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Determinants of Return on Equity in U.S. Local Farm Supply and Grain Marketing Cooperatives

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Farm supply cooperatives are an important component of the retail agribusiness industry in the United States. The objective of this research is to identify financial variables that are determinants of return on equity in these cooperatives. Firm effects are important and their effect is the result of managerial decision making and director policy. The estimated coefficient on asset size was not statistically significant, suggesting that return on equity is invariant to size over this time period.

Key Words: agribusiness, cooperatives, finance, management, profitability

JEL Classifications: Q13, Q14

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[1] It should be noted that the Cooperative Extension Service has a long history of providing research and education to local and regional cooperatives. In 1975, 37 specialists had appointments in cooperatives, but today, fewer than eight do. Cooperatives have invested more than $20 million in endowments in agricultural economics departments in North America. These funds are used to provide student scholarships, operating expenses, and program support. Extension programs are the single largest source of training for directors in local farm supply and marketing cooperatives in the United States. For example, extension specialists at Iowa State University, Kansas State University, Oklahoma State University, and Texas A&M University provide training for over 1,000 producer-directors annually in Colorado, Illinois, Indiana, Iowa, Kansas, Missouri, Montana, Nebraska, Ohio, Oklahoma, Texas, and Wyoming. These include programs in finance, governance, and strategic thinking.

Local farm supply and grain marketing cooperatives are an important component of the retail agribusiness industry in the United States.[1] They supply inputs such as chemicals, feed, fertilizer, tires, and similar products to producers. In some regions of the United States, many of these cooperatives also purchase feed grains (e.g., corn, grain sorghum) and food grains (e.g., soybeans, wheat) and merchandise those grains. These cooperatives are owned by producers who provide the equity capital for the cooperative and receive a share of the profits in the form of patronage refunds, a payment made in proportion to the amount of business volume conducted with the cooperative. These producers exercise control of the cooperative by electing fellow producers as directors who govern the cooperative. Then a board of directors hires a general manager to manage the cooperative.

In recent years, the profitability of local farm supply and grain marketing cooperatives has decreased considerably in the Great Plains and other regions of the United States (Figure 1). Whipker, Akridge, and Joshua and Scaff and Reca suggest possible reasons

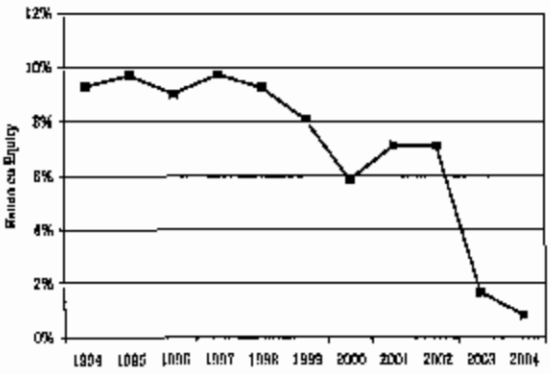

Figure 1. Average Return on Equity for 648 Local Farm Supply and Grain Marketing Cooperatives, 1994–2004

for this decline. These reasons include globalization (e.g., off-shore fertilizer sourcing); changes in U.S. farm policy; changes in acres planted and bushels produced; weather issues, such as extended drought because of lack of rainfall or snow; higher costs because of insurance and other inputs; increased regulatory requirements; and changes in buyers, suppliers, and competition that has caused margins on chemicals and other products to decline. Many of these drivers are "industry effects" in the sense that they impact every cooperative within the farm supply and grain marketing industry.

Firm effects are specific to a firm and are under the control of the manager. For farm supply and grain marketing cooperatives, firm effects are under the control of the manager, who is hired by a board of directors. Directors of these cooperatives are becoming aware of the need to better understand firm effects that determine profitability of their local cooperatives. These firm effects can be related to profitability (ability of a manager to negotiate more favorable input prices with suppliers, ability of a manager to get better prices, better merchandising of grain to buyers, ability of the manager to operate in a more cost efficient manner, etc.), liquidity (manager's preference regarding current asset and liability holdings), efficiency (intensity of asset utilization by a manager), solvency (board of director preferences for equity vs. debt financing), and risk (how variable profitability is within the industry).

