The Financial Performance of
North Dakota Grain Marketing and Farm Supply
Cooperatives

Gregory McKee

Department of Agribusiness and Applied Economics
North Dakota State University, 205A Morrill Hall, Fargo, ND 58105

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Abstract

The objective of this research is to assess the financial performance of North Dakota farm supply and grain handling cooperatives between 2002 and 2006. Audited financial statements from 120 cooperatives were used. Various financial variables are tested as determinants of profitability. Financial ratio analysis is used to observe trends in liquidity, solvency, and efficiency. Comparisons in ratio trends are made based on relative profitability. No statistical relationship is found between business size and profitability. The most profitable North Dakota agricultural input supply and grain marketing cooperatives were observed to have financial ratio values distinct from less profitable ones.

Keyword. Cooperative, agriculture, financial ratio, profitability, North Dakota

Introduction

Cooperatives are an important part of the agricultural economy of many states. Nationally, the business volume of agricultural cooperatives was over $110 billion in 2006. Net income, a source of economic benefits for cooperative business owners, was $3.2 billion that year (Deville et al. 2007).

The level of benefits obtained from cooperatives is related to a firm's profitability. Factors, such as business size, operational efficiency, liquidity, and solvency have been shown in the agribusiness literature to be determinants of a firm's profitability. However, the potential importance of business size is unclear, even though it has been explained by cooperative business leaders as a strategy to improve financial performance (Kenkel et al. 2003; Barton et al. 1993).

The North Dakota farm supply and grain handling cooperative sector has been evolving rapidly as the number of cooperatives in that state follows this nationwide trend. In 2001, 210 farm supply and grain marketing cooperatives were in operation (Kraenzle et al. 2003). By December 2006, this number had declined to 197 (DeVille et al. 2007).

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North Dakota State University, 205A Morrill Hall, Fargo, ND 58105

The size of North Dakota farm supply and grain handling cooperatives has also been evolving. Like states such as Texas, Oklahoma, Mississippi, and Alabama, North Dakota is characterized by many cooperatives with, on average, relatively small sales volumes. In 2001, average net sales per North Dakota cooperative were $10 million, ranking the state 35th of the 45 states surveyed (Kraenzle et al. 2003). In 2006, average net sales per cooperative were $20 million, ranking the state 34th of the 47 states surveyed (DeVille et al. 2007). In contrast, the nationwide average was approximately $40 million per cooperative that year (DeVille et al. 2007). Some farm supply and grain marketing cooperatives in North Dakota have been growing very rapidly, however. In 2002, the largest North Dakota farm supply and grain marketing cooperative had sales of $74 million. By 2006, sales increased to $157 million and were at least $219 million in 2007.

Despite this evolution, profitability for these cooperatives has remained steady, with a return on local assets of 19% in 2002 and 17% in 2006 for the largest cooperatives in those years.[1] Consequently, how factors such as business size affect the profitability of farm supply and grain marketing cooperatives when this evolution begins in a sector characterized by many firms with relatively low average sales volume is unclear. Understanding how decisions that affect profitability is, therefore, of practical interest to members and managers of cooperatives in states whose farm supply and grain marketing sectors have a similar composition to North Dakota.

The objective of this research is to identify the presence and strength of determinants of North Dakota farm supply and grain marketing cooperatives' profitability between 2002 and 2006. This study utilizes financial ratios of business size, asset composition, liquidity, solvency, and efficiency as determinants of profitability. No statistical relationship is found between North Dakota agricultural cooperative profitability and business size, as measured by assets. This finding is consistent with previous research (Boyd et al. 2007). Depending on trends in profitability, purchases of larger amounts of fixed assets may improve profitability. Variations in net income, an indicator of risk, may be rewarded with increased profitability for North Dakota cooperatives and on a nationwide scale.

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[1] Returns on local assets for the largest North Dakota farm supply and grain marketing cooperative were 32% in 2007. This occurred immediately following a merger.

Literature Review

Businesses are identified as cooperatives based on how their governing laws of conduct affect overall management of their firm's assets. Financial management practices which best distinguish cooperatives include how economic benefits are distributed and how the firm is controlled. Balance sheet and income statement data can be used to observe the effect of these practices on cooperative profitability.

