2004, representing 24% of dairy operations in the country. The region was second only to the Lake States' 24,900 dairy operations (USDA, 2005). Although there has been a "shift" of milk production from the Northeast and Midwest to the Western states, New York and Pennsylvania are still respectively ranked as 3rd and 5th nationally in milk production (USDA, 2008).

Following the national trend, the number of dairy farms and dairy cows has declined in this region. The number of dairy farms in the Northeast decreased from 22,094 in 2002 to 18,064 in 2007, while the number of dairy cows declined from 1.7 million in 2002 to 1.5 million in 2007 (USDA, 2009). Despite the

decrease in farm numbers, the overwhelming majority of dairy farms are small and medium sized.[4] While the farm and cow numbers have decreased, Northeast dairy farm productivity has shown a marked increase over the years. For example, per-cow output increased by more than 25% from an average of 14,700 pounds in 1990 to more than 18,400 in 2007.[5]

In terms of dairy pricing and policies, farmer advocacy groups contend that the federally determined base price for Class I milk does not reflect regional differences (NESAWG, 2007). Additionally, dairy farmers in the Northeast have a higher cost of production and are relatively small in size due to resource constraints, such as land availability, stricter environmental regulations, and other factors. In terms of the cost of production, the West enjoys a $4 per cwt[6] cost advantage over the Northeast (McNew, 2000). On the revenue side, dairy farmers have experienced extremely volatile markets since 1990 due to the lowering of support prices. Since 2002, dairy prices have gone from extremely low prices in 2002-03 (Class III price of $8.57/cwt) to nearly $20/cwt in 2004, again dipping in 2006, soaring over $20/cwt in 2008 due to world milk powder prices and then dropping below $11/cwt in 2009, a level which is less than what farmers received 30 years ago (nominal price).

The organic dairy sector has been growing steadily in the Northeast as well as in other parts of the country. According to USDA data, across the country, there are 86,072 certified organic milk cows, with 15,063 (17.5%) in the Northeast. Wisconsin leads the country with the largest certified organic dairy herd with 16,793 certified organic cows, while the entire Northeast had 15,063 certified organic cows in 2005 (USDA, 2006). In the major dairy states of the Northeast, New York and Pennsylvania, each are estimated to have about 300-320 organic dairy farms, Vermont has about 200, and Maine has about 60 organic dairy farms (PCO, 2009; NOFA-NY, 2009; NOFA-VT, 2009).[7]

3. RESEARCH DESIGN

3.1 Means Difference Test

In order to examine whether participant dairy farms were doing better than the non-participants, we compare them by their respective farm and farm operator characteristics, their risk management behavior, and their

[4] Small and medium sized farms make up 90%, 96%, and 86% of all dairy farms in New York, Pennsylvania, and Vermont, respectively. Pennsylvania has far more small farms due to Amish and Mennonite farmers (USDA, 2009).

[5] Milk production per cow averaged 19,859 in New York, 19,262 in Pennsylvania, and 18,414 in Vermont. Vermont numbers are believed to be lower due to relatively more Jersey cows and more organic cows (USDA, 2009).

[6] cwt or hundredweight is a unit of weight in the U.S. Customary System equal to 100 pounds (45.36 kilograms). Also called cental, short hundredweight.

[7] Most states do not keep numbers of organic dairy farms. Therefore, numbers have to be drawn from reports from certifiers. Farms do not have to be certified from an in-state certifier so no single certifier knows all the organic dairy farms in one state.

financial solvency. For example, we compare participants and non-participants with respect to attributes, such as the size of the dairy farm, amount of milk sold, prices received, age and cull rate of cows[8], age and education of the operator, operator's dairy farming experience, and liquidity of the dairy farm. That is, we examine the structural and financial performance of participants and non-participants, and hypothesize that cooperative participants are better at managing their dairy farms compared to their non-participant counterparts.

We employ a non-parametric means difference tests (the independent sample t-test) to compare participants and non-participants. This test assumes that these two groups of farmers (i.e., participants and non-participants) are normally distributed and their respective variances are homogenous in nature.[9]

3.2 Farmers Choice of Milk Marketing Outlet

Most dairy farmers in the United States sell their milk to dairy cooperatives, i.e., they participate in these cooperatives' marketing functions either as members or as non-member patrons. There are numerous reasons why farmers may use cooperatives to market their products, some of which may be economic (e.g., to receive a better price, or due to a lack of other alternatives outlets), others may be non-economic (e.g., to support a farmer-owned agribusiness). Here we make an attempt to explain the economic factors that may be contributing to such choices made by the dairy farmers in the Northeast US. Dairy farmers' outlet choice is modeled as a function of various farm and farmer characteristics, such as the number of cows, debt level, etc. This empirical model presented here uses earlier research in related areas, e.g., Alexander, et al., 2007; Medina and Ward, undated; Gillespie, Basarir, and Schupp. 2004; Park and Lohr, 2006; Wiersinga, van Wijk, and Luyen, 2007; and Tsourgiannisa, Eddisonb, and Warrena, 2008. We hypothesize that some of the factors that will influence dairy farmers' decisions to participate in cooperatives would include the price of milk, farm size, the farm operator's age and his/her level of education.

The dependent variable (SELLCOOP) is a binomial variable where SELLCOOP=1 implies a farmer is a participant and 0 implies the farmer is not a participant, i.e., does not sell his/her milk to a cooperative. The binomial logistic model assumes that an individual dairy farmer's probability of selling milk to a

[8] Culling refers to removing a cow from a herd. Depending on management practice, culling is followed by replacement, i.e., the culled cow is replaced with another cow, or a first-lactation heifer. Thus, the culling rate describes the percentage of cows removed from a herd. According to Hadley, Wolf & Harsh (2006), understanding culling rates is important for managing dairy production response and profitability because when dairy farm managers cull cattle too often or too quickly, replacement expenditures becomes excessive, and when managers keep cattle for too long, milk production, reproduction, or genetic improvement may be impaired.