With the exception of solvency, which is determined by a board of directors, these effects are under the control of the manager. In practice, a manager can make recommendations, but the board actually determines the level of equity through the income distribution decision each year. These particular firm effects can be quantified through financial ratios, and benchmarks can be established by a board of directors and can be used in a manager's evaluation. Information regarding the significance of these ratios can help a board determine which are more important when evaluating performance of the cooperative and, hence, the performance of the manager.

The objective of this research is to determine variables that are determinants of return on equity in local farm supply and grain marketing cooperatives. The first section discusses the literature on management and profitability. The second section provides a description of the data. Regression analysis is used to identify significant determinants associated with return on equity. Finally, conclusions and implications for managers and directors are provided. Financial data for 648 cooperatives in 36 states over 10 years are used in this study. The research suggests that there is no relationship between asset size and profitability and that firm effects are important and their effect is the result of managerial decision making and director policy.

Literature Review

A great amount of research has been done by agricultural economists to better understand the effect management has on profitability. This research has used farm-level and agribusiness-level data. Farm-level data studies are relevant because directors of cooperatives are farmers and farm supply and grain marketing cooperatives are an extension of the farm business enterprise. The literature can be divided into three main categories. One stream of research has focused on identifying financial and management variables that affect profitability. This is referred to as the Combined Financial Ratio and Management

Factor literature. A second stream of research has focused on isolating the effect of management variables on profitability. This is referred to as the Management Factor literature. A third stream of research has focused on identifying industry, diversification, corporate, and firm-specific variables and measuring their effect on profitability. This is referred to as the Industry and Resource Factor literature.

Many of these studies have provided recommendations for producers who manage farming operations and managers of food businesses and agribusinesses. The word agribusiness is used throughout to denote cooperatives and investor-oriented firms, although most of the research has been done on cooperatives. These recommendations include information that can be used in benchmarking performance. Virtually all of the studies have used cross-sectional time series data to determine the effect on performance. Examples of the more important studies in all three streams of research are summarized below.

Combined Financial Ratio and Management Factor Literature

Many studies have been conducted examining relationships between financial ratios and management factors and various performance measures. These studies used a variety of statistical (e.g., equality of means testing, stochastic dominance) and econometric and statistical procedures (e.g., regression, discriminant analysis) to answer questions related to farm growth (Musser and White; Patrick and Eisgruber) and a producer's ability to repay loans (Dunn and Frey; Hardy and Weed; Hardy et al.; Johnson and Hagen) and to identify characteristics of higher and lower profitability measures of return on equity and income per operator (Haden and Johnson; Kauffman and Tauer; Plumley and Hornbaker; Mishra, El-Osta, and Johnson; Purdy, Langemeier, and Featherstone). In general, these studies have found that variables related to size (e.g., number of cows, farm size) and output prices (e.g., milk) were associated with higher profitability, and variables related to greater costs (e.g., operating expense ratio) were associated with lower profitability.

Similar studies have looked at agribusinesses and food businesses (Akridge; Ariyaratne et al.; Baab and Keen; Barton, Schroeder, and Featherstone; Claussen; Forster; Ginder and Henningsen; Harris and Fulton; Holmes; Lerman and Parliament; Mitchell; Parcell, Featherstone, and Barton; Schrader et al.; Van Dyne and Rhodes). In general, these studies have found that firms with greater profitability were less leveraged, less diversified, and had better liquidity management. Only one of these studies (Barton, Schroeder, and Featherstone) found a significant relationship between firm size and performance.

Boards of directors are expected to set policy on the amount of equity a cooperative maintains on its balance sheet. They also decide the type of equity redemption program (i.e., age of patron, revolving fund, etc.) used in the cooperative.[2] Directors, through decisions on asset investment and equity management, decide the amount of interest expense, patronage payable, debt repayment, and similar variables. Factors such as equity and total assets are determined by the decisions of directors. Variables such as net margin (e.g., return on sales), asset turnover, and current ratio are more under the control of a manager.[3]

None of these studies measured specific management factors as variables (i.e., prices paid for specific inputs or received for outputs, a productivity measure such as employee productivity, etc.). This is not surprising given

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[2] Age of patron refers to an equity management program whereby producers have their allocated retained patronage refunds redeemed upon reaching some age (e.g., 65 years is a common age in many of these programs). Revolving fund refers to an equity management program whereby allocated retained patronage refunds are redeemed to all producers on a first-in, first-out basis. For example in 2006, for a cooperative whose oldest allocated equity was retained in 1996, a 10-year revolving fund would redeem all allocated patronage for the year 1996 before redeeming 1997, etc. These are the two most common systematic equity redemption methods.