Businesses are also identified as cooperatives based on their ownership and governance structures. Although recent changes in the laws of some states permit ownership by other groups, historically, cooperatives are owned by their users. Owners contribute equity through direct investment, retained profits, or other means. Such equity enables the cooperative to finance a portion of its assets, to provide desired services over an extended period of time, and to qualify for debt capital to finance the remaining portion of its assets. Control over investment policy is exercised through votes by members made on a democratic or proportional basis. The members, patrons who own a portion of the cooperative, elect a board of directors which is the member's agent, or representative, in the management process. Financial issues controlled by the board of directors include, but are not limited to, solvency goals and decisions about acquiring large amounts of fixed assets. The effect of member decisions on cooperative business profitability and economic efficiency has been measured in the agribusiness literature (Parliament et al. 1990; Schrader et al. 1985).

Based on financial data for cooperatives operating in 36 states between 1994 and 2003, Boyd et al. (2007) determined variables that are determinants of profitability in local farm supply and grain handling cooperatives. The authors tested for statistical significance of variables affected by director and manager decisions including liquidity, asset size, risk, the ratio of assets to equity, net profit margin, asset turnover, the times interest earned ratio, total assets, and lagged average return on equity. They concluded business size, as measured by assets, was not a determinant of profitability.

This paper examines the determinants of farm supply and grain marketing cooperative business profitability in a state composed mostly of relatively small businesses and a small group of rapidly growing businesses. Although this study uses a statistical model similar to Boyd et al., (2007), this study has merit since the dataset used by Boyd et al. contained financial information for farm supply and grain marketing cooperatives operating in 36 states. Sixteen of these states are characterized by cooperatives with sales volumes greater than the national average, and 22 have average sales larger than North Dakota cooperatives. Since

their data did not appear to be a random sample, such a dataset may have diluted the relatively unique set of factors at work in a state characterized by many relatively small firms.

Use of financial ratios to evaluate the performance of cooperatives is not an outcome of economic theory (Sexton and Iskow 1993). Since cooperatives represent a vertical integration between the farmer and the cooperative, using financial ratios of only part of an entity fails to account for all of the financial effects of management decisions on the joint entity. Although this limitation is acknowledged, this study uses financial data because of data limitations.

Financial data do capture some benefits that accrue to members of farm supply and grain marketing cooperatives. For example, prices paid to members for their grain, measured as the cost of goods sold in grain marketing cooperatives, partially measures a significant benefit for cooperative members. Furthermore, to the extent non-pooling grain handling and input supply cooperatives are examined, and only competitive prices are considered, no residual benefit from vertical integration exists. The use of financial ratio analysis is appropriate for measuring member benefits transmitted by the cooperative to members in the short-run. Financial ratios analysis is germane to cooperative stakeholders--members, management, and other leaders.

Liquidity management is commonly used in the agribusiness literature to assess the financial performance of firms (Adelaja et al. 1999; Barton et al. 1993; Kenkel et al. 2003; Richards and Manfredo 2003). Liquidity ratios measure the short-term solvency of a firm. High liquidity reflects an ability to repay debts and is valuable for obtaining debt capital. It also reflects a management team's disposition for using its cash and other short-term assets efficiently.

Solvency has also been used as an indicator of financial performance (Baourakis et al. 2002; Boyd et al. 2007). Solvency describes the preference of a cooperative's board of directors for equity capital versus debt capital. A solvency ratio measures the portion of the cooperative's assets held by the members.

Efficiency is also commonly used in the agribusiness literature to assess financial performance (Hazledine 1989; Kenkel et al. 2003; Lerman and Parliament 1990). A highly efficient firm is able to use its labor and capital resources to produce output at a lower cost than a relatively less efficient firm.

Regression analysis has been used to explain the statistical relationship between agribusiness performance and various financial performance indicators (Barton et al. 1993; Boyd et al. 2007; Siebert et al. 2000). These studies indicate that lower costs and greater productivity are important determinants of agribusiness profitability. Business size, however, is not always significant. The share of total assets comprised of fixed assets, however, has been shown to be

positively related to good management practices in agricultural cooperatives (Russo et al. 2000).

Data

Data for this study are obtained from balance sheets and income statements of 120 farm input supply and grain marketing cooperatives with headquarters in North Dakota for the years 2002 through 2006. All cooperatives observed in the data are members of the CHS, Inc., a large cooperative headquartered in Minneapolis Minnesota. Corporate members of this cooperative supply a combination of petroleum, fertilizer and crop protection products; farm supplies; convenience items; and grain marketing services. Cooperatives in North Dakota which market other agricultural products such as value-added agricultural products (specialty grains, pasta, sugar), meat (bison, lamb), vegetables (potatoes) and other commodities are not represented.

