The Impact of Size and Specialization on the Financial Performance of Agricultural Cooperatives

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Abstract

This study examines the impact of size and specialization on the mean and variability of financial performance of agricultural cooperatives in the United States using a system of equations approach. Profitability, risk, and size had the largest impact on mean financial performance. Diversified cooperatives tended to have less variability in financial performance over the 2005-2014 period.

1. Introduction

The agricultural cooperative sector has been undergoing a transition period with tight profit margins, competition, high commodity price volatility, and consolidations. The number of agricultural cooperatives has decreased by 25% since 2005 due to consolidations (USDA, 2015); however, the consolidations have not resulted in a significant decrease in the number of locations being served. Recent consolidations are associated with increased capital asset investments, changing profit allocations strategies, and human capital factors (Briggeman et al., 2016). The driving factors for the consolidations of cooperatives are economies of scale, and improvements in equity structure. Larger cooperatives tend to benefit from scale economies that may provide higher profitability and allow them to revolve allocated equity more rapidly (Briggeman et al., 2016) while smaller cooperatives tend to benefit from economies of scope (Pokharel, 2016).
Many agricultural cooperatives are diversified between grains and farm inputs, although the impact of diversification on the mean and variance of finance performance is not well examined.

The impact of diversification (specialization) on average financial performance depends on the benefits obtained from economies of scale. If economies of scale are present for an enterprise, specializing in the production of that enterprise would increase mean financial performance (Purdy et al., 1997). If economies of scope are present, an increase in specialization would decrease average financial performance. Past studies found evidence of economies of scale for grain marketing and farm supply agribusiness (Pokharel, 2016; Schroeder, 1992; Akridge and Hertel, 1986). In general, small-sized cooperatives could benefit by increasing size. This suggests that financial performance may differ by the size of cooperatives.

Specialization (diversification) also affects the variability of financial performance. Diversification is an important tool to reduce or minimize risk, particularly when returns between enterprises are not perfectly correlated or negatively correlated (Purdy et al., 1997; Lewellen, 1971). Specialized firms may benefit from economies of scale, but may reduce potential benefits from economies of scope or the ability to manage risk through diversification (Purdy et al., 1997).

The impact of specialization on firm value and financial performance has been well documented in the finance literature (Berger et al., 2010; Berger and Ofek, 1995; Lang and Stulz, 1994; Chatterjee and Wernerfelt, 1991). Past studies on cooperatives and agribusiness have mainly focused on examining financial performance using financial ratios and regression analysis (Pokharel et al., 2018; Katchova and Enlow, 2013; Bond, 2009; McKee, 2008; Boyd et al., 2007), while leaving the impact of size and diversification on the mean and variability of financial performance in agricultural cooperatives largely empirically unexamined.
The objective of this research is to examine the impact of risk and specialization on mean financial performance for agricultural cooperatives in the United States. This study contributes to the existing performance analysis literature in that it fills the gap in the cooperative specialization and financial performance literature by providing empirical evidence on mean and variability. This study has practical implications for cooperatives’ managers and policy makers who formulate policies to encourage (or discourage) the increasing size and diversification of cooperatives.

The remainder of this study is organized as follows. Section 2 reviews related literature on risk, size, and specialization, particularly focused on agribusinesses. Section 3 provides research methods. Section 4 discusses data and empirical results, and Section 5 concludes.

2. Literature on size and specialization

The impact of diversification or specialization is well empirically examined in the corporate finance and banking sectors, although a common conclusion has not been reached. Many studies argued that specialized firms perform better than diversified firms (Lang and Stulz, 1994; Berger and Ofek, 1995), while other studies reached the opposite conclusions. For instance, Wernerfelt and Montgomergy (1988) used Tobin’s \( q \) as a measure performance and found that firm profitability decreased as diversification increased. The authors further argued that the relative importance of industry structure and market share play an important role besides diversification in determining firm performance. Lang and Stulz (1994) reached the same conclusion as Wernerfelt and Montgomergy (1988) that diversification reduced mean financial performance during the 1980s.
Several recent studies examined the benefits and costs of diversification. The benefits of diversification include leveraging skills across enterprise and locations (Iskandar-Datta and McLaughlin, 2007), and providing markets for multiple products (Drucker and Puri, 2009). In addition, diversification may reduce the cost of financial distress by managing risk and spreading out cost across products and locations (Boot and Schmeits, 2000). However, diversified firms may decrease the comparative advantages of management if they go beyond their expertise (Klein and Saidenberg, 1998) and reduced profits (Berger et al., 2010). Moreover, the type of diversification affects firm value and performance. Diversification into related products-markets\(^1\) provides higher returns than into unrelated product-markets as human capital and other resources can be used in related diversification (Christensen and Montgomery, 1981).