[9] Details on the theory behind the independent sample t-test can be found in any standard text on applied statistics, e.g. Warner, 2008.

cooperative depends on a vector of independent variables (X_{ij}) associated with farmer i and variable j , and a vector of unknown parameters β:

$$P_i = F(Z_i) = F(\beta X_{ij}) = 1/[1+\exp(-Z_j)] \quad (1)$$

where, $F(Z_i)$ equals the value of the logistic cumulative density function associated with each possible value of the underlying index Z_i , and P_i equals the probability that a farmer sells milk to a cooperative given the independent variables X_{ij} . In the above equation, βX_{ij} is a linear combination of the independent variables so that,

$$Z_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + ... + \beta_k X_{ik} + e_i \quad (2)$$

where, Z_i = unobserved index level or the log odds of the i^{th} observation; X_{ij} = j^{th} attribute of the i^{th} respondent and j =1, 2, 3.....k; β = parameters to be estimated; and e = random error or disturbance term.

3.3 Explaining Dairy Farm Profitability

There is misperception regarding the objectivity of measuring the financial performance of agricultural producers, or more precisely whether such objectivity exists. As Mishra and Morehart (2001) admit, financial performance is ultimately a subjective measure dependent upon the individual researcher's objectives and assumptions. It comes as no surprise that researchers have used several different indicators to measure the financial performance of agricultural operations in previous studies. For example, El-Osta and Johnson (1998) employ two accounting measures in analyzing the financial performance of U.S. commercial dairy farms: net farm income (NFI) and net returns per unit (cwt) of milk sold (NRU). In another instance, however, El-Osta with his colleagues at the USDA use a farm's operating margin (FOM) (McBride, Short, and El-Osta, 2004).

To address the apparent subjectivity and variability in financial performance measurement, there have been two efforts to establish standard measures of financial performance. The American Agricultural Economics Association (AAEA) guidelines and the Farm Financial Standards Council's (FFSC) guidelines are the products of those efforts. To simplify, in measuring profitability, which is a type of financial performance measure, the AAEA guidelines tend to isolate the costs and returns of producing individual commodities and include the opportunity costs of commodity production. The FFSC guidelines, in contrast, tend to reflect the revenues earned and expenses incurred to earn those revenues for the whole farm enterprise while adjusting

for revenues and expenses that may have accrued, though not yet received/paid, during the time frame under study.

This study follows the Farm Financial Standards Council's (FFSC) guideline and uses the Net Farm Income (NFI) as the measure of dairy farm profitability. The FFSC interprets NFI as "the return to the farmer for unpaid labor, management, and owner equity" (FFSC 1997, III-16). The FFSC defines NFI as follows: NFI={(farm operating revenues-farm operating expenses) ± (changes in inventories)-(depreciation)-(interest ± interest accrued)} – real estate and property taxes. Considering that no single financial performance indicator is without limitations, additional financial performance measures, financial ratios of liquidity, solvency, and efficiency, as well as additional profitability ratios, are included to contribute further insight into dairy farm profitability in the Northeastern United States.

We conduct a multivariate ordinary least-squared (OLS) regression to determine the factors that influence dairy farm profitability. The dairy farm sample was divided into three groups and they are: (i) dairy farms in the Northeast which had positive profit, (ii) profitable and participating dairy farms in the region, and (iii) profitable and cooperative member dairy farms in the region. Three separate profitability models are analyzed using a multivariate regression method. The goal here is to try to explain the factors that determine profitability across dairy farms in the Northeast. Profitability, measured by the NFI is modeled as a function of input and output prices and a production constraint, which is dependent upon farm and farm operator characteristics. The conceptual model borrows heavily from McBride and Greene (2007), Mishra and Morehart (2001), El-Osta and Johnson (1998), and Short (2000).

Assume that the following profit function represents a profit-maximizing, price-taking firm:

$$\pi(P_1, P_m, \kappa, \delta) = \sum P_1 Q_1(P_1, \kappa, \delta) - \sum TC_m(P_m, Q_m, \eta, \gamma), \tag{3}$$

where $\mathbf{P_l}$ is a vector of output prices, $\mathbf{Q_l}$ is a vector of quantities of various outputs produced, $\boldsymbol{\kappa}$ is a vector of farm operator characteristics, $\boldsymbol{\delta}$ is a vector of farm characteristics, $\mathbf{TC_m}$ is a vector of costs, $\mathbf{P_m}$ is a vector of input prices, $\mathbf{Q_m}$ is a vector of inputs, $\boldsymbol{\eta}$ is a vector of farm operator characteristics**,** $\boldsymbol{\gamma}$ is a vector of farm characteristics. Here we hypothesize that farm and farm operator characteristics, sources of additional farm income, and dairy farmers' risk management options would influence the profitability of dairy farms in the Northeast USA. Transformation of the economic model in Equation (3) yields an econometric model as follows:

$$\pi = \alpha_0 + \alpha_1 \mathbf{X}_1 + \alpha_2 \mathbf{X}_2 + \alpha_3 \mathbf{X}_3 + \alpha_4 \mathbf{X}_4 + \alpha_5 \mathbf{X}_5 + \alpha_6 \mathbf{X}_6 + \alpha_7 \mathbf{X}_7 + \varepsilon, \tag{4}$$

where $\mathbf{X}_1$ is a vector of farm characteristics, $\mathbf{X}_2$ is a vector of farm operator characteristics, $\mathbf{X}_3$ is a vector of extra income variables, $\mathbf{X}_4$ is a vector of technology indicators, $\mathbf{X}_5$ is a vector of efficiency measures, $\mathbf{X}_6$ is a vector of risk management measures, and $\mathbf{X}_7$ is a vector of financial efficiency measures. In the regression models, NFI represents π in Equation (4). Thus, dairy farm profitability is hypothesized to be a function of output and input prices, farm characteristics, extra income, farm operator characteristics, technology, efficiency measures, risk management decisions, and financial efficiency. Assuming a competitive market for input and output, all organic dairy farms are assumed to be price takers. In addition, it is assumed that all dairy farms face the same market conditions.

3.4 Data

Data used in this analysis come from the 2005 Agricultural Resource Management Survey (ARMS) of U.S. dairy farms conducted by the Economic Research Service (ERS) and the National Agricultural Statistics Service (NASS) of the United States Department of Agriculture (USDA). The ARMS survey is a multiframe, probability-based survey, and it is designed to collect detailed financial data about farm financial performance (USDA, 2007). All data points in the 2005 ARMS survey refer to the calendar year 2004. The financial data can be used to construct various measures of financial performance, such as profitability, liquidity, and solvency. The survey also collects data on farm operator and farm characteristics, as well as on various production management decisions.