The data were compiled by CHS Member Services. Only selected variables from the financial statements were recorded by Member Services, including sales, net income, gross income, expenses, depreciation, current assets and liabilities, value of fixed and total assets, level of investments in other organizations, patron equity, and long-term debt. Identifying information about the individual cooperative's business type (farm supply only, grain marketing only, or both) was not available. Analysis over time is possible, however, since Member Services assigns a unique account number, maintained over time, to each cooperative. Other omitted variables include interest expense and other operational expense categories.

Member Services provided data for all North Dakota farm supply and grain marketing cooperatives that conducted at least $2 million of expenditures with CHS. A total of 451 observations, representing 120 unique cooperatives, met this description. Due to missing information in some of the observations, only 435 observations were useable for financial ratio analysis.

DeVille et al. (2007) observed 196 farm supply and grain marketing cooperatives operating in North Dakota in 2006. A dataset with observations of 120 of these are representative of all but the smallest of cooperatives in the state. Summary statistics for sales, net income, and assets for these data are provided in Table 1. The average North Dakota farm supply and grain handling cooperative tended to grow in sales volume, net income, and locally owned assets between 2002 and 2006.

Table 1. Summary statistics of North Dakota farm supply and grain marketing cooperatives sub-population, 2002-2006

	2002	2003	2004	2005	2006
N	99	100	77	75	88
Total Statewide Sales	$1,275,477,823	$1,599,590,282	$1,749,075,117	$1,806,500,513	$2,229,655,176
Average Sales per Co-op	$12,883,614	$15,995,903	$22,140,191	$24,086,674	$25,336,991
Total Statewide Local Net Income	$19,380,671	$24,627,218	$28,540,144	$37,458,157	$35,695,759
Average Local Net Income per Co-op	$195,764	$246,272	$361,268	$499,442	$405,634
Total Adjusted Local Assets	$240,224,450	$279,264,438	$272,822,191	$311,832,889	$362,286,561
Average Adjusted Local Assets per Co-op	$2,426,510	$2,792,644	$3,543,145	$4,157,772	$4,116,893

Methodology

Financial performance in cooperatives may differ based on several factors. Meaningful comparisons of variations in financial performance can be made by dividing the data into alternative categories. Examples of this approach include Barton et al. (1993); Boland and Akridge (1999); Boland and Akridge (2004); and Boyd et al. (2007).

As a first step for identifying relationships between cooperative business profitability and other factors in this study, the relationship between business size and net income source is examined. The data are ranked, for convenience, into sales quartiles and then, separately, into local asset size quartiles. In order to accurately measure the effect of business size on profitability, investment in other firms is not considered. The largest 25% of cooperatives are compared with the middle 50% and the smallest 25%. Local assets are adjusted for current liabilities,

by subtracting current liabilities from local total assets, so as to maintain a complete measure of solvency both in the short- and long-term. Profitability, measured as returns to adjusted locally owned assets (ROLA), is calculated as the ratio of net income before taxes divided by the liability-adjusted value of locally-owned assets. Also, returns to adjusted local assets are used instead of returns to local equity, since the latter is a function of the cooperative's leverage.

The second step is financial ratio analysis. Measures of liquidity, efficiency, solvency, and profitability are calculated for each cooperative on an annual basis. For this study, liquidity is represented as the ratio of current assets and current liabilities. Efficiency is represented in two ways. First, the asset turnover rate is calculated as the ratio of adjusted total local assets and sales. Second, it is also calculated as the ratio of salary and benefits expenses to sales. Solvency is represented in two ways. First, it is calculated as the ratio of member equity and adjusted total local assets. Second, it is calculated as the ratio of member equity and fixed assets. Since fixed assets can also be used to increase profitability, the ratio of fixed assets to total assets is also provided.

The selection of which ratios to calculate is based on data availability and their use in financial literature to analyze determinants of profitability. The financial ratios of 120 cooperatives in North Dakota are calculated from their fiscal year-end audited financial statements from 2002-2006. For convenience in making meaningful comparisons of relative profitability and financial performance, the top 25% percent of cooperatives as measured by profitability in any year are classified as "high." The middle 50% of cooperatives are classified as "medium," and the remaining 25% are classified as "low."