[3] A good practice of boards is to consider the general manager as if he or she were a member of the board. In most publicly traded companies, the general manager or CEO sits on the board of directors.

that financial and other data on agribusinesses are not disaggregated like farm-level data. Agribusinesses have multiple plants and locations and often buy in bulk for all locations, making it more difficult to isolate productivity measures. Agribusinesses have many employees, making it difficult to measure management. In addition, agribusinesses buy many inputs and sell many outputs, which make it difficult to isolate price variables. Finally, it is difficult to measure management; thus, management is often an omitted variable and part of the unexplained variation in these models.

Management Factor Literature

For the reasons cited above, few studies have estimated the statistical relationship between performance and various explanatory variables. Five studies used regression analysis to measure profit per hundredweight of pork produced (Boland and Patrick; Edwards, van der Sluis, and Stevermer), management returns per acre (Nivens, Kastens, and Dhuyvetter; Sonka, Hornbaker, and Hudson), net dairy farm income (Ford and Shonkwiler), and return on equity (Dean). These studies found that greater performance was associated with lower operating costs, higher crop yields, larger farm size, and higher output prices. Management affects all of these factors, but other variables such as weather can affect crop yields. No studies have been made on agribusiness firms that have used only management factors.

Industry and Resource Factor Literature

Given these difficulties, the management literature has used regression analysis to measure the statistical relationship between performance and various independent variables. Performance as measured by return on assets (e.g., McGahan and Porter 1999; Schumacher and Boland 2005) or Tobin's q (McGahan) is divided into variables that represent average profits that accrue to all firms in a given industry (industry effects), average profits that accrue to firms that are diversified ("corporate effects"), and the residual profits are assumed to accrue to firms with better (or worse) management of resources. These studies have found that greater performance comes from the industry in which a firm operates (e.g., industry membership) than whether a firm is diversified (McGahan and Porter 2002; Schumacher and Boland 2004). The residual returns are important but not as important as industry membership in determining profitability.

Summary of the Literature

The literature generally suggests that the ability to achieve lower costs is an important factor in achieving greater profitability in farms and agribusinesses. Profits were also found to be positively related to greater crop yields, animal productivity, and farm size. The ability to manage liquidity is an important measure of profits in farms and agribusinesses. However, size was not found to be a significant variable in determining profitability in agribusinesses, whereas mixed results were found for farms. This study contributes to the literature by modeling present profitability as a function of previous (as opposed to present) management decisions and studying local farm supply and grain marketing cooperatives (as opposed to farms and agribusinesses).

Description of the Data

This study uses fiscal year end financial data from cooperatives in 36 states, including Alabama, Arkansas, California, Colorado, Delaware, Florida, Idaho, Illinois, Indiana, Iowa, Indiana, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, and Wisconsin. The cooperatives are local farm supply and grain marketing cooperatives. Cooperatives with sales greater than $300 million were considered regional cooperatives and were excluded from the study. There were 648 cooperatives with complete financial data from 1994 to 2003. The data came from databases created by

Table 1. Summary Statistics of 648 Local Farm Supply and Marketing Cooperatives for 1994–2003

Variable	Units	Mean	SD	Minimum	Maximum
Total assets	$	8,276,003	13,452,004	256,946	181,094,462
Return on equity	%	6.81	6.11	−60.6	63.0
Total equity	$	4,742,526	4,933,775	245,864	51,325,953
Net margin	%	1.91	1.77	−4.76	13.85
Assets-to-equity	%	147.04	40.98	100.40	427.55
Asset turnover		2.53	1.42	0.82	21.21
Sales	$	23,210,144	37,227,013	157,463	293,198,585
Net income	$	174,376	289,781	−66,956	3,270,842
Return on assets	%	4.16	3.17	−14.76	20.40

a lender to cooperatives and used by the Arthur Capper Cooperative Center at Kansas State University. The total number of observations available for analysis was 6,480 (648 cooperatives multiplied by 10 periods). Table 1 shows the summary statistics of the variables used in the analysis.