The ARMS data used here represent a targeted sample of U.S. milk producers from the Northeast. The ARMS data are weighted according to their probability of occurring, which is based on certain farm characteristics and a known number of farms with those similar characteristics (McBride and Greene 2007). The stratified sample and the subsequent probability-weighted data allow each farm to represent several similar farms and adjust for the over-sampled, organic population. The USDA provides further details online (USDA, 2007).

This study is focused on the Northeast region of the U.S., specifically the states of Pennsylvania, New York, Vermont, and Maine, which together produces over 90% of the milk in the region (PCO, 2009). According to the 2005 ARMS data set, there were 430 dairy farms in these four states in the Northeast. After removing statistical outliers from the data set, there were 392 dairy farms left which were used for the analysis in this study. The ARMS dairy survey asked dairy farmers whether they sell their milk to cooperatives, but did not ask whether such cooperatives were simple bargaining associations or processors, and therefore, information on this type of distinction is not available.

4. RESULTS AND DISCUSSION

4.1 Distribution of Participant and Non-participant Dairy Farmers

The sample of 392 dairy farms in the Northeast was distributed among the constituent states as follows: 146 observations from New York, 121 observations from Pennsylvania, 83 observations from Vermont, and 42 observations from Maine. In terms of dairy farmer participation in cooperatives in the region, 308 out of 392, or 78.6% of the dairy farmers sold their milk to cooperatives (Table 1, column 2 and 3). Among those who sold their milk to cooperatives, 94% (or 291 out of 308) were cooperative members and over one-third of them were from NY (Table 1, column 4 and 5).

In terms of their farm size, defined by the number of cows in a herd, 28.75% (113 out of 393) were small dairy farms, 31.55% were medium-sized farms, and the rest (39.70%) were large farms (Table 2, column 1). Among the participants, about 41% (or 126 out of 309) were large farms and the rest were divided almost equally between small and medium-sized farms (Table 2, column 6). Non-participants were almost equally divided among the three size groups of farms (Table 2, column 7). Column 8 shows that among those who participated in marketing their milk to cooperatives, over 94% (or 291 out of 308) were members and most member dairy farms were large (41.6% or 121 out of 291). A non-parametric test of association shows that there is no statistically significant relationship between farm size and farmers' decisions to sell their milk to cooperatives (Chi-square 1.892, 2df, p-value 0.388). A similar test of association between farm size and cooperative membership also fails to establish any statistically significant relationship between farm size and farmers' decision to become members (Chi-square 1.975, 2df, p-value 0.373). A parametric test (regression analysis) examining farmers' choices of outlet for their milk is expected to validate such non-parametric findings (presented in Section 4.3).

4.2 Comparing Participant and Non-participant Dairy Farmers

The aim here is to examine if participants benefit from selling their milk to cooperatives. We achieve this by comparing the participant dairy farms to the non-participant dairy farms using various farm and farm operator attributes, such as prices received, farm income, risk management strategies, and financial health of the their respective dairy farms. The implicit assumption here is that cooperatives benefit their patrons (i.e., both member and non-member) and the comparison will illustrate that.[10]

[10] Due to lack of survey data, we were not able to address directly whether dairy farmers believe that selling their milk to cooperatives is beneficial and the reasons behind such beliefs.

Table 3 shows the results of the means difference test between participants and non-participants. Such comparison is made in terms of the following attributes: farm characteristics, farm operator characteristics, milking technology used, selected efficiency measures, dairy farmers' risk management decisions, and the financial health of the dairy farms. In terms of farm characteristics, there was a statistically significant difference between participants and non-participants in terms of the average number of milk cows in the milk herd, total milk sold in 2004, and the average price received by these dairy farmers. Results in Table 3 shows that although participants had more cows and sold more milk compared to non-participants, on average participants received $18.59 per unit of milk sold (hundredweight or cwt) compared to non-participant's $19.59 and this difference ($1/cwt) was statistically significant. Given milk price is the main source of revenue for these dairy farmers, one would expect that such a difference would have a serious impact on participants' profitability. Not surprisingly, a comparison of profitability between participants and non-participants show that on average, non-participants made $91,600 more profit in 2004 (this difference was, however, not statistically significant).

In terms of farm operator characteristics, participant dairy farmers had been operating their dairy farms on average 2.67 years longer than non-participants, i.e., participant dairy farmers were more experienced. There was no significant difference between the participant and non-participant dairy farmers in terms of technology used in the dairy farm – both groups used the 'barn with around the barn pipeline' as the principal milking facility and neither group used a computerized data gathering system nor had an automatic milk takeoff system.

In terms of operational efficiency, while a typical participant dairy farm was producing more milk per cow than a non-participant dairy farm (on average 4.9 cwt more), such a dairy farm was incurring more labor cost ("Efficiency Measures," Table 3). However, participant farms were more efficient in the use of purchased feed which is an important component of dairy farms in general and those without adequate pasture land in particular. In terms of their risk management decisions, there were no differences between the participants and non-participants except in terms of having a written contract[11] with processors or handlers to sell their milk – participant dairy farmers did have such contracts while non-participant dairy farmers did not have such contracts.

The additional financial performance measures, such as financial ratios of liquidity, solvency, and efficiency provide further insight into the profitability of participant and non-participant dairy farms in the Northeastern United States. Table 4 presents these financial performance measures for both of these groups

[11] A cooperative marketing agreement is a legal document recording the rights and duties of members and their cooperative with regard to marketing members' production through the cooperative. Such contracts may specify members' obligation in terms of the quality and quantity of the members' product as well as the cooperative's obligation in terms of prices paid to the members and related issues. A cooperative may also extend such contacts to non-member patrons, as typical in case of dairy cooperatives.

of dairy farms. Results in Table 4 show that on average, participant dairy farms had more liquid assets, as well as more working capital. Although participant farms had a slightly higher debt-to-asset ratio compared to the non-participants, the former had a higher operating profit margin. Participant dairy farms also had a slightly lower operating expense ratio compared to the non-participants. In terms of the ROR (rate of return) on farm assets, non-participants had a statistically significant advantage. Although there were practically no differences between the participants and non-participants, participant dairy farms were financially more efficient and healthier overall.