A linear statistical model is used to determine the presence and strength of the relationship between profitability, profitability in prior years, asset size, liquidity, efficiency, risk, and level of fixed assets. The following conceptual model is based on the research cited above:

$$\overline{ROLA}_{i,t-1} =$$

$$f\left(\overline{\text{Liquidity}}_{i,t-2}, \overline{\text{Solvency}}_{i,t-2}, \overline{\text{Profitability}}_{i,t-2}, \overline{\text{Efficiency}}_{i,t-2}, \overline{\text{Risk}}_{i,t-2}, \overline{\text{Fixed Asset Share}}_{i,t-2}\right)$$

where $\overline{ROLA}_{i,t-1}$ is the cooperative-specific average of the current and previous year ROLA (Return on Local Assets). Risk is measured as the sample standard deviation of cooperative-specific observations of ROLA between 2002 and 2006

(Ruefli et al. 1999), $\sqrt{\dfrac{1}{N}\sum\limits_{t=1}^{6}\left(ROLA_{i,t}-\overline{ROLA_i}\right)^2}$.

The conceptual model used in this study differs from the Boyd et al. (2007) model. First, it considers the effect of increasing proportions of fixed assets as a share of total assets, since this would be characteristic of small, relatively old firms whose assets are largely depreciated. These firms must purchase new fixed assets in order to grow. Also, in order to obtain more information about the effect of manager-controlled decisions on profitability, the ratio of sales to salary and benefits expense is used as a second measure of efficiency. Finally, due to data limitations, the times interest earned ratio is not included.

Since profitability in the current year likely depends on prior financial performance (Boyd et al., 2007), this concept is included in the statistical model in two ways. First, observations for the independent profitability variable, $ROLA*_{i,t-2}$, have been averaged over the current and previous years so as to eliminate effects unique to a single year. Second, values for the current ratio, efficiency, solvency, fixed asset ratio, and profitability variables are calculated using the average of the second and third lag (value from two and three years previous). This strategy is based on the assumption that it may take up to two years to experience the effect of these financial ratios. Third, the contemporaneous average is subtracted from each ratio, so as to remove current industry-wide effects from the average value. Hence, the current ratio used for cooperative *i* in the statistical model to represent 2006, for example, would be the average of the observed 2005 and 2004 current ratio values for cooperative *i*, with the 2006 statewide average subtracted from this value. Finally, since the scale of the adjusted assets variable is in dollars, its natural logarithm is used for the statistical model.

Since data were not available for all 120 cooperatives for all five years, and a balanced panel is used for estimation, observations for 63 cooperatives are removed. Financial data for 57 of the 120 cooperatives are retained, creating a balanced panel of 171 observations. This subset of data is less representative of the statewide population of farm supply and grain marketing cooperatives than the data used for the ratio analysis. On average, the 57 cooperatives studied had 20% more sales, 35% more assets, and 35% more local savings per cooperative than the average cooperative in the set of 120. This result makes sense because, as stated above, cooperatives with sales less than $2 million within the corporate members of the CHS cooperative were not recorded in the year in which sales below this level occurred, which suggests the relatively large cooperatives were

always observed in these data. Accordingly, the results of the statistical model cannot be used to infer determinants of profitability for all farm supply and grain handling cooperatives in North Dakota. The subpopulation retains explanatory power, however, because a difference of means test, using a *t*-statistic, indicates that the average 2006 sales volume for the group of 120 cooperatives and the group of fifty-two is not statistically different.

OLS (Ordinary Least Squares) is used to estimate the following:

$$ROLA_{i,t-1} = \alpha_t + \beta_1(current\ ratio^*_{i,t-2}) + \beta_2\left(\frac{total\ sales}{adjusted\ assets}\right)_{i,t-2} +$$

$$\beta_3\left(\frac{total\ sales}{salary\ and\ benefits}\right)_{i,t-2} + \beta_4\left(\frac{member\ equity}{adjusted\ assets}\right)_{i,t-2} + \beta_5(adjusted\ assets^*_{i,t-2})$$

$$+ \beta_6\ (risk^*_{i,t}) + \beta_7(ROLA^*_{i,t-2}) + \beta_8\left(\frac{fixed\ assets}{adjusted\ total\ assets}\right)_{i,t-2} + \varepsilon_{i,t}\ , (1)$$

where *t* represents a year between 2004 and 2006, inclusive, and *i* represents an individual cooperative. The asterisk denotes that each observation of the variable is modified to include the average of the two years previous to the current period minus the contemporary statewide average. The years 2002 and 2003 are dropped from the regression since data previous to these years were unavailable for calculating the lagged two-year average. White's test is used to test for heteroskedasticity and none is detected. Also, multicollinaearity is not suspected for two reasons. First, no two variables have a Pearson correlation coefficient greater than 0.52. Second, similar standard errors are given when a relatively large and small dataset are used for estimation.