Methodology

The theoretical model used in this analysis incorporates financial measurements from the areas of efficiency, liquidity, profitability, risk, and solvency. The literature review indicated that various financial variables representing these financial measurements have been found to be important in previous research. This model is similar to that used on agribusiness data by Forster, with one important distinction: The independent variables are lagged to determine the effect of previous managerial decisions on present performance. It appears reasonable to assume that the current period's profitability is a function of past managerial decisions. The theoretical model is given as

$$(1)\quad \overline{ROE}_{i,t} = f\big(\overline{LIQUIDITY}_{i,t-2}, \overline{SOLVENCY}_{i,t-2}, \overline{PROFITABILITY}_{i,t-2}, \overline{EFFICIENCY}_{i,t-2}, \overline{RISK}_{i,t-2}\big),$$

where $\overline{ROE}_{i,t}$ is the average return on equity (ROE) for year t and $t-1$.[4] The most recent time period in the 2-year average is denoted by the subscript t. The subscript i denotes the values corresponding to firm i. The bars above the variables denote that it is an average and not a single-year value. For example, $\overline{ROE}_{i,2003}$ refers to the 2-year average for the years 2003 and 2002. The variables on the right-hand side, $\overline{LIQUIDITY}_{i,t-2}$, $\overline{SOLVENCY}_{i,t-2}$, $\overline{PROFITABILITY}_{i,t-2}$, and $\overline{EFFICIENCY}_{i,t-2}$ are the average liquidity, solvency, profitability, and efficiency measures for the years $t-2$ and $t-3$. The time period subscript $t-2$ for these independent variables refers to the most current year in the 2-year average. For example, $\overline{EFFICIENCY}_{i,2001}$ is the 2-year average of the efficiency financial measurement for the years 2000 and 2001.[5] This model implies that the future financial success of cooperatives is a function of past financial performance. The variables were lagged in a manner

[4] Boyd also used McKinsey & Company's Value Created Index as a dependent variable. In general, the results were very similar between the two models, which is not surprising given previous research by Turvey et al., who found a high degree of correlation between economic value added and ROE. These results are not discussed here but are available on request from the authors.

[5] A 2-year average was used because it has been presented in past literature to be a better measure than a single year's measure. The reasoning behind the use of a 2-year average versus a single-year value is to help nullify a spike in the financial measurements caused by an abnormal year. This is especially true when looking at grain marketing cooperatives. A major lender to local cooperatives suggested to the authors that managers are usually given 2 years to analyze their performance. This provides further justification for the 2-year lag.

to avoid overlap between the dependent and independent variables.

The last variable in the empirical model is the risk variable. The risk variable in this time series is the measurement of the standard deviation of *ROE* over time. This is similar to that used by Mitchell, Claussen, and Dean but different from Forster, who used the coefficient of variation of *ROE*. Ruefli, Collins, and Lacugna showed that the standard deviation of *ROE* is the most common measurement of risk in management studies.

Equation (1) represents a theoretical model on the basis of financial measurements used in previous research. An empirical model that uses explicit variables representing each of the financial measurements is formulated. This empirical model, on the basis of the theoretical model in Equation (1) is shown in Equation (2):

$$(2)\quad ROE_{i,t} = f(CR_{i,t-2}, ATE_{i,t-2}, ROE_{i,t-2}, NPM_{i,t-2}, AT_{i,t-2}, TIE_{i,t-2}, RISK_{i,t-2}, ASSETS_{i,t-2})$$

Each of these variables has been used in previous research. The adjusted current ratio (*CR*) is the variable representing the liquidity of the firm. The current ratio is adjusted current assets divided by adjusted current liabilities. This measures a firm's ability to pay off short-term debt (debt due within one period) with its current assets (most liquid assets). The current assets are the most liquid assets that can be turned into cash within a year of the balance sheet date. These include inventories and account receivables. The current liabilities are short-term liabilities that are due within 1 year or an operating period. Current liabilities are adjusted to be current liabilities minus the sum of any patronage payable, taxes, and short-term loan payables. This adjustment is commonly made in cooperative finance research.