4.3 Factors Affecting Dairy Farmers' Choice of Cooperatives as the Marketing outlet

As explained in "Research Design," a binomial logit model (dependent variable: SELLCOOP) is estimated to determine factors that influence a dairy farmer's choice of cooperatives as the outlet to sell his milk (i.e., SELLCOOP=1). The covariates included various farm and farm operator characteristics and farm management efficiencies. Their descriptive statistics are presented in Table 5. Regression results are presented in Table 6 along with the marginal effects of the statistically significant variables. The marketing channel choice model had the desirable model properties as shown by the three separate measures of Goodness of Fit at the end of Table 6. To our knowledge, the only comparable study is that of Alexander et al., and we refer to it below when discussing results presented in Table 6.

Among all covariates, only the following variables were statistically significant: average price received for raw milk, level of education of a dairy farmer, whether a dairy farmer received government payment, whether a dairy farmer had a written contract with handlers and processors, whether a dairy farmer locked in input prices and had a nutrition plan for his cows, and how solvent the dairy farm was. The marginal effects of these significant covariates are presented in the third column in Table 6.

Results of the logistic regression show that for every $1 increase in milk price (per cwt), the likelihood of Northeast dairy farmers selling their milk to cooperatives declines by 1.2%, i.e., the probability of dairy farmers participating in cooperatives declines if milk price increases. Considering that over 74% of the sample (291 out of 392) was members of cooperatives, this result shows signs of member disloyalty which should be alarming to cooperative managers and the Boards. In their study using the 2005 ARMS data, Alexander, et al. specify cooperatives as one of the marketing channels for dairy farmers; however, their sample included members only and thus, it is difficult to compare their results to ours. Nonetheless, they found that herd size was a significant factor in determining dairy farmers' choices of marketing outlets. Those with larger herd size preferred not to sell their milk through cooperatives (though not significant, our results are opposite to those of Alexander et al. for the same variable; see Table 6, variable MILKCOWS).

In terms of farm operator characteristics, a dairy farmer's level of education impacted his decision to sell to cooperatives. With each level of increase in education, e.g., a high school graduate to a college graduate, the likelihood of such a dairy farmer selling his raw milk to a cooperative increased by slightly over 6%. Alexander et al. also found that dairy farmers that are diversified, e.g., had crop sales, are less likely to sell their milk through cooperatives (again, though not significant, our result does not support such a finding; see Table 6, variable LPSXMLKS). However, we find that if a dairy farmer was receiving government payments (GOVTYES), then the likelihood of him selling milk through a cooperative declines significantly by almost 10%.

Entrepreneurs prefer to minimize their risk of doing business and one would expect that if cooperatives were offering marketing contracts or forward contracts, dairy farmers in the Northeast US would prefer to sell to cooperatives, i.e., select cooperatives as their milk marketing channel. However, results in Table 6 show that only the availability of written contract (WRITTCON) made such an impact, i.e., the likelihood that dairy farmers in the Northeast will sell their milk to cooperatives increases by 25% if these farmers get to sign a written contract with a cooperative (recall from Table 3 that participants did have written contracts with cooperatives).

The variable PRICELOCK is negative and significant showing that if a dairy farmer is able to lock in his input price, he is unlikely to sell his milk through a cooperative (non-participation likelihood is about 11%). It is difficult to interpret this result because it is not clear whether such input price guarantee provisions are provided by dairy cooperatives in the region, or other cooperatives in the region, or non-cooperative businesses. Table 6 also shows that those dairy farmers in the Northeastern USA who had a nutrition management plan for their cows are about 9% more likely to avoid selling their milk to cooperatives.

Finally, Table 6 shows that those dairy farms with higher debt-to-asset ratio (i.e., financially less solvent relative to other dairy farmers in the sample) are more likely to sell their milk to cooperatives. More specifically, an increase in the debt-to-asset ratio by 1% would increase the likelihood of a dairy farmer selecting cooperatives as his choice of outlet for his milk by almost 26%. Perhaps the availability of written contracts and price guarantee through such contracts were good assurances of income for dairy farmers in the Northeast who therefore, were in a better position to manage their debt.

4.4 Factors Determining Profitability of Dairy Farms in the Northeast

This section presents the factors that impact the profitability of dairy farms in the Northeast. In this analysis, we use only those dairy farms (from the sample of 392) with a net profit in 2004, i.e., those with NFI>0. We conducted this analysis for three distinct groups of dairy farms: (i) all dairy farms in the sample that had

positive NFI in 2004, n=330, (ii) all participating dairy farms which had NFI>0 in 2004, n=262, and (iii) all members of dairy cooperatives which had NFI>0 in 2004, n=247. Three separate multiple regression analyses were carried out for these three groups of dairy farms using a weighted least squares regression procedure. Table 5 provides the summary statistics of the independent variables comprising the regression models and Table 7 presents the regression results for the three profitability models. All three models performed well as shown by their respective Goodness of Fit statistics measures (Table 7).

Receiving a higher milk price, ceteris paribus, was expected to increase profitability. The average organic milk price (AVEPRICE) shows a significantly positive impact on the profitability in all three models. Among these three models, the impact of a price increase on profitability was most prominent for member farms, e.g., for a $1/cwt rise in milk price, members would make an extra $50,416 profit per year compared to the participants who would make $46,620 profit and all dairy farmers would make $39,596 profit. Results in Table 7 also show that an increase in the number of cows in a milking herd also had a positive and significant impact on dairy farms' profitability, and this was true to both participants and members.

In terms of farm characteristics which show negative and statistically significant negative impacts on dairy farm profitability were the acres of grazing pasture each farm had, age of cows in the milking herd (except for members), and whether farmers dry off their cows seasonally. The larger a grazing pasture is, it may be more difficult for dairy farmers to do milking at regular intervals which may have negatively impacted their profits. As cows age, their productivity may decline and we expect it have a negative impact on dairy farmer profitability. The results show that cow age had a negative impact on the profitability of all dairy farms as well as all those of the participants. Taking milk cows out of production on a seasonal basis was likely to decrease milk production and as a result it showed a negative impact on the NFI of all three profitability models. These findings suggest the importance of finding an optimal level of production intensity.