Results and Discussion

North Dakota farm supply and grain handling cooperatives receive net income primarily from two sources. First, net income is generated from local management of assets. Second, because they are members of the CHS cooperative, as well as other cooperatives, net income is also generated through patronage dividends from investments in regional cooperatives, cooperative financial institutions, and rural utility cooperatives. In 2006, local asset

management of 88 North Dakota farm supply and grain marketing cooperatives generated a net income totaling $35,695,759. Patronage dividends from outside investments generated a net income totaling $22,475,524. Total net income was $58,171,283 in 2006 (Table 1).

The share of net income contributed from these sources is related to sales volume in Table 2. In 2006, the smallest 75% of cooperatives, as measured by sales volume, received, on average, at least 62.5%, of their net income from investments in assets outside the cooperative. In contrast, the largest 25% of cooperatives received 26% of their net income from investments in assets outside the cooperative. This pattern appears to be persistent. Between 2002 and 2005, the smallest 50% of cooperatives received at least 40% of net revenues from investments in assets outside the cooperative. Hence, North Dakota farm supply and grain marketing cooperatives with relatively less sales relied relatively more on returns from investments in assets outside the cooperative in order to obtain net income.

Table 2. Share of total net revenue from outside investments for North Dakota farm supply and grain marketing cooperatives, by sales quartile, 2002-2006

Sales Quartile	2006	2005	2004	2003	2002
Largest 25%	26.00%	22.00%	16.60%	15.50%	19.50%
Between median (inclusive) and third quartile	62.50%	30.10%	27.90%	22.40%	39.70%
Between first quartile (inclusive) and median	67.30%	40.90%	40.80%	43.50%	50.50%
Smallest 25%	69.70%	68.60%	68.30%	94.80%	94.40%

The relationship between net income source and sales volume suggests a relationship between profitability and total asset value. Profitability, measured as the annual return on adjusted local assets (ROLA), is calculated for each cooperative. In 2006, the average statewide ROLA for the 88 cooperatives observed was 7.37%. The cooperatives are then ranked by adjusted local assets. In 2006, the smallest 25% of cooperatives, the middle 50%, and the largest 25% obtained returns of 4.81%, 7.03% and 10.72%, respectively (Table 3). These results suggest that North Dakota farm supply and grain marketing cooperatives with more assets may be relatively more profitable.

Table 3. North Dakota farm supply and grain marketing cooperative ROLA, by asset size, 2002-2006

Year	Largest 25%	Middle 50%	Smallest 25%
2002	9.37%	6.27%	-6.17%
2003	10.20%	6.35%	5.29%
2004	11.76%	10.39%	0.77%
2005	13.65%	10.10%	-9.06%
2006	10.72%	7.03%	4.81%

If a relationship between asset size and profitability exists, the profitability of cooperatives with the most assets and the profitability of the most profitable cooperatives may be similar. Following the procedure described above, the 120 cooperatives are sorted into groups of high, medium, and low profitability. Table 4 presents the average profitability, as measured by ROLA, for the high, medium, and low profitability groups. An average cooperative in the high and medium profitability groups always has positive returns and usually exceeds the statewide average ROLA. In contrast, an average cooperative in the low profitability group always loses money. Since the ROLA for the most profitable cooperatives does not compare with that of cooperatives with the most assets, a direct relationship between profitability and business size alone may not exist.

Table 4. North Dakota farm supply and grain marketing cooperative average annual ROLA, by profitability group, 2002-2006

Year	All	High	Medium	Low
2002	3.91%	16.53%	7.29%	-15.32%
2003	7.05%	17.44%	7.60%	-4.42%
2004	8.20%	19.43%	9.16%	-2.56%
2005	6.56%	21.57%	9.56%	-12.19%
2006	7.37%	20.74%	7.17%	-5.03%

Relationship between efficiency and profitability

The ratio of sales to assets is one means of measuring the efficiency of a company's operations. The ratio of sales to adjusted total local assets, the asset

turnover rate, for all 120 cooperatives is calculated. The average annual asset turnover rate for each profitability group is presented in Table 5, panel (a). Efficiency generally increased during the 2002 through 2006 period. Low profitability cooperatives increased their ability to produce sales per unit of assets faster than the "high" and "medium" groups. No clear relationship between efficiency alone and profitability exists in these data.