The assets-to-equity (*ATE*) ratio measures the firm's financial leverage position or the inverse of the percentage of assets that have a claim by shareholders and is a measure of solvency. The profitability variables used are 2-year averaged, lagged values for *ROE* and net profit margin (*NPM*). Net profit margin is defined as net income before taxes divided by sales. Asset turnover (*AT*) is a measure of how efficiently a cooperative uses its assets and is calculated by dividing total sales revenue by total assets and explains how efficiently assets are being turned into sales. The times interest earned (*TIE*) variable measures a firm's ability to pay current interest expenses with gross income and is calculated as the sum of net income and interest divided by interest. The risk variable (*RISK*) measures variability of *ROE* over time. A variable for the total assets term (*ASSETS*) is included to account for possible economies of size.

Each of the variables was differenced by the contemporaneous 2-year industry average across all cooperatives. This differencing allows for changes in the market over time and removes any industry effect in the model. The *ROE* could be different in 1995 relative to 2003. The differenced variables represent comparative 2-year averages of each of the variables. Table 2 shows summary statistics of the differenced data. Note that the standard deviation measures the variation in each cooperative relative to the industry average.

The empirical model (Equation [2]) was estimated by ordinary least squares in SAS. The cross-sectional component corresponds to the individual cooperatives, whereas the time series component corresponds to the 1995–2003 2-year average time periods. Bartlett's test was used to check for heteroskedasticity, and the Durbin *h* statistic was used to check for autocorrelation. Neither was found in the model. Correlation coefficients and variance inflation factors were examined for possible evidence of multicollinearity and none was detected.

Results

On the basis of the R^2 measure, the econometric model was not very successful at predicting *ROE* for an individual cooperative. However, the results did show that certain variables were statistically significant. The poor performance is not unexpected because of the inherent difficulty in predicting future

Table 2. Summary Statistics of Differenced 2-Year Average Data of 648 Local Farm Supply and Marketing Cooperatives for 1995–2003[a]

Variable	Mean	SD	Minimum	Maximum
Return on equity	0.00	0.13	−5.38	0.51
Current ratio	0.00	3.25	−3.52	62.7
Assets-to-equity	0.00	0.77	−0.99	18.90
Lagged return on equity	0.00	0.17	−5.38	6.66
Net profit margin	0.00	0.03	−0.43	0.20
Asset turnover	0.00	1.38	−2.05	31.78
Times interest earned	0.00	0.01	−0.39	0.25
Total assets	0.00	0.12	−0.07	2.22
Risk	0.00	0.14	−0.11	1.71

[a] The year 1995 refers to a 2-year average from 1994–1995; 1996 refers to a 1995–1996 average, and so on.

Table 3. Regression Results for Equation (2) Estimating Lagged Financial Ratios on Future Return on Equity

Variable	Parameter Estimate	Standard Error
Intercept	0.0635	0.0090
Lagged current ratio	−0.0004	0.0002[a]
Lagged assets-to-equity ratio	−0.0092	0.0016[a]
Lagged return on equity ratio	1.4121	0.0165[a]
Lagged net profit margin ratio	0.9088	0.0635[a]
Lagged asset turnover ratio	0.0019	0.0007[a]
Lagged times–to–interest earned ratio	−0.1154	0.1907
SD of return on equity	−0.0265	0.0087[a]
Assets	−0.0107	0.0080
R^2	0.357	
Root mean squared error	0.068	

[a] The variable is significantly different from zero at the .10 level of significance.

ROE. The results in Table 3 from the regression show that 35.7% of the variation in the 2-year average for *ROE* is explained by variables in the model.[6] This is similar to values reported by Claussen, Dean, Forster, and Mitchell. The root mean square error was 0.068, which indicates that the standard error of the regression is 6.8%.