Farm operators bring different skill sets to each individual enterprise that may be captured by various operator characteristics, such as their age, education, and length of dairy farming experience. Higher education of dairy operators has been found to be correlated with higher levels of profitability (Mishra and Morehart 2001). Mishra and Morehart (2001) suggest that education may measure one's ability to process new and complex information. While both the age of the dairy farm operator and his dairy farming experience were not significant, higher education had a positive and significant impact on the profitability of all dairy farmers, e.g., a dairy farmer who is college educated would make $130,378 more profit per year compared to a dairy farmer who does not have a college degree. Higher education, however, did not seem to impact the profitability of the dairy farms operated by participants or cooperative members.

Integrating modern technology into the dairy production system is hypothesized to have a significant and positive impact on profitability. Such technologies may include computerized data gathering on raw milk quality and cows' health as well as automatic takeoff of milk by a machine (as opposed to milking by hand). Such technologies are necessary to increase efficiency, particularly when the dairy farm is large, i.e., have over 100 milking cows in the herd. Technological tools may free labor for other tasks. Moreover, technology adoption has been found to have a positive impact on dairy farm financial performance (El Osta and Johnson 1998; Short 2000). Short (2000) found that dairy farms with higher profitability were more likely to have milking equipment with automatic takeoffs and udder washers. Results in Table 7 shows that while a computerized system of data gathering did show a positive impact on all three profitability models, the use of auto takeoff units to milk cows shows a significantly negative impact on the profitability of all dairy farms in the region in general and those which sold their milk to cooperatives (i.e., participants) in particular.

Both production and cost efficiency measures were used to capture the variations in profit due to production and cost efficiencies. These variables are milk production per cow (MLKPRDCW) and cull rate (CULLRATE) which were used as measures of production efficiency, the cost of purchased feed per cow (PFEEDCOW), and labor cost per cow (LABCOW) which were used as measures of cost efficiencies. Short (2000) found that dairy farms with higher NFI typically had greater levels of milk production per cow. A greater level of milk production per cow was expected to positively impact profitability, while greater labor and feed costs per cow and a higher cull rate were expected to have a negative impact on profitability. The only variable that showed any significant impact on the profitability in the three profitability models was the cost of purchased feed, and as expected, it had a significant and negative impact on dairy farm profitability.

Farm operators used different mechanisms to manage the risk associated with fluctuations in the prices of inputs and output, and the risk involved with ensuring a market for their product. Various risk management strategies have been found to increase profitability (Mishra and Morehart 2001). We use the following risk management strategy variables to examine their impact on the three dairy farm profitability models: negotiating input price discounts (PDISCOUNT), locking in low input prices (PRICELOCK), locking in favorable milk prices via forward contracts (FWARDCON), having on-site processing, such as making cheese and selling it (ONSITPRO), and having nutrition management plans (NUTMNPLN) and regular veterinary service for cows (VETSERVIC). Such risk management strategies were expected to have a positive impact on the dairy farm profitability. Additionally, selling milk to cooperatives (SELLCOOP) was expected to have a positive impact on the profitability dairy farmers. Results of the impact of these risk management tools show that Northeast dairy farmers' decision to sell their milk to cooperatives, i.e., their decision to participate in dairy cooperatives, cost them dearly because those who sold their milk to cooperatives potentially reduced their profits by $233,845 on average per year (Table 7). This finding echoes

the results from Table 3 which shows that on average profits were lower by $91,600 for those dairy farms which participated in cooperatives compared to those dairy farms which did not participate.

While the availability of written contracts significantly increased the likelihood of dairy farmers selling their milk to cooperatives (Table 6), this factor shows a positive and significant impact on all three profitability models (Table 7). It was surprising, however, to find that both forward contract to sell milk and locking in input prices had a negative and significant impact on dairy farm profitability (Table 7).

In terms of financial efficiency, which depicts how efficiently financial risk is being managed, we use the debt-to-asset ratio which measures the proportion of farm assets owned by creditors, or the risk exposure of a farm business (FFSC 1997, Sec. 3, p. 9). Managing that risk to minimize its impact on the farm business was expected to be important in determining profitability. Greater levels of risk exposure were expected to have a negative impact on profitability. The results show that the debt-to-asset ratio (DEBT2ASST) had a significantly negative impact on profitability in all three models (Table 7). This finding is in accord with Short (2000) and El-Osta and Johnson (1989) who found that higher debt-to-asset ratios were negatively correlated with profitability.

5. CONCLUSIONS

There were several interrelated purposes of this study: first, we wanted to examine if dairy farmers who participate in cooperatives to market their milk were better off than those who do not participate; second, we wanted to identify and analyze factors that influence dairy farmers' decisions to sell their raw milk to cooperatives; and finally, we wanted to identify and analyze factors affecting dairy farm profitability in the Northeast United States. This study utilized a unique data set of farm financials, farm characteristics, and farm operator characteristics from the USDA's 2005 dairy farm ARMS survey. The analyses employ both non-parametric (means test and chi-square) and parametric (multivariate regression) techniques to evaluate and fulfill study objectives. The third objective was broken down into three parts (all dairy farmers, cooperative participants only, and cooperative members only) and three separate profitability models were estimated.

The majority of the dairy farmers in the sample were participants (78.6%), i.e., they sold their raw milk to cooperatives. This shows an excellent market penetration by dairy cooperatives in the region. Among these participants, almost all (over 94%) were members of dairy cooperatives, showing the success of these dairy cooperatives in recruiting members. In terms of the size distribution of dairy farms in the region, almost 40% were large farms – the rest almost equally divided among small and medium-sized farms. A similar distribution was observed among participants as well as members. There was no relationship between farm

size and dairy farmers' decisions to participate in cooperatives, or between farm size and dairy farmers' cooperative membership. The results of this study, therefore, counter the notion that cooperatives should target large farmers over small farmers for membership and participation.

Participants and non-participants were compared in terms of various farm and farm operator characteristics. Except for a few attributes, there were no differences between participant dairy farmers and non-participant dairy farmers, i.e., they were statistically indistinguishable from each other. Cooperative participants had more experience in dairy farming, they produced more milk and sold more milk compared to the non-participants, but received a lower price for their milk from the cooperatives. Unfortunately, we did not have data to explore the reasons for participants receiving lower price – one can speculate that cooperatives were paying a lower price because members will get additional financial benefit later in the form of patronage refunds.