Table 5. Measures of North Dakota farm supply and grain marketing cooperative operational efficiency, by profitability group, 2002-2006

(a) Ratio of Sales and Adjusted Assets				(b) Ratio of Sales and Salary and Benefits Expense			
Year	All	High	Medium	Low	All	High	Medium	Low
2002	4.50	6.68	4.66	3.00	NA	NA	NA	NA
2003	5.99	7.31	5.25	6.17	18.57	21.51	19.23	14.30
2004	6.67	8.61	6.11	5.90	20.97	24.32	22.61	14.32
2005	6.12	7.43	5.79	6.22	21.24	26.75	19.28	20.92
2006	6.59	7.89	5.76	6.91	21.75	28.27	19.72	19.08

The ratio of sales to salary and benefits expense is another means of measuring the efficiency of a company's operations. The average annual ratio of employee expenses to sales is presented for all 120 cooperatives in Table 5, panel (b). Ratios are not provided for 2002 because salary data were incomplete. These ratios show that, again, efficiency increased between 2002 and 2006. In contrast with the ratio of sales and adjusted assets, however, the most profitable cooperatives are consistently the most efficient and the least profitable cooperatives are consistently the least efficient.

Relationship between profitability and liquidity

Financial data provided by Member Services can be used to determine whether a relationship exists between profitability and liquidity in the observed sub-population of North Dakota farm supply and grain marketing cooperatives. The current ratio for all 120 cooperatives is calculated. Average annual ratio for each profitability group is presented in Table 6. Current ratios declined for the most profitable cooperatives between 2002 and 2006, from 1.66 to 1.43. Further analysis of the data indicates this change was due to relatively larger increases in

current liabilities than current assets. None of the data provided by Member Services explained these increases.

Cooperatives in the low and medium profitability groups experienced a trend of increasing current ratios between 2002 and 2006. Ratios were highest in 2005 for the low profitability group and 2006 for the medium group. In comparing this situation with that of the most profitable cooperatives, managers of the medium and low profitability cooperatives in North Dakota make relatively less use of available working capital to conduct operations. Manager of cooperatives in these three groups are likely to have difference preferences for liquidity in any given year. These differences may make it difficult to detect and gauge the effect on profitability of the entire cooperative population.

Table 6. North Dakota farm supply and grain marketing cooperative operational liquidity, by profitability group, 2002-2006

Year	All	High	Medium	Low
2002	1.80	1.66	1.87	1.81
2003	1.78	1.43	1.87	1.94
2004	1.38	1.42	1.17	1.71
2005	2.01	1.35	2.22	2.24
2006	2.38	1.43	2.99	2.17

Relationship between profitability and solvency

Financial data provided by Member Services can also be used to determine whether a relationship exists between profitability and solvency in the observed sub-population of North Dakota farm supply and grain marketing cooperatives. This determination is relevant because financial solvency refers to a firm's ability to leverage equity or acquire debt capital. The ratios are also indicators of the extent to which cooperative members, through their board of directors, are using long-term debt to adjust the size of their firm.

The average annual ratio of member equity and adjusted assets for each profitability group is provided in Table 7, panel (a). This ratio indicates the extent to which a cooperative leverages member equity with debt capital in order to operate. Cooperatives with high equity-to-asset ratios use relatively less debt capital in conjunction with equity capital to take advantage of business opportunities.

Values for the ratio of member equity and adjusted assets generally declined for the high and medium profitability groups between 2002 and 2006. Cooperatives in this group, especially the most profitable cooperatives, experienced increased current and fixed assets, with smaller corresponding increases in member equity. Member equity may have increased due to increases in the amount of patronage refunds received from investments in assets outside the cooperative. The ratio of member equity to adjusted total local assets was consistently highest for the least profitable cooperatives and usually lowest for the most profitable cooperatives during this period.

Table 7. Measures of North Dakota farm supply and grain marketing cooperative operational solvency, by profitability group, 2002-2006

(a) Member Equity and Total Assets					(b) Member Equity and Fixed Assets				
Year	All	High	Medium	Low	Year	All	High	Medium	Low
2002	1.67	1.66	1.61	1.76	2002	3.47	3.18	3.91	2.62
2003	1.63	1.67	1.46	1.96	2003	3.32	3.68	3.01	3.56
2004	1.53	1.38	1.45	1.84	2004	3.28	2.76	3.04	4.23
2005	1.42	1.20	1.49	1.67	2005	3.33	2.86	3.34	4.14
2006	1.50	1.30	1.47	1.77	2006	4.12	2.86	4.33	4.95

The North Dakota cooperatives purchased increasing amounts of fixed assets between 2002 and 2006. The average value of fixed assets for high profitability cooperatives increased 95%, from an average of $1,655,651 in 2002-2004 to $3,224,191 in 2005-2006. Low profitability cooperatives increased purchases of fixed inputs by 35% between the 2002-2004 and 2005-2006. Fixed assets also became an increasing share of total assets. In 2002, fixed assets comprised 53% of total local assets for high profitability cooperatives. This figure increased to 60% by 2006. For low profitability cooperatives, however, the share decreased from 59% to 46% during the same period. These increases suggest managers and directors of highly profitable cooperatives view fixed assets as a means to improve profitability.