Two of the eight variables in the model were not statistically significant at the .10 level of significance (assets and times interest earned). The coefficient for the current ratio variable was −0.0004. This implies that a one-unit increase in the current ratio (adjusted current assets divided by adjusted current liabilities) results in a decrease in *ROE* of 0.04%. An increase in the current ratio (liquidity) suggests that the cooperative is using less debt to finance current assets. This would suggest that the cooperative is not utilizing its liquidity efficiently, which implies that a manager has greater current assets and debt to finance those assets than is most

[6] Binary variables were also used for each of the 36 states as a measure of geography. However, the 35 variables (one was dropped in the estimation) only added .011 to the adjusted R^2 and a Chow Test did not find significant differences in the parameter estimates. It should be noted that 18 states had a significant sign. If a cooperative was located in Arkansas, Colorado, Idaho, Kansas, Louisiana, Missouri, Montana, Oklahoma, South Dakota, Texas, or Washington, it led to a lower ROE relative to West Virginia. If a cooperative was located in Illinois, Indiana, Iowa, Kentucky, Minnesota, Ohio, or Tennessee, it led to a higher ROE relative to West Virginia. The parameter estimates were very small.

efficient which, in turn, decreases *ROE*. This is not surprising given that many managers would prefer to have high liquidity on the balance sheet.

The lagged average *ROE* variable had a coefficient of 1.4121 and was highly significant. This was expected because past profitability suggests that a firm's management is making good decisions. These good decisions made in the past, theoretically, should carry over to future financial performance.

The *ATE* variable had a coefficient of −0.0092, which implies that firms could improve their *ROE* if they were to use more equity to finance investments. The coefficient for the net profit margin (profitability) was 0.9088. It is reasonable to expect that the net profit margin a cooperative is able to earn would have a large effect on net income and the numerator of *ROE*. The asset turnover variable had a coefficient of 0.0019. This suggests that if a cooperative can increase sales in relationship to assets for the year by one unit, it can increase its *ROE* by 0.19%. Mitchell and Claussen's results were similar for the relationships that asset turnover, gross margin, and asset-to-equity ratio had on *ROE*.

The risk variable coefficient was −0.0265. This implies that a cooperative that has higher risk relative to the industry, as measured by the standard deviation of *ROE*, tends to have a lower *ROE*. This sign was not expected because one would expect that greater risk would be associated with a higher *ROE*, but this negative relationship was also found by Mitchell, Claussen, and Dean and in a number of other studies in Ruefli, Collins, and Lacugna's review of over 100 similar studies. This could be a result of a lack of liquidity in the market. The market cannot adjust fast enough because of the lack of buyers and sellers to adjust risk and returns to efficient market conditions.

Conclusions

This research contributes to the management literature by modeling present performance as a function of previous financial performance by managers of local farm supply and grain marketing cooperatives. There are two important findings from this research.

First, industry effects are beyond the control of a board or manager. However, firm effects, such as efficiency, liquidity, profitability, and solvency, are controllable and their effect is the result of managerial decisions and director policy. For example, a board of directors' choice of how much equity to have determines the solvency measurement through the income distribution and equity redemption decisions. These decisions can affect profitability in the future (e.g., board decides to borrow money for asset reinvestment, which generates an interest expense in the future instead of retaining income to make that investment). These decisions are not within the direct control of a manager but generally controlled by board policy.

In addition, boards of directors implement (or decide not to implement) recommendations by a manager to close or sell off underutilized assets. This affects the efficiency measurement. If managerial evaluation is linked to benchmarks on firm effects such as profitability and efficiency for the previous year, a board should consider the effects of its previous decisions and whether it has given that manager the ability to achieve these benchmarks. This analysis would suggest that decisions made 2 years previously can be measured on this year's performance, which should be considered when boards of directors conduct annual evaluations of its manager. Managerial evaluations are conducted annually, and extension programs that teach a governance module on manager appraisal could discuss the role of benchmarks in these performance areas.

Second, there is no relationship between profitability and asset size. There was no significant sign on asset size, suggesting that *ROE* is invariant to size in these cooperatives over this time period. This finding is good news for local cooperatives with a smaller number of assets. It would suggest that any cooperative, regardless of size, can improve its

profitability by focusing on the variables identified in this research. Profitability experiences a high degree of variability, suggesting that other factors are more important in influencing profitability, such as asset utilization.

Local farm supply and grain marketing cooperatives are an important part of the retail agribusiness industry in the United States. Producers who are directors require information about the sources of profitability in their cooperative to better evaluate the performance of the manager. Managers control firm effects in a cooperative. However, boards of directors affect these effects through the income distribution and equity redemption decisions and through their actions on managerial recommendations, such as asset purchases. Awareness of how board decisions in the past affect present performance is important when evaluating a manager.

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