In terms of farm operational efficiency measures, there were no statistically significant differences between the participants and non-participants dairy farmers except for the fact that non-participants were using significantly more feed (purchased and grown) and not surprisingly, their average feed cost per cow was higher (though not significantly higher) than participants. We also compared these two groups of dairy farmers using various financial efficiency measures and once again, there was no statistically significant difference between them except for one attribute – non-participants had a higher rate of return on farm assets.

Dairy farmer's decision to sell his/her raw milk to cooperatives was influenced by the price of milk – when price is higher, dairy farmers are more likely to sell their milk to non-cooperative buyers. Given most of the dairy farmers in the sample were members (291 out of 392, or 74.23%), this finding should be a matter of concern for cooperative managers because this indicated member disloyalty, and steps should be taken to counter such potential member disloyalty. Similarly, those dairy farmers who received a higher level of payments from the government are less likely to participate in cooperatives. Two risk management strategies, price lock in for input and having a nutrition management plan for cows, also negatively impacted the likelihood of dairy farmer participation. There were, however, no statistically significant difference between participants and non-participants regarding adoption of these two strategies in managing their dairy farm operations.

The factors that significantly increased the likelihood of a dairy farmer in the Northeast to sell his/her raw milk to cooperatives include the educational level of the farmer, whether there was a written contract for marketing milk, and the degree of solvency of the dairy farm. More specifically, the higher the education level of the dairy farmer, the higher the likelihood of participation, ceteris paribus. Similar

conclusions can be made for the following factors: availability of a written contract and relatively higher level of farm debt. The availability of written contracts probably helps reduce dairy farmers' debt concerns and those dairy farmers with relatively higher debt decide to participate.

An examination of the factors influencing the financial performance of dairy farms in the region showed that the average milk price received, the number of milk cows, level of education of the dairy farm operator, use of computerized dairy operation data gathering, and the availability of written contracts had a significantly positive impact on the profitability of dairy farms in the Northeast in general and both participants and members in particular. Not surprisingly, farms that were operating more efficiently were more profitable. In addition, farms that better managed their level of debt exposure were more profitable than others. The use of automatic takeoffs had a significantly negative impact on the NFI. Automatic takeoffs represented an expensive investment that led to increased depreciation and interest expenses. Furthermore, milking technology designed to increase the productivity or efficiency of the milking operation may be less suitable to some of the dairy farms in the region, such as organic dairy farms.

This study's findings have important and useful implications for various stakeholders within the dairy sector in the region and beyond. This information is useful to dairy farms in the Northeast that are struggling to survive and may learn what factors they should focus on to manage better, e.g., do not sell to cooperatives if the price cooperatives offer is lower than other buyers. This study is valuable to the extension agents in the region, who may be advising dairy farmers on their dairy operation as well as organizations that help dairy farmers in the region, such as the Northeast Organic Farming Association (NOFA). Finally, findings of this study are also useful to cooperative managers who can identify successful dairy farmers in their market area, and target those farmers for membership and participation. In addition, the analysis and results of this study may help cooperative managers to address price and profitability concerns of the participants.

6. STUDY LIMITATIONS AND FUTURE RESEARCH

In terms of the shortcomings of this study, it is limited in that it utilizes cross-sectional data that represents only one year of dairy farming, i.e., 2004 only. Milk price varies from season to season and currently (spring 2009) it is at a historically low level. Such price variations could alter the findings of such a study in the future. Additionally, profitability is only one measure of financial performance. Future studies of this kind may want to expand the definition of profitability beyond the NFI.

This study was also unable to answer (due to data limitations) the current role dairy cooperatives in the region, including non-price benefits they offered to members and non-members, and how patronage refund factors into the price received by participants. Due to data limitations, we were also unable to address

why some dairy farmers do not participate, and those who do, how long they will continue to participate and what they expect from the cooperatives in order to continue their patronage. Finally, due to lack of an adequate sample, we were not able to make a comparison between members and non-members. Such data-related shortcomings, however, provide us with an opportunity to carry out additional research in future.

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Table 1: Distribution of Participant and Non-participant Dairy Farmers in Cooperatives by State, 2005

State	Dairy farmer participation in cooperatives (N=392)		Cooperative membership (n=308)	
	Participant *n=308*	**Non-participant** *n=84*	**Members** *n=291*	**Non-members** *n=17*
NY	122	24	113	9
PA	88	33	82	6
VT	72	11	71	1
ME	26	16	25	1

Source: 2005 ARMS dairy panel data.

Table 2: Distribution of Participant and Non-participant Dairy Farmers in Cooperatives by Farm size, 2005

Farm size	States (N=392)				Dairy farmer participation in cooperatives[a] (N=392)		Cooperative membership[b] (n=308)	
	NY	**PA**	**VT**	**ME**	**Participant**	**Non-participant**	**Members**	**Non-members**
Small (≤50 cows) *n=113*	37	43	17	15	83	29	76	7
Medium (50 <cows ≤100) *n=124*	46	33	32	13	99	25	94	5
Large (> 100 cows) *n=156*	63	45	34	14	126	30	121	5
Total	146	121	83	42	308	84	291	17

Source: 2005 ARMS dairy panel data.

Note: a= Chi-square 1.892, 2df (p-value 0.388), and b=Chi-square 1.975, 2df (p-value 0.373). Therefore, not able to reject the null that there is no relationship (a) between farm size and farmers' participation, and (b) between farm size and farmers' membership decisions. The parametric marketing channel choice model presented in Table 6 should support this non-parametric finding.