Pandya and Rao (1998) examined the impact of diversification on risk and return using accounting and market based measures for investor-owned firms. They found that diversified firms performed better than undiversified firms on a risk-return measure though the average return on equity of undiversified firms was 4 times higher than those measures of highly diversified firms. The volatility of such firms was 36 times greater than the volatility of diversified firm for the best performing group. The results support the notion of trade-off between risk and return in the economics literature.

Prior literature examining the financial performance of farms and agribusiness has shown that size, operational efficiency, solvency, return on assets, and specialization are the determinants of firm’s performance (McKee, 2008; Purdy et al., 1997). However, the potential impact of business size on the firm’s performance is mixed, even though it has been considered as a tool to improve financial performance (McKee, 2008; Barton et al., 1993). The impact of

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\(^1\) Related diversification involves business that uses similar supply chain, markets, and distribution systems etc. (See Salter and Weinhold, 1979).
size, measured by total assets, was not a determinant of profitability for grain marketing and farm supply cooperatives (Boyd et al., 2007; McKee, 2008). However, Barton et al. (1989) found that larger cooperatives had a higher rate of return on equity than smaller cooperatives using regression analysis for Kansas cooperatives for the 1985-1989 period, indicating that size plays an important role in financial performance. Because most agricultural cooperatives are diversified between grain and farm inputs, profitability may vary across enterprises (product types). In other words, product mix may also affect financial performance measures so these factors need to be considered when analyzing financial performance of agricultural cooperatives.

Agricultural cooperatives use a variety of risk management tools. For example, Blank and Thompson (1994) indicated that diversification, insurance, and hedging were the major risk management tools in 1994 using a survey of financial officers and managers of cooperatives. More than one-third of interviewed cooperatives viewed diversification as the preferred risk management strategy. However, the inability of the small-sized cooperatives to diversify may be a major constraint.

3. Research Methods

The most commonly used approach to examine the tradeoff between risk and return in economics is the expected value (E) – variance (V) approach of Markowitz (1952). The relationship between risk and return can be specified if choices can be made among various combinations of risky and safe assets (Robinson and Barry, 1987).

\[ E(y) = \alpha + \frac{\lambda}{2} Var (y) \]  

where \( E(y) \) is expected outcome, \( Var(y) \) is the variance of outcomes, \( \alpha \) is intercept, and \( \lambda \) is the Pratt-Arrow absolute risk aversion coefficient. Risk is measured as the variance of return on
equity. The following two equations measure the components that affect the mean and variance of return on equity. These equations provide consistent estimates even if the variance of return on equity is a stochastic regressor (Jude et al., 1988).

\[ MROE = f(VROE, ROA, PR, DA, SPEC, LogAssets, SqLogAssets) \]  \hspace{1cm} (2)

where \( MROE \) is the mean return on equity, \( VROE \) is the variance of return on equity, \( ROA \) is the rate of return on assets, \( PR \) represents profit margin, \( DA \) is the debt to asset ratio, \( SPEC \) is the measure of specialization (diversification), and \( LogAssets \) is the measure of size for each agricultural cooperative. The square term of size \( (SqLogAssets) \) is used to capture the potential non-linear relationship between size and financial performance. The variance equation can be expressed as:

\[ VROE = f(ROA, PR, AE, SPEC, Assets) \]  \hspace{1cm} (3)

where \( AE \) represents the assets to equity ratio and the remaining notations have the same meaning as equation (2). Specialization (diversification) is measured using the Herfindahl index \( (HI) \) that shows the extent to which cooperatives are specialized or diversified. The HI is calculated as the sum of squares of percentage of income from grain sales, farm input supply sales, service income, and other income. For example, a cooperative with 40% income from grain sales, 30% income farm input supply sales, and 30% income from service has the HI of 0.34. The HI score of 1.0 indicates that cooperatives receive all income from one enterprise, while the HI score less than 0.50 indicates that cooperatives receive income from more diversified sources. The equations (2) and (3) are estimated using a system of equations (a three-stage least squares \( (3SLS) \) regression) because the system approach estimates both equations simultaneously and the estimates are consistent and asymptotically efficient (Jude et al., 1988).
4. Data and Empirical Results