The average annual ratio of member equity and fixed assets for each profitability group is provided in Table 7, panel (b). One way a cooperative might become profitable is to substitute fixed assets for labor, or purchase new fixed assets to replace aging ones. Alternatively, a cooperative could reduce costs by

maintaining relatively old and mostly depreciated fixed assets. Anecdotal evidence indicates consolidations and purchases of fixed assets are becoming more common in recent years.

The ratio of member equity to fixed assets decreased for the most profitable 25% of the North Dakota cooperatives, from a high of 3.18 in 2002 to a low of 2.76 in 2004, and then remained steady at 2.86 in 2005 and 2006. This result can be explained, at least in part, by a contemporaneous increase in fixed assets, but a relatively smaller growth in member equity. Member equity increased 42% between the 2002-2004 and 2005-2006 periods for high profitability cooperatives. It increased by 46% for low profitability cooperatives between the same periods.

Together, these solvency ratios indicate that members of relatively profitable cooperatives may be making similar decisions about leverage. Highly profitable cooperatives appear to be more willing to leverage member equity than less profitable cooperatives. Highly profitable cooperatives are also willing to increase fixed assets purchases when member equity grows, whereas less profitable cooperatives tend to let equity accumulate. Hence, a relationship between solvency and profitability may exist in North Dakota farm supply and grain marketing cooperatives.

Statistical Model

To statistically examine the relationship between financial ratios and profitability, Equation 1 is estimated. The fit statistics indicate Equation 1 is modestly successful at describing the relationship between the return on local equity and other variables. The R-squared value (0.49) and *F*-statistic (17.44) indicate the model is statistically valid.

Five explanatory variables in the model are statistically significant: the liquidity variable; *current ratio*$*_{i,t-2}$; the lagged profitability variable; *ROLA*$*_{i,t-2}$; (Sales/salary and benefits)$_{i,t-2}$ (the second efficiency variable); the *Risk*$*_{it}$ variable; and the ratio of fixed assets to total assets (Table 8). The coefficient on the lagged ROLA average variable indicates that prior profitability is an indicator of current performance. This indication makes sense if revenues are retained for working capital or as an indicator of credit worthiness. The results indicate profitability is negatively related to the level of risk it encounters, as measured by the *Risk*$*_{it}$ variable. This indication means that farm supply and grain handling cooperatives that experience greater income variability are rewarded with lower returns. Improved liquidity improves profitability. Finally, increasing the level of fixed assets for the entire subpopulation tends to increase profitability, which suggests

that, on the whole, the purchase of new fixed assets may be a strategy that boards and managers can use to improve profitability. Finally, efficient use of assets and labor is not significantly associated with improved profitability, though efficient use of labor is significant at the 10% level.

Despite the contribution of fixed assets to the profitability of this population, the results of this statistical model indicate either no measurable or structural relationship exists between a cooperative's size (as measured by adjusted assets) and its return on local assets, or that no relationship exists between these two criteria that can be detected with available data. The business size variable *adjusted assets*$^*_{i,t-2}$ is small negative and, using *t*-statistics, statistically insignificant at the 5% level. The insignificant result corresponds with Boyd (2007), which cites other papers with the same result.

Table 8. Estimated coefficients of determinants of North Dakota farm supply and grain handling cooperative profitability

No control for persistent profitability			Controlled for persistent	
Variable	Coefficients	Standard Error	Coefficients	Standard Error
Intercept	**0.09**	0.02	**0.10**	0.02
Current ratio* $_{i,t-2}$	**0.02**	0.01	(0.00)	0.01
(Member equity/Adjusted assets)* $_{i,t-2}$	0.01	0.02	(0.01)	0.01
ROLA* $_{it-1}$	**0.30**	0.08	**0.77**	0.08
NPM* $_{i,t-2}$	(0.11)	0.15	(0.05)	0.10
(Sales/adjusted assets)* $_{i,t-2}$	(0.01)	0.01	0.00	0.00
(Sales/salaries)$_{*i,t-2}$	**0.00**	0.00	0.00	0.00
Risk* $_{i,t}$	**(0.28)**	0.06	**0.29**	0.17
ln(Adjusted Assets)* $_{i,t-2}$	0.01	0.01	0.01	0.01
Fixed asset ratio* $_{it}$	**0.09**	0.03	**(0.06)**	0.03

Boldface type *Indicates significant at the 5% level.*

Due to changes in relative profitability, 32 of the 57 cooperatives with five years of observations shifted among the "high," "medium," and "low" profitability groups between 2002 and 2006. Since relative profitability was not held constant for purposes of estimation, the ability of the model to measure the relationship between financial ratios and profitability may have been weakened.