Table 3: Farm and Farm Operator Characteristics of Participant and Non-participant Dairy Farmers in Cooperatives in the Northeast USA, 2005

Attribute	Participant *n=308*	Non-participant *n=84*	Mean difference
Farm Characteristic:			
Average number of milk cows in milking herd	210	147	**63***
Total milk sold (cwt)	40,454	27,250	**13,204***
Average price received ($/cwt)	$18.59	$19.59	**-$1.00***
Acres of pasture for grazing	48.46	57.18	-8.72
Average age of milking herd (yrs)	4.74	4.77	0.03
Dry off cows seasonally	No@	No@	--
Government Payments ($)	$25,823	$18,435	$7,388
Net Farm Income (NFI), ($)	$126,300	$217,900	-$91,600
Farm Operator Characteristics:			
Years operation has been producing milk	24.37	21.70	**2.67***
Primary operator's age	51.51	49.55	1.96
Primary operator's highest level of education	High school and some college@	High school and some college@	--
Technology			
Milking Facility Used	Barn with around the barn pipeline@	Barn with around the barn pipeline@	--
Milking system uses computerized data gathering	No@	No@	--
Has milking system with automatic takeoffs	No@	No@	--
Efficiency Measures			
Milk production (cwt) per cow	162.4	157.5	4.90
Feed (cwt) per cow	1,359	61,856	**-60,497***
Purchased feed cost per cow ($/cow)	778	823	-45
Purchased feed cost as a percentage of total operating cost (%)	0.289	0.300	-.011
Acres of pasture for grazing per cow	0.914	1.018	-0.105
Farm labor expenses per cow ($/cow)	303.3	283.4	19.95
Farm labor expenses per unit of milk sold ($/cwt)	1.777	1.757	0.02
Risk Management Decisions:			
Keep individual cow production records	Yes@	Yes@	--
Lock in input prices	No@	No@	--
Negotiate input price discounts on inputs	No@	No@	--
Receive volume premiums	No@	No@	--
Written contract for milk handling payments	Yes@	No@	--

Use forward contracts to sell milk	No@	No@	--
Process milk on site	No@	No@	--
Use a nutrition plan to manage herd	Yes@	Yes@	--
Use veterinary services regularly	Yes@	Yes@	--

Note: Statistically significant means are as follows: *** p ≤ .01, ** p ≤ .05, * p ≤ .10, @ denotes use of mode.

Table 4: Financial Ratios of Participant and Non-participant Dairy Farms in the Northeast by Size Class, 2005

Financial Ratios [12]	**Participant** *n=308*	**Non-participant** *n=84*	**Mean difference**
Liquidity			
Current Ratio	1.176	0.788	0.388
Working Capital	$139,284	$111,000	$28,284
Solvency			
Debt/Asset	0.1855	0.1542	0.0313
Equity/Asset	0.8145	0.8458	-0.0313
Debt/Equity	0.1237	0.2852	-0.161
Profitability			
Rate of Return on Farm Assets	0.009	0.112	**-0.103***
Operating Profit Margin Ratio	0.041	0.003	0.038
Financial Efficiency			
Asset Turnover Ratio	0.328	0.376	-0.048
Operational Ratios			
Operating Expense Ratio	0.706	0.709	-0.003

Note: Statistically significant means are as follows: *** p ≤ .01, ** p ≤ .05, * p ≤ .10

[12] (i) Current Ratio = Total current farm assets / Total current farm liabilities; (ii) Working Capital = Total current farm assets - Total current farm liabilities; (iii) RRFA = (NFIFO + Interest - Withdrawals for unpaid labor) / Average total farm assets; (iv) Asset Turnover Ratio = Gross revenues / Total farm assets; (v) Operating Profit Margin Ratio = (NFIFO + Interest - Withdrawals for unpaid labor) / Gross revenues; (vi) Operating Expense Ratio = (Total operating expenses - Depreciation) / Gross revenues

Table 5: Definitions and Summary Statistics of Regression Variables, n=330 (NFI>0 only)

Variable	Definition	Expected Sign	Unit	Mean	Std. Dev.	Min.	Max.
Profitability							
NFI	Net Farm Income	NA	'000 $	192.192	692.561	0.577	10,851.14
Farm Characteristics:							
AVEPRICE	Average milk price received	+	$/cwt	18.87	4.272	11	31.58
MILKCOWS	Number of milk cows	+	Number	192	329.53	20	3,921
ACGFEED	Acres of grazing pasture	+	Acres	62.45	102.60	0	1,400
COWAGE	Average age of the milking herd	-	Years	4.72	1.08	2	8
HRSMLKON	Hours per day milking system in operation	+	Hours	6.69	5.38	1	24
DRYOFF	Choice to dry off cows seasonally	-	Yes/No	0@	0.350	0	1
Farm Operator Characteristics:							
OPEAGE	Operator's age	-	Years	50.89	11.47	25	85
OPEEDU	Operator's highest level of education	+	Scale	2@	0.682	1	3
MILKEXP	Years dairy farm has been in operation	+	Years	23.51	14.27	1	95
Extra Income:							
LPSXMLKS	Livestock and poultry sales (excludes milk sales)	+	$	36,068.52	68,779.02	0	588,000
GOVTYES	Receive government payments	+	Yes/No	1@	0.425	0	1
Technology:							
COMPUTER	Milking system uses computerized data gathering	+	Yes/No	0@	0.312	0	1
AUTTAKOF	Milking system with automatic takeoffs	+	Yes/No	0@	0.495	0	1
Efficiency Measures:							
MLKPRDCW	Milk production per cow per year	+	CWT	164.79	57.22	41.56	377.42
LABCOW	Labor costs per cow per year	-	$	272.56	313.90	0	1878.54
PFEEDCOW	Purchased feed cost per cow per year	-	Ratio	787.33	383.059	2.344	2,337.21
CULLRATE	Cow loss rate per year	-	Ratio	0.045	0.034	0	0.185
Risk Management:							
SELLCOOP	Sell mostly or only to dairy cooperatives	+	Yes/No	1@	0.410	0	1

PDISCOUNT	Negotiate input price discounts	+	Yes/No	0@	0.498	0	1
WRITTCON	Have a written contract for marketing milk	+	Yes/No	1@	0.463	0	1
FWARDCON	Have a forward contract for marketing milk	+	Yes/No	0@	0.296	0	1
PRICELOCK	Lock in input prices	+	Yes/No	0@	0.436	0	1
ONSITPRO	Processed milk on site	-	Yes/No	0@	0.122	0	1
NUTMNPLN	Use of a nutrition management plan	+	Yes/No	0@	0.495	0	1
VETSERVIC	Use of regularly scheduled veterinary Services	+	Yes/No	1@	0.471	0	1
Financial Efficiency:							
DEBT2ASST	Debt/Asset ratio	-	$	0.172	0.202	0.00011	1.881