Financial data from CoBank was used for the empirical analysis. The data consist of income, expense, and balance sheet information from audited financial statements of agricultural marketing and farm supply cooperatives from 36 states in the United States. The major sources of income for cooperatives were grain and farm input sales. Cooperatives with a debt to asset ratio of less than zero or greater than one were not used for the analysis. The number of cooperatives used for the analysis was 531 cooperatives (3,375 observations) from 2005 to 2014.

Table 1 shows the summary statistics of financial ratios, total assets, and risk for agricultural cooperatives. The average rate of return on equity was 13.4% over the study period. The income from farm input sales was the largest source of income that accounted for 34.4% of total income. The average value of the HI was 0.47 and ranged from 0.33 to 1.00. Approximately 66% of cooperatives had an index value of less than 0.5, 26% of cooperatives had a value between 0.5 and 0.75, and 8% of cooperatives had the HI score greater than 0.75. This indicates that the vast majority of cooperatives received income from multiple sources.

Table 2 reports the estimates of the system of equations (3SLS). The 3SLS regression was estimated using Stata 15. For the mean performance equation, all the coefficients except specialization were statistically significant at the 5% level, whereas all the coefficients were statistically significant at the 5% or lower levels in the VROE equation. Positive (negative) estimates in the MORE (VORE) equation indicate mean financial performance increasing (risk decreasing).

The variance of the return on equity (risk) had a positive relationship with mean financial performance (Table 2). Cooperatives with a higher mean financial performance had a higher variance. The results support the notion of risk-return trade-off in the economics literature. The
rate of return on assets, debt to assets ratio, and profit margin had a positive impact on mean financial performance. There was a positive correlation between mean financial performance and size. This evidence of positive impact of size on average financial performance is consistent with the fact that recent consolidations of agricultural cooperatives is motivated by scale economies that result in higher profitability (Briggeman et al., 2016). The result is consistent with the findings of Barton et al. (1989), who found that larger cooperatives had a higher rate of return on assets than smaller cooperatives. However, the result contradicts the findings of Boyd et al. (2007) and McKee (2008), who found that size had no statistically significant impact on financial performance. The debt to asset ratio was positively related with mean financial performance, indicating that an increase in leverage resulted in an increase in mean performance. This is consistent with the notion that debt financing is a way to grow business when the cost of debt is lower than the return on assets. However, debt financing may create financial stress and affect the variability of returns, particularly during the bust cycle of business.

The impact of diversification on mean financial performance was negative; however, not statistically significant at the 5% level (Table 2). The impact of specialization on the variability of financial performance was positive. This indicates that whole cooperative business specialization (diversification) increases (decreases) the variability of financial performance.

More than 90% of cooperatives in the sample did sell both grain and farm input together. This suggests that the primary reason for operating two enterprises together is to reduce risk. In other words, diversification is an important risk management tool for agricultural cooperatives. However, if increases in diversification results in lower benefits from economies of scale, reduction in risk (the variance of financial performance) need to be weighed against potential reduced average return on equity.
The results have important implications for managers of agricultural cooperatives. Mean financial performance was positively correlated with the size of cooperatives. This implies that benefits are associated with increasing the size of cooperatives, indicating that mergers and acquisitions will likely continue in the agricultural cooperative sector. However, the coefficient of the square term of size had a negative relationship with mean financial performance, indicating that the benefits of economies of scale will be exhausted beyond a certain size. Diversified cooperatives had a lower variability of financial performance. This suggests that a cooperative can reduce risk by diversifying its businesses. If the benefits from diversification continue, diversified cooperatives will be more common in the United States in the future.

5. Conclusions

This study used the mean-variance approach to examine the impact of size, risk, and specialization on the financial performance of agricultural cooperatives for the 2005-2014 period. Financial ratios such as the return on asset, debt to asset ratios had a positive impact on mean financial performance. Diversification had a negative (positive) impact on mean (variance) of financial performance.