The validity of the conclusions from the above statistical model may be improved by controlling for the persistence of relative profitability. Six (10%) of 65 cooperatives were in the high group for at least four years. Nineteen cooperatives (29%) were in the medium group for at least four years. Eight cooperatives (3%) were members of the low group at least four years.

The statistical model is estimated again with the subpopulation of 33 cooperatives that were members of the "high," "medium," and "low" profitability groups, respectively, for at least four years, which creates a balanced panel of 84 observations. The fit statistics for this model are improved relative to the previous one, with an R-squared value of 0.78 and *F*-statistic of 30.65. This estimation shows the robustness of the insignificance, based on *t*-statistics, of the (*adjusted assets*)$*_{i,t-2}$ and ROLA$*_{i,t-1}$ variables.

Estimating the statistical model with observations from the group of 33 cooperatives with persistent profitability levels generates a few qualitatively different results when compared with the previous estimation. First, *Risk*$*_{i,t}$ is statistically significant only at the 10% level and now has a positive sign. This result suggests that when controlling for persistence of business performance, greater variability in returns leads is generally associated with increased profitability. Second, while the fixed asset ratio variable remains significant, it also changes sign. Examination of the data shows that between 2002 and 2006, when the most profitable cooperatives purchased fixed assets at an increasing rate, increases in net income are observed. In contrast, when medium and low profitability cooperatives purchased fixed assets at an increasing rate, their net income decreased. Since observations from the medium and low profitability groups comprise most of the data used for the estimation, this pattern dominates the results. Third, the liquidity variable is no longer significant, which suggests that the relatively disparate liquidity preferences of the high, medium, and low profitability groups tend to cancel each other in this estimation. Finally, the business size variable (*adjusted assets*)$*_{i,t-2}$ remains positive and statistically insignificant at the 5% level. The insignificant result corresponds with Boyd et al., 2007.

Conclusion

This study identifies the presence and strength of various determinants of profitability for farm supply and marketing cooperatives in North Dakota. This subpopulation of farm supply and grain marketing cooperative is worth attention because of their its size in the region and nation, and the apparent transition in North Dakota from many small cooperatives to a small set of very large and rapidly growing cooperatives. Data from audited financial statements from 120 cooperatives filed between 2002 and 2006 are analyzed. Inferences are made about the relationship between local financial resource management and profitability through ratio analysis and a statistical model.

The financial ratio analysis conducted in this study suggests relationships between North Dakota farm supply and grain marketing cooperative sales volume, assets, liquidity, efficiency and profitability. Larger cooperatives in terms of sales have positive returns on local assets. Relatively small cooperatives have negative returns on local assets and tend to provide returns as transfers from other entities. No statistical relationship is found, however, between a cooperative's asset size and profitability. This result agrees with previous findings about farm supply and grain marketing cooperatives in the literature.

Statistical analysis of the financial data from a sub-population of North Dakota farm supply cooperatives suggests strategies for improving profitability. Managers of cooperatives that are experiencing persistent profitability may not improve profitability by consistently purchasing additional fixed assets, although this fact is most likely to be true for medium and low profitability cooperatives. In contrast, when performance has been irregular, purchases of fixed assets may improve profitability. Second, greater variance in net income levels tends to reward consistent performance, but reduce profitability for irregular performance. Boards of directors should be mindful of their cooperative's experience when returns are likely to become more variable. Third, liquidity, which is controlled by managers, is less important for improving profitability when performance is consistent over time. Finally, both managers and directors can associate current levels of profitability as positively related to prior levels, but cannot associate it with any guarantee of relative profitability.

Since this study does not use a random sample of data, but instead a sub-part of the entire population, generalization of these results is limited since the statistical estimates do not retain their usual meaning. However, since the cooperatives observed in the data represent all but a very small portion of the overall population, the assumption is reasonable that, at worst, the results are representative of all but the very smallest of farm supply and grain marketing cooperatives.

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