Note: @ denotes use of mode. Source: authors' own computation from the 2005 ARMS data

Table 6: Results of the Milk Marketing Channel Choice Model (N=392)

Variable	Dependent variable: SELLCOOP	
	Coefficient (SE)	*Marginal Effect*
Intercept	0.884 (1.571)	
Farm Characteristics:		
AVEPRICE	**-0.087* (0.048)**	**-0.012**
MILKCOWS	0.0002 (0.0001)	
ACGFEED	-0.001 (0.002)	
COWAGE	-0.008 (0.124)	
HRSMLKON	0.085 (0.058)	
DRYOFF	0.165 (0.419)	
Farm Operator Characteristics:		
OPEAGE	0.005 (0.017)	
OPEEDU	**0.453* (0.236)**	**0.064**
MILKEXP	0.016 (0.014)	
Extra Income:		
LPSXMLKS	1.187E-6 (4.333E-6)	
GOVTYES	**-0.669* (0.392)**	**-0.094**
Technology:		
COMPUTER	-0.7420 (0.551)	
AUTTAKOF	0.592 (0.386)	
Efficiency Measures:		
MLKPRDCW	-0.001 (0.004)	
PFEEDCOW	-0.002 (0.0004)	
LABCOW	-5.12E-6 (0.0005)	
CULLRATE	-0.827	

	(4.277)	
Risk Management:		
PDISCOUNT	-0.053 (0.314)	
WRITTCON	**1.787***** **(0.309)**	**0.252**
FWARDCON	0.161 (0.474)	
PRICELOCK	**-0.757*** **(0.412)**	**-0.107**
ONSITPRO	-0.622 (0.768)	
NUTMNPLN	**-0.657**** **(0.310)**	**-0.093**
VETSERVIC	-0.028 (0.354)	
Financial Efficiency:		
DEBT2ASST	**1.740*** **(0.924)**	**0.259**
Likelihood ratio (20 df)	**62.982*****	
Percentage of correct predictions	77.6	
McFadden's Likelihood Ratio Index (LRI), or Pseudu-R^2	0.155	

Note: Values displayed are parameter estimates and corresponding p-values are in parentheses. Statistically significant means are as follows: *** $p \leq .01$, ** $p \leq .05$, * $p \leq .10$.

Table 7: Factors Determining Profitability of Participant and Non-participant Dairy Farmers in the Northeast U.S., 2005

Variable	Expected Sign	NFI ('000 $)		
		All dairy farmers, NFI>0 (N=330)	**Participants, NFI>0 (n=262)**	**Members, NFI>0 (n=247)**
		Coefficient (SE)	*Coefficient* (SE)	*Coefficient* (SE)
Intercept		76.169 (630.837)	-324.451 (652.125)	-411.283 (735.599)
Farm Characteristics:				
AVEPRICE	+	**39.596* (22.102)**	**46.620** (22.897)**	**50.416** (24.434)**
MILKCOWS	+	**1.233*** (0.182)**	**1.332*** (0.214)**	**1.344*** (0.227)**
ACGFEED	-	**-2.663*** (0.325)**	**-2.754*** (0.349)**	**-2.761*** (0.381)**
COWAGE	-	**-92.260** (45.677)**	**-90.641* (47.340)**	-102.384 (50.692)
HRSMLKON	+	-3.618 (9.802)	-6.310 (9.721)	-6.791 (10.581)
DRYOFF	-	**-283.784** (105.320)**	**-246.604** (116.240)**	**-236.292** (120.205)**
Farm Operator Characteristics:				
OPEAGE	-	2.230 (4.765)	2.399 (4.754)	2.605 (5.128)
OPEEDU	+	**130.378** (62.255)**	100.195 (64.314)	110.465 (67.904)
MILKEXP	+	-3.590 (3.634)	-3.628 (3.565)	-3.752 (3.753)
Extra Income:				
LPSXMLKS	+	0.0007 (0.0007)	0.0004 (0.0007)	0.0003 (0.0007)
GOVTYES	+	-133.323 (139.374)	-17.054 (149.301)	-2.021 (155.837)
Technology:				
COMPUTER	+	**281.799** (96.595)**	**315.281** (103.250)**	**340.638** (110.141)**
AUTTAKOF	+	**-264.715** (124.917)**	**-240.044* (130.694)**	-229.468 (139.057)
Efficiency Measures:				
MLKPRDCW	+	1.710 (1.368)	2.078 (1.379)	2.249 (1.637)

PFEEDCOW	-	**-0.608*** (0.135)**	**-0.695*** (0.138)**	**-0.701*** (0.152)**
LABCOW	-	-0.007 (0.164)	0.042 (0.173)	0.040 (0.179)
CULLRATE	-	457.507 (1305.869)	-361.925 (1325.812)	-452.529 (1401.037)
Risk Management:				
SELLCOOP	+	**-233.845** (119.320)**	--	--
PDISCOUNT	+	153.316 (99.612)	**173.533* (103.722)**	176.589 (108.388)
WRITTCON	+	**242.146** (96.536)**	**242.414** (94.590)**	**241.646** (101.190)**
FWARDCON	+	**-350.564** (140.672)**	**-396.733** (93.147)**	**-418.242** (155.213)**
PRICELOCK	+	**-293.214** (90.734)**	**-309.570** (93.482)**	**-329.023** (100.539)**
ONSITPRO	+	-28.805 (310.350)	67.394 (313.017)	120.067 (328.561)
NUTMNPLN	+	-65.421 (100.326)	-64.009 (102.489)	-47.115 (107.906)
VETSERVIC	+	8.356 (160.183)	-21.529 (166.520)	-26.426 (173.492)
Financial Efficiency:				
DEBT2ASST	-	**-317.878* (164.590)**	**-298.795* (164.370)**	**-330.115* (171.461)**
F-stat		**18.13*****	**19.15*****	**18.15*****
Adj. R^2		0.575	0.635	0.635

Note: Values displayed are parameter estimates and corresponding p-values are in parentheses. Statistically significant means are as follows: *** $p \leq .01$, ** $p \leq .05$, * $p \leq .10$.