Size had a positive (negative) impact on mean financial performance (variability of performance). This evidence of a positive impact of size on financial performance is consistent with past studies that found that larger cooperatives benefit from economies of scale (Pokharel 2016; Barton et al. 1989). The evidence of positive impact of size on the mean financial performance of agricultural cooperatives may be useful in policy discussion for enhancing small-sized cooperatives to be scale efficient. Scale inefficient smaller cooperatives could merge with other firms or cooperatives to benefit from economies of scale. Mean financial performance
could be improved by policies that allow cooperatives to grow larger until economies of scale are exhausted. However, if increases in scale results in reduced diversification, increases in mean financial performance need to be weighed against potential increased risk.
References


Tables

Table 1. Descriptive statistics of financial and income measures for agricultural cooperatives from 20005 to 2014

<table>
<thead>
<tr>
<th>Variable (Unit)</th>
<th>Average</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return on Equity (%)</td>
<td>13.44</td>
<td>10.73</td>
</tr>
<tr>
<td>Return on Assets (%)</td>
<td>8.12</td>
<td>4.97</td>
</tr>
<tr>
<td>Assets to Equity (%)</td>
<td>237.44</td>
<td>111.93</td>
</tr>
<tr>
<td>Profit Margin (%)</td>
<td>2.71</td>
<td>3.00</td>
</tr>
<tr>
<td>Debt-to-Assets (%)</td>
<td>50.66</td>
<td>17.81</td>
</tr>
<tr>
<td>Log(assets)</td>
<td>16.526</td>
<td>1.232</td>
</tr>
<tr>
<td>Net Income ($)</td>
<td>2,027,803</td>
<td>3,493,281</td>
</tr>
<tr>
<td>Specialization Index (%)</td>
<td>47.22</td>
<td>17.22</td>
</tr>
<tr>
<td>Percent Income from Grain (%)</td>
<td>23.65</td>
<td>24.56</td>
</tr>
<tr>
<td>Percent Income from Farm-input Sales (%)</td>
<td>34.42</td>
<td>24.66</td>
</tr>
<tr>
<td>Percent Income from Service Income (%)</td>
<td>26.08</td>
<td>16.72</td>
</tr>
<tr>
<td>Percent Income from Other Income (%)</td>
<td>15.85</td>
<td>23.6</td>
</tr>
<tr>
<td>Number of Cooperatives</td>
<td>531</td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Regression of the mean and variance of return on equity on cooperative-level characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>MORE</th>
<th>VROE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variance of Return on Equity</td>
<td>1.4604*</td>
<td>0.0383***</td>
</tr>
<tr>
<td>(0.6566)</td>
<td>(0.0091)</td>
<td></td>
</tr>
<tr>
<td>Return on Assets</td>
<td>0.6442***</td>
<td>0.0383***</td>
</tr>
<tr>
<td>(0.0381)</td>
<td>(0.0091)</td>
<td></td>
</tr>
<tr>
<td>Debt to Asset Ratio</td>
<td>0.0774***</td>
<td></td>
</tr>
<tr>
<td>(0.0175)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit Margin Ratio</td>
<td>0.2363***</td>
<td>-0.0298*</td>
</tr>
<tr>
<td>(0.0564)</td>
<td>(0.0149)</td>
<td></td>
</tr>
<tr>
<td>Income Specialization Index</td>
<td>-0.0150</td>
<td>0.0117***</td>
</tr>
<tr>
<td>(0.0118)</td>
<td>(0.0021)</td>
<td></td>
</tr>
<tr>
<td>Log(Assets)</td>
<td>0.0647***</td>
<td>-0.0022***</td>
</tr>
<tr>
<td>(0.0184)</td>
<td>(0.0003)</td>
<td></td>
</tr>
<tr>
<td>Square of Log (Assets)</td>
<td>-0.0016**</td>
<td></td>
</tr>
<tr>
<td>(0.0006)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asset to Equity Ratio</td>
<td>0.0043***</td>
<td></td>
</tr>
<tr>
<td>(0.0004)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-0.6076***</td>
<td>0.0255***</td>
</tr>
<tr>
<td>(0.1535)</td>
<td>(0.0054)</td>
<td></td>
</tr>
</tbody>
</table>

**System R²** 0.271

Notes: The numbers in parentheses represent standard errors. Single, double, and triple asterisks (*) represent statistical significance at the 5%, 1%, and 0.1% level, respectively. The dependent variables MORE and VROE are the mean return on equity and variance of return on equity, respectively.